Evaluation of Lexia Software in Boston Public Schools

Final Report

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Executive Summary

The following report presents the findings of a quasi-experimental study conducted by Davis Square Research Associates (DSRA) for Boston Public Schools (BPS) on the effects of using Lexia software. This software is designed to improve the reading abilities of elementary age children. DSRA research found that Lexia was consistently effective in helping first, second, and third grade children perform better on the DRA. In comparison to traditional instruction, the software was significantly more effective for third grade students.

Key Findings

Key findings from the study include

- Lexia was consistently effective for first, second, and third grade students as measured by the DRA.
- Lexia was effective with ELL and SPED students as well as regular education students
- Lexia students statistically outperformed comparison students in third grade
- Teachers expressed high levels of satisfaction with Lexia
- Teachers strongly endorsed the implementation of a structured phonics program for the entire district.

Method and Sample

A complete presentation of the Lexia products can be found on the company web site (http://www.lexialearning.com), including a good introduction to the product's uses. Briefly, Lexia is an interactive computer program designed to respond the user's abilities to handle phonics problems, with the problems gradually increasing in difficulty as the student's abilities improve. The software also has the ability to generate detailed reports on the user's progress through the materials.

The participating teachers (N=63) were selected by OIT for the project after having volunteered and with the promise of compensation for their work. The computer skills and familiarity with Lexia varied widely, as did the availability of computer resources within the schools (N=14). All teachers received Lexia training and follow up support from OIT. Participants who completed the project submitted a binder with varying amounts of student work, including reports generated by Lexia for treatment group students.

The selection of students was left to the participating teacher. Participants were told by OIT to select eight low-achieving students, with half of these receiving exposure to Lexia on a consistent basis (about one hour per week), and the comparison group students receiving traditional instruction.

Participating teachers agreed to have treatment students complete 60 sessions of Lexia, thus using the software nearly every day for the duration of the study. Whether this was done or not is difficult to determine from the data. Even when a user logs in, it may be that the one logging in is not the same person, and even if it is, it is not clear that the person doing the work is actually the person who logs in. These kinds of perplexities invariably bedevil the data analysis of many computer-based programs, and in this sense Lexia is no different from others.

The assessment used was the DRA, a test administered to BPS students three times per year. The scores from the baseline were taken from the January, 2004 DRA (administered just before the start of the Lexia implementation), with the post-test DRA administered in May 2004. These tests are consistent with the BPS curriculum, and they are administered under normal conditions, without undue stress. Kindergarten students who used Lexia materials as part of this study were dropped from the analysis as these students do not take the DRA, though the responses of kindergarten teachers to the surveys were included in the analyses.

Effects on Student Achievement

This section presents the findings from the analysis of the pre-post test scores for the students. In the first section, DSRA analysis looks at within group differences. By "within group" is meant that the analysis is focused solely on the changes that can be observed among the members of one group, whether Lexia or comparison. In the second section, the analysis turns to between group differences, or the comparison of the two groups to one another.

Within Group Differences

Before going on to compare groups, DSRA looked at how much each group (whether Lexia or comparison) improved from pre- to post-test. Using a paired samples t-test, the analysis shows that each group improved significantly from pre- to post-test. This means that both the use of Lexia and traditional instruction can be associated with significant improvements on the post-test DRA. In this sense, both approaches can be considered effective and beneficial for the students.

Table 1: Within Group Differences

Grade	Group	January 2004 DRA	May 2004 DRA
1st Grade	Comparison (N=45)	4.38	9.60*
	Lexia (N=46)	4.11	9.85*
2nd Grade	Comparison (N=42)	16.17	21.55*
	Lexia (N=48)	14.96	20.25*
3rd Grade	Comparison (N=44)	23.57	26.80*
	Lexia (N=43)	24.37	29.16*

*Significant at $p<.05$; Third grade groups differ significantly.

Table 2: DRA Scores: All Students Except SPED

Grade	Group	January 2004 DRA	May 2004 DRA
1st Grade	Comparison (N=31)	4.16	9.52*
	Lexia (N=33)	4.42	9.24*
2nd Grade	Comparison (N=29)	16.14	21.66*
	Lexia (N=30)	16.80	22.93*
3rd Grade	Comparison (N=20)	25.30	29.90*
	Lexia (N=33)	25.33	30.48*

*Significant at $p<.05$; No between group differences are significant.

Turning to the effects on SPED students, DSRA analyses reveal that both Lexia and comparison groups made significant gains in first grade, while only Lexia students made significant gains in second and

third grade. In addition, the between group differences for third grade were significant, using the ANCOVA statistic controlling for pre-test differences.

Table 3: DRA Scores: SPED Students Only

Grade	Group	January 2004 DRA	May 2004 DRA
1st Grade	Comparison (N=5)	5.60	10.40*
	Lexia (N=7)	3.71	12.00*
2nd Grade	Comparison (N=4)	20.75	25.00
	Lexia (N=10)	10.60	13.60*
3rd Grade	Comparison (N=7)	18.29	17.71
	Lexia (N=9)	20.44	24.22*

*Significant at $p<.05$; Third grade groups differ significantly.

Looking at the effects on English language learners, DSRA analyses show that all groups made statistically significant gains, and that there were no significant differences between the comparison and Lexia groups.

Table 4: DRA Scores: ELL Students Only

Grade	Group	January 2004 DRA	May 2004 DRA
1st Grade	Comparison (N=7)	4.14	12.29*
	Lexia (N=10)	3.80	9.50*
2nd Grade	Comparison (N=5)	15.20	19.60*
	Lexia (N=6)	16.33	21.00*
3rd Grade	Comparison (N=10)	16.60	19.80*
	Lexia (N=7)	27.71	30.86*

*Significant at $p<.05$; No between group differences are significant.

Between Group Differences

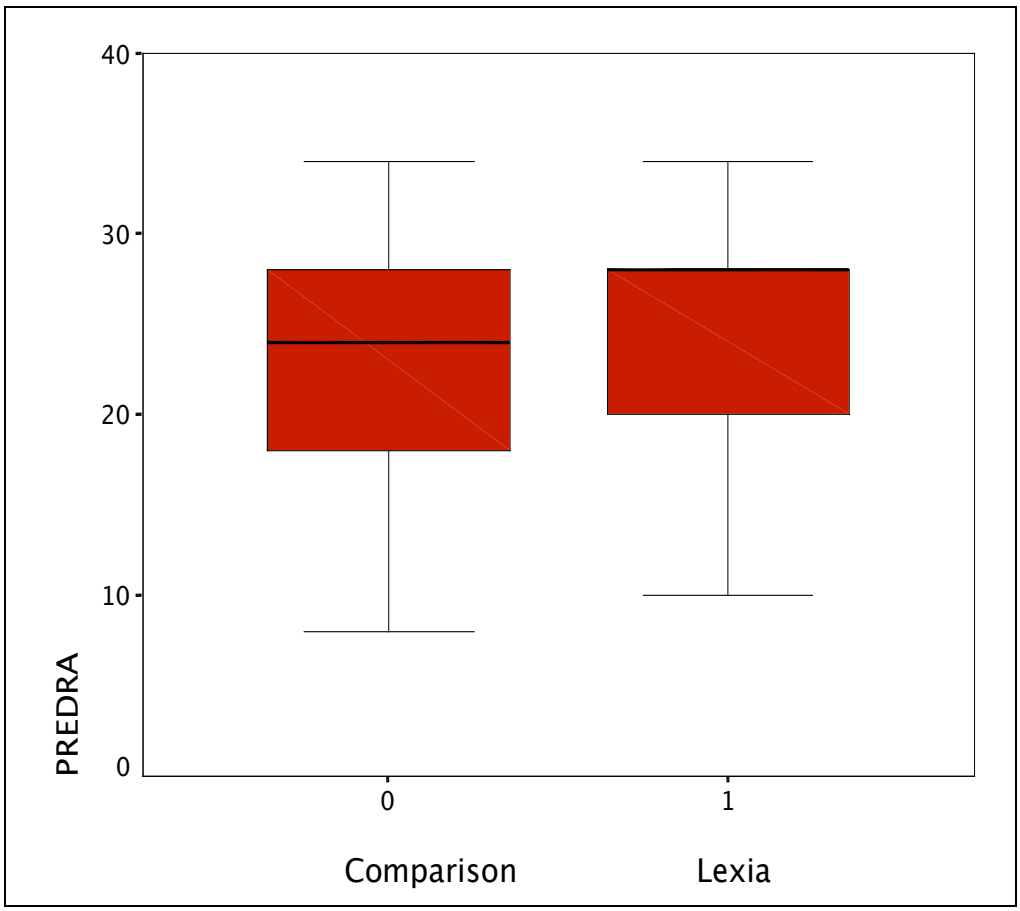
A key component of the evaluation focused on whether the Lexia students did significantly better than comparison students. This question cannot be answered by comparing within group differences. Instead, the analysis must use a between-groups statistic, in this case, an ANCOVA. This statistic allows the analysis to control for pre-test differences, and is thus especially valuable for this kind of research design.

A one-way between-group analysis of covariance (ANCOVA) was conducted to compare the effectiveness of the two different approaches to teaching patterns for each grade. The independent variable was the type of intervention (traditional or Lexia) and the dependent variable consisted of the scores on the post-assessment DRA. The scores on the pre-test were used as covariates, allowing the analysis to control for pre-test differences.

After adjusting for the pre-test score differences, it was found that there were no significant differences between the Lexia and comparison group gains on the post-test in first and second grade. In contrast, third-graders using Lexia significantly outperformed their classmates who received traditional instruction ($p<.05$). This also held true when looking at the achievement of SPED students only. The following chart shows that Lexia and comparison groups (composed of

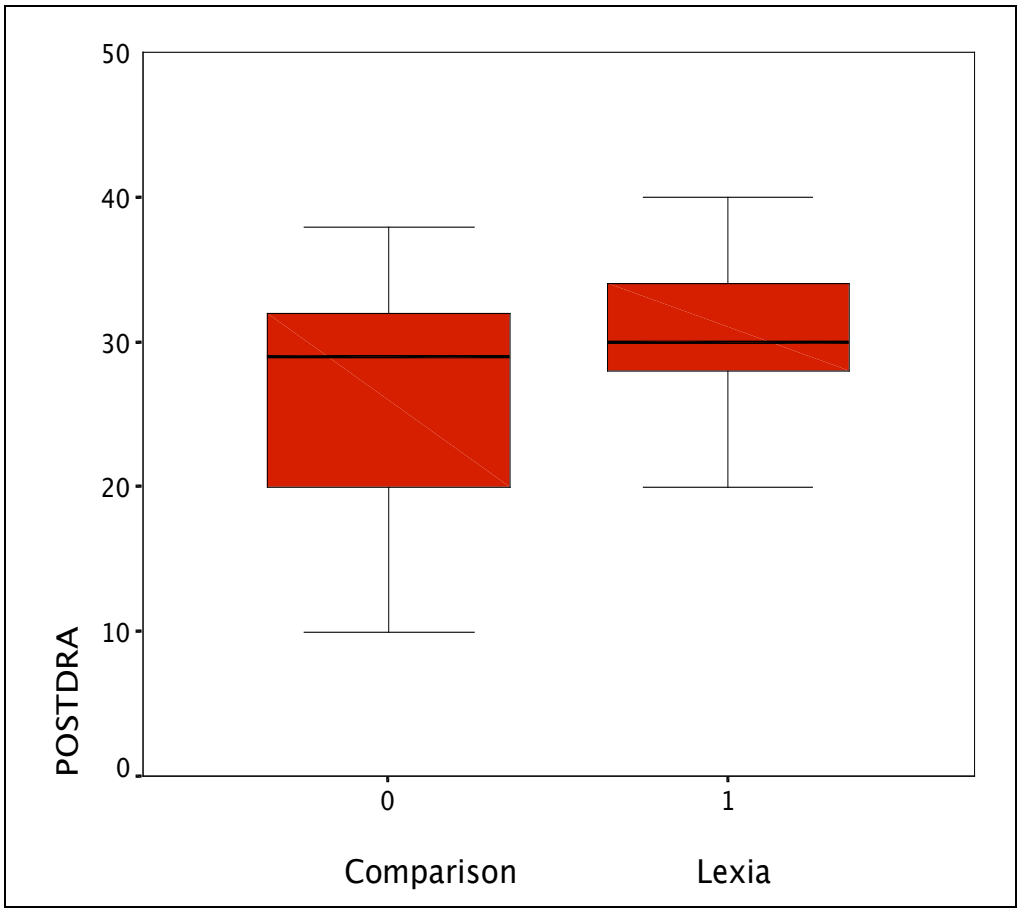
all participating third graders) scored similarly on the January 2004 DRA.

Figure 1: Pre-Test Differences: 3rd Grade



After four months of exposure to the software, third grade Lexia students show higher levels of achievement than comparison students as well as a greater degree of consistency (less variation) in their achievement.

Figure 2: Post-Test Differences: Third Grade



Teacher Pre- Survey Findings

As the Project was about to be launched early in 2004, DSRA conducted a pre-test survey of all participating teachers (N=63) from all fourteen elementary schools. The groups for each of the K-3 levels were nearly equal, with K and 2 having 14 and 1 and 3 having 15. Other teachers taught more than one grade level. The average number of years of experience was 13.

The first page of the pre-test survey asked a series of questions about computer use and attitudes toward the educational uses of computers. These questions can be found in the Appendix. Looking at the teacher responses by grade, one can see that there is only one significant difference (using a MANOVA statistic with grade level as the independent variable and survey responses as dependent variables), and this is that kindergarten teachers report using computers in helping students learn to read more than the other teachers (1-3). The

difference in actual time is difficult to estimate, but the data suggest that kindergarten teachers use computers perhaps as much as 30 minutes per week more than the other responding teachers.

Table 5: Teacher Pre-Test Responses by Grade

Question	Grade Level			
	K	1	2	3
How comfortable would you say you are in using a computer for your personal needs outside the classroom?	3.2 ("Generally comfortable")	3.3	3.7 ("Very")	3.2
How comfortable would you say you are in using a computer for teaching in the classroom?	3.0 ("Generally comfortable")	2.7	3.0	2.8
Overall, how effective do you think computers are in helping young children learn to read?	3.0 ("Often effective")	3.0	3.1	3.1
How often do you use computers to teach your students to read?	2.5 ("Fairly often")	2.1 ("Occasion-ally")	2.1	1.9
On average, how much time per week do your students use computers for reading activities?	3.0* ("30-60 minutes per week")	2.4 ("Less than 30 minutes")	2.1	1.8
One of the challenges in designing educational software is ensuring that the content correlates to state standards. Which of the following statements best expresses your opinion?	2.0 ("It can be a problem once is a while")	2.0	2.7 ("It's an ongoing problem")	2.1
How often do you use computers for assessing the students' learning in reading?	1.6 ("Maybe once in a while.")	1.6	1.6	2.1

*Significant at $p<.05$

Teacher Post- Survey Findings

The attitudes of participating teachers with regard to using computers to teach literacy was looked at through a general pre-test question on

the efficacy of computer-assisted literacy instruction and a post-test question on the effectiveness of Lexia in particular. While "computers" and "Lexia" are different, the slight upward shift in responses was not statistically significant. This finding suggests that the participants' already positive attitudes toward computer-assisted instruction were improved incrementally, though not significantly, by their experience of Lexia.

Of importance to the project was the teacher response to questions regarding the advisability of adopting a district-wide program supporting structured phonics. In response to the question, *How strongly would you like to receive training on explicit phonics instruction?*, the average response was a strong 3.33 out of a possible 4 ("A good idea").

In response to the question, *On the basis of your experience with Lexia, how strongly would you favor the district-wide adoption of a structured phonics program?*, respondents strongly declared that this would be a good idea, with responses averaging 3.46 out of 4 ("I strongly favor this").

The teachers were similarly enthusiastic regarding the effectiveness of Lexia, with responses averaging 3.2/4 ("I think Lexia is often effective") to the question, *Overall, how effective do you think Lexia is in helping young children learn to read?* These responses, especially when coupled with the previous two just discussed, combine to create a strong endorsement of the Lexia software from responding teachers (N=40, or 64% of those who began the project).

The following table presents the findings from one section of the pre- and post-surveys of the teachers. In this section of the survey, teachers were asked about their expectations regarding the benefits of using Lexia. In the post-test, the teachers were asked about their perceptions of the effectiveness of using Lexia. Paired sample t-tests were conducted to identify the extent and direction of change for the period off the Project. The range of possible responses is from 1 (most negative) to 4 (most positive).

Table 6: Pre-Post Survey Responses

	Pre- Survey (N= 63; Feb 2004)	Post- Survey (N= 38; May 2004)
Students can work at their own pace	3.44	3.61
Students can receive immediate feedback	3.29	3.63
It's easier to individualize instruction.	3.04	3.44
Students find computer work engaging	3.67	3.30*
Students find it easier to concentrate using computers	3.09	3.18
Computers make it easier to sequence skills effectively	2.74	3.30*
Computers are good for helping children learn to write	2.48	2.78
Computers make it easier to find developmentally appropriate materials	2.71	3.17*

*Significant at $p<.05$

Note in the above table that the participants' expectations were met or exceeded in all areas except that of student engagement. Going into the Project, teachers had quite high expectations for using the software (perhaps creating a "ceiling effect" in which there is little room for improvement). These expectations were consistently met across the categories below, with expectations being significantly exceeded in two areas: skill sequencing, and the ease of finding the right materials. Teacher expectations were significantly exceeded in the capacity of Lexia to sequence skills effectively and finding the right materials for struggling students. In one area, Lexia fell significantly short of expectations: student engagement. Survey data indicate that the participating teachers thought that students would find Lexia more engaging than would prove to be the case.

Another section of the pre-test asked participants a series of questions regarding the anticipated benefits of using Lexia. These expectations were then compared to the post-test responses on the observed benefits of using Lexia. The already high expectations of the pre-test

again may have created a "ceiling effect" in which it would be unlikely for expectations to be exceeded. However, in five of the seven areas, expectations were met, with significantly negative differences observed by the teachers in two areas: increasing collaboration among students and the improvement of writing (again relying on the paired samples t-test). Lexia directly addresses neither of these two areas.

Table 7: Pre-Post Survey Results

	Pre-Test	Post-Test
Help students become more fluent readers	2.96	2.88
Help you with remediation of students who fall behind	3.28	3.12
Help increase collaboration among students on reading assignments	2.68	2.27*
Help students develop vocabulary	3.00	2.75
Help increase the level of student engagement in reading	3.12	2.92
Help promote student communication skills	2.83	2.30*
Help students become better writers	2.79	2.50

*Significant at $p<.05$

Other Anecdotal Data

Participating teachers included comments in their binders on using Lexia. These comments were provided without any question prompt, and they can be considered nearly spontaneous reactions to the experience of using Lexia through the spring of 2004. The overall tone to these comments is highly positive, though there is occasionally raised some issue related to implementation (trouble with the technology, etc.).

The following are a sampling of the responses.

- [Lexia] informed my teaching by specifying skills which need teaching and review.
- [The children] have become more aware of their spelling, choosing appropriate words for word study, and spelling more words correctly in their everyday writing.
- It is a positive activity to integrate Lexia to our literacy workshop.

- Using this program allowed me time to incorporate one extra guided reading group in my daily routine.
- Students with language barriers gained more confidence in oral fluency.
- It worked well as a component of our Readers' Workshop.
- I wish I could have gotten the system in the beginning of the year.

Discussion and Recommendation

The name of educational change theorist Michael Fullan (2001) is frequently associated with the notion of "implementation dip." While this idea extends beyond education, it is certainly of great utility when looking at the introduction of an innovation such as Lexia in the diverse environments participating in this study.

The basic idea of the implementation dip is that, when introducing an innovation, things will, in the short term, likely get worse before they get better. There are many reasons for this. It may be that the teachers are not implementing the innovation as designed, or that they are using the innovation with the wrong students. The teachers may be using the new materials correctly, but inconsistently, or at the wrong times, or assessing the results incorrectly, or it may be that other forces in the school are derailing the implementation. In any case, there are numerous factors that may conspire to limit the effectiveness of the innovation, thus inadvertently engendering Fullan's "implementation dip."

In the case of the current study, one would reasonably expect there to be an implementation dip given the sophistication of the product and the lack of experience with the product among participating teachers. The expected dip, however, did not occur. The product was consistently effective for all three grades assessed using the DRA, and it even outperformed the comparison group in third grade. This result is a remarkable success, in the judgment of this evaluator.

The success of the product masks yet another consideration, and this is the relative match between the experience of using Lexia for the child and the experience of the DRA assessment. Given that Lexia is computer-based and the DRA is not, the Lexia students have the additional burden of transferring their knowledge from one context to another. For children who have difficulty generalizing their learning across different environments, the switch from the computer to the DRA can create additional challenges. Given that the students in the current study had been identified as low-achieving, one would expect that this burden of transfer to have impeded the performance of the Lexia students on the DRA.

The success of the program, despite this added burden of transfer, and despite the expected implementation dip, is striking. The timeframe for the training was narrow, and the efforts of the OIT personnel did much to offset local technology and training challenges. However, what is still not known is whether, given a fully functioning technology and a fully trained staff, Lexia will consistently outperform traditional instruction across multiple grade levels in Boston. In order to answer this question, DSRA recommends that BPS consider supporting a yearlong study with more extensive training and a number of participants at least equal to that of the current study.

References

Fullan, M. (2001). *Leading in a culture of change*. San Francisco: Jossey-Bass.

Appendix I: Teacher Surveys

DavisSquare Research Associates
Survey on Using Computers to Teach Reading

January, 2004

Dear Colleagues, As part of the evaluation of the Lexia Phonics Program, we are conducting the following pre-survey on your current uses of computers to teach reading. All answers will be kept in strict confidence, and thank you for your kind and generous cooperation!

Your Name: _____

Your School: _____

How many years have you been teaching in an elementary school?

_____

1. How comfortable would you say you are in using a computer

For your personal needs *outside the classroom:*	Not at all comfortable	Somewhat comfortable	Generally comfortable	Very comfortable
For teaching *in the classroom:*	Not at all comfortable	Somewhat comfortable	Generally comfortable	Very comfortable

2. Overall, how effective do you think computers are in helping young children learn to read?

I don't think computers are very effective.	Perhaps computers can be effective, under some conditions.	I think computers are often effective.	I think computers are an excellent way to teach reading.

3. How often do you use computers to teach your students to read?

Never	Occasionally	Fairly often	Very often

4. On average, how much time per week do your students use computers for reading activities?

None	Less than 30 minutes	30 minutes to an hour.	More than an hour.

5. One of the challenges in designing educational software is ensuring that the content correlates to state standards. Which of the following statements best expresses your opinion?

It's a non-problem.	It can be a problem once in a while.	It is an ongoing problem.	It's such a problem that I worry about using software at all.

6. How often do you use computers for assessing the students' learning in reading?

Never.	Maybe once in a while.	Sometimes, but I still rely on paper and pencil tests.	I frequently rely on computer-based assessments.

7. What are the three top pieces of software that you are presently using to teach reading in your class?

8. On a scale of 1-4, how would you rate the following features of using computers to teach reading. Think of the software that you use most frequently.

	Computers are not effective at this	**Computers are somewhat effective at this**	**Computers are quite effective at this**	**Computers are highly effective at this**
Students can work at their own pace	1	2	3	4
Students can receive immediate feedback	1	2	3	4
It's easier to individualize instruction.	1	2	3	4
Students find computer work engaging	1	2	3	4
Students find it easier to concentrate using computers	1	2	3	4
Computers make it easier to sequence skills effectively	1	2	3	4
Computers are good for helping children learn to write	1	2	3	4
Computers make it easier to find developmentally appropriate materials	1	2	3	4

9. How do you expect Lexia to help students improve their reading abilities?

	Not at all	Maybe a little	To help a lot	To make a critical difference
Help students become more fluent readers	1	2	3	4
Help you with remediation of students who fall behind	1	2	3	4
Help increase collaboration among students on reading assignments	1	2	3	4
Help students develop vocabulary	1	2	3	4
Help increase the level of student engagement in reading	1	2	3	4
Help promote student communication skills	1	2	3	4
Help students become better writers	1	2	3	4

DavisSquare Research Associates
Survey on Using Computers to Teach Reading

May, 2004

Dear Colleagues, As part of the evaluation of the Lexia Phonics Program, we are conducting the following post-survey on your opinions on using Lexia. All answers will be kept in strict confidence, and we thank you for your kind and generous cooperation!

Your Name: _____

Your School: _____

1. Overall, how effective do you think Lexia is in helping young children learn to read?

I don't think Lexia has been very effective.	Perhaps Lexis can be effective, under some conditions.	I think Lexia is often effective.	I think Lexia is an excellent way to teach reading.

2. On a scale of 1-4, how would you rate the following features of using Lexia to teach reading.

	Lexia is not effective at this	**Lexia is somewhat effective at this**	**Lexia is quite effective at this**	**Lexia is highly effective at this**
Students can work at their own pace	1	2	3	4
Students can receive immediate feedback	1	2	3	4
It's easier to individualize instruction.	1	2	3	4
Students find Lexia work engaging	1	2	3	4
Students find it easier to concentrate using Lexia	1	2	3	4
Lexia makes it easier to sequence skills effectively	1	2	3	4
Lexia is good for helping children learn to write	1	2	3	4
Lexia makes it easier to find developmentally appropriate materials	1	2	3	4

3. How strongly would you like to receive training on explicit phonics instruction?

❑ **Not at all** ❑ **Maybe somewhat** ❑ **Yes, good idea** ❑ **I strongly favor this**

4. How has Lexia helped students improve their reading abilities?

	It hasn't helped at all	It has helped a little	It has helped a lot	It has made a critical difference
Helped students become more fluent readers	1	2	3	4
Helped you with remediation of students who fall behind	1	2	3	4
Helped increase collaboration among students on reading assignments	1	2	3	4
Helped students develop vocabulary	1	2	3	4
Helped increase the level of student engagement in reading	1	2	3	4
Helped promote student communication skills	1	2	3	4
Helped students become better writers	1	2	3	4

5. **On the basis of your experience with Lexia, how strongly would you favor the district-wide adoption of a structured phonics program?**

❑ **Not at all** ❑ **Maybe somewhat** ❑ **Yes, good idea** ❑ **I strongly favor this**

6. **What further training or support would you like to receive?**

	This would not be helpful	This might help a little	This would be helpful	This would help a lot
Further training in a structured phonics program to accompany Lexia	1	2	3	4
Help in keeping Lexia working	1	2	3	4
Inservice training on using Lexia	1	2	3	4
Training on integrating Lexia into the curriculum	1	2	3	4
Training on integrating Lexia into the Workshop model	1	2	3	4
Training on using the Lexia assessment system	1	2	3	4