

A Cost Analysis of K-2 Early Literacy Assessments
STAR Early Literacy, DIBELS and TPRI

A case study conducted by
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Abstract

Interviews were conducted at seven public schools in five states regarding the materials, time and other resources required to administer three different early literacy assessments for students in kindergarten through second grade. All seven of the schools used STAR Early Literacy. Five of the schools used the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) and two used the Texas Primary Reading Inventory (TPRI) in addition to STAR Early Literacy. The basic costs that schools incur for giving the assessments are of two general types: direct costs, which represent materials expenditures and student fees for using scoring and reporting services, and opportunity costs, which represent the time spent by professional staff (teachers and support staff) administering the assessments. It is assumed that teachers would be engaged in planned classroom instruction if not for the time spent on the assessments.

Both DIBELS and the TPRI are administered using a one-to-one interview format, using either pencil and paper or a handheld computer (PDA). STAR Early Literacy is a computer adaptive literacy assessment typically administered to an entire classroom in a computer lab setting. The results of this study indicate that both in terms of direct costs and opportunity costs, STAR Early Literacy is a more cost effective assessment relative to DIBELS and TPRI. Costs were measured and applied to an average school, based on the demographics of the schools in the study.¹ A summary of the annual costs associated with these assessments is presented below:

<u>Assessment</u>	<u>Annual</u>	<u>Per Assessment</u>	<u>Per Student</u>
STAR Early Literacy	\$ 1,838	\$ 613	\$ 6.86
DIBELS	\$ 5,423	\$1,808	\$20.24
TPRI			
paper	\$13,098	\$4,366	\$48.87
handheld	\$11,190	\$3,730	\$41.75

In addition to the cost savings, STAR Early Literacy was widely recognized for the ease with which it can be repeatedly administered, for performance reports that can be accessed in a timely fashion and for the specific information that those reports convey. Training and preparation time was reported to be greater for DIBELS in particular, than for the other tests. Finally, because they are time-intensive assessments both DIBELS and TPRI create additional opportunity costs due to foregone direct instruction and classroom disruptions that are minimized when administering STAR Early Literacy to an entire classroom at one sitting.

¹ Six of the seven respondent schools were used to determine the average school. One school had just 27 students in kindergarten through second grade and was vastly different than the other respondent schools and was therefore analyzed separately.

Background

Christensen Associates has been contracted by Renaissance Learning to conduct a usability study for their product, STAR Early Literacy. This computer adaptive assessment has been developed to assess the reading abilities of elementary school students in kindergarten through second grade. The study was designed to examine the resources and costs required for schools to use STAR Early Literacy in comparison with the costs associated with other widely used early literacy assessments. The two comparison assessments in this study are the Dynamic Indicators of Basic Early Literacy Skills (DIBELS), which was developed in conjunction with the University of Oregon and the Texas Primary Reading Inventory (TPRI), which was developed by the Texas Education Agency.² We examine costs associated with administering these assessments to students in kindergarten through second grade only.

Standardized literacy assessments are used to help teachers determine a student's literacy skills and to help measure a student's progress as compared to a baseline ability level. Schools are often required to report the progress students have made over the course of a school year to state and federal departments of education. These assessments have taken on added importance due to the increased emphasis placed on early literacy by the US Department of Education and related state programs. In many cases, grants are available to schools to purchase materials used in the assessments.

Methodology

Seven schools were selected to participate in the study; two each in the states of Alabama and Texas, one in Oklahoma, one in Kansas and one in Pennsylvania. Six of the schools were similar in size ranging from 3 to 7 classes per grade level, kindergarten through second grade. The average class size in this study was approximately 18 students. Detailed information on the demographics of the respondent schools can be found in Appendix A. All of the respondent schools employ the STAR Early Literacy assessment. Five of them use DIBELS as their primary standardized assessment tool and two of the schools use the TPRI, which is similar to DIBELS in process and scope, though not all

² It has since been revised with the assistance of the University of Texas-Houston.

components are strictly timed. Interviews were conducted either on site or by telephone, with teachers and administrators, to determine the time and resources required to conduct the assessments.

One respondent school is a small, rural school in Kansas with only 10 students in kindergarten, 9 in first grade and 8 in the second grade. They had a license to use STAR Early Literacy on only one computer and were therefore required to give the assessment to only one student at a time. In addition, the teachers at this school provided estimates to give and score the DIBELS test that were much greater than their counterparts at the other respondent schools. For these reasons, when considering averages in this study, results from this school were excluded and their costs are discussed in detail in a separate section.

The method of administering the DIBELS and TPRI varies from school to school while most schools administer STAR Early Literacy to an entire classroom of students, in a computer lab. A brief description of the assessments being evaluated in this study is provided below.

Dynamic Indicators of Basic Early Literacy Skills (DIBELS)

DIBELS is a timed assessment given by one interviewer to one student at a time. There are a number of components for each grade level, kindergarten through sixth grade, that are timed in one to three minute intervals. DIBELS can be administered using a pencil and paper format or using a handheld computer. All of the respondents in the study used the pencil and paper format. Developed in conjunction with the University of Oregon, the DIBELS assessment booklets can be downloaded and printed from the DIBELS website at no cost.³ Test kits containing the booklets and instructions can also be purchased from Sopris West, an education services company, for a fee. Schools are also charged one dollar per student per year to use the DIBELS Data System. This is an internet based scoring system and database that keeps a record of a student's scores over time. Educators can also have performance reports printed using this system.

³ Other than associated costs for printing the booklets (staff time, paper, ink, etc.).

As it is a one-on-one assessment tool, the primary cost components for DIBELS include testing materials, staff time and, depending on the method of administering the test, foregone planned instruction. This DIBELS benchmark assessment is generally administered to students three times per year; at the beginning, middle and end of the school year. An optional companion component to the benchmark assessment is progress monitoring, consisting of mini-assessments directed at students who score below the grade level benchmarks, often given weekly. DIBELS components and the grade level to which they are typically administered are listed below:⁴

<u>Component</u>	<u>Grade Level</u>
Letter Naming Fluency	K (Beg.) - 1st (Beg.)
Initial Sound Fluency	K (Beg. Mid.)
Phoneme Segmentation Fluency	K (Mid.) - 1st (End)
Nonsense Word Fluency	K (Mid.) - 2nd (Beg.)
Oral Reading Fluency	1st (Mid.) - 3rd (End)
Retell Fluency	1st (Mid.) - 3rd (End)
Word Use Fluency	K (Beg.) - 3rd (End)

The Texas Primary Reading Inventory (TPRI)

TPRI is similar to DIBELS in that it has several components for each grade level and is administered using a one-on-one format. Unlike DIBELS, however, most of the components administered in this assessment are not timed. The TPRI can be administered using a pencil and paper approach or using a handheld computer. Respondents in this study employ both techniques. It is administered two times per year for kindergarten students (middle and end of year) and three times per year for students in grades 1-3 (beginning, middle and end). At all grade levels, the TPRI consists of both a screening section and an inventory section. The screening section provides a quick assessment of child's literacy skills and the inventory section provides a more detailed assessment of a child's specific deficiencies.⁵ Schools purchase classroom kits for each

⁴ From DIBELS Administration and Scoring Guide, http://dibels.uoregon.edu/measures/files/admin_and_scoring_6th_ed.pdf

⁵ TPRI Technical Report; <http://www.tpri.org/Documents/19981999TechnicalReport.pdf>.

grade level for a flat fee that includes access to an online tabulation and reporting system. TPRI components and grade levels to which they are administered are listed below:⁶

<u>Component</u>	<u>Grade Level</u>
 Screener 	
Graphophonemic Knowledge	K – 1st
Phonemic Awareness	K – 1st
Word Reading	1st – 3rd
 Inventory 	
Book and Print Awareness	K
Phonemic Awareness	K – 1st
Listening Comprehension	K – 1st
Graphophonemic Knowledge	K – 3rd
Reading Accuracy	1 – 3rd
Reading Fluency	1 – 3rd
Reading Comprehension	1 – 3 rd

STAR Early Literacy

STAR Early Literacy is described as a computer-adaptive assessment. It is primarily designed for use by students in kindergarten through second grade, though it can be used for students in Pre-K through grade three. The test is taken by students working at a computer using both audio and visual prompts, requiring minimal teacher supervision. In addition, the questions are adaptive based on the student’s previous answers, allowing customized measurements within a specific time frame. It is also designed to be brief, allowing repeated testing with minimal effort.

Renaissance Learning currently offers two options for STAR Early Literacy. The actual assessment is the same in both versions. The first is a stand-alone network/desktop version that schools install on specific computers or a local area network. Schools pay upfront licensing fees to use this version of the assessment and incur no annual fees. The second version is called Renaissance Place, which is a web based platform on which STAR Early Literacy and other Renaissance Learning products operate. For this version, schools pay a one-time set-up and license fee and an additional amount for each student that is enrolled to use the assessment. The per-student charge is the only recurring cost

⁶ From TPRI Brochure: http://www.txreadinginstruments.com/pdf/TPRI_brochure.pdf.

for using the assessment.⁷ A database tracks a student's performance over time and enables the teacher to generate and print a series of reports. Although STAR Early Literacy does not have specific subtests, the assessment covers seven skill domains identified as critical for reading development, as listed below:⁸

General Readiness (GR) – Understanding of written word length, position words, words vs. letters, basic numeracy, word matching, word boundaries, shapes, and sequences.

Graphophonemic Knowledge (GK) – Understanding of letter names and sounds, alphabetic letter sequence, and alphabetical order.

Phonemic Awareness (PA) – Understanding of rhyming words, ability to blend word parts and phonemes, sound discrimination, oral word length, and ability to identify missing sounds.

Phonics (PH) – Understanding of long vowels, short vowels, beginning and ending consonants, consonant and vowel replacement, word families (onset and rime), consonant blends, clusters and digraphs.

Comprehension (CO) – Ability to read and derive meaning from words, sentences, and paragraphs.

Structural Analysis (SA) – Ability to find words within other words, build words and compound words.

Vocabulary (VO) – Knowledge of high frequency words, synonyms, and antonyms.

This report makes no determination regarding the functional reliability or validity of the assessments. It is assumed that they are equally reliable and valid, thus providing similar measures of a student's early literacy skills.⁹ The main purpose of this study is to compare the relative costs in time and resources required by each of the three assessments. During the interviews participants were asked a series of questions to measure these costs and were asked how the assessment results were used. Anecdotal information is cited regarding additional costs or benefits that could not be empirically measured.

The interviews took place between May and October of 2005. The method of interviews varied between individuals and small groups. In each school the administrator and at

⁷ This fee also includes technical support.

⁸ STAR Early Literacy Technical Manual.

⁹ Many respondents stated that the results of the different assessments appeared to be highly correlated.

least one teacher per grade level K-2 was interviewed. Other relevant staff members were interviewed depending on their role in administering the assessments (i.e. Reading Coordinators, Title I teachers, technology teachers, etc.). An outside consultant was interviewed at one school. The consultant was a retired teacher hired by the school specifically to administer the DIBELS assessment.

Results

The two primary cost components compared in this study are direct costs and opportunity costs. Direct costs represent the price of the testing materials, licensing fees and/or fees for access to internet based scoring and reporting services. Opportunity costs, on the other hand, refer to the cost of professional staff time in terms of both compensation and lost classroom instruction.

Direct Costs

First we examine the direct costs. In many cases, schools do not pay for the testing materials or the cost is covered by grants or specific funds, however, the materials are being purchased at some level.

Respondents in the study reported that no additional desktop computers or server hardware purchases were required to administer the assessments. STAR Early Literacy requires desktop computers or workstations to administer the assessments and both DIBELS and TPRI require computers with internet access to process scores and to print reports. One school purchased handheld computers specifically to administer the TPRI. Therefore, with the exception of the handheld computers, no computer hardware costs were included in our analysis.

The cost of DIBELS testing materials is varied by school. Generally the materials include stopwatches/timers for each test administrator and a benchmark test booklet for each student (plus booklets for progress monitoring, if applicable).¹⁰ In some cases test booklets were provided by the respective state department of education or school district.

¹⁰ DIBELS can also be administered using a handheld computer, though no schools in this study reported using this method of administration.

At least one school in the study purchases DIBELS administration kits from an educational services company called Sopris West. Kits purchased from Sopris West include all materials for three benchmark assessments per year for 25 students and progress monitoring booklets for six students. These kits cost \$69 and one kit covers one classroom.

While it is possible that there may be cost savings from printing and copying the booklets internally, none of the schools interviewed currently print their own benchmark booklets. In all cases the test booklets were either provided by the state department of education, by the school district or were purchased through Sopris West. Two schools had prepared the booklets internally in past years. One respondent stated that it took four days to print, copy and prepare the benchmark booklets and an additional day and a half to prepare progress monitoring booklets. A respondent at another school reported purchasing an ink printing cartridge for \$800 to print the booklets because they must be in color. In this study, the cost for DIBELS test materials is assumed to be \$69 per classroom.

In addition, schools are charged one dollar per student to use the DIBELS Data System for online scoring and reporting. All schools in the study pay for and use this feature. Given this, it would cost about \$87 per classroom per year (assuming an average class size of 18 students) for materials and other direct costs associated with administering the DIBELS assessment. Using \$69 per classroom for materials costs, the total annual cost for schools in the study ranged from \$965-\$1701.¹¹

The TPRI can be administered either using a pencil and paper test or using a handheld computer (PDA). Two schools using the TPRI were interviewed for this study; one used a pencil and paper version of the assessment, while the other used a handheld computer. In either case, specific test materials are required to administer the TPRI and include a magnetic board, foam letters and other manipulative items, in addition to scoring booklets.

¹¹ One respondent school from Kansas excluded from these numbers because of their extremely low class sizes. It would be more efficient to make copies.

TPRI grade level classroom kits are available through various publishers and are listed online at Texas Reading Instruments. They are available in either one or two year kits.¹² One year kits cost \$225 per classroom and two year kits cost \$275 per classroom. In each case 10% of the purchase price is added for shipping and handling. Assuming schools will be interested in the cost savings, we assume that schools will purchase two year classroom kits, at an average annual cost of \$150 per year.¹³

In addition, one respondent school used handheld computers to administer the TPRI. These devices reportedly cost \$50 each and one was purchased for each classroom teacher. The expected lifetime of these devices is approximately three years.¹⁴ Therefore, the per classroom materials cost over three years is \$167 ($\$150 + \$50/3$) per year for this school. In order to use the devices, software must be installed to enter and score the TPRI results. This software also enables the device to upload the scores directly to the TPRI scoring and reporting website. This service, provided through a third party supplier, cost the school \$6.50 per student.¹⁵

As mentioned above, Renaissance Learning offers two versions of the STAR Early Literacy Assessment with slightly different cost structures. The Renaissance Place version of STAR Early Literacy can be purchased for a one time fee of \$1,299 for licensing, set-up and technical support to use this version of the assessment. Schools also pay an annual fee of \$.39 per student to access the database and reporting services.¹⁶ We use this pricing scenario when evaluating costs related to this assessment, however, it is important to note that each of the respondent schools used an older, stand alone version of STAR Early Literacy. The cost for this version is a one time licensing fee of \$1,999 for 200 students, plus \$129 for each additional 50 students. At this price, the schools in the study would have spent an average of \$2,235.50 on the software. Under this pricing

¹² From TPRI Brochure: http://www.txreadinginstruments.com/pdf/TPRI_brochure.pdf.

¹³ \$275 plus \$27.50 for shipping is \$302.50. Divided by two is approximately \$150 per classroom, per year.

¹⁴ Per the learning coordinator at the respondent school, some of the devices are already starting to malfunction in the second year.

¹⁵ It is my understanding that DIBELS is also available through this third party service. One web page suggests the cost could be as high as \$15.00 per student (<http://www.cltl.org/new/dibels.htm>).

¹⁶ Renaissance Place can also be accessed for a flat fee of \$4.50 per year for each student, with no up front fee. This option may be preferable for a small school, such as the respondent school from Kansas.

scenario, there is no recurring annual fee for using this software. At least two of the schools indicated that they were moving to Renaissance Place versions of STAR Early Literacy, although this question was not directly asked.

Table 1 identifies the direct costs associated with the three assessments based on the demographics of an average school in our study.¹⁷ There are two distinct methods of administering the TPRI; using pencil and paper and using a handheld computer, therefore, there are two distinct direct cost measures. STAR Early Literacy requires a one-time fee. To more directly compare the annual costs, this one time fee is spread out over three years. It is likely that a school will use the same version of STAR Early Literacy for greater than three years and the longer a school uses this assessment, the lower its average annual cost. The only recurring charge for using the Renaissance Place version of STAR Early Literacy is a fee of \$.39 per student. As Table 1 indicates, the average annual cost for the materials and fees associated with the assessments is lowest for STAR Early Literacy at approximately \$538. The annual direct cost for DIBELS is \$1,303 and for TPRI it is \$2,250 using pencil and paper and \$4,244 using a handheld computer.

Opportunity Costs

An added cost associated with any assessment is the opportunity cost of the teacher's time in delivering lessons to their students. In order to attach an empirical value to these opportunity costs, we measure the time that staff spend administering the assessments and use an average salary rate to determine the cost of the time spent on assessments instead of on delivering planned instruction.

Teachers were asked to describe the school's method for giving the assessments and were questioned about their involvement in the process including the time and resources they use to administer the tests, how they score the tests and how they use the results of the assessments.

¹⁷ Excluding the respondent school in Kansas, average class size in the study is 18 students, average number of classes per grade level is 5 (15 for K-2). Average total students in grades K-2 is 268.

Respondents reported using a variety of methods for administering the DIBELS assessment. These methods ranged from using a testing team composed of professional staff, hired consultants and/or classroom teachers where students are pulled out individually to a separate testing location, to having the classroom teacher give the assessment during their regular class time while the remaining students work at their desks. One school used a hybrid approach, sending an entire classroom to a separate location where each child is separately tested away from the large group by a dedicated team of test administrators.

The least obtrusive method of administering the test among the respondents was a process in which a team of four retired teachers were hired by the school district as consultants through an employment agency. The testers went to each classroom and pulled out students one at a time. In this scenario classroom teachers reported that they continued teaching their regular lesson plan and generally reported that, aside from the students entering and leaving the classroom, disruption was minimal and no lesson time was lost. When the tester is a classroom teacher giving the assessment in the classroom, the time spent administering the assessment represents foregone instruction.

In measuring opportunity costs, the time to administer the actual assessment plus the time required to score and enter the data were measured. Other time components are involved, however, they were either difficult to measure or were not as directly comparable. These additional components include training, teacher preparation time (e.g. time spent making copies, gathering and organizing materials, etc.) and reviewing the test results. These non-comparable costs will be discussed in more detail later.

The DIBELS Administration and Scoring Guide provides some indication of the time required to give the assessment.¹⁸ Each grade level is administered various DIBELS components depending on the testing period, therefore, an average of the DIBELS timed components was determined for each grade level to allow a per assessment measurement of the time required. Teacher estimates from the interviews generally included the transition time for getting the students prepared to take the assessment. This transition

¹⁸ http://dibels.uoregon.edu/measures/files/admin_and_scoring_6th_ed.pdf

time includes getting the student physically to and from the testing location, giving instructions to the student and addressing any disruptions that take place during the testing period. An additional measure was included for the time required to tabulate the scores and enter them into the online DIBELS Data System.

During the interviews, per-student time estimates given by the teachers were varied, however, they generally fell in the range of the timed data provided by DIBELS, plus added minutes for transition time. These estimates were in the range of five minutes per student to as high as 15 minutes per student. Estimates provided for scoring and entering data for each student also varied and were in the range of two minutes to 15 minutes per student.

In an effort to streamline the measures used in the study, the average DIBELS time per component was applied (particularly given that these are timed tests) with an additional five minutes added per assessment to account for transition time and scoring and entering the scores into the DIBELS database. The assumption of an additional five minutes is based on the weighted average difference between the DIBELS estimates for giving each component compared to the estimates given by the interviewed teachers in our study. For kindergarten this average is approximately 11.33 minutes per student, for first grade, 11.67 minutes and for second grade, it is 8.67 minutes per student.¹⁹ These times compare favorably with the estimates provided by the interviewees²⁰ and these averages were applied to measure the opportunity costs associated with administering DIBELS. Using the actual numbers provided by the respondents for time and hourly compensation, the average opportunity costs per round of testing ranged from \$650 to \$1375 per round.²¹

Teachers in both schools using the TPRI conducted the assessments during regular class time. As noted above, one school used a handheld computer, while the other used a

¹⁹ See Table 2.

²⁰ Average time for kindergarten, first and second grade as estimated by study subjects is, 11.36, 10.15 and 9.27 minutes respectively. Not all schools tested each and every component recommended by DIBELS, therefore it is expected that these estimates would be slightly lower.

²¹ \$650 is an estimate from a school that does not administer two of the recommended DIBELS components. The other three respondents all had costs greater than \$1,300 per round.

pencil and paper approach. For kindergarten through second grade, the average time as reported by the classroom teachers using the handheld computer was 15, 20 and 17.5 minutes per student respectively. No time was required for scoring the assessments because they were scored and entered automatically using the handheld device. For the school using the pencil and paper approach, times were more varied by grade level, however these estimates were 15, 30 and 15 minutes to administer the assessment, with an additional 1 to 15 minutes estimates to score each test and enter the data. Overall, the average time to give the assessment using a handheld computer was approximately nine minutes per student less than using pencil and paper. Opportunity costs for these two schools were estimated at approximately \$1,900 and \$2,200 per round respectively.

Although there was some variation in the method of assessment, the majority of schools administered STAR Early Literacy during a regularly scheduled computer lab period. During the period it was common to have two professional staff members present (e.g. specialist teacher and regular classroom teacher), though this was not always the case. In one respondent school classroom teachers had the option to administer the assessment on computers in their classroom, though this option was a rarely used. The time required to administer the STAR Early Literacy assessment was typically estimated at an average of 15 minutes per student and an average of 30 minutes for an entire classroom. While 10-20 minutes was given as a per student range by many respondents, there is added time transitioning the classroom to the computer lab, logging each child into the program, giving assistance, addressing disruptions and printing out the results once the test is completed. For STAR Early Literacy, consistent estimates were given that an entire classroom could complete the assessment in 30 minutes.

To compare the opportunity costs across assessments associated with professional staff time, the average cost per round of testing was determined using the average assessment times discussed above and an average hourly compensation for staff involved in administering the assessment. Administrators at each school were also interviewed to determine average teacher salary. Where precise estimates were not given, teacher pay was determined using a state average based on a wage study conducted by the NEA from

the 2003-2004 school year.²² To apply an average hourly value to the teacher's time, the average annual salary was divided by 187 work days²³ at eight hours per day.²⁴ To determine total hourly compensation we added the value of fringe benefits which were determined to be approximately 19.1% of salary for the respondent schools as measured at the state level.²⁵

In order to more directly compare the results, the time per test was averaged over grade levels K-2 for all of the schools involved in the study. For DIBELS the average time is 10.56 minutes per student. For the TPRI, the average time required for administering and scoring the assessment was determined to be 18 minutes per student using a handheld and 27 per student minutes using the pencil and paper approach (including transition and scoring time). Both assessments are given one-to-one, therefore, the more students enrolled, the more staff time will be required to administer the test (i.e. these are variable costs depending on the number of students). The time required to administer the STAR Early Literacy Assessment averaged 30 minutes for an entire class for a single round of assessment.

To compare baseline costs, we apply these average estimates to an average school as determined by the respondent schools. The average number of K-2 students in the average school is 268, with 5 classrooms per grade level (15 classes total, one teacher per classroom) and an average class size of 18 students.²⁶ Given these averages we can determine the time required per round. Using the average hourly teacher compensation (wages + fringe benefits) for schools in our study, \$28.91, opportunity costs for each assessment are shown Table 3.²⁷ The cost as valued by a teacher's hourly compensation is much less for STAR Early Literacy than for either of the one-to-one assessments. As Table 3 indicates, staff time per round of testing is minimal, at 30 minutes for two staff

²² <http://www.nea.org/edstats/images/05rankings.pdf>, Table C-11, p. 19. Also, one respondent school employed outside consultants to administer the DIBELS assessment. They reported earning \$28.50 per hour and we applied this hourly rate to this particular school.

²³ <http://www.nea.org/edstats/images/status.pdf>, p. 7.

²⁴ Because teachers are salaried employees working on a 10 month work year and hours per day spent at school varies greatly by teacher, therefore a standard eight hour work day was used to determine hourly pay. See Appendix B.

²⁵ Source: http://nces.ed.gov/pubs2004/rev_exp_02/table_06.asp. See Appendix B.

²⁶ See Appendix A.

²⁷ For the United States, the average hourly salary rate for teachers is \$31.25. See Appendix B.

members per classroom. For an average school in our study, the opportunity costs are \$434 in staff compensation to administer the STAR Early Literacy assessment, compared to \$1,374 to give each round of DIBELS and \$2,315 and \$3,616 per round for the TPRI (handheld and pencil/paper, respectively).

Summary of Costs

DIBELS is typically administered to all students in grades K-2 three times per year, as was the case at all schools in the study. The TPRI is given twice a year to all kindergarten students and three times to all students in first and second grades. All respondent schools reported administering STAR Early Literacy at least three times per year. Several schools allow the classroom teacher discretion over how many times the assessment will be given beyond that. Two schools administered the assessment three times per year in conjunction with either DIBELS or TPRI. STAR Early Literacy was administered an average of four to six times per year across the respondent schools, which can be attributed to its ease of administration. However, several respondents reported only using STAR Early Literacy at the beginning of second grade.

In order to annualize and compare costs it is assumed that each assessment is administered to students three times per year. Table 4 presents a summary of the direct costs and the opportunity costs of all three assessments broken into three measures; cost per round of testing, annual cost and cost per student. All of these costs are reported based on an average respondent school, with 268 students, five classrooms per grade level and an average class size of 18 students. As in Table 1, the direct costs are presented as an annual cost spread over three years for the STAR Early Literacy licensing fee.

As Table 4 indicates, STAR Early Literacy is relatively inexpensive to administer in terms of both direct costs and opportunity costs, expressed as the value of an educator's time, compared to both DIBELS and TPRI. When taken together the annual cost for administering STAR Early Literacy three times is \$1,838, compared to \$5,423 for DIBELS, \$13,098 for TPRI using the pencil and paper approach, and \$11,190 using a handheld computer. Table 4 also presents an average cost per student for both direct

costs and opportunity costs to arrive at a total cost per student. This figure is most meaningful in terms of the average opportunity costs for the one-to-one assessments, DIBELS and TPRI, because these costs are determined on a per student basis and are variable (i.e. each student incurs additional opportunity costs). STAR Early Literacy is typically administered to a classroom at a time, and is therefore not relatively more expensive with each additional student until an additional classroom is added. However, these averages provide a general measure of the costs required to administer these assessments.

Results from an outlier school

One respondent school represents a distinct exception relative to the other schools in the study both in the size of the school and in the methodology for giving the assessments. There is one classroom per grade level in kindergarten through second grade. There are 10 students in kindergarten, nine in first grade and eight in second grade.

The grade level teachers administered the DIBELS assessment with one child at a time in the classroom. The remaining students were present during this time. In kindergarten, one additional staff member assists with the testing while the remaining students work at their desks; in first grade, support staff (Title I and Special Ed. Teacher) instructs the class while the teacher gives the assessment (during a regularly scheduled Guided Reading session); and in second grade, the teacher gives the assessment without additional assistance. It was estimated that a Title I paraprofessional spent approximately 15 hours per year helping prepare and administer the DIBELS assessment.²⁸ DIBELS test booklets are printed and assembled at the school for all 27 students in K-2 as part of this time. Estimates for administering the DIBELS assessment and scoring and printing reports were reported to be 30 minutes per student at kindergarten and first grade and 37 minutes for 2nd grade. Including the \$1 per student fee, the total annual cost for administering DIBELS to all 27 students was determined to be about \$415 per year.

This respondent school only purchased one computer license to use STAR Early Literacy which necessitates that they administer one assessment at a time. Students are sent to the

²⁸ The hourly pay for this employee was reported to be \$10.00 / hour.

computer lab and the technology teacher provides assistance such as logging into the software and giving general instructions. The classroom teacher is not in attendance during the STAR Early Literacy assessment and the technology teacher is actively instructing other students. It was estimated that the technology teacher spends about an hour and a half per round of testing on STAR Early Literacy. Classroom teachers reported that it took students approximately 20 minutes to leave and return from taking the assessment. Given the optional pricing for Renaissance Place referenced above, this school would likely pay the \$4.50 per student rate, for a total annual cost of \$121.50 ($\4.50×27 students). The current staff time per round for this school was estimated at 1.5 hours at an average hourly wage of \$21.37 (for the Technology Teacher), for a total cost of \$32.06 per round, or \$96.17 annually. This represents total annual costs of \$218 to administer STAR Early Literacy.

Qualitative Factors

Added opportunity costs also arise depending on the methodology used to administer the assessment. Schools that employ the classroom teacher to administer the assessment or methods that otherwise disrupt the routine of the entire classroom also create foregone hours of instruction during each round of testing. Teachers giving the DIBELS and TPRI in their classrooms reported that the testing environment can be challenging due to disruptions from other students who were not taking the test.

First grade teachers administering the TPRI at both schools reported that the test was particularly burdensome. At one school, the first grade teachers reported taking nearly four weeks to complete a round of testing. In both schools administering the TPRI, respondents provided the highest per student estimates at the first grade level.

Training provided to teachers and test administrators also varied greatly among the schools. In general, teachers required more training and periodic review for the TPRI and DIBELS assessments. These one-to-one assessments require a teacher to directly administer the assessments and rate a student's response, and in most cases to score the test. Training ranged from two full-days for a team of testers at one school, to an hour or two of training given by a staff member who had previously been formally trained.

Formal training was typically given only one time to testers. The most time spent on training was at a school where all respondents reported receiving a day and a half of training to give the DIBELS assessment. The formal training reported for the TPRI was less than DIBELS with respondents reporting about an hour of test specific training on average. Additional training was required for administering the TPRI using the handheld computer, though the estimate was about 15-20 minutes per teacher. Training for STAR Early Literacy also varied from staff members attending conferences sponsored by Renaissance Learning to teachers simply taking the assessment themselves. Generally the least amount of time was reportedly spent on training for the STAR Early Literacy Assessment compared to DIBELS and TPRI.

The amount of time spent preparing materials for the assessments varied widely as reported by the respondents. Teachers most often reported a quick review of the materials and instructions for DIBELS and TPRI accompanied with some discussion at team or grade level meetings. More time was reportedly spent prior to the first round of testing in the fall. In schools using a team of testers about an hour per day, per round, was reported for preparation and organizational time. Other teachers reported review time between 30 minutes to an hour before each round. For STAR Early Literacy, some staff time was spent entering the names of new students into the system and ensuring that the software was functional prior to the first round of testing. In general no additional preparation time was required once a teacher was familiar with the assessment. On average, more time was reportedly spent preparing for DIBELS and TPRI, particularly with the use of the pencil and paper approach, as compared to STAR Early Literacy.

DIBELS also uses a separate progress monitoring component. Progress monitoring is generally a one-minute timed test of one or more components. This is designed to measure a student's progress between the benchmark assessments. One of the schools interviewed had decided to forego progress monitoring completely. Other respondent schools do not progress monitor with the same frequency, which made a direct measure difficult. Some schools elected to progress monitor only at-risk students while some progress monitor all students, with less frequency for students who are benchmarked than for those who are at-risk. In schools where progress monitoring was routinely used,

classroom teachers spent about one-half hour to one hour per week on this activity. This was not included in the cost comparison but represents an additional time burden to the teachers. It was noted that teachers performing progress monitoring appreciate the opportunity to work one-on-one with their students on the assessment, particularly in schools where the classroom teacher did not administer the DIBELS benchmark assessment.

Use of additional support staff to administer assessments was relatively uncommon at the subject schools. Educational Aides were most often cited as being used to help supervise students during testing periods and were not used to administer any assessments. At one school, paraprofessional aides provided class coverage for three classroom teachers who were on the DIBELS testing team. However, these aides were already assigned to the classrooms and therefore did not represent an additional cost. Generally, no additional staff was hired as direct result of the assessments, with the exception of one school at which four retired teachers were hired to administer the DIBELS assessments.

Teachers discussed the potential for “test administrator” bias entering into the DIBELS and TPRI administration. This can occur if a classroom teacher gives prompts or when anonymous testers invoke apprehension in younger students. Some interpretation is required because portions of the assessments are delivered orally. Because STAR Early Literacy is administered on a computer, no test taker bias is possible. For this reason, several teachers and administrators reported that STAR Early Literacy is a helpful compliment to assessments such as DIBELS and TPRI, which are state or district required.

STAR Early Literacy is rated as easy to administer and the performance reports provide specific information regarding a student’s deficiencies that cannot be obtained from the other assessments. Each of the assessments provides printed reports, however, the STAR Early Literacy reports were typically received more promptly by respondents in the study. The results for DIBELS and TPRI often lagged the completion of the tests from a week to more than a month. STAR Early Literacy reports were generally received on the same day as the assessment.

The amount of time spent reviewing the assessment results was found to vary greatly among the respondents. Some teachers stated several hours of review for each round, while others reported reviewing the results only briefly or intermittently. The amount of time spent reviewing results was not substantially different between the three assessments. However it was widely reported that the STAR Early Literacy reports were more intuitive and provided more specific information regarding a child's deficiencies. This is particularly true if the classroom teacher is not the administrator of the DIBELS or TPRI assessment. In schools where classroom teachers administered the assessments, it was generally cited that the one-on-one interview format allowed the teacher to ascertain a student's deficiencies. As noted above, however, lost instruction time is greatest using this testing method. Teachers reported using results from all assessments to help guide their instruction for individual students. Respondents often reported using the STAR Early Literacy parent report for use in parent/teacher conferences.

Teachers generally reported few problems with the students using the computer and/or the mouse. To help assuage this concern, teachers often had the youngest students practice on the computer before taking the test and some schools delayed administering the STAR Early Literacy assessment to ensure students received some computer instruction beforehand.

One disadvantage of STAR Early Literacy reported by a small number of respondents was the inability to determine a student's intent when answering questions and that a student could possibly guess the answer. This concern was cited by teachers who administered the DIBELS or TPRI directly to their students. In this situation, teachers reported that the one-to-one interaction allowed them to discern a student's deficiencies because of their direct involvement. However, when classroom teachers did not directly administer the assessments, they reported that STAR Early Literacy reports provided more detailed information regarding a student's abilities.

Conclusion

Among the three early literacy assessments identified in this study, STAR Early Literacy proved to be the most cost effective in terms of both direct costs represented by materials

expenditures and student fees and opportunity costs, as measured by teacher time and hourly compensation. DIBELS ranked behind STAR Early Literacy in terms of both costs but ahead of the TPRI. Administration of the TPRI using the pencil and paper approach was the most costly assessment overall. Time saved by using the handheld computer to administer the TPRI made up for the relatively high per student fee associated with the third party software vendor. Finally, on other measures such as ease of administration, training and preparation time required, lost classroom instruction and the usefulness of printed reports, STAR Early Literacy consistently ranked ahead of the two comparison assessments in this study, as reported by respondents.

Table 1
Direct Costs for Assessment Materials
 annual, over three years¹

Direct Costs, annually	STAR E.L.	DIBELS	TPRI	
			pencil/paper	handheld
Per test kit/software ²	\$1,299	\$69	\$150	\$167
annual, over three years ³	\$433	\$1,035	\$2,250	\$2,505
Per student fees ⁴	\$0.39	\$1.00	\$0.00	\$6.50
average annual fees per school year ⁵	\$105	\$268	\$0	\$1,739
Total Direct Costs / Year	\$538	\$1,303	\$2,250	\$4,244

Notes:

¹ Estimated at the average respondent school (268 students, 15 classes, average class size, 18). See Appendix A.

² Costs for Star Early Literacy Renaissance Place, DIBELS booklets from Sopris West. For TPRI, booklets from http://www.txreadinginstruments.com/pdf/TPRI_brochure.pdf. For handheld computers, \$50/3 = \$17 + \$150 for the booklets.

³ For Star Early Literacy, the \$1,299 fee is divided by three years to determine the annual cost. For DIBELS / TPRI, the per test kit cost is multiplied by 15 classrooms.

⁴ Per student fees for Star E.L. Renaissance Place, DIBELS Data System and TPRI (affiliated with handheld software).

⁵ Per student fees multiplied by 268 students, based on average respondent school.

Table 2
DIBELS Timed Components

Component¹	Grade Level	Timed (minutes)
Letter Naming Fluency (LNF)	K (Beg.) - 1st (Beg.)	1
Initial Sound Fluency (ISF)	K (Beg, Mid)	3
Phoneme Segmentation Fluency (PSF)	K (Mid) - 1st (End)	2
Nonsense Word Fluency (NWF)	K (Mid) - 2nd (Beg)	2
Oral Reading Fluency (ORF)	1st (Mid) - 3rd (End)	1
Retell Fluency (RF)	1st (Mid) - 3rd (End)	1
Word Use Fluency (WUF)	K (Beg) - 3rd (End)	1

DIBELS Recommended Components, by grade level¹

Grade Level	Beginning		Middle		End	
	Components (#)	Time ²	Components (#)	Time ²	Components (#)	Time ²
Kindergarten	LNF, ISF, WUF (3)	4	LNF, ISF, PSF, NWF, WUF (5)	9	LNF, PSF, NWF, WUF (4)	6
1st Grade	LNF, PSF, NWF, WUF (4)	6	PSF, NWF, ORF, RF, WUF (5)	7	PSF, NWF, ORF, RF, WUF (5)	7
2nd Grade	NWF, ORF, RF, WUF (4)	5	ORF, RF, WUF (3)	3	ORF, RF, WUF (3)	3

Grade Level	Average across three periods³	Average time for Respondents⁴	Avg. Diff.⁵	DIBELS Average + 5 mins.⁶
Kindergarten	6.33	11.36	5.03	11.33
1st Grade	6.67	10.15	3.48	11.67
2nd Grade	3.67	9.27	5.61	8.67

Average time, K-2: 10.56

Notes:

¹ From DIBELS Administration and Scoring Guide, http://dibels.uoregon.edu/measures/files/admin_and_scoring_6th_ed.pdf

² Sum of component times as listed

³ Straight average based on three rounds of components as listed

⁴ One respondent school did not give Retell Fluency and Word Use Fluency in first and second grades, and one respondent did not give Retell Fluency in first or second grades. Therefore, the first and second grades times are underestimated.

⁵ Average difference = average time for respondents minus average DIBELS timed components.

⁶ DIBELS average timed components plus five minutes for transition, scoring and entering data.

Table 3
Opportunity Costs
 based on average respondent school¹

Opportunity Costs (per round of testing)	STAR E.L.	DIBELS	TPRI	
			handheld	pencil/paper
Per student (minutes) ²	15	10.56	17.80	27.80
per classroom (mins.) ³	30	190	320	500
Per school (mins.) ⁴	450	2851	4806	7506
Per school (hours)	7.5	47.5	80.1	125.1
Avg. hourly compensation ⁵	\$28.91	\$28.91	\$28.91	\$28.91
Total Costs per round⁶	\$434	\$1,374	\$2,315	\$3,616

Notes:

¹ Average respondent school (268 students, 15 classes, average class size, 18), see Appendix A.

² Star Early Literacy and TPRI averages based on respondent estimates, for DIBELS, see Table 2.

³ Per student average multiplied by 18 students (average class size).

⁴ For STAR, 30 minutes was given by respondents as time to assess an entire classroom. For DIBELS/TPRI, per classroom average based on 15 classes, grades K-2.

⁵ Compensation = Salary + Fringe Benefits. See Appendix B.

⁶ Hourly compensation multiplied by hours per school.

Table 4
Summary of Assessment Costs
 based on the average respondent school

Direct Costs¹

Assessment	Annual	Per Assessment ³	Per Student ⁴
STAR Early Literacy	\$538	\$179	\$2.01
DIBELS	\$1,303	\$434	\$4.86
TPRI paper	\$2,250	\$750	\$8.40
TPRI handheld	\$4,244	\$1,415	\$15.83

Opportunity Costs²

Assessment	Annual ³	Per Assessment	Per Student ⁴
STAR Early Literacy	\$1,301	\$434	\$4.85
DIBELS	\$4,121	\$1,374	\$15.38
TPRI paper	\$10,848	\$3,616	\$40.48
TPRI handheld	\$6,946	\$2,315	\$25.92

Total Costs⁵

Assessment	Annual	Per Assessment	Per Student ⁴
STAR Early Literacy	\$1,838	\$613	\$6.86
DIBELS	\$5,423	\$1,808	\$20.24
TPRI paper	\$13,098	\$4,366	\$48.87
TPRI handheld	\$11,190	\$3,730	\$41.75

Notes:

¹ Direct Costs from Table 1, measured annually.

² Opportunity costs from Table 3, measured per assessment round.

³ For direct comparison, all assessments assumed to be administered three times per year.

⁴ Average number of K-2 students per school assumed to be 268, based on average schools (Appendix A). To determine average costs per student, annual totals are divided by 268.

⁵ Total costs = Direct Costs + Opportunity Costs in each column.

Appendix A
Schools in Study, Demographic Information

School	Location	Kindergarten			First Grade			2nd Grade		
		Students	Teachers	Avg. Class	Students	Teachers	Avg. Class	Students	Teachers	Avg. Class
Eastern Heights El.	Kirwin, Kansas	10	1	10	9	1	9	8	1	8
Curtiston El.	Atalla, Alabama	113	7	16	99	6	17	109	7	16
A.M. Windham	Daleville, Alabama	92	6	15	103	6	17	102	6	17
Carter & MacRae	Lancaster, Pennsylvania	68	3	23	85	4	22	53	4	14
Ingram El.	Ingram, Texas	72	5	14.4	105	5	21	97	5	19.4
Llano, EL	Llano, Texas	70	4	18	68	4	17	72	4	18
Lindsay, EL	Lindsay, OK	82	4	21	115	6	19	100	5	20
Totals (excluding Eastern Heights)		497	29	17	575	31	19	533	31	17
Average # of students		83	5	17	96	5	19	89	5	17

average class size (excluding Eastern Heights) 1605 91 18

