Content Analysis of Early Grade Readers in Khmer

E-books for Khmer Project (E4K)

Compiled by Kampuchean Action for Primary Education

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1. INTRODUCTION

1.1 Background

The present analysis has been developed by the *E-books for Khmer Project (E4K),* which is an innovative program in early grade reading funded under an *All Children Reading Grand Challenge* seed grant provided to Kampuchean Action for Primary Education. The project seeks to develop leveled early grade readers based on the existing reading curriculum recently developed by the Ministry of Education, Youth, and Sport. These readers, known by the term 'basal' reader will be electronic in form with interactive features to facilitate the acquisition of tool reading skills. While the use of basal readers to facilitate early grade reading is hardly new in many countries, it is still something quite novel in Cambodia, where there is little differentiation in reading instructional approaches based on a child's reading level. The successful use of basal readers is well-documented and includes many advantages including systematic and logical sequencing of reading content, smooth transition from being an emergent to an advanced reader, and appropriate tools to assess children based on their reading level. [1] The movement to levelled readers is a global one, which provides an important justification for E4K to provide some practical experience for Cambodia's education system in this area.

The first step needed to develop basal readers for L1 children learning to read Khmer script is to first identify some key goal posts relating to reading difficulty. These goal posts will help the project to empirically validate that the text to be included in basal readers is appropriate to designated reading levels that are classified as *basic, intermediate, and advanced.* This need to validate graduated reading levels in comparison to an agreed standard underlines the rationale for the present content analysis of the existing readers.

1.2 Using Readability Formulae to Determine Text Difficulty

The present analysis has been guided by the use of what are known as 'readability formulae,' which have been used successfully in other languages. One of the oldest and most accurate of these formulae was developed by an academic named Rudolph Flesch in 1948.[2] Many similar formulae have since been developed and continue to be very popular in terms of helping writers to make their work as reader-friendly as possible. Readability formulae are based on one or more 'readability criteria' including word length (i.e., average number of letters per word) as well as syllables and words per sentence among others (see Box 1). More recent readability formulae have become increasingly sophisticated and also include measures of commonly and infrequently used words to add accuracy to the assessments of text difficulty.

> **Box 1: Common Criteria for Assessing Text Readability**
> - Letters per word
> - Words per sentence
> - Syllables per sentence
> - Percentage of commonly used words

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[1] http://childparenting.about.com/od/schoollearning/a/what_is_basal_reading_instruction.htm

[2] Flesch, R. (1948) 'A new readability yardstick,' *Journal of Applied Psychology* **32:** 221-233.

Readability scores generated by the various formulae used in English can be expressed in different ways such as grade level (e.g., Flesch-Kincaid Grade Level Formula) or a standardized scale of 1-100 (e.g., Flesch Reading Ease Formula)[3]. For example, the *Flesch-Kindaid* formula generates grade level scores such as 5.5 (Grade 5), 10.1 (Grade 10) or 14.2 (2nd Year of University) while the *Flesch Reading Ease Formulae* generates scores from 1 to 100 where a high score indicates high readability and a low score indicates more difficult text. For purposes of the E4K Project, program staff will likely also use a scaling system that is linked to grade level to facilitate easy interpretation of assessments.

2. KEY ASSUMPTIONS & GENERAL PARAMETERS

2.1 Key Assumptions

The present section lays out how the project has gone about conducting the required content analysis including some key assumptions and subsequent steps. These steps are summarized in Box 2. As noted earlier, a key first step in developing a readability scale in Khmer has been to look for some goal posts to make comparisons with a common standard. Given the time constraints in project development, the project has made an assumption that recently developed Ministry readers for Grades 1, 2, and 3 provide a useful national standard for determining reading level goal posts. Although this is a major assumption given that Ministry writers did not empirically verify the reading difficulty of the reading texts currently in use in the official readers, the books have been shown to be contributing to improved reading scores on EGRA-administered tests. This evidence, therefore, provides some degree of confidence in making this assumption. [4]

> **Box 2: Summary of Assumptions & Parameters Leading to Readability Criteria**
>
> Start with Assumption that current readers provide difficulty level appropriate to children of that grade
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> ⬇⬇
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> Select 10 mid-point lessons from Grades 2, 3, and 4 to establish goal posts for average readability based on grade level
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> ⬇⬇
>
> Analyze text based on selected readability criteria (e.g., word length, sentence length, etc)
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> ⬇⬇
>
> Select average word length as key criteria for readability levels
>
> ⬇⬇
>
> Fix goal posts at the mid-point of each grade level based on mean word length
>
> ⬇⬇
>
> Interpolate readability levels between agreed readability goal posts
>
> ⬇⬇
>
> Match interpolated guide posts with a 10 –level scale based on grade (e.g., 3.0, 3.1, 3.2, etc)

Another key assumption made in this analysis is that the readability criteria used in other phonetic languages such as word and sentence length may also be applied to the Khmer language though the written script is quite different. Nevertheless, the language building blocks in the Khmer language are the same as other phonetic languages and include letters, discrete words, sentences, and paragraphs. There are of course certain features of the Khmer language that make it quite different from European languages such as the use of consonant sub-

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[3] http://www.readabilityformulas.com/flesch-reading-ease-readability-formula.php

[4] World Bank, (2012*). Summary Report on the Early Grade Reading Assistance Program in Cambodia,* Phnom Penh: MoEYS.

scripts when forming consonant blends (also known as consonant 'legs'), vowels that take the form of superscripts, the use of consonants that have inherent vowel sounds, and other features that are unique to the Khmer language. Nonetheless, word and sentence length can also increase the complexity of Khmer language text, which provides reasonable justification for the assumption that these commonly used readability criteria can also be applied to Khmer.

2.2 Establishing Goal Posts for Readability at Relevant Grade Levels

Based on the above assumption, the project has conducted a textual analysis of the reading passages found in each of the ten lessons at the 'midpoint' of the readers for Grades 2, 3, and 4. If the assumption described above is correct, these midpoints should represent a text difficulty level appropriate to most children's reading ability at mid-year for each grade level.

Although the project will not be producing any basal materials for Grade 1 due to the extensive work already done at this grade level under the *Total Reading Approach for Children Project (TRAC),* it was still necessary to establish a base level or starting point for readability at Grade 1 that would provide a range of interpolated values between itself and the Grade 2 midpoint values. Because most of the lessons in the Grade 1 reader focus heavily on the phonic building blocks of the Khmer language, there are no reading texts at all until the very end of the reader (the last seven lessons). Thus, the analysis did not use a midpoint set of lessons for Grade 1 but rather the final seven lessons of the reading book.

The Grade 4 Reader used in the present analysis has presented something of a problem because the Ministry has not yet revised the reading curriculum for the upper primary grades, whereas readers for Grades 1 to 3 have recently

FIGURE 2.1: Progression in Text Complexity by Average Word & Sentence Length

	Grade 1	Grade 2	Grade 3	Grade 4
Letters per Word	3.26	3.65	4.17	3.89
Words per Sentence	11.69	13.31	15.66	14.77

been completely re-written, field-tested, and revised accordingly. Therefore, there was a concern that there may not be the continuity in text difficulty presentation from Grade 3 to Grade 4 that is true of the grades at the lower primary school level. This is especially true since the new readers focus heavily on a more phonics-based approach to reading instruction than was true of the old reading curriculum that is still being used at upper primary level. And indeed, it was found that average levels
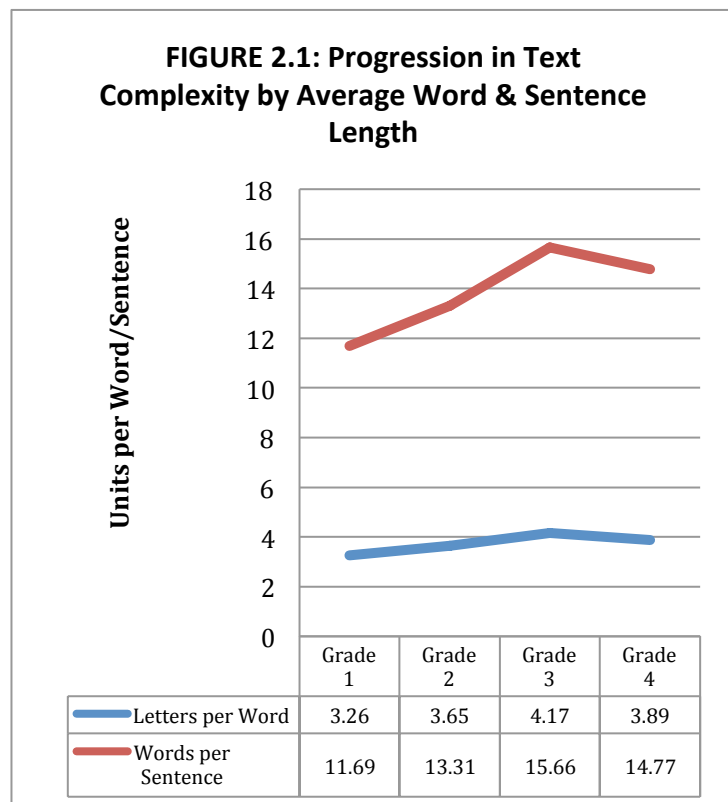
of word and sentence length at Grade 4 did not follow the the same gradient as generated by transitions between Grades 1, 2, and 3 as shown by the results depicted in Figure 2.1. In this respect, word and sentence length at midpoint lessons in the Grade 4 Reader were somewhat lower than those found at Grade 3, which accounts for the downward trend in the gradient at Grade 4. A possible solution to this problem is discussed further below.

2.3 Creating a Readability Scale by Interpolating Readability Values between Reading Goal Posts

Using multiple readability criteria such as word length, sentence length, etc., the present analysis will establish mean score values for each of the ten mid-point lessons that were analyzed at each grade level. One overall mean score will be established across all ten lessons in any given grade for each of the criteria identified. These overall mean scores will then provide the needed goal posts described earlier for each grade. Between these goal posts, the project will determine graduated increments across the ten intervals that lie between each midpoint through a process of interpolation so that each increment is equal in size to the one before and after it. These interpolated increments will then be cross-referenced to a grade-based scale ranging from 1.9 (the end of Grade) to 4.5 (the middle of Grade 4). The outline of this scheme is presented in Table 2.1 below.

TABLE 2.1: Proposed System for Interpolating Values between Midpoint Mean Scores for Readability (1)

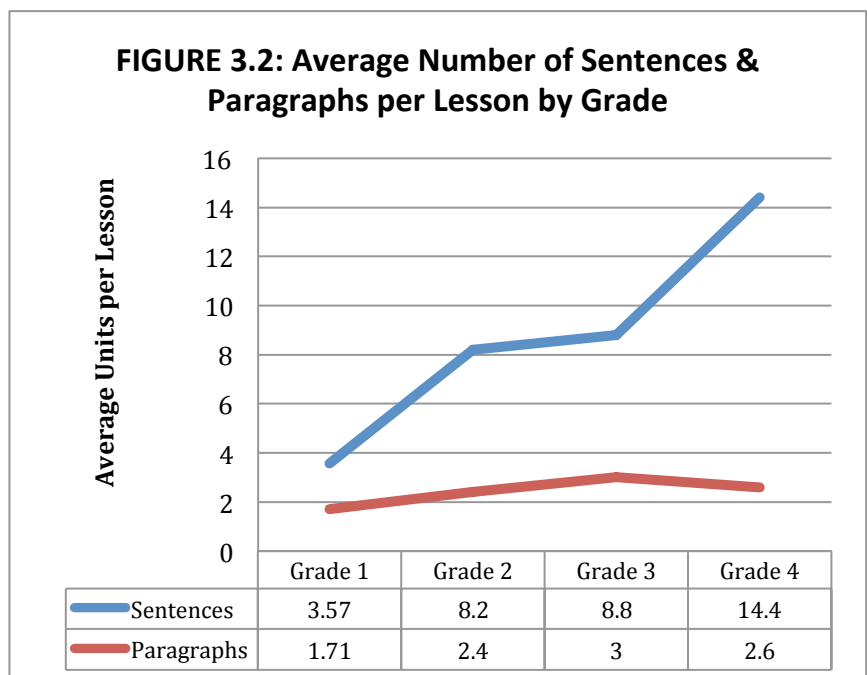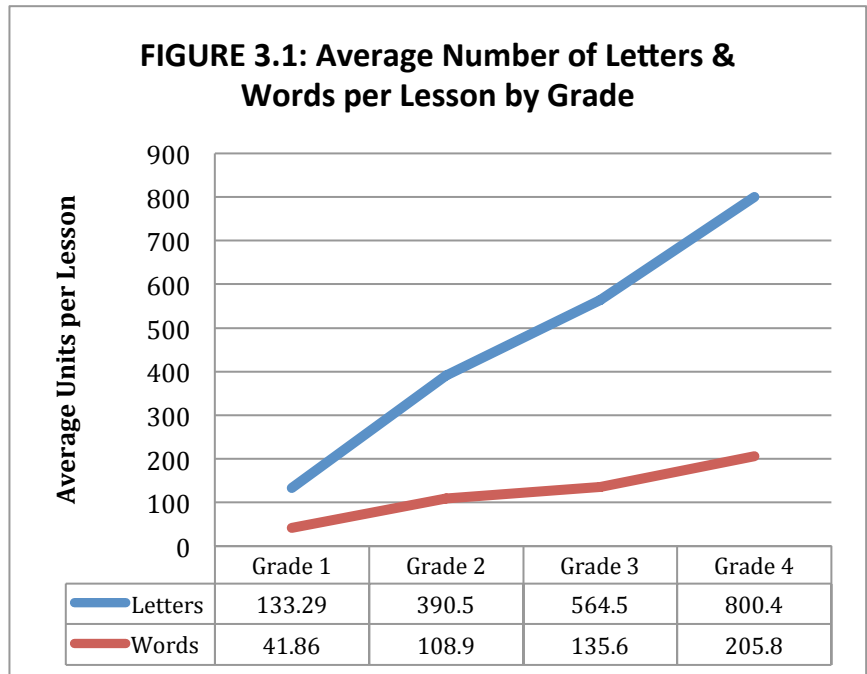| Grade Level Goal Posts	1.9	⟷					2.5	⟷									3.5	⟷									4.5
Interpolated Scale Values	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5
Interpolated Readability Values											To be determined in analysis below																
Grade Level	Grd 1		Grade 2 (Target Grade)							Grade 3 (Target Grade)									Grade 4								

Although goal posts have been determined for Grades 1 and 4, the project will be focusing mainly on readability values that are generated for Grades 2 and 3 only (the area in grey in Table 2.1). Goal posts for Grade 1 and Grade 4, however, were identified in order to establish a lower and upper limit of values between which intermediate scores could be interpolated.

3. READABILITY VALUES GENERATED BY THE CONTENT ANALYSIS OF READERS AT GRADES 1 to 4

3.1 Changes in the Average Number of Reading Units by Grade

The present content analysis began by first calculating the average number of basic reading units for each of the midpoint lessons reviewed. Basic reading units in this case were understood to take in letters, words, sentences, and paragraphs. This assessment sought to determine whether the increase in the number of basic reading units presented to students followed a consistently upward gradient from grade to grade as children increased their level of reading proficiency.

An assessment of letters and words found that the average number of letters per lesson increased from an average of 133 letters in the last seven lessons of the Grade 1 reader to about 800 letters by the middle of Grade 4 with the comparable increase in the number of words changing from about 42 words per lesson at Grade 1 to about 206 at the midpoint of Grade 4 (see Figure 3.1).

FIGURE 3.1: Average Number of Letters & Words per Lesson by Grade

	Grade 1	Grade 2	Grade 3	Grade 4
Letters	133.29	390.5	564.5	800.4
Words	41.86	108.9	135.6	205.8

FIGURE 3.2: Average Number of Sentences & Paragraphs per Lesson by Grade

	Grade 1	Grade 2	Grade 3	Grade 4
Sentences	3.57	8.2	8.8	14.4
Paragraphs	1.71	2.4	3	2.6

The number of sentences per lesson seemed to increase sharply during the transition from Grade 1 to Grade 2 moving from 3.57 sentences per lesson to more than 8 (see Figure 3.2). This value then levelled off during the transition from Grade 2 to Grade 3 (8.2 to 8.8 sentences) with a sharp increase to 14.4 at Grade 4. With respect to the
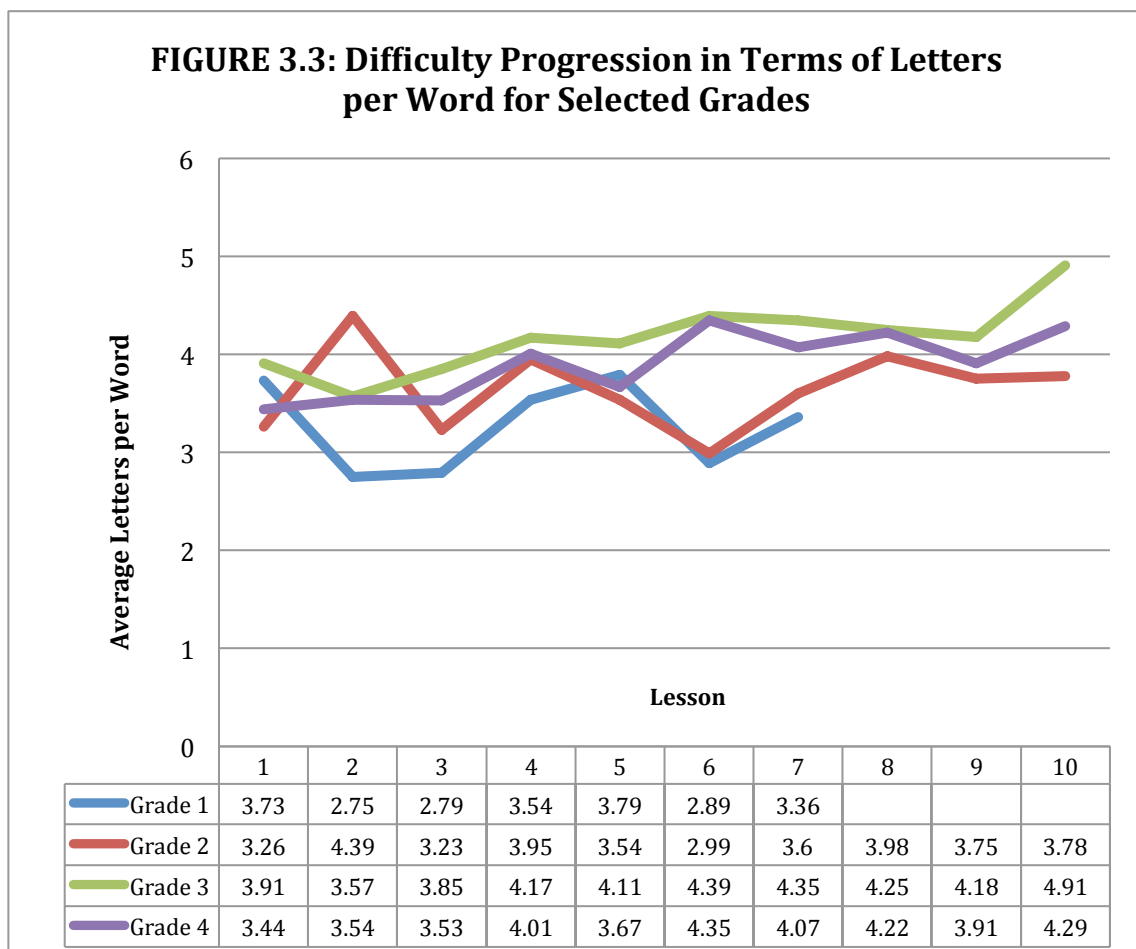
number of paragraphs per lesson, the transition from Grade 1 to 3 followed a very smooth upward gradient but then unexpectedly declined at Grade 4.

Overall, this assessment of the current readers found that the transitions in presentation of basic reading units appeared to be consistent with a relatively smooth upward trend from grade to grade, the main exception to this observation being the change in the number of paragraphs at the higher grade levels (i.e., Grade 4).
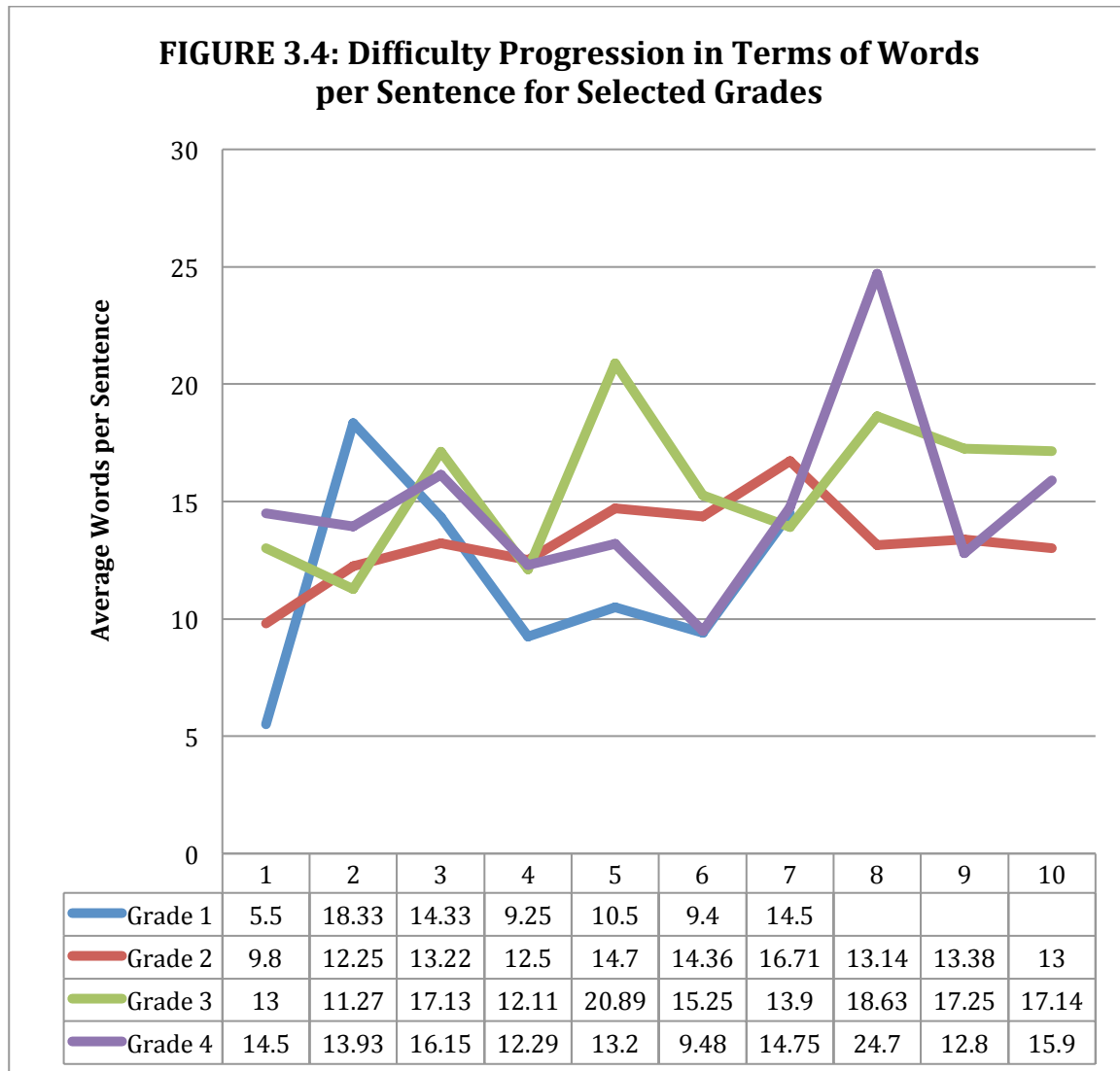
3.2 Readability Levels by Selected Criteria

This analysis also considered several additional measures of readability such as word, sentence, and paragraph length using letters, words, and sentences as the counting units. A full presentation of data according to these various measures is provided in Annex 1. Given their prominence in other readability formulae, the project has focused most heavily on outcomes that involve the number of letters per word (i.e., word length) and the number of words per sentence (i.e., sentence length). Higher values imply greater textual complexity and difficulty.

It was earlier reported that overall mean scores for word and sentence length followed a logical trajectory for Grades 1, 2, and 3, but not for Grade 4 (see Figure 2.1). However, when reviewing the trajectory of readability values from lesson to lesson, a more erratic picture emerges, especially when considering sentence length. For word length, text from the end of Grade 1 generally appears to be less complex than text

FIGURE 3.3: Difficulty Progression in Terms of Letters per Word for Selected Grades

	1	2	3	4	5	6	7	8	9	10
Grade 1	3.73	2.75	2.79	3.54	3.79	2.89	3.36			
Grade 2	3.26	4.39	3.23	3.95	3.54	2.99	3.6	3.98	3.75	3.78
Grade 3	3.91	3.57	3.85	4.17	4.11	4.39	4.35	4.25	4.18	4.91
Grade 4	3.44	3.54	3.53	4.01	3.67	4.35	4.07	4.22	3.91	4.29

presented in the middle of Grade 2 while text from the middle of Grade 3 generally seems to be characterized by more complexity than that presented in Grade 2 (with the exception of Lesson 2) (see Figure 3.3). However, the complexity of text in Grade 4 appears to be lower than that presented in Grade 3, which is counterintuitive to what one would expect.

FIGURE 3.4: Difficulty Progression in Terms of Words per Sentence for Selected Grades

	1	2	3	4	5	6	7	8	9	10
Grade 1	5.5	18.33	14.33	9.25	10.5	9.4	14.5			
Grade 2	9.8	12.25	13.22	12.5	14.7	14.36	16.71	13.14	13.38	13
Grade 3	13	11.27	17.13	12.11	20.89	15.25	13.9	18.63	17.25	17.14
Grade 4	14.5	13.93	16.15	12.29	13.2	9.48	14.75	24.7	12.8	15.9

When assessing readability in terms of sentence length, there appears to be much less of a consistent pattern of complexity that reflects grade level (see Figure 3.4). Transitions from lesson to lesson within each grade appear to alternate in an inconsistent manner between very high and very low levels of complexity with Grade 4 text generating the highest levels of text variability. In this respect, textual complexity jumps from a low point of 9.48 words per sentence to as high as 24.7 words per sentence at one point. Significant variations can also be seen in the other grades as well but these are not as extreme as in Grade 4 suggesting that the more recently revised readers do appear to be better written.

3.3 Interpolated Readability Values by Grade Level

In spite of some of the inconsistencies found in readability levels within grade levels,

this assessment found that overall mean scores for readability for the new Ministry readers demonstrated a logical and consistently upward trajectory in complexity from grade to grade, as one would expect. The measures of readability in this respect mainly comprise average word and sentence length. These mean scores provide useful goalposts between which the project can interpolate readability values using increments of equal magnitude.

TABLE 3.1: Proposed System for Interpolating Values between Midpoint Mean Scores for Readability Based on Word Length (Letters per Word)

	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5
Grade Level Goal Posts	1.9						2.5										3.5										4.5
Interpolated Scale Values	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5
Interpolated Readability Values	3.260	3.325	3.390	3.455	3.520	3.585	3.650	3.702	3.754	3.806	3.858	3.910	3.962	4.014	4.066	4.118	4.170	4.222	4.274	4.326	4.378	--	--	--	--	--	--
Grade Level	Gr 1	Grade 2										Grade 3										Grade 4					

Table 3.1 above summarizes the calculation of interpolated values for readability using *Word Length Mean Scores* at Levels 1.9, 2.5, and 3.5. For example, the mean score value for word length for the 7 lessons at the end of Grade 1 was 3.260 letters per word (equivalent to a level of Scale Level of 1.9). Similarly, the mean score value for the 10 lessons at the middle of Grade 2 (equivalent to a Scale Level of 2.5) was 3.650 letters per word. The difference between these two goal post values is 0.39 letters per word (i.e., 3.650 – 3.260 = 0.39). Since there are 6 intervals between the Scale Level of 1.9 and 2.5, the interpolated increment for one level would be 0.065 (or 0.39/6). Thus, Scale Level 2.0 is calculated as 3.260 + 0.065 or 3.325. The same process is used for calculating the interpolated increment values for all scale levels between the identified goal posts.

The Grade 4 reader, however, presents a problem because it did not follow the same pattern of textual complexity as was true of the new readers, as noted earlier; it is, therefore, difficult to use Grade 4 readability values for the purpose described above because the mean score values for readability are lower than those generated in Grade 3 (when they should actually have been higher). Thus, in the absence of a usable mean score value for Grade 4 readability, the project has decided to simply extend the use of incremental values calculated for the interval between the middle of Grade 2 to the middle of Grade 3 (i.e., Scale Level 2.5 to 3.5) to the end of Grade 3 (i.e., to Scale Level 3.9).

Table 3.2 below presents a similar statement of readability values using *Sentence Length Mean Scores* as the goal posts. Incremental values for each Scale Level are cal-

culated in the same way as described above. These values are interpolated based on the difference in goal post values divided by the total number intervals in between.

A more detailed analysis of the calculation of interpolated values by Scale Level is provided in Annex 2.

TABLE 3.2: Proposed System for Interpolating Values between Midpoint Mean Scores for Readability Based on Sentence Length (Words per Sentence)

Grade Level Goal Posts	1.9						2.5										3.5										4.5
Interpolated Scale Values	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5
Interpolated Readability Values	11.69	11.96	12.23	12.50	12.77	13.04	13.31	13.55	13.78	14.02	14.25	14.49	14.72	14.96	15.19	15.43	15.66	15.90	16.13	16.37	16.60	--	--	--	--	--	--
Grade Level	Gr 1	Grade 2										Grade 3										Grade 4					

4. USING THIS CONTENT ANALYSIS TO GUIDE THE DEVELOPMENT OF LEVELLED TEXT IN E-BOOK READERS

4.1 General Observations

The purpose of this content analysis is to provide an empirical basis through which to validate texts that are relevant and appropriate to the level of a beginning reader. The identification of difficulty levels of text within the approved reading textbooks at different grade levels will provide good guidance to the project in terms of developing revised texts that are easier, more challenging or equal to the established readability goal posts discussed above. The provision of such texts to children at different stages of reading acquisition will help to facilitate their efforts to learn to read and provide differentiated instruction to students at different levels.

Although the current analysis does not include any psychometric testing to validate the assumption that the current readers are appropriate to Cambodian children at a particular grade level, World Bank testing to assess the effectiveness of the new readers has indicated that the books are more effective in helping children to learn to read than earlier used texts.[5] In addition, the present analysis has found that within the three new readers at Grades 1, 2, and 3, there is a relatively smooth upward trajectory of text complexity using certain measures of readability such as the number of reading units presented as well as word and sentence length. Given this observation and the tendency of other readability formula to use word and sentence length as key measures of readability, the present analysis makes a recommendation to similarly rely on these two criteria when assessing readability for E-book reader texts (see Box 3).

> **Box 3: Suggested Criteria for Modulating Text Readability in E4K**
>
> • Word Length
> • Sentence Length

4.2 Suggested Criteria to Guide the Development of Leveled Text Based on This Analysis

The system of interpolated values based on word and sentence length presented in an earlier section is intended to provide an empirical basis for writers developing leveled text with three levels in mind: Basic (Level 1), Intermediate (Level 2), and Advanced (Level 3). Using the interpolated values calculated at each scale level, writers developing leveled reading passages could develop text that is 30% less complex than the given standard for struggling readers by multiplying a selected percentage value (in this case, 1 – 0.3 = 0.7) by the interpolated readability value associated with any scale level. Similarly, they could develop text that is 30% more complex for faster readers by adding 30% to the interpolated value (e.g., 1 + 0.3 = 1.3). For students whose ability is middle of the road, writers would develop text at the same level of complexity as indicated by the given interpolated readability value. In all cases, there would be some level of flexibility in the readability value achieved of perhaps 10% (i.e., ±10%). The degree to which a writer might want to reduce or increase text complexity (e.g., 30%, 40%, etc.) can be modified according to individual preferences.

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[5] Op. Cit.

A value of 30% has been suggested in the example given above. The interpolated values for average word and sentence length provided earlier give a starting point for how these changes in text readability can be brought about.

An example of how these modifications in the readability of a given text can be undertaken using word length as a readability criterion is provided in Table 4.1 below. In this example, average readability values for word length associated with each scale level are provided in Column B. These values represent the official standard currently used in Ministry textbooks, as calculated and discussed in earlier sections of this analysis. If the project envisions developing 24 E-books across Grades 2 and 3 at three levels of complexity, guidelines for average word length in the text developed can be calculated for each intended reading level according to the formulae provided in Columns D, E, and F. Column D indicates that words at Level 1 (a Basic Level) should be 30% shorter than the agreed standard indicated by the earlier calculated RV; those at Level 2 (Intermediate Level) are at the standard RV, while those at Level 3 should be 30% longer (Advanced Level). It should be noted that no values have been provided for intervals 2.0 to 2.4 because the first 32 lessons[6] (or about 40% of all lessons) in the Grade 2 reader focus on a review of phonics that children already learned in Grade 1 with little presentation of reading passages. Reading instruction that comprises the use of stories and reading passages begins from about interval 2.5, onwards.

TABLE 4.1: Example of How Interpolated Values for <u>Word Length</u> Can Be Manipulated to Match Differentiated Reading Levels among Students

A	B	C		D	E	F
Scale Level	Interpolated Readability Value (RV)	Designated Reader		Level 1 Formula 0.7 x RV ± 10%	Level 2 Formula 1.0 x RV ± 10%	Level 3 Formula 1.3 x RV ± 10%
2.0	3.325	--		--	--	--
2.1	3.390	--		--	--	--
2.2	3.455	--		--	--	--
2.3	3.520	--		--	--	--
2.4	3.585	--		--	--	--
2.5	3.650	E-Book 2A E-Book 2B		0.7 x 3.650 =2.555	3.650	1.3 x 3.650 = 4.745
2.6	3.702	E-Book 2C E-Book 2D		0.7 x 3.702 = 2.5914	3.702	1.3 x 3.702 = 4.8126
2.7	3.754	E-Book 2E E-Book 2F		0.7 x 3.754 = 2.6278	3.754	1.3 x 3.754 = 4.8802
2.8	3.806	E-Book 2G E-Book 2H		0.7 x 3.806 = 2.6642	3.806	1.3 x 3.806 = 4.9478
2.9	3.858	E-Book 2I E-Book 2J		0.7 x 3.858 = 2.7006	3.858	1.3 x 3.858 = 5.0154
3.0	3.910	E-Book 3A		0.7 x 3.910 = 2.737	3.910	1.3 x 3.910 = 5.083
3.1	3.962	E-Book 3B		0.7 x 3.962 = 2.7734	3.962	1.3 x 3.962 = 5.1506
3.2	4.014	E-Book 3C		0.7 x 4.014 = 2.8098	4.014	1.3 x 4.014 = 5.2182

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[6] There are 81 Lessons in the Grade 2 Reader in all.

A	B	C		D	E	F
Scale Level	Interpolated Readability Value (RV)	Designated Reader		Level 1 Formula 0.7 x RV ± 10%	Level 2 Formula 1.0 x RV ± 10%	Level 3 Formula 1.3 x RV ± 10%
3.3	4.066	E-Book 3D E-Book 3E		0.7 x 4.066 = 2.8462	4.066	1.3 x 4.066 = 5.2858
3.4	4.118	E-Book 3F E-Book 3G		0.7 x 4.118 = 2.8826	4.118	1.3 x 4.118 = 5.3534
3.5	4.170	E-Book 3H E-Book 3I		0.7 x 4.170 = 2.919	4.170	1.3 x 4.170 = 5.421
3.6	4.222	E-Book 3J E-Book 3K		0.7 x 4.222 = 2.9554	4.222	1.3 x 4.222 = 5.4886
3.7	4.274	E-Book 3L		0.7 x 4.274 = 2.9918	4.274	1.3 x 4.274 = 5.5562
3.8	4.326	E-Book 3M		0.7 x 4.326 = 3.0282	4.326	1.3 x 4.326 = 5.6238
3.9	4.378	E-Book 3N		0.7 x 4.378 = 3.0646	4.378	1.3 x 4.378 = 5.6914

The use of readability values provided for word length as shown above can similarly also be used for other readability measures such as sentence length, paragraph length, and other measures of text complexity. An analysis using sentence length as the readability measure that employs the same guidelines in Table 4.1 is provided in Annex 3 for purposes of further project planning.

ANNEX 1: Readability Data Tables for All Grades

GRADE 1 STATS								
Lesson	Paragraphs	Sentences	Words	Letters	Letters/Sentence	Letters/Word	Words/Sentence	Wprds/Para	Sentences/Para
1	1	2	11	41	20.50	3.73	5.50	11.00	2.00
2	1	3	55	151	50.33	2.75	18.33	55.00	3.00
3	1	3	43	120	40.00	2.79	14.33	43.00	3.00
4	2	4	37	131	32.75	3.54	9.25	18.50	2.00
5	2	4	42	159	39.75	3.79	10.50	21.00	2.00
6	3	5	47	136	27.20	2.89	9.40	15.67	1.67
7	2	4	58	195	48.75	3.36	14.50	29.00	2.00
Total	12	25	293	933	259.28	22.85	81.82	193.17	15.67
MEAN	1.71	3.57	41.86	133.29	37.04	3.26	11.69	27.60	2.24
STD	0.755928946	0.975900073	15.47501827	47.41558916	10.94489081	0.447769779	4.280713794	15.9906967	0.534522484

GRADE 2 STATS								
Lesson	Paragraphs	Sentences	Words	Letters	Letters/Sentence	Letters/Word	Words/Sentence	Words/Para	Sentences/Para
1	3	10	98	319	31.90	3.26	9.80	32.67	3.33
2	3	8	98	430	53.75	4.39	12.25	32.67	2.67
3	1	9	119	384	42.67	3.23	13.22	119.00	9.00
4	3	6	75	296	49.33	3.95	12.50	25.00	2.00
5	4	10	147	521	52.10	3.54	14.70	36.75	2.50
6	1	11	158	472	42.91	2.99	14.36	158.00	11.00
7	3	7	117	421	60.14	3.60	16.71	39.00	2.33
8	2	7	92	366	52.29	3.98	13.14	46.00	3.50
9	1	8	107	401	50.13	3.75	13.38	107.00	8.00
10	3	6	78	295	49.17	3.78	13.00	26.00	2.00
Total	24	82	1089	3905	47.62	3.59	13.28	45.38	3.42
MEAN	2.4	8.2	108.9	390.5	48.44	3.65	13.31	62.21	4.63
STD	1.075	1.751	27.205	74.594	7.71	0.42	1.79	47.49	3.36

GRADE 3 STATS								
Lesson	Paragraphs	Sentences	Words	Letters	Letters/Sentence	Letters/Word	Words/Sentence	Wprds/Para	Sentences/Para
1	3	10	130	508	50.80	3.91	13.00	43.33	3.33
2	2	11	124	443	40.27	3.57	11.27	62.00	5.50
3	3	8	137	527	65.88	3.85	17.13	45.67	2.67
4	3	9	109	455	50.56	4.17	12.11	36.33	3.00
5	3	9	188	773	85.89	4.11	20.89	62.67	3.00
6	3	8	122	535	66.88	4.39	15.25	40.67	2.67
7	4	10	139	605	60.50	4.35	13.90	34.75	2.50
8	3	8	149	633	79.13	4.25	18.63	49.67	2.67
9	3	8	138	577	72.13	4.18	17.25	46.00	2.67
10	3	7	120	589	84.14	4.91	17.14	40.00	2.33
Total	30	88	1356	5645	64.15	4.16	15.41	45.20	2.93
MEAN	3	8.8	135.6	564.5	65.62	4.17	15.66	46.11	3.03
STD	0.471	1.229	21.721	95.906	15.26	0.36	3.08	9.65	0.91
GRADE 4								
Lesson	Paragraphs	Sentences	Words	Letters	Letters/Sentence	Letters/Word	Words/Sentence	Wprds/Para	Sentences/Para
1	2	14	203	699	49.93	3.44	14.50	101.50	7.00
2	1	14	195	690	49.29	3.54	13.93	195.00	14.00
3	1	20	323	1140	57.00	3.53	16.15	323.00	20.00
4	3	14	172	689	49.21	4.01	12.29	57.33	4.67
5	2	10	132	484	48.40	3.67	13.20	66.00	5.00
6	4	21	199	866	41.24	4.35	9.48	49.75	5.25
7	3	16	236	960	60.00	4.07	14.75	78.67	5.33
8	4	10	247	1043	104.30	4.22	24.70	61.75	2.50
9	3	15	192	751	50.07	3.91	12.80	64.00	5.00
10	3	10	159	682	68.20	4.29	15.90	53.00	3.33
Total	26	144	2058	8004	55.58	3.89	14.29	79.15	5.54
MEAN	2.6	14.4	205.8	800.4	57.76	3.90	14.77	105.00	7.21
STD	1.075	3.893	53.214	198.720	17.97	0.34	3.99	87.83	5.48

ANNEX 2: Interpolated Values for Readability

Grade Intervals	Letter/Word	Interval Size	Increment Size	Words/Sentence	Interval Size	Increment Size
1.9	3.260	0.39	0.065	11.690	1.62	0.27
2.0	3.325			11.960		
2.1	3.390			12.230		
2.2	3.455			12.500		
2.3	3.520			12.770		
2.4	3.585			13.040		
2.5	3.650	0.52	0.052	13.310	2.35	0.235
2.6	3.702			13.545		
2.7	3.754			13.780		
2.8	3.806			14.015		
2.9	3.858			14.250		
3.0	3.910			14.485		
3.1	3.962			14.720		
3.2	4.014			14.955		
3.3	4.066			15.190		
3.4	4.118			15.425		
3.5	4.170	Interpolations from this point onward based on 0.052 intervals	0.052	15.660		Interpolations from this point onward based on 0.235 intervals
3.6	4.222			15.895		
3.7	4.274			16.130		
3.8	4.326			16.365		
3.9	4.378			16.600		
4.0	4.430			16.835		
4.1	--			--		
4.2	--			--		
4.3	--			--		
4.4	--			--		
4.5	3.900	????		14.770		

ANNEX 3: Example of How Interpolated Values for Sentence Length Can Be Manipulated to Match Differentiated Reading Levels among Students

A Scale Level	B Interpolated Readability Value (RV)	C Designated Reader		D Level 1 Formula 0.7 x RV ± 10%	E Level 2 Formula 1.0 x RV ± 10%	F Level 3 Formula 1.3 x RV ± 10%
2.0	11.960	--		--	--	--
2.1	12.230	--		--	--	--
2.2	12.500	--		--	--	--
2.3	12.770	--		--	--	--
2.4	13.040	--		--	--	--
2.5	13.310	E-Book 2A E-Book 2B		0.7 x 13.310 =9.317	13.310	1.3 x 13.310 = 17.303
2.6	13.545	E-Book 2C E-Book 2D		0.7 x 13.545 = 9.4815	13.545	1.3 x 13.545 = 17.6085
2.7	13.780	E-Book 2E E-Book 2F		0.7 x 13.780 = 9.646	13.780	1.3 x 13.780 = 17.914
2.8	14.015	E-Book 2G E-Book 2H		0.7 x 14.015 = 9.8105	14.015	1.3 x 14.015 = 18.2195
2.9	14.250	E-Book 2I E-Book 2J		0.7 x 14.250 = 9.975	14.250	1.3 x 14.250 = 18.525
3.0	14.485	E-Book 3A		0.7 x 14.485 = 10.1395	14.485	1.3 x 14.485 = 18.8305
3.1	14.720	E-Book 3B		0.7 x 14.720 = 10.304	14.720	1.3 x 14.720 = 19.136
3.2	14.955	E-Book 3C		0.7 x 14.955 = 10.4685	14.955	1.3 x 14.955 = 19.4415
3.3	15.190	E-Book 3D E-Book 3E		0.7 x 15.190 = 10.633	15.190	1.3 x 15.190 = 19.747
3.4	15.425	E-Book 3F E-Book 3G		0.7 x 15.425 = 10.7975	15.425	1.3 x 15.425 = 20.0525
3.5	15.660	E-Book 3H E-Book 3I		0.7 x 15.660 = 10.962	15.660	1.3 x 15.660 = 20.358
3.6	15.895	E-Book 3J E-Book 3K		0.7 x 15.895 = 11.1265	15.895	1.3 x 15.895 = 20.6635
3.7	16.130	E-Book 3L		0.7 x 16.130 = 11.291	16.130	1.3 x 16.130 = 20.969
3.8	16.365	E-Book 3M		0.7 x 16.365 = 11.4555	16.365	1.3 x 16.365 = 21.2745
3.9	16.600	E-Book 3N		0.7 x 16.600 = 11.62	16.600	1.3 x 16.600 = 21.58