A Comparison Study of the Effectiveness of the Lexia Reading Programme.

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ABSTRACT

This study evaluates the efficacy of the Lexia Reading (LR) programme with a cohort of 37 students in a Decile 1 primary school. The students were randomly assigned to experimental (who used LR) and control groups (who did not use LR). The WIAT-II was used to provide pre and post measures of literacy skills. Results indicated that students who used LR did not outperform students in the control group and no statistical significance was found between the two groups at post -test. The study discusses the evidence base that Lexia presents in support of LR and raises questions in relation to LR efficacy. The study concludes that the LR computer programme's evidence base and efficacy is equivocal.

Research Paper

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INTRODUCTION

Computers are now ubiquitous in schools and as a result there is an ever-growing number of computer software packages being marketed to schools. Some of these packages appear to offer effective solutions to some of the most intractable problems faced by teachers and many, such as Lexia, now target students who might be described as presenting with special needs. As such, these programmes may appear very attractive to schools. Packages are generally targeted at individual students underpinned by the rationale that the students will benefit from Computer Assisted Instruction (CAI).

When using a computer, students can be presented with auditory, visual and tactile-kinaesthetic stimuli as they learn. Carlisle and Rice (2002) write that CAI was primarily developed as a way of increasing instructional time and practice for students without placing further demands on teacher time. They further note that CAI enables instruction to be tailored to individual students, can allow for self-paced learning, can provide immediate feedback to students and that CAI can be both fun and engaging for students, especially for those who have reading difficulties. One other possible 'benefit' for the student is that they are withdrawn from classroom work which may be of less interest to them than spending time on the computer. In this way CAI can be quite appealing to students.

There has been extensive debate over the last 20 years as to the effectiveness of CAI. Slavin, Cheung, Groff and Lake (2008) conducted a review of the literature in relation to CAI. Of the eight studies that were reviewed (involving a total of 12,984 students) the overall weighted mean of the effect size of CAI programmes was +0.10. This is a very weak positive correlation and is on the verge of being negligible (Coolican, 2007). These findings are in line with practice guidelines for reading instruction from the US Department of Education's Institute of Education Sciences, which found that while there was little evidence to show that CAI was effective, CAI was an area that could have some potentially positive effects for students who used it (US Department of Education, 2010).

Lexia Reading is one of the main programmes marketed by Lexia Learning Systems (LLS). Lexia Reading (LR) is a computer-based supplementary reading tool aimed at improving reading skills. It has an age range of 4 years to adult (and can also be used for ESOL students). LR is designed to supplement and complement classroom instruction; however it can be used as a stand-alone tool (Lexia Learning Systems, 2006). LR uses games and interactive activities to "build skills with explicit practice in phonemic awareness and phonics while promoting gains in vocabulary, fluency and comprehension" (Lexia Learning Systems 2010, p.2).

As students begin LR they are placed at a level that matches their ability. In order to progress through the levels they are required to complete tasks, which they must achieve before being able to move on to a higher level.

Within the Lexia programme a multisensory approach is intended to engage learners with the material. Students use headphones to listen to words/word sounds, and then interact with the computer, using a mouse to click on images to provide responses to the questions related to the word/sound. Other exercises do not require the students to listen to sounds/words but rather to complete the task on the screen using the mouse or keyboard.

Lexia offer three main sources of supporting information by way of providing an evidence base: the first is peer- reviewed journal articles and the second is testimonial studies largely written by RTLBs and schools. Lastly, the company offers a webinar.

There are three articles, cited on the Lexia website, from peer-reviewed academic journals. In exploring this evidence it appears that these articles were all written following extensive work in the United States of America with a group of public schools in Revere, Massachusetts (Macaruso, Hook & McCabe 2006; Macaruso & Rodman 2009; Macaruso & Walker 2008). It appears that Lexia was given a rare opportunity to tailor-make their programme to fit with the schools' curriculum. These three studies appear to support the value for students who accessed the Lexia programme, particularly those students who were furthest behind (described as 'at risk').

There are a number of studies which have been written by Resource Teachers: Learning and Behaviour (RTLB), schools and a single personal testimonial which Lexia currently place on their website. These studies present information which is highly supportive of the Lexia programme.

Lexia also claim that the What Works Clearinghouse and the Florida Centre for Reading Research have positively evaluated the Lexia programmes.

The research team was invited to attend a webinar hosted by LR (a combined telephone/internet tutorial and discussion). During the Webinar the research team asked what progress might be expected from students who used LR. The LR representative confirmed that we might expect to see one years progress in one term (most likely in 'at risk' students) for students who used LR.

Schools with a high demand for literacy teaching could be considered as the target for the presentation of this positive evidence. In particular, schools may well feel that the amount of teacher-time they are able to direct to raising literacy is limited, and the promise of having the process automated to some extent can easily be seen as attractive. In particular, Lexia's summary of the research shows potential:

- Lexia Reading Improves Reading Score in grades K – 3 and Middle School
- Lowest Performing Students Benefit the Most from using Lexia Reading
- Title 1 Students Using Lexia Reading Close the Achievement Gap (Title 1 Students is a term used in the USA. They are equivalent to NZ students functioning at Level 1 of the curriculum or below)
- Benefits of Lexia Reading are Tied to Strong Use Patterns
- Teachers Strongly Endorse Lexia Reading (Lexia International, 2011).

Given the positive indications the research team adopted the following hypothesis: given a single term of prescribed learning with LR, students will show significant improvement in literacy scores (one year in one term), when compared with students in a control group. The null hypothesis is that despite access to the Lexia programme (for the experimental group) no significant differences between the two conditions will be found.

METHOD

In order to further inform Lexia's claims the research team sought to explore Lexia's efficacy with 'at risk' students in a New Zealand educational context. The team were invited to help support a Decile 1 primary school which was considering purchasing the Lexia Reading Programme. Lexia provides free of cost, an unlimited number of licences for the duration of a single term (10 weeks).

Participants

Forty students were identified, ten in each of four combined school year classes; Years 1-2, Years 3-4, Years 4-5, Years 5-6. All the children were identified by the school as 'at risk' in terms of their literacy i.e. their literacy was tracking at two years or more below their chronological age. The ten students from each class were randomly assigned to the control or the experimental condition. Two learners with English as an additional language were excluded from the study and one learner left the school, leaving a total of 37 participants.

Procedure

The students followed normal classroom programmes and curriculum with the exception that the experimental group took part in LR for at least 100 minutes per week for a single school term in 2010. Some students had significantly more time than this.

Measures

The pre and post tests for the study were selected from the Wechsler Individual Achievement Test, (WIAT-II, 2nd ed,). This test was selected as it is arguably comparable to the tests used in the three peer-reviewed studies on the LLS research website (Lexia International, 2011). Adjustments were made to allow for differences in the New Zealand and Australian education systems. For the administration of this test all five year old students were treated as pre-schoolers (as pre-schoolers, the 10 five year old children were only administered the Word Reading and Spelling subtests). The following tests and descriptions are taken directly from the WIAT-II manual:

Word Reading - assesses early reading (phonological awareness), word recognition and decoding skills.

Reading Comprehension - assesses the types of reading comprehension skills taught in the classroom or used in everyday life.

Spelling - assesses the ability to write dictated letters, letter blends, and spell words.

Pseudoword Decoding - assesses the ability to apply phonetic decoding skills to 'nonsense' words.

Additionally, the team sought to evaluate curriculum data supplied by the school alongside the results of the WIAT-II pre and post tests. The researchers also devised a 'Student Voice' questionnaire to explore learners' self-perception and their enjoyment of the Lexia programme. Interviews with members of the teaching staff were also conducted.

Independent sample *t* tests on the pre-test data between the control and experimental conditions revealed no significant differences across the four WIAT-II subtests prior to beginning the trial.

Results

All children achieved levels of Lexia usage that fell within the required range. Using the WIAT-II data, age equivalencies were calculated in months for the purposes of data analyses. The following tables show the means and standard deviations across the two conditions and the four subtests. The difference between the pre and post test means are included at the end of each table. Tables 1 and 2 record the control and experimental data respectively, and Table 3 allows comparison of the control and experimental means across the four sub-tests.

Table 1

Mean scores and standard deviations across the control sub-tests (all values in months)

Subtest	Pre-test mean	Standard Deviation	Post-test mean	Standard Deviation	Difference between means
Word Reading	77.05	14.84	80.11	15.73	3.06
Spelling	78.35	11.14	75.53	21.99	-2.82
Reading Comprehension	86.22	17.10	83.67	18.56	-2.55
Pseudoword decoding	81.09	9.48	81.82	8.46	0.73

Table 2

Mean scores and standard deviations across the experimental sub-tests (all values in months)

Subtest	Pre-test mean	Standard Deviation	Post-test mean	Standard Deviation	Difference between means
Word Reading	79.2	12.3	76.2	13.3	-3
Spelling	74.5	14.15	78.8	10.79	4.3
Reading Comprehension	76.67	5.32	77.5	5.21	0.83
Pseudoword decoding	86.86	35.98	74.5	6.74	-12.36

Table 3

Comparison of means between the control and experimental conditions (all values in months)

Subtest	Control Pre-test mean	Experimental Pre-test mean	Control Post-test mean	Experimental post-test mean
Word Reading	77.05	79.2	80.11	76.2
Spelling	78.35	74.5	75.53	78.8
Reading Comprehension	86.22	76.67	83.67	77.5
Pseudoword decoding	81.09	86.86	81.82	74.5

A student voice questionnaire was also administered as an additional information source. The results are included in Appendix A.

The curriculum data supplied by the school was not complete at the end of the study and has therefore not been included in the results section.

When the independent sample t-tests were repeated on the post-test data between the experimental and control conditions across the four WIAT-II subtests, no statistical significance was found. The results do not serve or support any significant advantage for the experimental group. The null hypothesis must therefore be accepted that despite access to the Lexia programme (for the experimental group) no significant differences between the two conditions were found.

Discussion

From a Lexia standpoint these results would appear to be very disappointing. The cohort of 37 'at risk' readers who completed the trial would arguably be Lexia's target group. These learners all worked on Lexia at or above the minimum amount of time required by the programme as stipulated by Lexia for a period of a school term, which is supported by the trial period offered by Lexia to schools. In searching for a rationale for the uninspiring results generated by this research it seems important to revisit the evidence base in a little more detail.

The testimonial research, as it is presented on Lexia's website, is typically narrative rather than experimental. Whilst acknowledging the excellent intentions of these projects, the research team found that there is little or no evidence of rigorously applied methodologies, the use of control groups, pre and post measures or statistical analysis. The researchers therefore struggled to see how they might convincingly support the evidence-base for Lexia.

In support of LR, the LLS website states "the What Works Clearinghouse (WWC) finds Lexia Reading to be effective, meeting the WWC research standards" (Lexia International, 2011). The WWC was established in 2002 by the US Department of Education's Institute of Education Sciences to provide professions with guides to the effectiveness of programmes, practice guidelines and policies concerning education, including literacy and numeracy. LLS claims that the Lexia Reading programme is one of only ten programmes that meets the evidence standards set out by the WWC and shows "positive or potentially positive effects in at least two of the four beginning reading skills (alphabetics, comprehension, fluency and general reading achievement)" and "Based on the studies reviewed by WWC, Lexia Reading was found to have potentially positive effects on alphabetics and reading comprehension, and showed statistically significant effects in general reading achievement for subgroups of at-risk students" (Lexia International, 2011).

The researchers examined the What Works ClearingHouse report pertaining to Lexia Reading. LLS presented 11 studies to the WWC for evaluation. Of these 11 studies, only two met the evidence standards with one further study meeting the evidence standards with reservations (US Department of Education, 2009). The other eight studies did not meet the evidence standards due to flaws in research design, methodology or conclusions. The WWC report determined that the evidence in support of the Lexia Reading programme to be "small for alphabetics, fluency, comprehension, and general reading achievement" (US Department of Education, 2009). The WWC found that the Lexia Reading programme had "potentially positive effects on alphabetics, no discernable effect on fluency, potentially positive effects on comprehension, and no discernable effects on general reading achievement" (US Department of Education, 2009). This appears to be at odds with the statements made by LLS.

On closer examination the team found the three Macaruso studies are far from unequivocal. Macaruso (2006) in the first of the trio of studies available, worked with 179 students from ten first grade classes, allocated to experimental and control conditions. Initially no significant difference was found between these two groups which was disappointing considering the advantages of matching Lexia directly to a literacy curriculum over a six month period. Macaruso et al., (2006) note this apparent failure and embark upon further analysis. These endeavours did reveal that there was apparently a significant advantage for those in the experimental group described as 'at risk' (also known as Title 1 Students in the USA) when compared with the same group of students in the control group. However, this advantage was only found for 'letter sound correspondences' in contrast to 'recognising basic story words' where no significant advantage was found.

The second study (Macaruso et al., 2008) examines Lexia in kindergartens. Encouragingly, the study claims to have shown significant differences between the experimental and control conditions. However, the research team noted that the pre and post test measures used were not the same. Instead, all children were tested on a reading test (the Gates McGinitie) by way of identifying differences only at the end of the Lexia programme. This proved

very difficult for the research team to overlook and arguably the team did not agree with the rationale shared in the study for this aspect of their methodology.

It would seem important for the research team to acknowledge that testing is seldom perfect and the use by the researchers of a test standardised on an Australian population is not, arguably, an ideal method of measurement. However it has only been used within this study's specific experimental methodology. It has not been compared with other data gathered by the school or post hoc tests. Furthermore, the adjustment for ages discussed in the introduction provides some protection from the influence of age on literacy ability. The team aspired to include school curriculum data on reading development to further inform the study. However, this data was incomplete at the time the study finished and has therefore not been included.

The third Macaruso study appears to build on Lexia's apparent benefit for a cohort of 47 sixth and seventh grade middle school students with identifiable special needs in the area of literacy. The participants are described as 'attending remedial reading classes'. In contrast to the previous study, Macaruso et al., (2009) employs the Woodcock-Johnson III Tests for Achievement. This standardised test has seven subtests and has been standardised alongside the WIAT-II used in the present study. Through the use of statistical analysis, Macaruso et al. was only able to show a significant advantage for the experimental group for the Word Attack sub-test. No significant differences were found in any of the other six areas tested (letter-word identification, reading fluency, reading vocabulary, passage comprehension, oral comprehension and spelling). In making this claim the researchers noted that in the area of word attack the control group's mean scores pre to post dropped from 87.7 to 85.3. As the post-test score for the experimental group was 88.3 it is not difficult to see that the apparent reversal of the control group has helped to make the findings significant. The question of why the control group made negative progress in this area is not fully explored.

A preference for simple statistical analysis might be seen by some as a potential weakness of the present study. In the Macaruso studies a number of tests and investigations were conducted with skill and rigour. However the present research group would argue that from the way in which Lexia is marketed the data gathered should be unequivocally in favour of those students in the experimental condition. In reading the discussion sections of the Macaruso articles it becomes clear that there are some very strong claims made in favour of the Lexia programme but these would not appear to be fully supported by the results.

By way of support for schools, Askov and Bixler offer a list of criteria by which to evaluate the appropriateness of computer software for educational purposes (1998, cited in Dunsmuir & Clifford, 2003). This list asks how well any given programme matches the more general curriculum objectives. The learners in the Macaruso studies "were taught with *Language!* An intensive reading programme that includes exercises to improve phonic skills" (Macaruso & Rodman, 2009, p.109). It may be that any advantages claimed by the Macaruso studies are as a result of the opportunity to match Lexia with the curriculum but even this argument appears to be insecure.

In the most recent of the Macaruso studies (2009) it is noted that in order for students to make progress "further instruction and practice are necessary" (Torgesen et al., 2003, cited in Macaruso 2009, p.109). In the same study there is a very brief reference made to additional study support on page 106: "Students … branch to more highly scaffolded practice activities when necessary". This perhaps signals the use of additional one-to-one instruction which would potentially have a very significant influence on scores in the experimental group. Whilst almost an aside of the 2009 study, the researchers and the participating school found the use of one-to-one instruction to be a major issue.

When a learner has more than three failures on a task on LR, a yellow dot is placed on the record for the teacher to see. These dots are an indication to the teacher that the student requires one-to-one instruction. The LR system carries hundreds of pages of one-to-one instruction exercises to this end. When the school agreed to the LR trial they were unaware of these yellow dots. At no time were the yellow dots mentioned to the school or the researchers by LLS. When they began to appear on the student records the teachers were surprised to hear that they were then required to spend considerable additional one-to-one instruction time to the students. The school made the decision to not deliver the additional teaching materials to the students due to the extensive time demands of such individualised teaching.

It is important to note that all of the students had yellow dots on their records at some stage during the trial. When a student fails to make progress at LR a teacher is required to give the student one-to-one instruction in the specific skill until it is established. They are then able to go back on LR and pass the level they were stuck on. This pattern is repeated every time a student has difficulty with a skill-set in LR. It might be argued that LR was not delivered with fidelity during this study but the contrary argument

is that through the delivery of significant one-to-one tuition until the learner has successfully learnt the identified skill, a student cannot fail on LR.

We identify what appears to be a self-fulfilling prophecy. It would seem to the researchers that the benefits of LR lie not necessarily in the computer instruction medium, but rather in that it support teachers to provide students with targeted one-to-one instruction in specific skill areas that are key to literacy development. This form of instruction (one-to-one) is widely supported by evidence and research as being an effective way of supporting literacy development (Carlisle & Rice, 2002). LLS appear to support this notion in that these lessons are an integral part of supporting students to succeed on LR. It does seem important to note that a single yellow dot can require over 90 pages of colour photocopying alongside the teaching time to deliver these additional materials.

As this work has been completed there has been a growing concern within the research team that the marketing and efficacy of school targeted software do not necessarily share the same agenda. The team have questioned the evidence base and, at best, the answers have been equivocal.

It is an ubiquitous feature of conclusions to research articles that more detailed and exhaustive research needs to be undertaken and this case is no exception. This was, after all, a comparatively small study limited to a single school. The discovery of additional teaching materials requiring significant time and resources is a further variable which warrants further exploration. In the final analysis there seem to be two programmes at work for the learner: computer time and direct teaching time. The individual instruction ensures that any shortcomings of the computer programme are ameliorated.

CAI has a glamorous profile in schools but if it does not work, is it worth the investment of scarce school funds? This study found that CAI (as in LR) did not seem to help struggling readers. A future larger study is now needed to verify and extend the present results.

REFERENCES

Carlisle, J. F., & Rice, M. S. (2002). Improving reading comprehension. *Research-based principles and practices*. Baltimore: York Press

Coolican, H. (2007). *Research methods and statistics in psychology* (4th ed.). London: Hodder & Stoughton.

Dunsmuir, S., & Clifford, V. (2003). Children's writing and the use of information and communications technology. *Educational Psychology in Practice*, 19(3), 171-187.

Lexia International. (2011). *Lexia Learning > Research*. Retrieved October 13, 2011, from Lexia Learning: http://www.lexialearning.com/research/index.html

Lexia Learning Systems. (2006). *Lexia foundational reading. Teacher's guide*. Motueka: Lexia Learning Systems NZ.

Lexia Learning Systems. (2010). *Lexia reading. Our world begins with reading* . Motueka: Author.

Lexia Learning Systems New Zealand. (n.d.). *Lexia Learning NZ*. Retrieved 10 13, 2011, from Lexia Learning NZ: http://www.lexialearning.co.nz/

Macaruso, P., Hook, P.E., & McCabe, R. (2006). The efficacy of computer-based supplementary phonics programs for advancing reading skills in at-risk elementary students. *Journal of Research in Reading*, 29(2), 162-172.

Macaruso, P., & Rodman, A. (2009). Benefits of computer-assisted instruction for struggling readers in middle school. *European Journal of Special Needs Education*, 24(1), 103-113.

Macaruso, P., & Walker, A. (2008). The efficacy of computer-assisted instruction for advancing literacy skills in kindergarten children. *Reading Psychology*, 29(3), 266-287.

Slavin, R. E., Cheung, A., Groff, C., & Lake, C. (2008). Effective reading programmes for middle and high school: A best-evidence synthesis. Reading Research Quarterly, 43(3), 290-322.

US Department of Education. (2010). Improving adolescent literacy: Effective classroom and intervention practices. Retrieved from: http://ies.ed.gov/ncee/wwc/pdf/practiceguides/adlit_pg_082608.pdf

US Department of Education. (2009). Lexia reading. Retrieved from: http://ies.ed.gov/ncee/wwc/pdf/wwc_lexia_063009.pdf

APPENDIX A

The Student Voice Questionnaire

The student voice questionnaire contained seven questions. For all items, apart from Question 5, the participants were asked to indicate their answer on a scale ranging from 0 – 10, where 0 is the least and 10 is the most. The researchers followed a semi-structured set of instructions to make sure each participant understood how to offer an answer. Question 7 was only for those in the experimental group and asked how much they enjoyed being part of the programme. The mean result for Question 7 was 8.13 (with a standard deviation of 3.67) suggesting that, despite scores across a wide range, participants reported that they enjoyed working on the Lexia programme. Question 5 asked participants to list their strategies to reading an unfamiliar or difficult word. The table below (Table 4) presents the means across the two conditions for all items.Table 5 records the verbatim responses of the participants to Question 5.

Table 4

Questionnaire questions 1, 2, 3, 4, - , 6 and 7 mean scores for across conditions

Question	**Pre-test mean control**	**Post-test mean control**	**Pre-test mean experimental**	**Post test mean experimental**
How much do you like reading at home?	7.63	7.88	7.05	8.16
Like reading at school?	7.05	7.4	5.76	5.55
How good are you at reading?	7.3	7.18	5.84	7.32
How good does your teacher think you are at reading?	7.85	7.55	7.47	7.76
How much do you enjoy school?	9.23	7.55	8.68	8.89
How much did you enjoy Lexia?	N/A	N/A	N/A	8.13

Table 5.

Verbatim responses to Question 5.

Control Group pre-test	**Control Group post-test**
sound it out	sound it out
get another book	get a different book
sound it out	skip it
ask for some help maybe	sound it out
sound it out	sound it out or go back and read it again
sound it out	skip it or sound it out
sound it out in my head	chunking
sad because what one	you say I can't do it
I think and then I know	ask a teacher
I ask teacher to help me	ask the teacher to help me read it
happy or sad	my teacher tells me what word it is
no answer	just look away just say it
put book back	I like going to the park I like going to the beach
just think	sound it out
look at picture and sound it out	sound it out
get a little angry and keep trying	have a go

sound it out	sound it out
sound it out	sound it out
stop and sound it out	sound it out
skip it	skip it and move on
Experimental Group pre-test	**Experimental Group post-test**
don't know	sound it out
sound it out	sound it out
try, chunk it	skip it
try to think it out and if you don't know it you can skip it and come back to it	sound it out
don't know (shrug)	sound it out
chunk it up	chunk it
my dad helps me when I don't know it. He tells the girls to help you	ask the teacher
don't know	ask the teacher
ask my mum	ask the teacher
I don't like reading at home so I just like reading at school	I get sad when my mum always don't give us food
ask mum	ask a teacher
say the word in front of the whole word (pointed at first letter of word)	I sound the first word out
no answer	fun
I don't know	go to my teacher
miss it	sound it out
sound it out	sound it out
sound it out	sound it out with your arm
sound it out	chunk it up
sound it out	read on

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