

RENAISSANCE®

Accelerated Reader Understanding Reliability and Validity

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Introduction

This document provides evidence that Renaissance Accelerated Reader quizzes and cumulative quiz information are reliable and valid.

Accelerated Reader is an independent reading practice program that helps students in years 1 to 13 to become confident, lifelong readers. Supporting more than 36,000 fiction and non-fiction books and articles at a wide range of levels, Accelerated Reader gives students extensive choice in what they read—and keeps them engaged in independent reading practice as they work toward personalised targets. An article collection provides additional opportunities for daily non-fiction reading, while in-depth reporting supports regular teacher-student conversations about reading time, reading comprehension and reading growth.

For more information about Accelerated Reader and how it works, see the Renaissance website at www.renlearn.co.uk.

Overview of Accelerated Reader Quizzes

There are several types of Accelerated Reader quizzes—Reading Practice, Literacy Skills, Article Quizzes and Vocabulary Practice. Each type of quiz is described below, and following that is a table summarising the number of Accelerated Reader quizzes available for each type of quiz.

Reading Practice Quizzes

The most common type of Accelerated Reader assessment is the Reading Practice Quiz. They are so-named because the purpose of the assessment is to provide quality information for both the management and motivation of reading practice. Reading Practice Quizzes are primarily intended to determine whether or not a student has read a book. These quizzes are encouraging rather than intimidating, chiefly because a student who has read a book should be able to pass the quiz. Questions typically focus on significant events, characters and literary features of a book. In addition, questions are presented in an order that matches the chronology of a book, a practice that reinforces the story structure as a student takes a quiz.

Quizzes incorporate multiple-choice items that focus on literal understanding. Selecting this type of assessment is consistent with Stiggins' (2005) recommendation that:

[Selected-response] tests are efficient in that we can administer large numbers of multiple-choice or true/false test items per unit of testing time. Thus, they permit us to sample widely and draw relatively confident generalizations from the content sampled. For this reason, when the target is knowledge mastery, selected response formats fit nicely into the resource realities of most classrooms. (p. 70)

Reading Practice Quizzes are accessible to a broader range of students with the addition of Recorded Voice Quizzes. Recorded Voice Quizzes are read by professional narrators and allow preliterate and emergent readers to take the same quizzes as independent readers without extra assistance from the teacher. This enables students to take quizzes on all books that they read independently, books that they read with an adult or peer tutor and books that were read to them. Recorded Voice quizzes are available for lower-level books suitable for emergent readers.

Reading Practice Quizzes are available in 3-, 5-, 10- and 20-item formats. The number of items is largely a function of book level. The 3-item and 5-item quizzes are primarily used to cover short books read by emergent readers, while 20-item quizzes cover longer books at higher reading levels. The most common length of Reading Practice Quizzes is 10 items.

Literacy Skills Quizzes

In response to teachers' requests, Literacy Skills Quizzes were developed to help identify students' reading strengths and weaknesses. The skills are grouped into four categories (Constructing Meaning, Inferential Comprehension, Literary Analysis and Initial Understanding) so that diagnostic reports can be generated to give teachers an accurate picture of students' reading abilities. Inferential reasoning, main idea, cause and effect, characterisation and recognising plot are examples of the kinds of skills tested. Currently, Literacy Skills Quizzes are available for many of the most popular titles in the Accelerated Reader database. Many of these books are considered classics, such as *Charlotte's Web*, *A Farewell to Arms* and *Macbeth*.

Questions on Literacy Skills Quizzes are randomly generated from a 24-item, 30-item, 36-item or 60-item bank.

The item-bank approach is appropriate for testing literacy skills because there is ample content in the books for which the tests have been developed. In addition, the quizzes are not intended as a motivational tool, but rather as an instrument to diagnose students' strengths and weaknesses. As a supplemental option to Reading Practice Quizzes, Literacy Skills Quizzes may be administered to students for various reasons, such as test preparation or to assess a deeper understanding of a book. Teachers are advised that the best time for students to take Literacy Skills Quizzes is after they have taken the Reading Practice Quiz for the book.

Literacy Skills Quizzes have 12 items.

Article Quizzes

Accelerated Reader includes non-fiction articles on high-interest topics that students can read within the software. After reading each article, students take a brief comprehension quiz about it. Articles are available at various reading levels to give students more non-fiction practice.

Vocabulary Practice Quizzes

Vocabulary Practice Quizzes are designed to facilitate implicit and explicit vocabulary instruction through authentic, in-context literature experiences. We recommend that students take a Vocabulary Practice Quiz after passing the Reading Practice Quiz for the same book. These vocabulary and comprehension quizzes include current and previous vocabulary words, and can be 5, 10 or 15 items long (the 1st-try quiz is 5, 10 or 15 words long, but quizzes could be longer with the inclusion of the 2nd-try and review words). Accelerated Reader then generates reports on each student's continuing vocabulary development.

Summary of Available Quiz Titles

Table 1 is a summary of available Accelerated Reader quiz titles as of February 2020, broken down by type of quiz, fiction/non-fiction and number of items per quiz. In addition to the number of quiz titles available in each category, the average readability level (ARL) is also presented to demonstrate that as the readability level increases, so do the number of items per quiz.

Overview of Accelerated Reader Quizzes
Summary of Available Quiz Titles

Table 1: Accelerated Reader Quiz Titles Available in the UK as of 19 February 2020

Quiz Type	Fiction or Non-fiction	Quiz Length (In Number of Questions)												Total
		3		5		10		12 ^a		15		20		
		Count	ARL ^b	Count	ARL ^b	Count	ARL ^b	Count	ARL ^b	Count	ARL ^b	Count	ARL ^b	
Reading Practice ^c	Fiction	697	1.3	8,346	2.7	18,318	4.7					597	6.5	27,958
	Non-fiction	369	1.7	4,547	3.9	3,320	6.2					14	7.6	8,250
	Both	1,066	1.4	12,893	3.1	21,638	4.9					611	6.5	36,208
Vocabulary Practice	Fiction			229	3.4	647	4.6			310	5.4			1,186
	Non-fiction			17	4.0	9	5.9			8	6.4			34
	Both			246	3.5	656	4.6			318	5.5			1,220
Literacy Skills	Fiction							131	6.5					131
	Non-fiction							4	6.0					4
	Both							135	6.5					135
Article	Non-fiction	1,940	6.5	40	7.9									1,980
All	Both	3,006	–	13,179	–	22,294	–	135	–	318	–	611	–	39,543

a. Literacy Skills Quizzes have 12 questions, but they may have an item bank of 24, 30, 36, or 60 items.

b. ARL = Average Reading Level (Average ATOS Book Level).

c. 1,317 of these quizzes are also available as Recorded Voice Quizzes.

Vocabulary Practice and Literacy Skills Quizzes are produced for books on which a Reading Practice Quiz already exists, so the total number of available quizzes shown in the table exceeds the total number of book titles.

The Development of Accelerated Reader Quizzes

Accelerated Reader quizzes¹ conform closely to the most widely accepted principles of assessment. Most importantly, the quizzes are valid because they are tied directly to the content of a specific book or passage and focus on facts rather than conjecture. The results of analyses of student performance with Accelerated Reader suggest that students who read the book perform well on the quiz. Those who take quizzes despite not having read the book perform at a level that is not different than would be expected by chance.² When students read the book and do well on the corresponding quiz, they are motivated to read additional books and take the corresponding quizzes. This tendency is consistent with the observations of Black and Wiliam (1998) that students respond more favourably when they can establish their own targets and are presented with “a meaningful, interesting, and reasonably demanding challenge”.

To ensure that Accelerated Reader quizzes present a meaningful, interesting and reasonably demanding challenge, the development of the quizzes entails a multi-step process with quality checks at several points. Accelerated Reader quizzes are developed following multiple-choice guidelines from Frary (1995) and others. Quizzes are developed by dedicated quiz writers and reviewed by multiple editors. The two main targets of writers and editors are to make sure that the quiz questions (1) are key to the text or advance the plot in an important way and (2) are not easily guessable without having read the book.

The process begins when a quiz writer reads a book and drafts items that reflect key points in the text or plot. The quiz is then reviewed by editors, who check for content and plausibility, spelling, usage, grammar, punctuation and conformation to quiz style. Special attention is paid to ensure that the distracters (the incorrect responses for each question) are neither too unlikely nor too close to the correct answer. Following those reviews and modifications (if necessary), the quiz goes through a quality check during which an editor reviews the quiz electronically in the Accelerated Reader format and makes sure that the correct responses are recognised by the program. The final quality check involves spell-checking and proofing.

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1. For more information on the development of Accelerated Reader quizzes, refer to Renaissance Learning, Inc., 2011, *The Design of Accelerated Reader Assessments*.
 2. For a summary of this analysis, refer to the “Quiz Validity Study” on page 18.

Standardisation of Quizzes

In two respects, Accelerated Reader quizzes are standardised. First, they fit the definition of “standardised” given by Popham (1999): they are “administered and scored in a predetermined, standard manner.” This characteristic is important because it ensures that the quizzes are fair. Even though Accelerated Reader is considered a low-stakes formative assessment, both students and teachers invest much of themselves in the program, and the perception of fairness contributes importantly to the widespread acceptance of Accelerated Reader. Second, the consistent manner in which Accelerated Reader quizzes are developed and administered means the information they provide is comparable over time and from student to student.

In order to maintain fairness and consistency, Accelerated Reader does not allow the teacher the option of assigning point values or changing the number of questions required to pass a quiz for individual students or records.³ This approach would render the information collected meaningless because data would not be comparable from student to student. In addition, this approach is arbitrary and might be perceived by students and parents as being unfair.

Cheating and Related Issues

Reading Practice Quizzes and Article Quizzes discourage casual cheating (e.g., students sharing correct answer choices) because the answer choices appear in randomised order each time the quiz is started. This level of security has proven successful and is consistent with the purposes of Accelerated Reader quizzes. Further, in the typical Accelerated Reader class, at any given time students are all reading different books, and take a quiz only once. Therefore, it is unlikely that they will be sufficiently familiar with a quiz to provide useful information to another student.

When Accelerated Reader is used according to Renaissance’s recommended best practices, the incidence of cheating is virtually eliminated because teachers conduct daily reviews of each student’s reading. Called “Status of the Class”, this review takes about 30 seconds to a minute for each student per day, during which time the teacher checks each student’s reading log, noting the book that the student is reading, how many pages have been read that day and whether or not the student

3. Each quiz has a predetermined passing percentage, which is a minimum percentage of items that a student must answer correctly. Students who do not pass the quiz are not eligible to receive any points. The following defaults are in place for passing percentages based on quiz length: on 5- and 10-item quizzes, the passing percentage is 60 per cent correct – that is, at least 3 correct on the 5-item quizzes, and at least 6 correct on the 10-item quizzes; for 20-item quizzes, students must get 70 per cent, or 14 items, correct in order to pass.

might be ready to finish the book, take a quiz and select a new book. If the number of pages read that day is significantly lower than expected, the teacher checks to make sure that the book is at an appropriate level for the student, asks the student if he or she has encountered a difficult passage or has questions, etc. If the amount of materials read is significantly higher than expected, the teacher makes sure that the student is actually reading and comprehending the book by asking the student to paraphrase what he or she has just read, explain who the main characters are, etc.

Retaking Quizzes

Retaking the identical quiz typically increases students' scores but is likely to be perceived by parents as being unfair (Snow, 1993). The tendency to score better increases when students receive feedback about whether their answers are right or wrong. Given this tendency, one might question the purpose of allowing students to retake a quiz, or more specifically, to retake a Reading Practice Quiz that is meant to determine if a student has read a book.

Therefore, students are discouraged from taking Reading Practice Quizzes more than once. If students have read a book within their zone of proximal development (ZPD), they are likely to pass the quiz because of the way it has been designed. If a student does not pass a quiz, it is probably because the student has not read the book or the book was too difficult in the first place. In neither case does it make sense for the student to retake the quiz.

Occasionally, there may be extenuating circumstances that contribute to a student's failing a quiz. These circumstances include disruptions, illness, personal situations and so on. When this is the case, the teacher has the option of deactivating the student's score and allowing the student to retake the quiz.

In essence, the regular retaking of quizzes may indicate cheating. Allowing students to retake a Reading Practice Quiz on a regular basis promotes guessing and may lead students to choose books that are too difficult for them. In fact, allowing students to take a quiz more than once may cause some students to take quizzes on books they have not read because they have a good chance of passing the quiz after taking it several times.

Literacy Skills Quizzes, on the other hand, are an exception to this recommendation. The items on these quizzes are drawn from item banks correlated to specific comprehension skills. The purpose of Literacy Skills Quizzes is to measure various aspects of comprehension. Teachers may choose to have students retake Literacy Skills Quizzes in order to provide additional practice or to assess specific elements of comprehension, such as inferential comprehension. Also, Literacy Skills Quizzes can be useful

The Development of Accelerated Reader Quizzes Retaking Quizzes

for diagnostic purposes, to measure the change in students' skills after an intervention or to determine if students have mastered one or more skills. For these purposes, item-bank technology is appropriate because equivalent forms of the assessment can be generated within a skill category, such as constructing meaning.

Reliability

Reliability is the extent to which the scores from an assessment are consistent across repeated administrations of the same or similar tests to the same group or population. The more reliable test scores are, the greater their freedom from errors of measurement. In educational assessment, some degree of measurement error is inevitable. One reason for this is that a student's performance may vary from one occasion to another.

The research data presented in this chapter was compiled and conducted in the United States.

Description of US Data Used for Reliability Analysis

In the US, over 200,000 Accelerated Reader quizzes are available, and in the 2013–2014 school year, US students took more than 380 million quizzes. Conducting reliability analyses on such a large data set was unworkable, so a sampling plan was devised. A stratified random sample of Accelerated Reader quizzes taken during the 2013–2014 school year was created with data pulled from the Accelerated Reader hosted database. The sample was stratified by quiz type, ATOS range and fiction/non-fiction. From each of the groups created by our strata, we randomly selected a proportionate number of quizzes and then looked at all of the quiz records for the selected quizzes.

We included 10% of quizzes in the sample ($n = 1,094$). In all, 1,164,243 quiz records from 963,213 unique students were included, and this constituted the database on which reliability analyses were conducted.

The total number of quiz titles in the database was 1,094, which represents a sample of the total number of existing Accelerated Reader quizzes. Summary statistics on each type of Accelerated Reader quiz are presented in Table 2.

Table 2: Summary Statistics on the Numbers of Students Taking Reading Practice (RP), Literacy Skills (LS), Vocabulary Practice (VP) and Other Reading (OR) Quizzes

Type of Quiz	Number of Quizzes	Average Number of Students per Quiz	Standard Deviation	Minimum	Maximum
Reading Practice	762	915.27	32.57	624	976
Literacy Skills	35	874.03	137.03	106	967
Vocabulary Practice	143	916.03	23.78	753	948
Other Reading	154	922.18	110.54	282	989
Total	1,094	915.02	56.28	106	989

Table 3 below breaks out the numbers from Table 2 according to the status of the books as Fiction or Non-fiction.

Table 3: Number of Students Taking Quizzes by Type of Quiz and Fiction/Non-fiction Status

Type of Quiz	Fiction/Non-fiction	Number of Quizzes	Average Number of Students per Quiz	Standard Deviation	Minimum	Maximum
Reading Practice	Non-fiction	296	909.35	32.16	745	973
	Fiction	466	919.02	32.30	624	976
	Total	762	915.27	32.57	624	976
Literacy Skills	Non-fiction	2	924.50	60.10	882	967
	Fiction	33	870.97	140.25	106	943
	Total	35	874.03	137.03	106	967
Vocabulary Practice	Non-fiction	21	910.10	38.52	753	942
	Fiction	122	994.72	1.15	991	997
	Total	143	916.03	23.78	753	948
Other Reading	Non-fiction	72	906.81	138.84	282	989
	Fiction	82	935.67	76.08	566	989
	Total	154	922.18	110.54	282	989
Total	Non-fiction	404	995.22	1.72	989	999
	Fiction	712	995.00	1.46	991	999
	Total	1,094	915.02	56.28	106	989

The Reliability of Accelerated Reader Quiz Scores

The reliability of Accelerated Reader quiz scores was evaluated in two ways. First, the internal consistency, as measured by Cronbach's alpha coefficient, was calculated for each individual Accelerated Reader quiz in the sample. Second, and more importantly, internal consistency data (also measured by Cronbach's alpha) are presented for cumulative test records. In actual class use of Accelerated Reader, a student's average percentage correct on several quizzes is the key indicator that is monitored by both the teacher and student via Accelerated Reader. Performance on any one quiz is not as important, because all of the target setting and monitoring of student progress are tied to average percentage correct for books read over an extended period. Therefore, reliability coefficients are presented for groups of quizzes over time as well as for individual quizzes.

Reliability: Individual Quiz Scores

Because small sample sizes tend to yield unstable reliability results, quizzes taken by fewer than 1,000 students were removed from the

analysis, unless the specific quiz category did not consist of any quizzes that were taken by 1,000 or more students.

Table 4: Summary Reliability Statistics on Accelerated Reader Quizzes

Type of Quiz	Number of Items	Number of Quizzes	Mean	Median	Standard Deviation	Minimum	Maximum
Reading Practice	3	8	0.45	0.45	0.08	0.34	0.56
	5	499	0.59	0.59	0.09	0.34	0.84
	10	248	0.77	0.78	0.08	0.22	0.91
	20	7	0.89	0.88	0.03	0.83	0.95
Literacy Skills	12	34	0.72	0.73	0.06	0.60	0.85
	24	1	0.84	0.84	0.0	0.84	0.84
Vocabulary Practice	5	108	0.58	0.60	0.17	-0.01	0.83
	10	32	0.70	0.71	0.07	0.55	0.84
	15	3	0.73	0.71	0.05	0.70	0.80
Other Reading	3	8	0.48	0.45	0.08	0.37	0.64
	5	107	0.56	0.57	0.10	0.027	0.77
	10	39	0.70	0.69	0.06	0.55	0.80
Total		1,094	0.64	0.64	0.13	-0.1	0.95

Table 4 displays summary statistics of quiz reliability for quizzes with 1,000 or more student records, broken out by quiz type (Reading Practice, Literacy Skills, Vocabulary Practice and Other Reading) and number of items within each quiz type. The summary statistics include means, medians, standard deviations and minimum and maximum values.

Table 4 indicates that overall reliability values were similar for all three types of quizzes, but varied systematically by quiz length. For example, among Reading Practice Quizzes the mean reliability of 3-item quizzes was 0.45; for 5-item quizzes it was 0.59, for 10-item quizzes it was 0.77 and for 20-item quizzes it was 0.89. The relationship between quiz length and reliability is well established in psychometrics. All other things being equal, reliability increases with the number of items in a test.

In theory, values of internal consistency reliability should range from zero to one. In practice, Cronbach's alpha values may be negative if the average covariance among the items is negative. This is rare, but was observable in one case in the sample. Hence, in Table 4 and Table 5, one of the values in the "Minimum" column is negative.

Table 5 presents a more detailed analysis of the reliability data that went into Table 4 by disaggregating quizzes into Fiction or Non-fiction categories. For all quiz types, the data in Table 5 indicate that reliability tended to be higher for quizzes on fiction rather than non-fiction.

Table 5: Reliability Statistics by Quiz Type, Fiction/Non-fiction and Length in the United States

Type of Quiz	Fiction/Non-fiction	Number of Items	Number of Quizzes	Mean	Median	Standard Deviation	Minimum	Maximum
Reading Practice	Fiction	3	2	0.35	0.35	0.01	0.34	0.35
		5	238	0.55	0.55	0.09	0.34	0.84
		10	52	0.71	0.71	0.11	0.22	0.88
		20	4	0.87	0.88	0.03	0.83	0.92
	Non-fiction	3	6	0.48	0.48	0.06	0.40	0.56
		5	261	0.62	0.63	0.08	0.39	0.84
		10	196	0.79	0.80	0.07	0.42	0.91
		20	3	0.90	0.89	0.03	0.88	0.95
Literacy Skills	Non-fiction	12	2	0.64	0.64	0.04	0.60	0.68
	Fiction	12	32	0.73	0.72	0.06	0.60	0.85
		24	1	0.84	0.84	0.0	0.84	0.84
Vocabulary Practice	Non-fiction	5	17	0.55	0.59	0.14	0.28	0.79
		10	2	0.63	0.63	0.01	0.62	0.64
		15	2	0.75	0.75	0.05	0.71	0.80
	Fiction	5	91	0.58	0.61	0.17	-0.01	0.83
		10	30	0.71	0.72	0.08	0.55	0.84
		15	1	0.70	0.70	0.0	0.70	0.70
Other Reading	Non-fiction	3	5	0.46	0.46	0.07	0.37	0.57
		5	51	0.51	0.53	0.09	0.27	0.67
		10	16	0.66	0.66	0.06	0.55	0.78
	Fiction	3	3	0.51	0.45	0.09	0.44	0.64
		5	56	0.61	0.60	0.09	0.43	0.77
		10	23	0.72	0.73	0.05	0.63	0.80
Total			1,094	0.64	0.64	0.13	-0.1	0.95

Reliability: Cumulative Quiz Scores

Central to class use of Accelerated Reader is a student’s performance on multiple quizzes; performance on individual Accelerated Reader quizzes is not nearly as important. All of the important features of Accelerated Reader, including target setting and monitoring of student progress, are done in terms of the student’s performance on all quizzes completed over an extended period—a marking period, a semester or an entire school year. This pattern of practice is reflected in the large database of Accelerated Reader quiz records used for this analysis; the mean number of quizzes taken per student was about two per week during the school year. In actual

class use of Accelerated Reader, targets are typically set per marking period, which are usually nine weeks long. On average, students take approximately 20 quizzes per marking period.

Therefore, more important than the reliability of individual quiz titles is the reliability of cumulative quiz scores over an extended period of time.

Construction of Quiz Composites. To estimate the reliability of cumulative quiz scores taken over extended periods of time such as marking periods, groups of quizzes, called composites, were created that shared key characteristics. Composites contained varying numbers of quizzes, but were constructed so that the quiz characteristics of each composite were as uniform as possible. The criteria used for creating each composite were as follows:

- ▶ Quizzes were taken by the same student
- ▶ Quizzes contained the same number of items (5-, 10- or 20-item)
- ▶ Quizzes were taken during a three-month time period
- ▶ Quizzes were at the same book level
- ▶ Quizzes were all either fiction or non-fiction

For example, one composite consisted of four 10-item non-fiction quizzes. Each quiz was at book level 6, and each was taken by the same student during the period of February to May of 2014. These four 10-item quizzes essentially became a 40-item composite.

Reliability coefficients (Cronbach's alpha) were calculated separately for composite scores of 5-, 10- and 20-item quizzes. Because Reading Practice and Other Reading Quizzes are both available in 5-, 10- and 20-item formats, composites were constructed containing these two types of quizzes. Literacy Skills Quizzes were not included because they are generated using item banks, and there were insufficient numbers of Literacy Skills Quizzes to create composites of Literacy Skills-only quizzes.

In all, 345,477 composites were created for 5-item quizzes, 336,728 composites were created for 10-item quizzes and 65,631 composites were created for 20-item quizzes. Composites ranged in size from 2 to 20 quizzes for 5- and 10-item quizzes. Composites ranged from two to thirteen quizzes for 20-item quizzes; there were no cases in which a group of more than thirteen 20-item quizzes met the above criteria.

All other things being equal (such as item difficulty and discriminating power), longer tests are more reliable than shorter ones, and that is the case for the individual quiz reliability coefficients presented previously. Therefore, we would expect the reliability of quiz composites to increase as their length (in number of items) increases. This notion was tested using the well-known Spearman–Brown formula (Lord & Novick, 1968).

Reliability The Reliability of Accelerated Reader Quiz Scores

The Spearman–Brown formula describes the relationship of the reliability of a lengthened test to the ratio of the revised length to the original length. The Spearman–Brown formula is shown below.

$$R'_{xx} = kR_{xx} / (1 + (k - 1)R_{xx})$$

where

k is the ratio of the revised length of the test to its original length

R_{xx} is the reliability coefficient of the test at its original length

R'_{xx} is the expected reliability coefficient at the revised length

The reliability coefficients for the actual composites are presented in Table 6, alongside the projected reliability of each as calculated using the Spearman–Brown formula.

Table 6: Actual versus Predicted Reliability of Quiz Composites in the United States

Number of Quizzes in the Composite	5-Item Quizzes ^a			10-Item Quizzes ^a			20-Item Quizzes ^a		
	Number	Actual	Projected	Number	Actual	Projected	Number	Actual	Projected
2	18,385	0.737	0.742	18,686	0.859	0.876	18,286	0.954	0.936
3	18,323	0.757	0.812	18,719	0.889	0.914	18,323	0.965	0.957
4	18,276	0.788	0.852	18,783	0.907	0.934	18,337	0.972	0.967
5	18,355	0.812	0.878	18,759	0.918	0.947	6,317	0.977	0.973
6	18,277	0.834	0.896	18,842	0.930	0.955	3,414	0.977	0.978
7	18,295	0.849	0.910	18,837	0.938	0.961	613	0.985	0.981
8	18,250	0.860	0.920	18,810	0.943	0.966	197	0.985	0.983
9	18,261	0.870	0.928	18,821	0.948	0.970	83	0.983	0.985
10	18,225	0.880	0.935	18,856	0.951	0.973	33	0.988	0.987
11	18,208	0.887	0.940	18,841	0.957	0.975	10	0.988	0.988
12	18,159	0.894	0.945	18,818	0.959	0.977	12	0.993	0.989
13	18,098	0.900	0.949	18,866	0.961	0.979	6	0.996	0.990
14	18,109	0.906	0.952	18,834	0.964	0.980	–	–	–
15	18,125	0.910	0.956	18,807	0.967	0.982	–	–	–
16	18,085	0.912	0.958	18,823	0.969	0.983	–	–	–
17	17,962	0.918	0.961	18,342	0.970	0.984	–	–	–
18	18,118	0.921	0.963	14,776	0.972	0.985	–	–	–
19	18,026	0.924	0.965	11,986	0.973	0.985	–	–	–
20 ^b	17,940	0.927	0.966	9,522	0.974	0.986	–	–	–

a. Number of composites, actual and projected reliability. Actual reliability = Cronbach's alpha. Projected reliability = Spearman–Brown formula using the mean reliability of individual quizzes of the same length, as reported in Table 5 on page 13.

b. For 5- and 10-item quizzes, composites could have been created containing more than 20 quizzes. In these instances, only the first 20 quizzes were included.

The reliability values of the composites as well as the projected values from the Spearman–Brown formula are also presented graphically in Figures 1, 2 and 3. Included for each graph are the mean reliability coefficients of individual quizzes, which were used in the Spearman–Brown calculations.

Figure 1: Actual versus Projected Reliability: Composites of 5-Item Quizzes

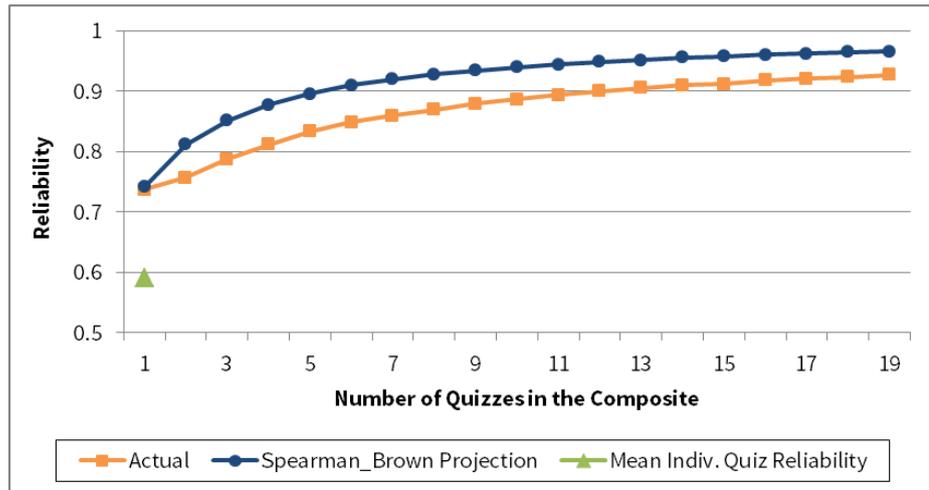


Figure 2: Actual versus Projected Reliability: Composites of 10-Item Quizzes

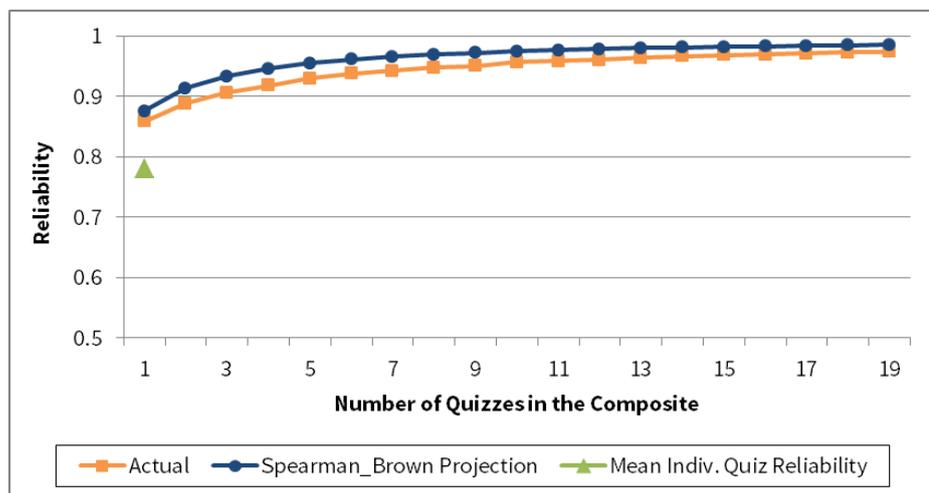
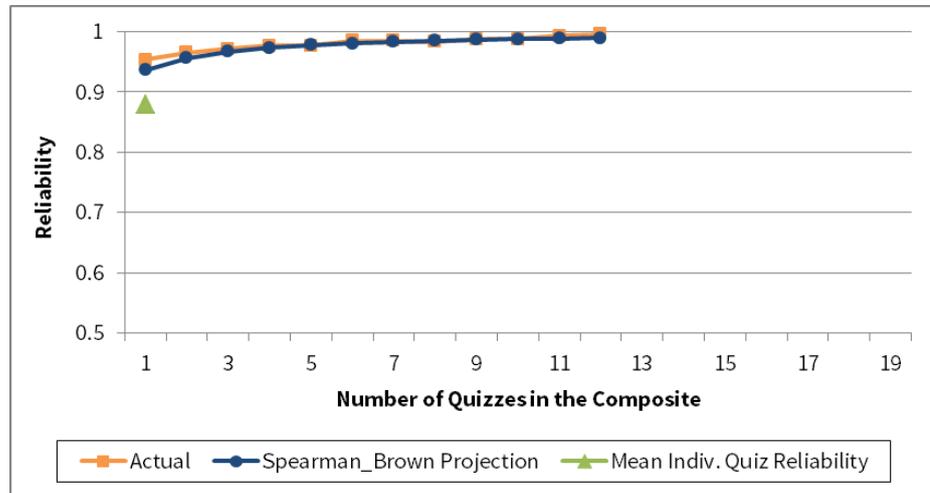


Figure 3: Actual versus Projected Reliability: Composites of 20-Item Quizzes



The tables and graphs indicate that the composite reliability coefficients increased, as predicted, as the number of quizzes/items increased. The composite coefficients tend to be somewhat lower than the projected values derived from the Spearman–Brown formula for the 5- and 10-item quizzes. In the case of the composites of 20-item quizzes, reliability coefficients of the composites are slightly greater than the projected values.

Although the reliability of the 5- and 10-item quizzes is slightly lower than the projected values, the coefficients reach 0.8 at five 5-item quizzes and just two 10-item quizzes. Given that students take an average of about two quizzes per week, it does not take very long for students' cumulative quiz record to achieve this level of reliability.

Although the reliability of the 5-item quizzes is lower than 10- and 20-item quizzes, as expected, students take those with greater frequency because they are tied to relatively lower-level, shorter books. Students take an average of 1.2 5-item quizzes per week during the school year (as opposed to 0.6 10-item quizzes and 0.1 20-item quizzes per week).

Validity

Assessment validity is the degree to which a test measures what it claims to measure. Evidence of test validity is often indirect and incremental, consisting of a variety of data that in the aggregate are consistent with the theory that the test measures the intended construct.

Accelerated Reader quizzes are intended to assess whether or not students have read and comprehended books or articles. Students read multiple books and articles throughout the school year, and their cumulative progress is measured against targets suggested by Renaissance and set by teachers.

To be valid, Accelerated Reader quiz scores should:

- ▶ Discriminate between students who have read books and those who have not
- ▶ Correlate positively with valid and reliable state and other standardised reading assessments

This section contains evidence, accumulated in the US to date, of Accelerated Reader's performance in these two areas. First, a controlled "validity study" is described that involved groups of randomly selected students that took Accelerated Reader quizzes for books that they had not read. The results indicate that Accelerated Reader quizzes were effective at discriminating between instances of students having read the book and not having read the book. Second, cumulative Accelerated Reader data are correlated with 11 US state tests and other standardised tests of general reading ability. Although this is not an ideal comparison (in the sense that Accelerated Reader quizzes measure whether students read and comprehended books and the state/standardised tests measure general reading ability), the correlations are positive and in the moderate range, suggesting that the tests are measuring something similar.

Quiz Validity Study

In the spring of 2005, a study was conducted to test the assumption that Accelerated Reader Reading Practice Quizzes are effective in discriminating between students who have actually read the books and those who have not.

Two research hypotheses were identified. First, the passing rate⁴ on books that the students had not read would be no greater than would be expected by chance. Second, student performance on quizzes covering

⁴ To pass a quiz, students must get 60 per cent correct on 5- and 10-item quizzes and 70 per cent correct on 20-item quizzes when the default settings are used.

books they have read would be much higher than on books that they have not read.

To test these hypotheses, random samples of students from three elementary schools were selected, and the students were asked to take Accelerated Reader quizzes for books that they had not read. The quizzes assigned to each student were carefully selected to match each student's reading level, and also to match a recently completed quiz on book genre, reading level and book length. The processes of selecting schools, students and quizzes are described below.

Sample Selection and Data Collection

Because the study design called for schools to strictly follow unusual data collection procedures (students being asked to take quizzes on books that they had not read), it was determined that Associate Renaissance Consultants (ARCs), individuals affiliated with schools that have a proven track record of correctly using Renaissance products and participating in tightly controlled research studies, should be involved to ensure adherence to the study design. Applications to participate in the study were distributed through 35 ARCs. Thirteen schools returned applications, and three schools were selected randomly to participate.

From each school, 20 students in grade 3 and 20 in grade 4 were randomly selected to participate, for a total of 120 students. It was decided to include those grades because the greatest number of Accelerated Reader quizzes are available at those levels. The study design necessitates having a large number of quiz titles available because the process of assigning quizzes to students calls for identifying at least five quizzes per student that match specific characteristics. The quiz selection process is described below.

Each of the three schools provided data files that included student names, Accelerated Reader quiz history from the 2004–2005 school year and most recent performance on the computer-adaptive Star Reading test from the 2004–2005 school year. After students were randomly selected from both grades, replicate samples were also randomly selected as backups, in case the selected students were unable to participate in the study.

For each selected and replicate student, we selected the most recent Accelerated Reader Reading Practice Quiz that was at a reading level very close to the students' reading abilities as measured by their most recent Star Reading test completed. When a student completes a Star Reading test, the software analyses the student's performance and calculates his or her Instructional Reading Level (IRL), a criterion-referenced score (available only in the United States) that is the highest reading level at which a student is at least 90–98% proficient at recognising words

(Gickling & Havertape, 1981; Johnson, et al, 1987; McCormick, 1999) and 80% proficient (or higher) at comprehending material with assistance (Gickling & Thompson, 2001). IRL is not the same as Grade Equivalent (available only in the United States), but corresponds closely to it. For each student, we selected the most recently taken Accelerated Reader quiz that had a reading level within ± 0.2 points of the student's Star Reading IRL. For the vast majority, the selected Accelerated Reader quiz was within this range, but for a few, the closest quiz match to a recent IRL was greater than ± 0.2 points.

With a recently completed Accelerated Reader quiz having been selected for each student, we then attempted to identify five quizzes that matched the selected quiz on a number of important characteristics. The five quizzes would be presented to each student, who would be asked to pick a title that he or she had not previously read and complete a quiz for it. First, a master list of Accelerated Reader Reading Practice Quizzes was generated so it could be used for the random selection of matched quizzes. Quizzes that were part of a series or were non-fiction were removed from the list because it was determined students should not have prior knowledge of the subject matter on which they would be quizzed. Then, for each selected quiz, five quizzes were identified that matched the selected quiz on the following criteria: reading level equal to ± 0.2 , same genre/topic, and having a book word count within ± 20 per cent.

Schools were sent names of selected and replicate students and given explicit instructions on how each student should pick one of the five quiz titles. Extra emphasis was paid to making sure that the quiz selected by the student was for a book that he/she had not read. A web server running Accelerated Reader was established for each student to access to select and take the quiz.

Data collection was completed in March 2005. Each school was successful in having a total of 40 students (20 from each grade) complete one of the assigned quizzes as instructed. Less than ten per cent of the students taking quizzes were from replicate samples. In cases where a student from the replicate sample had to be used, it was because a selected student had either recently moved out of the school district or was out (holiday or sick) when the school decided to complete the quizzes.

Study Results

Table 7 below presents the study's results for the quizzes taken by students on books they had not read. Because the quizzes exclusively use multiple-choice questions, there is a non-zero probability of obtaining a passing score by chance alone. To pass Reading Practice quizzes, students had to answer at least 60 per cent of the questions correctly on 5- and 10-item quizzes, and 70 per cent on 20-item quizzes. Overall, a

very small number of students—about six per cent—were able to answer enough questions correctly to obtain a passing score.

The probabilities of passing an Accelerated Reader book quiz by chance have been calculated and are also presented in Table 7. The probabilities vary according to the number of questions in the quiz and the number of multiple-choice options per question. Accelerated Reader quizzes use four multiple-choice options.

Table 7: Number and Percentage of Students Passing and Failing Accelerated Reader Quizzes for Books Not Read, by Grade and Number of Questions per Quiz

Grade	Quiz Fail/ Pass Status	Study Quiz: Number of Questions Administered						Total	
		5		10		20			
		n	Per cent	n	Per cent	n	Per cent	n	Per cent
3	Quiz Failed	14	73.7%	40	97.6%	0	0.00%	54	90.0%
	Quiz Passed	5	26.3%	1	2.4%	0	0.00%	6	10.0%
	Total: Grade 3	19	100.0%	41	100.0%	0	0.00%	60	100.0%
4	Quiz Failed	12	100.0%	46	97.9%	1	100.0%	59	98.3%
	Quiz Passed	0	0.00%	1	2.1%	0	0.00%	1	1.7%
	Total: Grade 4	12	100.0%	47	100.0%	1	100.0%	60	100.0%
All	Quiz Failed	26	83.9%	86	97.7%	1	100.0%	113	94.2%
	Quiz Passed	5	16.1%	2	2.3%	0	0.00%	7	5.8%
	Total	31	100.0%	88	100.0%	1	100.0%	120	100.0%
Pass Rate by Chance			10.4%		2.0%		0.1%		

Table 7 shows that students' pass rates on books not read were slightly higher than chance rates. On 5-question quizzes, 16.1 per cent of students passed their quizzes, and the rate of passing by chance was 10.4 per cent. On 10-question quizzes, 2.3 per cent of students passed their quizzes, and the rate of passing by chance was 2.0 per cent.

The first hypothesis—that student pass rates on books not read would be no greater than chance—was tested on 5- and 10-item quiz results separately using a one-sample z-test for a proportion.⁵ For both tests, the null hypothesis was that the student pass rate on books not read was equivalent to chance. The z-test produces probabilities (*p*-values) that correspond to the likelihood of obtaining a result that is as far or farther away as our sample mean is from the population mean (in this case the probability of passing by chance), if the null hypothesis is true. A low probability (0.05 or less) would provide justification to reject the

5 Only one student took a 20-item quiz, so that was not included in the analysis. Note that in the master list of Accelerated Reader Reading Practice Quizzes, most quizzes contain 5 or 10 items. Only a small number (about two per cent) use 20 items. Approximately 34 and 64 per cent are 5- and 10-question quizzes, respectively.

null hypothesis and accept an alternative hypothesis. A higher probability would lead us not to reject the null hypothesis and, in this case, to conclude that the sample mean does not differ significantly from the chance pass rate.

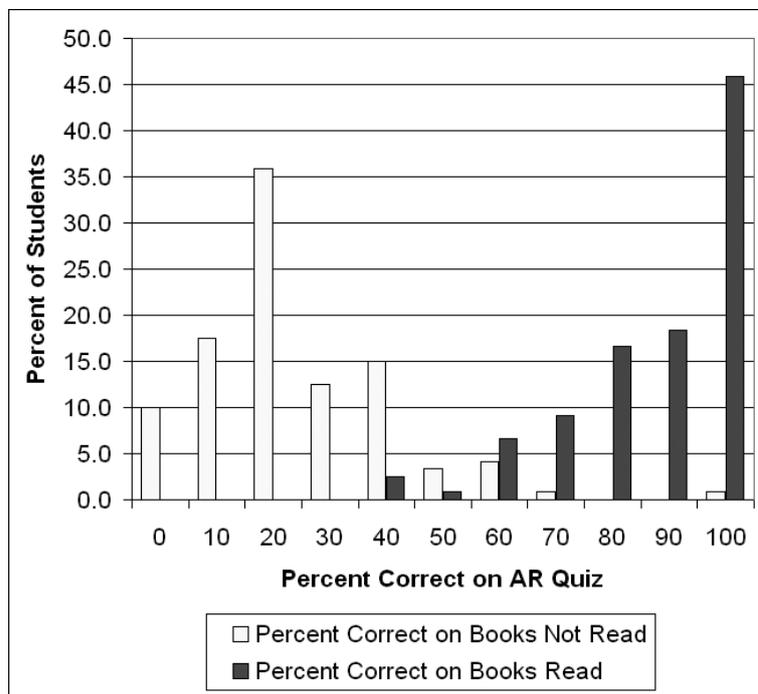
The *p*-values generated by the z-tests were 0.30 for 5-item quizzes and 0.86 for 10-item quizzes, leading us not to reject the null hypothesis that the students' pass rate was the same as the pass rate from chance. Although students' average pass rates on books not read were slightly higher than the chance pass rates, the differences were not statistically significant. In other words, when quizzed on books they have not read, students pass at a rate that is not significantly different than what would be expected by chance.

The second hypothesis involved examining the difference between student performance on quizzes for books read versus performance on quizzes for books not read. The descriptive data for these two quizzes reveals quite substantial differences. Table 8 presents the means and standard deviations, by grade, of quiz percentage correct and pass rates. Figure 4 depicts in a bar graph the quiz percentage correct on books not read versus books read.

Table 8: Means and Standard Deviations of Quiz Percentage Correct and Pass Rate on Books Not Read versus Books Read in the United States

	Grade 3		Grade 4		Both Grades	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Percentage Correct on Quizzes for Books Not Read	25.00	19.53	23.50	13.88	24.25	16.89
Percentage Correct on Randomly Selected Quizzes for Books Read	85.00	15.78	90.00	14.26	87.50	15.19
Percentage of Students Passing Quizzes for Books Not Read	10.00	30.25	1.67	12.91	5.83	23.54
Percentage of Students Passing Quizzes for Books Read	95.00	21.98	98.33	12.91	96.67	18.03

Figure 4: Percentage Correct on Accelerated Reader Quizzes for Books Not Read and Books Read in the United States



As Table 8 on the previous page shows, the mean percentage correct on books not read by students was about 24 per cent, and the mean percentage correct on books read was about 88 per cent. In terms of quiz pass rates, only 6 per cent of the quizzes for books not read were passed, compared with 97 per cent for books read.

Paired sample *t*-tests were conducted in the United States to test the null hypothesis that there would be no difference between performance on quizzes for books read versus books not read. Separate tests were conducted in the United States for students' percentage correct score and pass/fail grade. The results of the test on percentage correct are summarised in Table 9, while Table 10 summarises the pass rate results. Both tests reveal that the differences in student performance between books read and not read are significant.

The mean paired difference between the percentage correct on quizzes on books not read versus quizzes on books read is quite large (63.25). By US grade, the mean differences for grades 3 and 4 were 60.0 and 66.5, respectively. As shown in Table 9, the *t*-test was significant at $p < 0.001$. Therefore, we can comfortably reject the null hypothesis and accept the alternative that quiz scores after having read the book were substantially higher than quiz scores after not having read the book.

Table 9: Paired Samples t-test: Percentage Correct on Book Read—Percentage Correct on Book Not Read

Grade	Paired Differences					t	df	Sig. ^a (2-Tailed)
	Mean	Standard Deviation	Standard Error of Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Grade 3	60.00	21.71	2.80	65.61	54.39	21.411	59	p < 0.001
Grade 4	66.50	17.25	2.23	70.96	62.04	29.854	59	p < 0.001
All Grades	63.25	19.80	1.81	66.83	59.67	35.001	119	p < 0.001

a. Sig. = significant

As shown in Table 10, the test comparing the differences between pass/fail rates on books read versus not read was also highly significant at $p < 0.001$, further confirming that both Accelerated Reader Reading Practice Quiz scores and pass/fail grades are effective in discriminating between having read the book or not.

Table 10: Paired Samples t-test: Pass/Fail Grade on Book Read—Pass/Fail Grade on Book Not Read

Grade	Paired Differences (Pass = 1; Fail = 0)					t	df	Sig. ^a (2-Tailed)
	Mean	Standard Deviation	Standard Error of Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Grade 3	0.85	0.36	0.046	0.94	0.76	18.29	59	p < 0.001
Grade 4	0.97	0.18	0.023	1.01	0.92	41.36	59	p < 0.001
All Grades	0.91	0.29	0.027	0.96	0.86	34.33	119	p < 0.001

a. Sig. = significant

Conclusion

Testing the two research hypotheses using rigorous statistical methods leads us to conclude the following: when students take Accelerated Reader Reading Practice Quizzes and have not read the books that are the subjects of those quizzes, they pass the quizzes at a rate that is not significantly different from the probability of passing by chance alone. In addition, when students are given two book quizzes to take that are similar in reading level and other characteristics, but differ in that the student has read one book and not the other, performance on the book not read is significantly lower than on the book read.

In summary, Accelerated Reader Reading Practice quizzes are effective at discriminating between instances of students having read the book and not having read the book.

Correlation with Standardised Reading Assessments

This section summarises the external validity of Accelerated Reader Reading Practice Quizzes by describing their relationship with US state tests and other standardised reading assessments. In some respects, Accelerated Reader is a unique assessment in that it assesses whether students read and comprehended books and selections of text. Ideally, its validity could be measured, in part, by the extent to which its scores correlate with assessments that both (1) assess the same thing, and (2) are of a sufficient quality, as judged by published studies, and reliability and/or validity data. Unfortunately, no assessment systems meet these criteria. Therefore, Renaissance collected student-level data from state and other standardised reading tests.

Correlations between Accelerated Reader and 24 reading tests are presented in this section. For some of the tests, scores were available pertaining to specific skills (for example comprehension and fluency), but in most cases, only a score of general reading ability was available. Although the tests of general reading ability measure more skills than Accelerated Reader does, one would expect a positive correlation overall. One would also expect a higher correlation with the tests of reading comprehension. The correlations between Accelerated Reader and the general reading assessments are positive and generally in the moderate range, providing evidence of Accelerated Reader's validity. That the correlations are not higher is not surprising given that Accelerated Reader is more narrowly focused than the general reading assessments. Also, the way that comprehension is measured is somewhat different. Accelerated Reader measures students' ability to recall literal information from books or stories that they have read. This is comparable to, but more challenging than, traditional tests of comprehension, in which the passage of text is available to the student. As expected, Accelerated Reader correlations with reading comprehension measures are higher than with the general reading measures.

Description of Data Used for Validity Analyses

A total of 216 schools provided student-level Accelerated Reader data along with matching scores from popular standardised reading assessments. The schools were from the following 34 US states plus one Canadian province (Saskatchewan): Alabama, Arizona, Arkansas, California, Colorado, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Virginia, Washington, Wisconsin and Wyoming.

A total of 4,532,589 unique students were included in the sample used for the validity analyses. This is smaller than the total number of matched-student Accelerated Reader-external test pairs (4,799,152) due to the fact that a single student may be included in correlations with more than one test. Additionally, a student may be included in correlations across multiple school years (e.g., spring 2002 as a fourth-grade student, and spring 2003 as a fifth-grade student).

The Accelerated Reader quiz data were collected in the US and Canada over a period of fifteen school years. During the first three of those years (2000–2001, 2001–2002 and 2002–2003), data were collected under the auspices of a consulting service provided by Renaissance. The service involved the submission to Renaissance of schools' student-level electronic data on Accelerated Reader, Star Reading and other assessments. In turn, the company provided schools with detailed summaries of student, teacher, class and school performance compared to best practice implementation standards for Accelerated Reader, as well as suggestions for improvement. Some schools also provided student-level results on such standardised tests as the Stanford Achievement Test (SAT-9) and Measures of Academic Progress (MAP), as well as several state tests.

Starting with the 2003–2004 school year, Accelerated Reader data and scores from Star Early Literacy (a criterion-referenced test developed by Renaissance) and Star Reading were collected from schools that had signed hosting agreements with Renaissance whereby the company hosts the schools' assessment data on its web servers and may use those data for research purposes.

Including the two Renaissance computerised assessments—Star Reading and Star Early Literacy—student-level Accelerated Reader data were matched with data from a total of 21 reading assessments done in the US and Canada. Those assessments are listed in Tables 11 and 12 on pages 28–33.

In addition to the assessments of general reading ability, correlations are also provided between Accelerated Reader and a number of subtests measuring specific reading skills. Those subtests are from DIBELS (Dynamic Indicators of Basic Early Literacy Skills), GRADE (Group Reading Assessment and Diagnostic Evaluation) and TPRI (Texas Primary Reading Inventory). These data were collected during the fall 2004 semester. Two elementary schools provided student-level Accelerated Reader data along with matching scores from DIBELS, GRADE and TPRI.

It should be noted that Accelerated Reader is much more specific than the 21 general tests of reading ability. Accelerated Reader measures the amount of reading and comprehension by asking students to respond to literal questions about text they have read. In other words, the underlying

tasks are somewhat different. Therefore, the correlations between Accelerated Reader and the general reading assessments are likely to be not as strong as the correlations among the general reading assessments themselves. However, there is a moderate positive relationship between the two, suggesting that Accelerated Reader is measuring something that the general reading tests are measuring, even though Accelerated Reader is more limited in scope. The correlations between Accelerated Reader and the reading comprehension subtests are generally stronger than the correlations between Accelerated Reader and the general reading assessments.

Correlations with External Tests

Because students take multiple Accelerated Reader quizzes during a school year, semester, quarter or even week, and the program emphasises cumulative performance such as words read and percentage correct on quizzes, correlating student performance on individual Accelerated Reader quizzes with external tests would not be meaningful. Therefore, cumulative performance on Accelerated Reader quizzes was aggregated by semester, and was correlated with the state or standardised test taken during that semester. Semesters were defined as fall including August through December, and spring including January through June.

In the cases of two of the tests—Star Reading and Star Early Literacy—some students completed more than one test in a semester. In those instances, the mean of student scores from the semester was computed and used to correlate with the cumulative Accelerated Reader data from the same semester.

The external data were correlated with Accelerated Reader points, which combines number of words read, book level and percentage correct on quizzes.

Accelerated Reader Points

The software automatically computes Accelerated Reader points every time a student takes a quiz and tracks the accumulation of points over time. Points are one of the indicators that teachers can use to monitor student progress on both book reading and comprehension of those books. Points are part of the feedback provided by Accelerated Reader that has been shown to be motivational for students (Sadusky & Brem, 2002; Husman et al, 2005; Samuels & Wu, 2003). The formula for points is as follows:

Points = [(10 + Reading Level) × (Number of words in book/100,000)] × Percentage Correct

Correlation Coefficients Between Accelerated Reader Points and External Reading Measures

Correlation coefficients between Accelerated Reader points and external reading measures are presented in Table 11 and Table 12. Table 11 presents validity coefficients for grades 1 through 6, and Table 12 presents the validity coefficients for grades 7 through 12. The bottom of each table presents a grade-by-grade summary, including the total number of students for whom test data were available, the number of validity coefficients for that grade and the average value of the validity coefficients.

**Table 11: External Validity Data from the United States: Accelerated Reader Points^a
Correlations with External Tests of General Reading Ability, Grades 1–6**

Date	Score	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6	
		n ^b	r ^c	n	r	n	r	n	r	n	r	n	r
Delaware Student Testing Program—Reading (DSTP)													
Spr 2002	Scaled	–	–	–	–	128	0.29**	–	–	284	0.60**	–	–
Spr 2003	Scaled	–	–	–	–	265	0.44**	–	–	296	0.33**	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Letter Naming Fluency—Benchmark 1													
Fall 2004	Raw	21	0.53*	–	–	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Phoneme Segmentation Fluency—Benchmark 1													
Fall 2004	Raw	21	0.56*	–	–	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Phoneme Segmentation Fluency—Benchmark 2													
Fall 2004	Raw	21	0.45*	–	–	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Nonsense Word Fluency—Benchmark 1													
Fall 2004	Raw	21	0.71**	22	0.28	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Nonsense Word Fluency—Benchmark 2													
Fall 2004	Raw	21	0.60**	–	–	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Word Use Fluency—Benchmark 1													
Fall 2004	Raw	9	0.11	11	0.14	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Word Use Fluency—Benchmark 2													
Fall 2004	Raw	9	–0.23	11	0.58	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Oral Reading Fluency—Benchmark 1													
Fall 2004	Raw	–	–	22	0.73**	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Oral Reading Fluency—Benchmark 2													
Fall 2004	Raw	21	0.85**	22	0.68**	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Retell Fluency—Benchmark 1													
Fall 2004	Raw	–	–	11	0.30	–	–	–	–	–	–	–	–
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)—Retell Fluency—Benchmark 2													
Fall 2004	Raw	–	–	11	0.58	–	–	–	–	–	–	–	–

**Table 11: External Validity Data from the United States: Accelerated Reader Points^a
Correlations with External Tests of General Reading Ability, Grades 1–6**

Date	Score	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6	
		n ^b	r ^c	n	r	n	r	n	r	n	r	n	r
Florida Comprehensive Assessment Test—Reading (FCAT 2.0)													
Spr 2013	Scaled	–	–	–	–	7,772	0.48	6,789	0.51	5,611	0.56	481	0.41
Group Reading Assessment and Diagnostic Evaluation (GRADE)—Vocabulary Composite													
Fall 2004	Scaled	18	0.72**	22	0.73**	–	–	–	–	–	–	–	–
Group Reading Assessment and Diagnostic Evaluation (GRADE)—Comprehension Composite													
Fall 2004	Scaled	18	0.86**	22	0.80**	–	–	–	–	–	–	–	–
Group Reading Assessment and Diagnostic Evaluation (GRADE)—Total													
Fall 2004	Scaled	17	0.87**	22	0.80**	–	–	–	–	–	–	–	–
Idaho Standards Achievement Test—Reading (ISAT)													
Fall 2001	Scaled	–	–	–	–	–	–	–	–	–	–	29	0.42*
Spr 2002	Scaled	–	–	–	–	–	–	–	–	–	–	28	0.47*
Fall 2002	Scaled	–	–	–	–	–	–	–	–	–	–	28	0.15
Spr 2003	Scaled	–	–	–	–	–	–	–	–	–	–	27	0.17
Kentucky Performance Rating for Educational Progress—Reading (K-PREP)													
Spr 2013	Scaled	–	–	–	–	555	0.49	543	0.46	534	0.52	–	–
Measures of Academic Progress—Language Usage (MAP)													
Fall 2012	RIT	–	–	404	0.33**	400	0.40**	405	0.44**	431	0.50**	390	0.41**
Spr 2013	RIT	–	–	412	0.39**	406	0.42**	386	0.43**	448	0.52**	405	0.44**
Measures of Academic Progress—Reading (MAP)													
Fall 2002	Scaled	–	–	83	0.52**	92	0.47**	75	0.48**	79	0.58**	–	–
Spr 2003	Scaled	–	–	81	0.44**	93	0.44**	72	0.49**	83	0.65**	–	–
Fall 2012	RIT	398	0.37**	420	0.42**	412	0.42**	408	0.47**	446	0.50**	390	0.45**
Spr 2013	RIT	453	0.33**	441	0.39**	410	0.41**	428	0.47**	459	0.54**	406	0.46**
Mississippi Curriculum Test—Reading (MCT)													
Spr 2002	Scaled	–	–	92	0.56**	98	0.26**	98	0.36**	81	0.52**	–	–
New Mexico Achievement Assessment Program—Reading (NMAAP)													
Spr 2002	Scaled	–	–	–	–	–	–	41	0.18	–	–	110	0.21*
Spr 2003	Scaled	–	–	–	–	128	0.34**	156	0.27**	153	0.28**	–	–
Ohio Achievement Assessments—Reading (OAA)													
Spr 2013	Scaled	–	–	–	–	–	–	79	0.58	57	0.55	73	0.55
Oklahoma Core Curriculum—Reading (OCCT)													
Spr 2013	Scaled	–	–	–	–	412	0.43**	424	0.41**	369	0.38**	49	0.59**

**Table 11: External Validity Data from the United States: Accelerated Reader Points^a
Correlations with External Tests of General Reading Ability, Grades 1–6**

Date	Score	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6	
		n ^b	r ^c	n	r	n	r	n	r	n	r	n	r
Stanford Achievement Test, 9th Ed.—Reading (SAT-9)													
Spr 2002	Scaled	–	–	–	–	36	0.24	–	–	–	–	–	–
Spr 2003	Scaled	–	–	–	–	97	0.35**	–	–	–	–	–	–
Star Early Literacy													
Fall 2003	Scaled	208	0.31**	94	0.11	27	0.53**	–	–	–	–	–	–
Spr 2004	Scaled	244	0.26**	159	0.35**	47	0.49**	–	–	–	–	–	–
Fall 2004	Scaled	1,722	0.35**	870	0.31**	349	0.13**	–	–	–	–	–	–
Spr 2005	Scaled	2,518	0.32**	940	0.29**	173	0.29**	–	–	–	–	–	–
Spr 2014	Scaled	124,359	0.29**	38,785	0.36**	9,696	0.35**	–	–	–	–	–	–
Star Reading													
Fall 2000	Scaled	–	–	35	0.21	821	0.09**	2,234	0.44**	1,818	0.39**	1,307	0.38**
Spr 2001	Scaled	–	–	167	0.30**	2,103	0.29**	2,805	0.43**	2,612	0.47**	1,703	0.47**
Fall 2001	Scaled	35	0.35*	1,422	0.10**	3,652	0.38**	5,330	0.41**	4,172	0.48**	3,073	0.48**
Spr 2002	Scaled	159	–0.05	2,467	0.36**	4,072	0.46**	4,077	0.49**	4,418	0.53**	3,287	0.49**
Fall 2002	Scaled	2,520	0.14**	5,033	0.41**	5,847	0.46**	6,398	0.49**	6,414	0.53**	6,805	0.50**
Spr 2003	Scaled	5,031	0.38**	5,558	0.45**	6,239	0.46**	6,745	0.49**	6,595	0.51**	7,032	0.51**
Spr 2014	Scaled	372,993	0.32**	583,102	0.40**	631,812	0.47**	632,844	0.51**	599,282	0.52**	394,929	0.51**
Standards of Learning—Reading (SOL)													
Spr 2014	Scaled	–	–	–	–	1,366	0.31	1,624	0.45	1,499	0.34	975	0.44
State of Texas Assessments of Academic Readiness—Reading (STAAR)													
Spr 2013	Scaled	–	–	–	–	21,156	0.37	19,370	0.35	14,412	0.37	11,036	0.49
Tennessee Comprehensive Assessment Program—Reading (TCAP)													
Spr 2014	Scaled	–	–	–	–	127	0.50	122	0.66	–	–	–	–
Terra Nova Reading													
Spr 2002	PR ^d	–	–	–	–	–	–	12	0.47	–	–	–	–
Spr 2003	PR ^d	–	–	–	–	–	–	17	0.52*	–	–	–	–
Texas Assessment of Knowledge and Skills—Reading (TAKS)													
Spr 2003	Scaled	–	–	–	–	47	0.53**	1,132	0.38**	1,097	0.41**	1,013	0.51**
Texas Primary Reading Inventory (TPRI)—Phonemic Awareness													
Fall 2004	Raw	21	0.56**	–	–	–	–	–	–	–	–	–	–
Texas Primary Reading Inventory (TPRI)—Graphophonemic Knowledge													
Fall 2004	Raw	21	0.57**	21	0.35	–	–	–	–	–	–	–	–
Texas Primary Reading Inventory (TPRI)—Fluency													
Fall 2004	Raw	20	0.83**	21	0.58**	–	–	–	–	–	–	–	–

**Table 11: External Validity Data from the United States: Accelerated Reader Points^a
Correlations with External Tests of General Reading Ability, Grades 1–6**

Date	Score	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6	
		n ^b	r ^c	n	r	n	r	n	r	n	r	n	r
Texas Primary Reading Inventory (TPRI)–Reading Comprehension													
Fall 2004	Raw	21	0.81**	21	0.22	–	–	–	–	–	–	–	–
Transitional Colorado Assessment Program–Reading (TCAP)													
Spr 2013	Scaled	–	–	–	–	52	0.33**	64	0.43**	69	0.53**	175	0.50**
Wyoming Comprehensive Assessment System–Reading (WyCAS)													
Spr 2002	Scaled	–	–	–	–	–	–	12	0.39	–	–	–	–
Spr 2003	Scaled	–	–	–	–	–	–	17	0.56*	–	–	–	–
Summary													
Grade	All	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6						
Number of students	3,631,849	510,920	640,804	699,570	693,416	652,565	434,574						
Number of coefficients	172	27	32	33	30	26	24						
Average validity	–	0.45	0.42	0.38	0.45	0.48	0.44						
Overall average	0.44												

a. Accelerated Reader points are calculated by the software when students pass a quiz. The points value that is correlated with the external score is the sum of points earned in the semester in which the external test was administered. The formula is as follows: $[(10 + \text{Reading Level}) \times (\text{Words in Book}/100,000)] \times \text{Percentage Correct}$.

b. n = Sample sizes

c. r = Correlations

d. PR = Percentile Rank

* Correlation is significant at the 0.05 level.

** Correlation is significant at the 0.01 level.

**Table 12: External Validity Data from the United States: Accelerated Reader Points^a
Correlations with External Tests of General Reading Ability, Grades 7–12**

Date	Score	Grade 7		Grade 8		Grade 9		Grade 10		Grade 11		Grade 12	
		n ^b	r ^c	n	r	n	r	n	r	n	r	n	r
Delaware Student Testing Program–Reading (DSTP)													
Spr 2002	Scaled	–	–	232	0.46**	–	–	119	0.46**	–	–	–	–
Spr 2003	Scaled	–	–	245	0.47**	–	–	198	0.43**	–	–	–	–
Florida Comprehensive Assessment Test–Reading (FCAT 2.0)													
Spr 2013	Scaled	466	0.43	464	0.47	–	–	–	–	–	–	–	–
Measures of Academic Progress–Language Usage (MAP)													
Fall 2012	RIT	307	0.35**	66	0.46**	–	–	–	–	–	–	–	–
Spr 2013	RIT	307	0.39**	67	0.48**	–	–	–	–	–	–	–	–
Measures of Academic Progress–Reading (MAP)													
Fall 2012	RIT	392	0.45**	66	0.48**	–	–	–	–	–	–	–	–
Spr 2013	RIT	299	0.41**	68	0.47**	–	–	–	–	–	–	–	–
New Jersey Assessment of Skills and Knowledge–Reading (NJ ASK)													
Spr 2013	Scaled	869	0.42**	784	0.50**	–	–	–	–	–	–	–	–
New Mexico Achievement Assessment Program–Reading (NMAAP)													
Spr 2002	Scaled	83	0.62**	–	–	–	–	–	–	–	–	–	–
Spr 2003	Scaled	136	0.38**	112	0.54**	107	0.47**	–	–	–	–	–	–
Ohio Achievement Assessments–Reading (OAA)													
Spr 2013	Scaled	74	0.34	62	0.55	–	–	–	–	–	–	–	–
Standards of Learning–Reading (SOL)													
Spr 2014	Scaled	794	0.25	985	0.27	–	–	–	–	–	–	–	–
Star Reading													
Fall 2000	Scaled	1,826	0.51**	1,696	0.53**	836	0.45**	905	0.47**	1,053	0.40**	1,088	0.38**
Spr 2001	Scaled	2,040	0.50**	2,107	0.52**	872	0.47**	1,532	0.47**	1,357	0.35**	1,039	0.28**
Fall 2001	Scaled	3,396	0.51**	3,385	0.45**	595	0.39**	1,217	0.35**	1,379	0.34**	1,132	0.33**
Spr 2002	Scaled	3,706	0.53**	3,894	0.45**	975	0.49**	1,295	0.44**	1,413	0.36**	1,095	0.38**
Fall 2002	Scaled	5,088	0.49**	4,343	0.47**	3,106	0.43**	2,378	0.39**	1,760	0.34**	1,373	0.27**
Spr 2003	Scaled	5,197	0.51**	4,600	0.48**	3,115	0.40**	2,226	0.34**	1,577	0.31**	1,066	0.14**
Spr 2014	Scaled	274,739	0.48**	243,131	0.45**	43,458	0.42**	33,066	0.39**	21,617	0.35**	14,378	0.32**
State of Texas Assessments of Academic Readiness–Reading (STAAR)													
Spr 2013	Scaled	9,590	0.45	5,772	0.34	–	–	–	–	–	–	–	–
Transitional Colorado Assessment Program–Reading (TCAP)													
Spr 2013	Scaled	164	0.44**	161	0.46**	–	–	–	–	–	–	–	–

**Table 12: External Validity Data from the United States: Accelerated Reader Points^a
Correlations with External Tests of General Reading Ability, Grades 7–12**

Date	Score	Grade 7		Grade 8		Grade 9		Grade 10		Grade 11		Grade 12	
		n ^b	r ^c	n	r	n	r	n	r	n	r	n	r
Texas Assessment of Knowledge and Skills—Reading (TAKS)													
Spr 2003	Scaled	921	0.36**	890	0.42**	782	0.31**	597	0.32**	499	0.07	–	–
Summary													
Grade	All	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12						
Number of students	1,167,303	310,394	273,130	53,846	43,533	30,655	21,171						
Number of coefficients	75	20	21	9	10	8	7						
Average validity	–	0.44	0.46	0.42	0.36	0.32	0.30						
Overall average	0.41												

a. Accelerated Reader points are calculated by the software when students pass a quiz. The points value that is correlated with the external score is the sum of points earned in the semester in which the external test was administered. The formula is as follows: [(10 + Reading Level) × (Words in Book/100,000)] × Percentage Correct.

b. n = Sample sizes

c. r = Correlations

* Correlation is significant at the 0.05 level.

** Correlation is significant at the 0.01 level.

United States Meta-Analysis of Accelerated Reader External Validity Data

Meta-analysis is a set of statistical procedures that combine results from different sources or studies. When applied to a set of correlation coefficients that estimate test validity, meta-analysis combines the observed correlations and sample sizes to yield estimates of overall validity, as well as standard errors and confidence intervals, both overall and within grades. To conduct a meta-analysis of Accelerated Reader validity data, the 247 correlations displayed in Table 11 and Table 12 on pages 28 through 33 were combined and analysed using the fixed effects model for correlations advocated by Hedges & Oklin (1985). The results are displayed in Table 13. The table includes results for the correlations within each grade, as well as results with all 12 grades' data combined. The table includes weighted mean estimates of validity, a standard error and the lower and upper limits of a 95 per cent confidence interval for the validity coefficient. The overall validity estimate using Accelerated Reader points is 0.452.

Table 13: Results of the Meta-Analysis of Accelerated Reader Quiz Correlations (Points) with Other Tests

US Grade	Effect Size		95% Confidence Level	
	Validity Estimate	Standard Error	Lower Limit	Upper Limit
1	0.313	0.001	0.310	0.315
2	0.397	0.001	0.395	0.399
3	0.463	0.001	0.460	0.465
4	0.503	0.001	0.501	0.505
5	0.515	0.001	0.513	0.518
6	0.508	0.002	0.505	0.511
7	0.479	0.002	0.476	0.483
8	0.449	0.002	0.445	0.453
9	0.420	0.004	0.417	0.429
10	0.392	0.005	0.382	0.401
11	0.345	0.006	0.333	0.356
12	0.312	0.007	0.299	0.326
All	0.452	0.001	0.451	0.453

The process of establishing the validity of a progress-monitoring system such as Accelerated Reader is an ongoing one. Accelerated Reader is a dynamic progress-monitoring system; hundreds of new quizzes are added every year. Likewise, matched Accelerated Reader-state and standardised assessment data are collected on a fairly regular basis. Renaissance will continue to collect data and will update these correlations in the future.

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Appendix A: Student Reading Plan



Student Reading Plan

Student: _____ Year: _____ Teacher: _____

School Year: _____ Beginning ZPD: _____

1. Minimum Avg % Correct

Marking Period	Target	Actual
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

2. Points

Marking Period	Target	Actual
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

3. Minimum Avg Book Level

Marking Period	Target	Actual
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

4. Reader Certification Target*

Marking Period	Rdy	Ind	Ris	Sup	Adv	Sta	Cl	Hon
1								
2								
3								
4								
5								
6								

Fill in the bottom half of a box to indicate a target.
Fill in the whole box when you reach the target.

5. Additional Targets

Marking Period	Target	Actual
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

6. Commitment to Targets

Marking Period	Student Signature/Date	Teacher Signature/Date	Parent Signature/Date
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____
5	_____	_____	_____
6	_____	_____	_____

*Certification Codes: Rdy=Ready Reader, Ind=Independent Reader, Ris=Rising Reader, Sup=Super Reader, Adv=Advanced Reader, Sta=Star Reader, Cl=Classic Reader, Hon=Honours Reader

Appendix B: Diagnostic Report—Reading Practice



Diagnostic Report—Reading Practice

8 of 13

School: Renaissance Place UK School 1

Printed Thursday, 19 March 2015 17:42:12

Reporting Period: 27/11/2014 - 19/03/2015
(MP2 to today)

Class: Mr. Henry's Class

Teacher: Henry, S

Student	Diag. Codes	RP Quizzes		% Correct		Points			Engaged Time		Book Level		Certification	
		Passed	Taken	Target	Avg	Target	Earned	% of Target	% Read Indep.	Fiction	per Day	Target		Avg
Brown, Alva	E%	8	10	88	79.0	34.4	38.5	111.9	87	100	31	5.0	4.8	Working Towards
Coll, Angel	D	3	3	85	93.3	9.5	1.4	14.7	100	64	2	3.0	3.0	Advanced
Dorsey, Dennis	%	4	4	88	80.0	14.9	8.7	58.3	48	100	10	4.0	4.0	Rising
Houg, Dawn	A	0	0	85	-	-	-	-	-	-	0	-	-	Ready(2)
Tompkins, Arthur	E%	5	6	88	75.0	22.4	19.3	86.1	100	100	20	5.0	5.4	Rising
Summary		20	23	87	81.8				84	91	13	-	4.3	

Diagnostic Code Summary

Number of Students	Percentage of Students	Diag. Code	Description
1	20	A	No quizzes taken during period
0	0	B	Low average percentage correct (70% to 79%)
0	0	C	Very low average percentage correct (below 70%)
1	20	D	Low points earned - less than 1/2 median points (1/2 median = 7.0 points)
2	40	E	Low percentage correct with above median points (median = 14.0 points)
0	0	F	Very low percentage correct with above median points (median = 14.0 points)
3	60	%	Percentage of quiz takers with average percentage correct below 85%

At Risk: 80.0% of students (4 out of 5) with at least one code A-F

Class Summary

Number of Students	5
Total Quizzes	20
Passed	23
Taken	-
Total Points	67.9
Target	84%
Earned	84%
% Read Independently	91%
% Fiction / Non-Fiction	9%

◀ Trouble value

Appendix C: Reading Practice TOPS Report



Reading Practice TOPS Report for Leah Allen

Printed 12 November 2007 1:02:05PM

School: Thorpe Primary School
Class: Year 5 (Baker)

Year: 5
Teacher: Mr M Baker

What I Read	How I Did
Stellanuna by Janell Cannon ATOS BL ^a : 3.5 Quiz Number: 200337 F/NF: Fiction Quiz Date: 12/11/2007 1:01 PM Word Count: 1,463 Interest Level: Lower Grades (LG) TWI: Read Independently	Correct: 5 of 5 Percentage Correct: 100% ●●●●● <i>Terrific, Leah!</i> Points Earned: 0.5 of 0.5

My Progress in Winter Term 15/10/2007 – 21/12/2007 (44% Complete)	
Average % Correct: 97.5% 	Points Earned: 3.9
Average ATOS BL: 3.3 	Marking Period Totals Quizzes Passed: 4 Quizzes Taken: 4 Words Read: 24,399

My School Year Summary 14/8/2007 – 27/6/2008 (29% Complete)		
Average Percentage Correct: 91.7%	Quizzes Passed: 12	Last Certification: Super Reader
Points Earned: 9.9	Quizzes Taken: 12	Date Achieved: 12/10/2007
Average ATOS BL: 2.9	Total Words Read: 67,335	Certification Target: Super Reader (2)

Teacher

Comments:

^aATOS BL: ATOS Book Level

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