Perspectives on Text Complexity BMGF LA Literacy Convening

February 18-19, 2010

Presented by:
A. Jackson Stenner

MetaMetrics.
LINKING ASSESSMENT WITH INSTRUCTION

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Overview

- Introduction to MetaMetrics and the Frameworks
- Text Complexity, Reader Ability, and Comprehension Rates
- **Text Complexity Continuum**
- **Dimensionality of Reading**
- **How Well Does the Lexile Theory Work?**
- Free Resources for Educators

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Introduction to MetaMetrics

- Founded in 1984 as an organization focused on psychometric research and development
- Research funded by five grants from NIH
- Introduced *The Lexile Framework® for Reading* in 1997
- Introduced *The Quantile Framework® for Mathematics* in 2005
- Introduced *The Lexile Framework® for Writing* in 2006

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Features and Benefits of Our Frameworks

- Measurement Properties
  - Vertical Scale
  - Common Supplemental Scale
  - Focus on Individual Student Growth K-16
  - Connects the Day-to-Day with the Year-to-Year
- Metric is Instrument-Independent
- Instructional Properties
  - Differentiated Instruction
  - Links Assessment/Instruction
  - Educator, Parent, and Student Actionable

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Reading is a process in which information from the **text** and the knowledge possessed by the **reader** act together to produce **meaning**.

Anderson, R.C., Hiebert, E.H., Scott, J.A., & Wilkinson, I.A.G. (1985)
Becoming a nation of readers: The report of the Commission on Reading
Urbana, IL: University of Illinois

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The Lexile Framework for Reading

- A causal model relating reader ability, text complexity and comprehension
- Measures **reader ability** and **text complexity** on a common scale—the Lexile scale
- Allows educators to forecast the level of comprehension a reader is likely to experience with a particular text

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An Equation

Conceptual

$$\text{Comprehension} = \text{Reader Ability} - \text{Text Complexity}$$

Statistical

$$\text{Raw Score} = \sum_{i} \frac{e^{(RA - TC_i)}}{1 + e^{(RA - TC_i)}}$$

RA = Reader Ability

TC = Text Complexity

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Comprehension Rates for Fixed Text Complexity

Comprehension Rates for Readers of Different Ability with Texts of the Same Complexity or How Reader Ability and Comprehension Rate Relate Under Constant Text Complexity

Reader Ability	Classroom Textbook	Comprehension Rates
500L	1000L	25%
750L	1000L	50%
1000L	1000L	75%
1250L	1000L	90%
1500L	1000L	96%

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Comprehension Rates for Fixed Reader Ability

Comprehension Rates for Readers of the Same Ability with Texts of Different Complexity or How Reader Ability and Comprehension Rate Relate Under Varying Text Complexity

Reader Ability	Text Complexity	Text Titles	Comprehension Rates
1000L	500L	*The Magic School Bus, Inside the Earth* (Cole)	96%
1000L	750L	*The Martian Chronicles* (Bradbury)	90%
1000L	1000L	*The Reader's Digest*	75%
1000L	1250L	*The Call of the Wild* (London)	50%
1000L	1500L	*On Equality Among Mankind* (Rousseau)	25%

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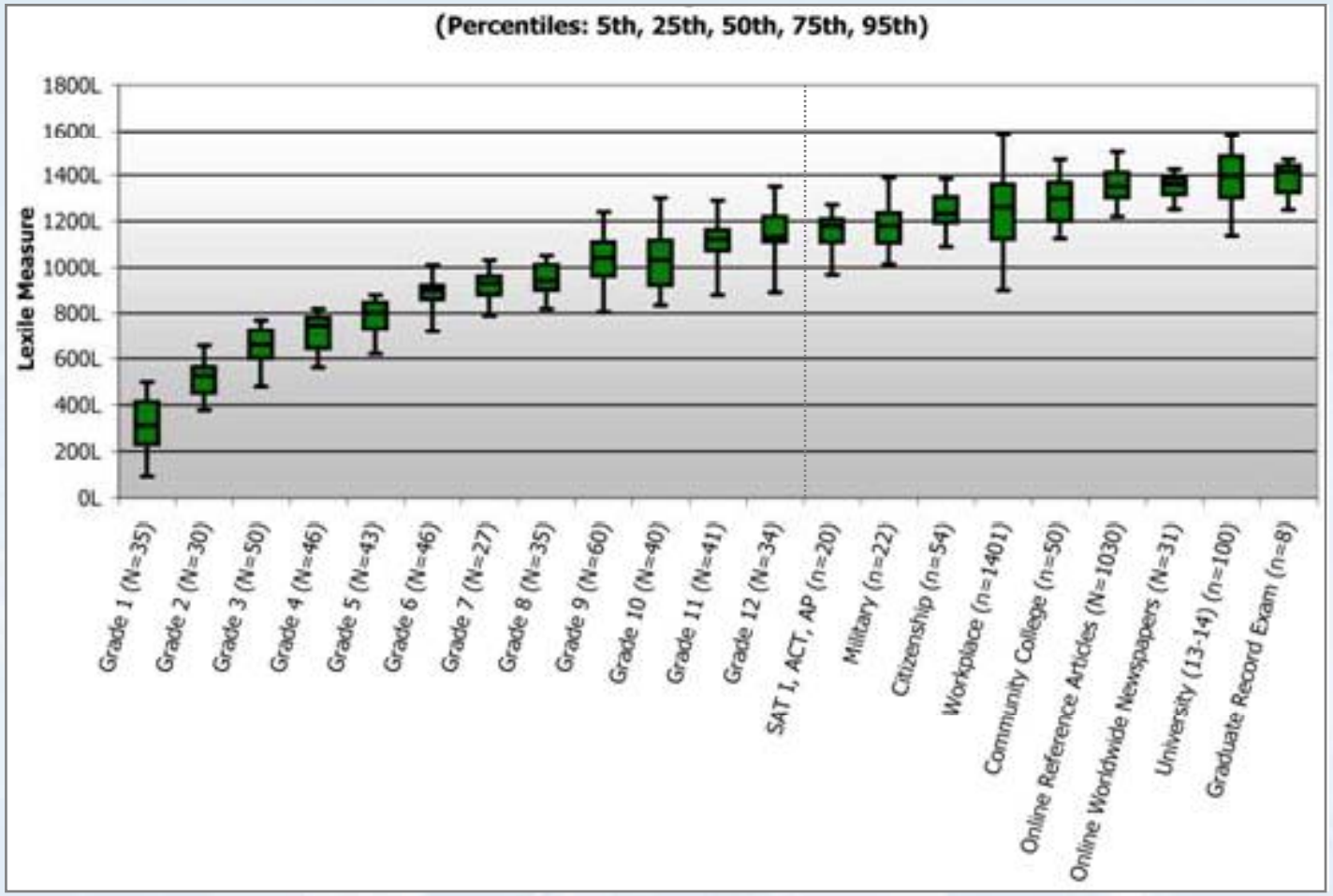
Text Complexity Continuum



Williamson, G.L. (2008). A text readability continuum for post-secondary readiness. *Journal of Advanced Academics, 19(4)*, 602-632.

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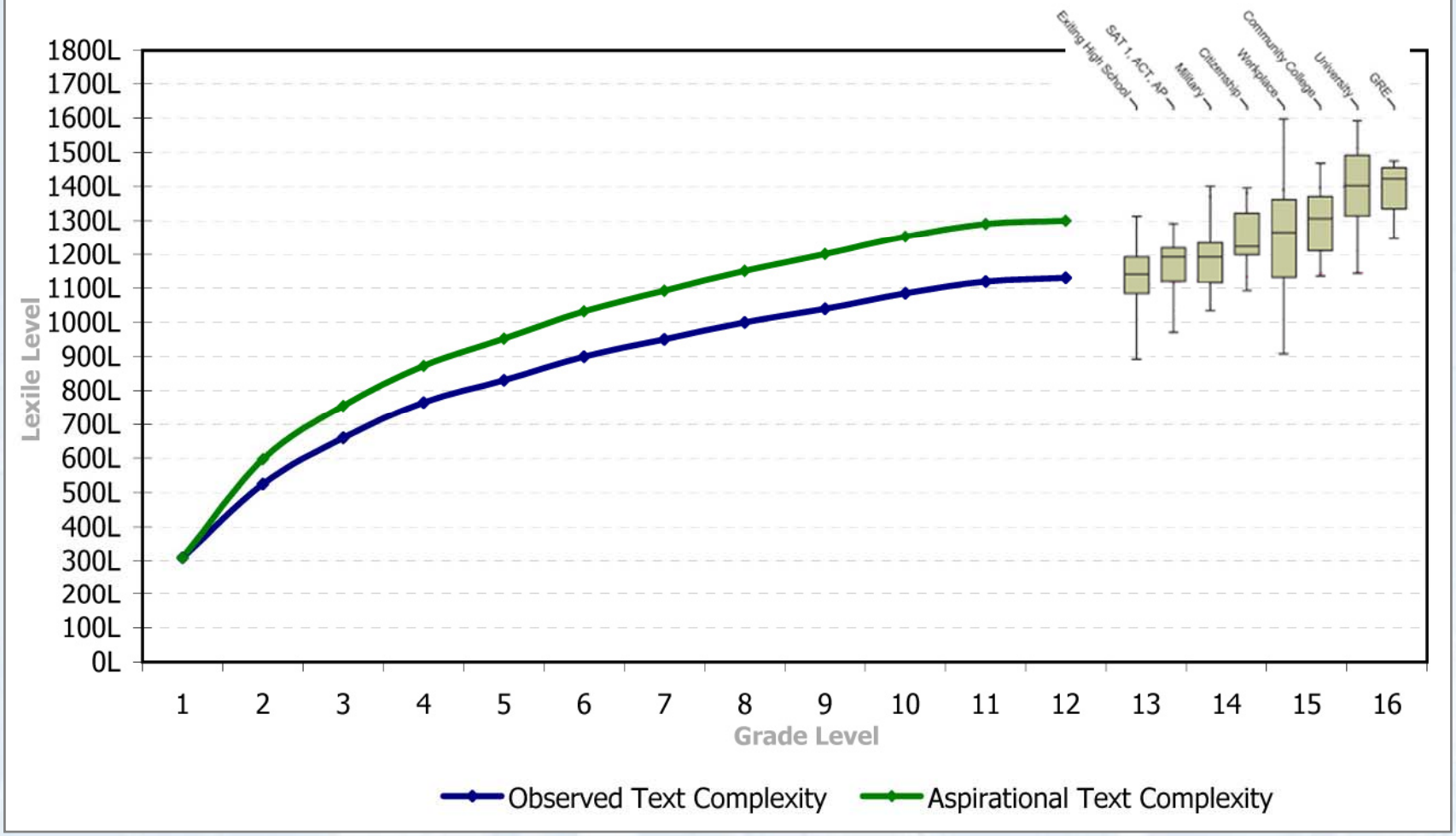
Observed vs. Aspirational Text Complexity

Stenner, A.J., Koons, H., Swartz, C.W. (2009). Closing the text complexity gap: Reconceptualizing the text curve.



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Reading as a Unidimensional Construct 2008

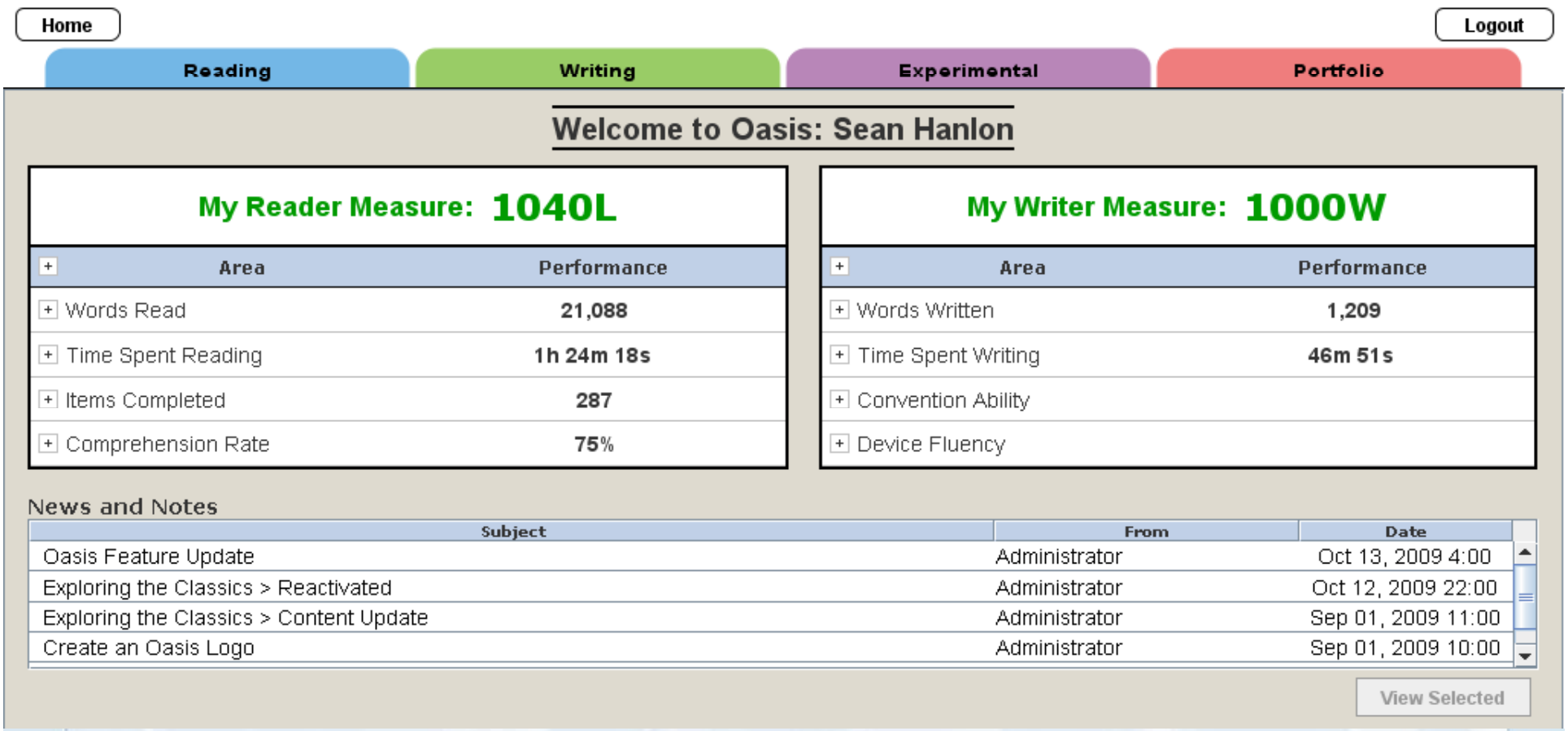
Alternate Forms Reliabilities From Test Manuals

Grade Level	SAT-9	SDRT-4	TerraN	Iowa	GMRT	SAT-10	MAT8	Mean
1	0.86					0.87	0.84	0.86
2	0.83		0.67			0.85	0.87	0.81
3	0.85			0.82		0.83	0.86	0.84
4	0.84	0.82	0.72	0.79		0.85	0.85	0.81
5	0.80	0.82		0.83		0.83	0.84	0.82
6	0.76	0.80	0.65	0.78		0.83	0.80	0.77
7	0.77	0.80		0.84		0.79	0.81	0.80
8	0.81	0.80	0.65	0.79		0.81	0.79	0.78
9	0.83	0.71		0.79		0.77	0.83	0.79
10	0.78	0.71		0.78		0.78	0.83	0.78
Mean								0.80

Correlation Between Target Tests and Linking Tests

Grade Level	SAT-9	SDRT-4	TerraN	Iowa	GMRT	SAT-10	MAT8	Mean
1								
2			0.68		0.81	0.79	0.79	0.77
3				0.80				0.80
4	0.81	0.75	0.75		0.84	0.81	0.85	0.81
5				0.82				0.82
6	0.80	0.72	0.78		0.77	0.77	0.80	0.78
7				0.80				0.80
8	0.77	0.77	0.65		0.81	0.76	0.83	0.76
9				0.72				0.72
10	0.85	0.67			0.72	0.80	0.77	0.76
Mean								0.78

Dimensionality of Text Complexity



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Pizza Problems (Weekly Reader)

Some experts question rewarding reading with pizza.

Should kids be reading for pizza? A nationwide reading program is drawing [criticism] for putting pizza front and center. Since 1985, the restaurant chain Pizza Hut has been running the Book It program, which rewards students for reading with personal pan pizzas. Now some people are taking a slice at Book It. They say the program [promotes] poor eating habits and gives Pizza Hut free advertising in public schools.

"It's clear that Pizza Hut's Book It has no place in public schools. ...It promotes junk food," says Susan Linn, a cofounder of the [Campaign] for a Commercial-Free Childhood. The group has called for schools to stop [participating] in the Book It program.

Nearly 22 million children in 50,000 U.S. schools take part in Book It. Since the program began, more than 200 million pizzas have been given away. Each year, from October 1 through March 31, students read books to meet monthly reading goals set by teachers. When students meet their goal for the month, they get a certificate for a personal pan pizza.

"We're really proud of the program," says Leslie Tubbs, the [5] of Book It. "We get hundreds of e-mails from [past participants] who praise it and say it helped them get started with reading." In 1988, President Ronald Reagan honored the program for [6] literacy, or reading, skills.

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Title:
Pizza Problems (Weekly Reader)

Category:
Weekly Reader

Lexile:
1060L

Words:
309

Item Type:
Word Cloze

Items:
6

Nearly 22 million children in 50,000 U.S. schools take part in Book It. Since the program began, more than 200 million pizzas have been given away. Each year, from October 1 through March 31, students read books to meet monthly reading goals set by teachers. When students meet their goal for the month, they get a certificate for a personal pan pizza.

"We're really proud of the program," says Leslie Tubbs, the [5] of Book It. "We get hundreds of e-mails from [past participants] who praise it and say it helped them get started with reading." In 1988, President Ronald Reagan honored the program for [6] literacy, or reading, skills.

But critics say schools can teach students to enjoy reading without the help of a fast-food company. "Schools need to realize that they are undermining their students' well-being," says nutrition expert Jane Levine. She explains that the Book It program is a problem not just because it rewards kids with fast food but also because it makes a large company a regular part of the school day.

Everyone loves pizza, but should it be used as a reward for reading?

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Oasis: Usage Report by Grade

	Student Count	Mean Reader Measure	sd	Articles	Words	Minutes Spent	WPM	Items	Observed Correct	Expected Correct	Observed Performance	Expected Performance
Overall	1,619	951	371	103,696	94,065,406	641,071	326	1,632,799	958,813	979,525	76.10%	72.74%
Grade 1	20	287	166	250	65,467	854	103	2,432	1,130	1,216	49.08%	42.01%
Grade 2	109	472	233	7,082	2,654,408	34,041	93	74,532	44,627	45,431	69.14%	63.93%
Grade 3	180	736	207	14,991	5,075,871	72,941	134	172,212	120,344	124,739	76.51%	69.61%
Grade 4	179	811	202	15,971	11,592,470	72,475	191	224,457	156,613	157,285	76.76%	70.07%
Grade 5	161	899	190	2,764	1,924,130	16,148	143	34,772	28,027	28,957	74.36%	71.37%
Grade 6	135	970	232	4,142	3,112,687	20,920	155	54,382	40,888	38,051	75.36%	69.96%
Grade 7	139	1008	271	3,494	1,874,729	10,091	219	27,520	21,548	20,262	78.27%	73.63%
Grade 8	142	1159	285	6,984	4,592,225	116,772	205	70,121	51,457	50,488	73.36%	72.01%
Grade 9	137	1201	247	12,091	12,121,900	65,643	225	150,233	114,794	114,147	76.41%	75.98%
Grade 10	139	1357	224	15,482	16,936,969	80,195	251	183,053	144,147	144,455	78.74%	78.92%
Grade 11	65	1324	169	12,089	15,834,135	65,956	235	150,047	115,697	117,301	77.12%	78.19%
Grade 12	96	1411	165	12,284	17,173,091	73,862	260	172,027	140,170	139,843	81.48%	81.28%

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Oasis: Usage Report by Reader Lexile

Data From 2007-09-15 to 2008-04-15

	Articles	Words	Minutes Spent	WPM	Items	Observed Correct	Expected Correct	Observed Performance	Expected Performance
Overall	106,696	94,055,406	641,071	205	1,328,799	988,815	979,856	74.41%	73.74%
< 400L	7,645	3,204,871	34,258	125	83,324	43,018	42,797	51.63%	51.36%
400L - 499L	4,590	2,278,253	21,608	128	53,686	36,886	37,077	68.71%	68.99%
500L - 599L	6,761	5,701,765	51,925	151	84,145	60,992	61,164	71.71%	72.69%
600L - 699L	7,695	4,522,611	38,277	135	98,409	72,100	72,014	73.27%	73.18%
700L - 799L	8,513	5,703,644	42,030	167	113,754	82,968	82,174	72.94%	72.24%
800L - 899L	7,161	5,095,600	36,008	172	96,714	71,559	69,728	73.99%	72.10%
900L - 999L	7,266	5,445,351	35,263	184	97,478	72,100	70,143	73.97%	71.96%
1000L - 1099L	7,897	6,441,314	125,746	205	106,617	79,096	77,367	74.19%	72.57%
1100L - 1199L	7,901	7,123,298	39,394	223	102,616	77,265	74,567	75.30%	72.67%
1200L - 1299L	8,104	8,412,729	47,338	241	111,847	84,768	82,067	75.78%	73.37%
>= 1300L	34,006	41,073,353	188,653	285	378,879	306,006	309,245	81.54%	81.60%

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Oasis: Usage Report By Category of Article

Data From 2007-9-15 to 2008-04-15

	Unique Articles	Mean Article Measure	sd	Mean Article Length	Unique Students	Student-Article Encounters	Words	Minutes Spent	WPM	Items	Observed Correct	Expected Correct	Observed Performance	Expected Performance
Overall	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Civics	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Earth & Space Sciences	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Geography	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Language Arts	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Physical Sciences	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
U.S. History	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
World History	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Weekly Reader	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
World Book	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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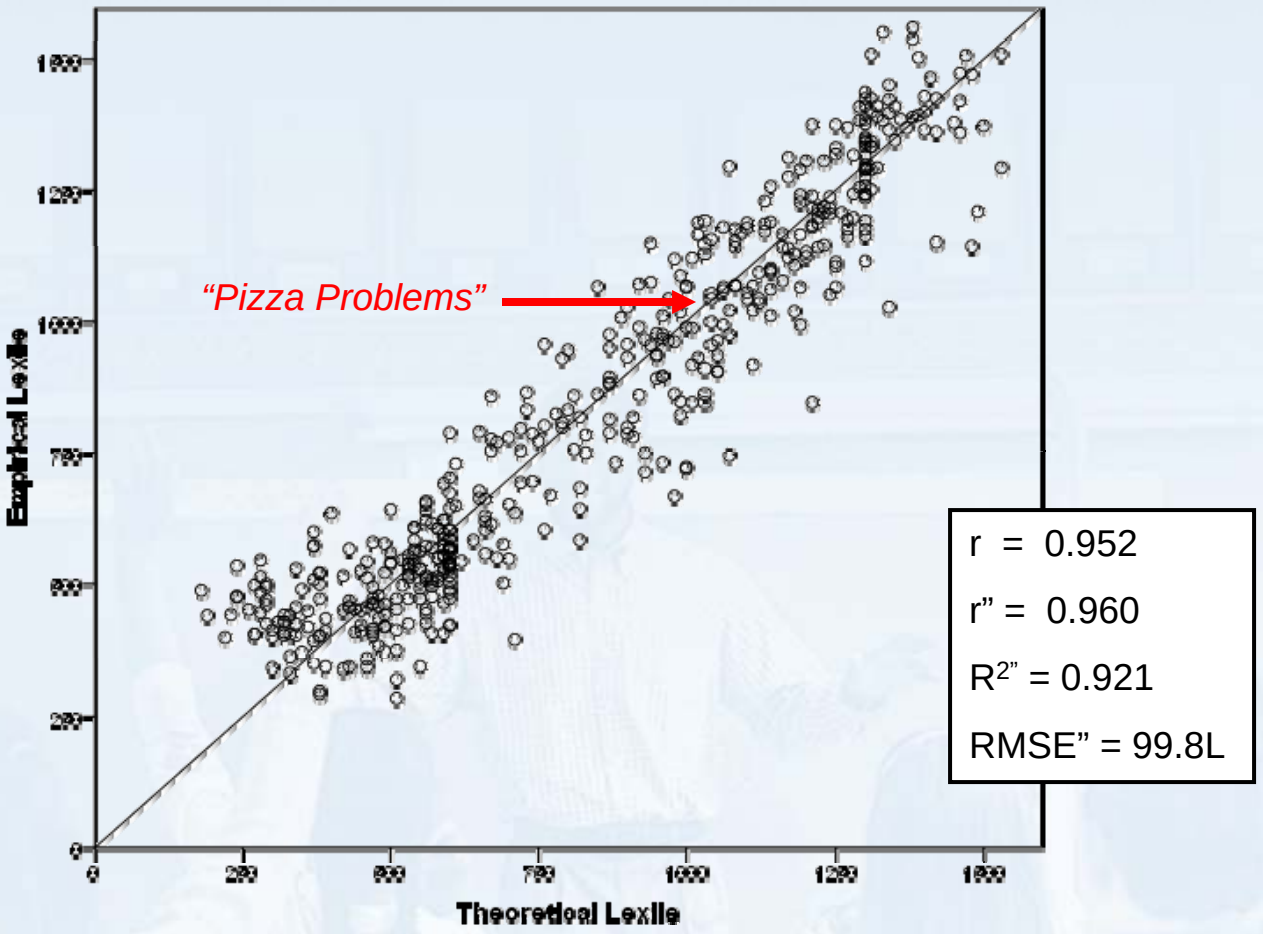
Figure 1: Plot of Theoretical Text Complexity versus Empirical Text Complexity for 475 articles



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Key Points

- Reading may be treated as unidimensional from text and reader perspectives
- Grade equivalents are not equal interval, and thus should not be used to characterize either text complexity or reader ability
- The text continuum is a useful way to describe college and career reading expectations
- The two features that explain variation in empirical text complexity are the semantic demand and syntactical complexity
- Continued research is needed to account for the 8% unexplained variation in empirical text complexities

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Resources Available to Educators at Lexile.com

- Introductory Materials and Best Practices
- Research Articles and White Papers
- Lexile Text Analyzer (English and Spanish)
- "Find a Book"

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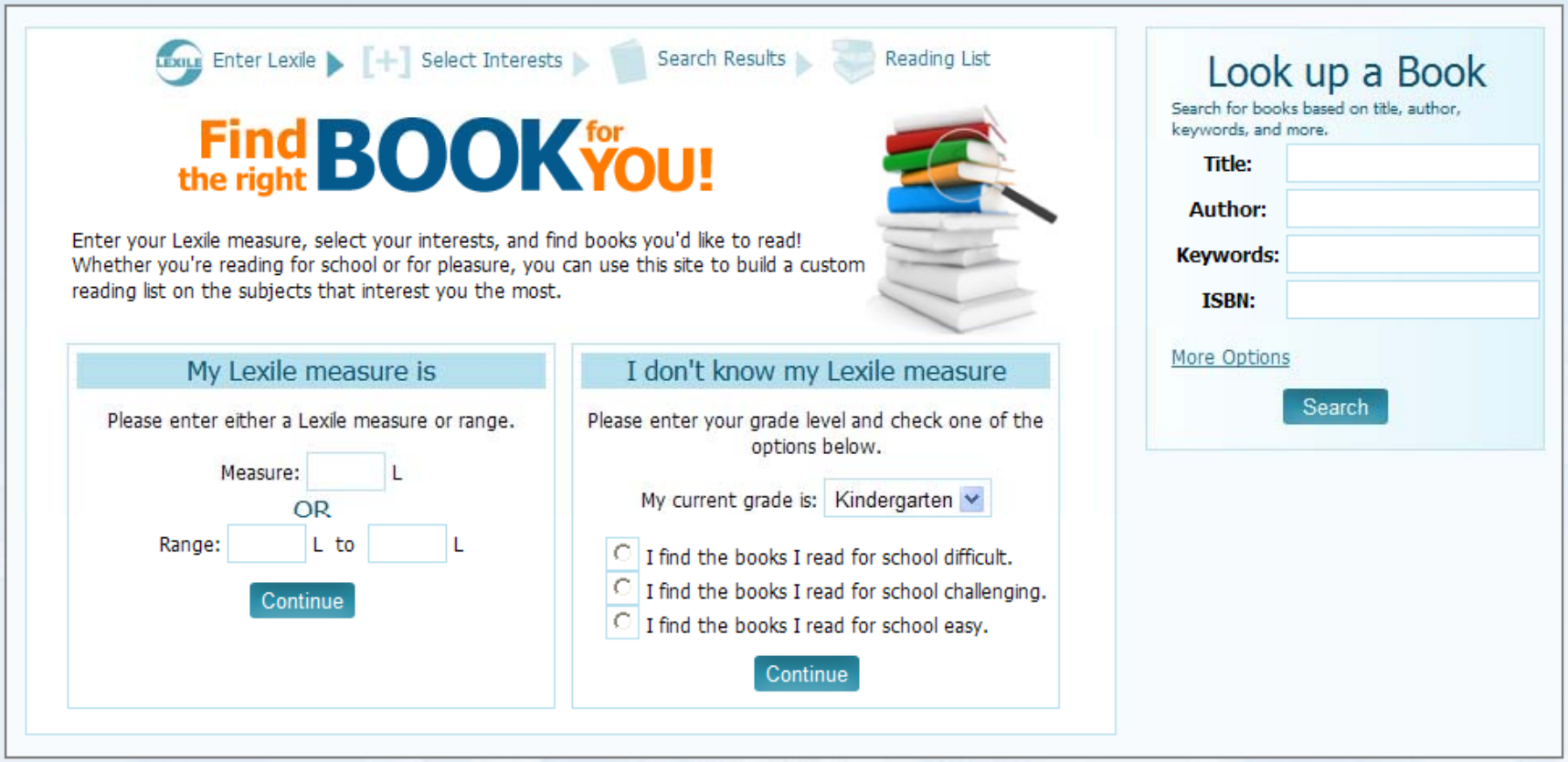
"Find a Book"



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Text Studies

- Postsecondary – Summer 2004
- High School Grades (9-12) – Fall 2005
- Middle School Grades (6-8) – Spring 2007
- Primary School Grades (1-5) – Spring 2008
- Texas Higher Education Coordinating Board – 2008
- Additional States – 2009 - ongoing
- Hayes et. al – SAT – 2010 - ongoing

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Postsecondary Text Study
Lexile Framework

Requested by NAGB

Military

Citizenship

Workplace

Community College

University

SAT, ACT, GRE

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Text Sources

- **Military** (N=22) - U.S. Army; General Dennis J. Reimer Training and Doctrine Digital Library
- **Citizenship** (N=54) - various sources, newspapers, jury instructions, DMV manual…
- **Workplace** (N=1401) – ICLE career cluster workplace materials
- **University** (N=100)/**Community College** (N=50) Questia Media America, Inc.
- **SAT,ACT,AP** (N=20) / **GRE** (N=8) - Released/published admissions tests

LEXILE®

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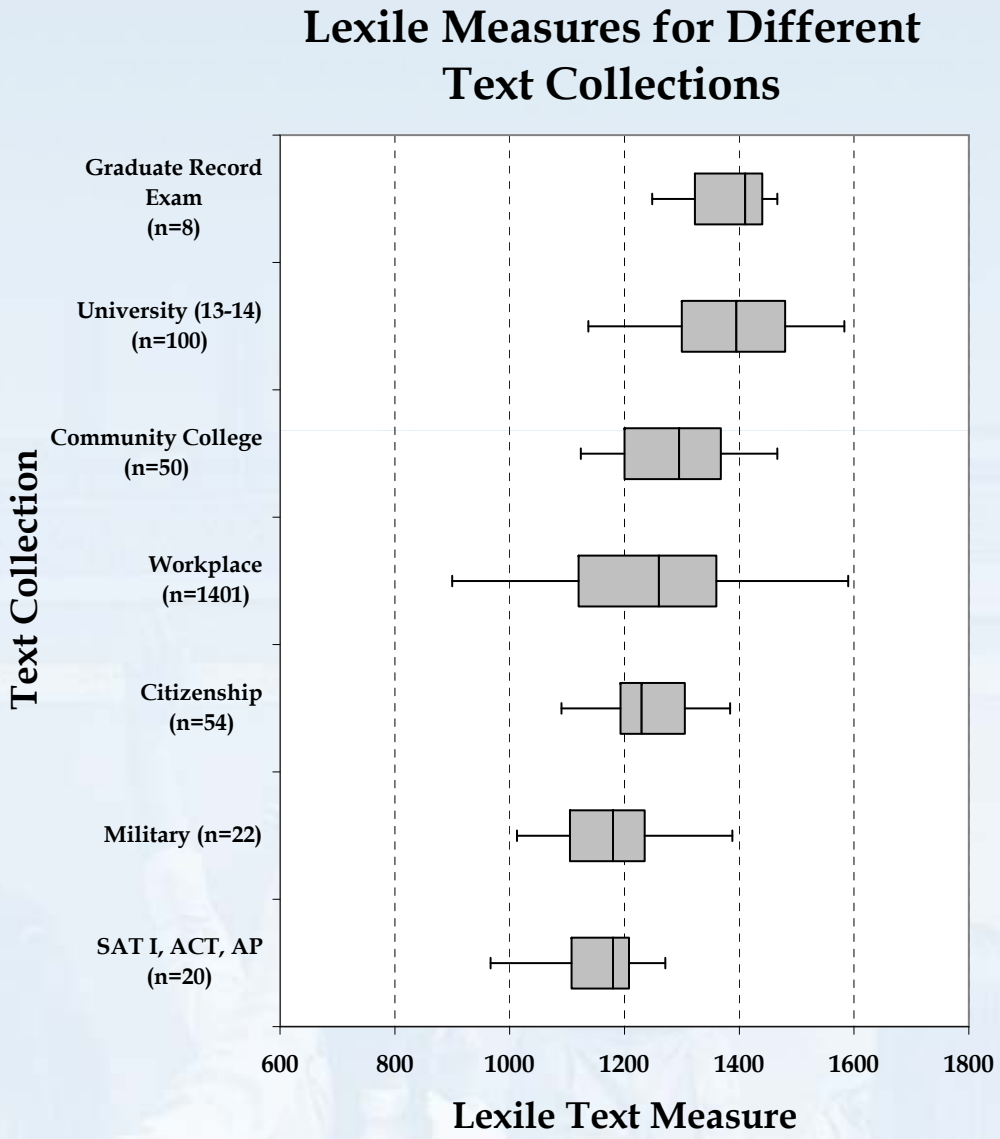
Lexile Framework



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Study Procedures (Grades 1-12)
Lexile Framework

- Identified texts
  - Surveyed adoption lists from a sample of statewide adoption states (e.g., FL, GA, IN, NC, OR, TX, VA)
  - Focused on student editions
- Organized texts into six categories
  - Health, Language Arts, Literature, Mathematics, Science, Social Studies

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Study Procedures (Grades 1-12)
Lexile Framework

- Complete series
  - Red, blue, yellow, green
  - Level I, II, III, IV
  - Bronze, silver, gold
- Obtained Lexile measures
  - List of textbooks matched with the titles in the existing MetaMetrics database
  - When needed, textbooks were purchased and measured

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Final Samples

Primary School

- Grade 1 (N=35)
- Grade 2 (N=30)
- Grade 3 (N=50)
- Grade 4 (N=46)
- Grade 5 (N=43)

Middle School

- Grade 6 (N=46)
- Grade 7 (N=27)
- Grade 8 (N=35)

High School

- Grade 9 (N=60)
- Grade 10 (N=40)
- Grade 11 (N=41)
- Grade 12 (N=34)

⭐ Based on texts with a single grade designation

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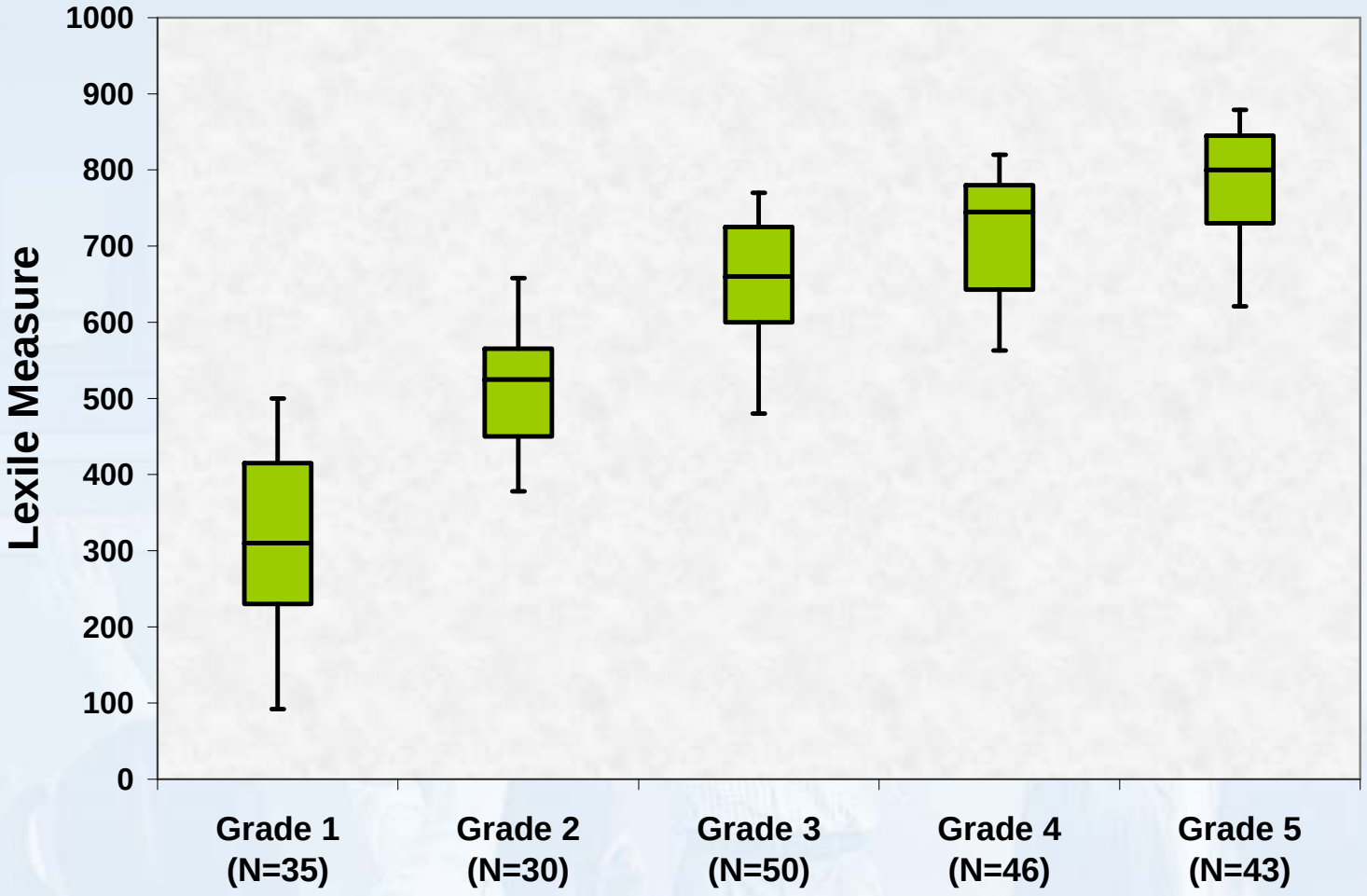
Text Distributions by Grade (1-5)



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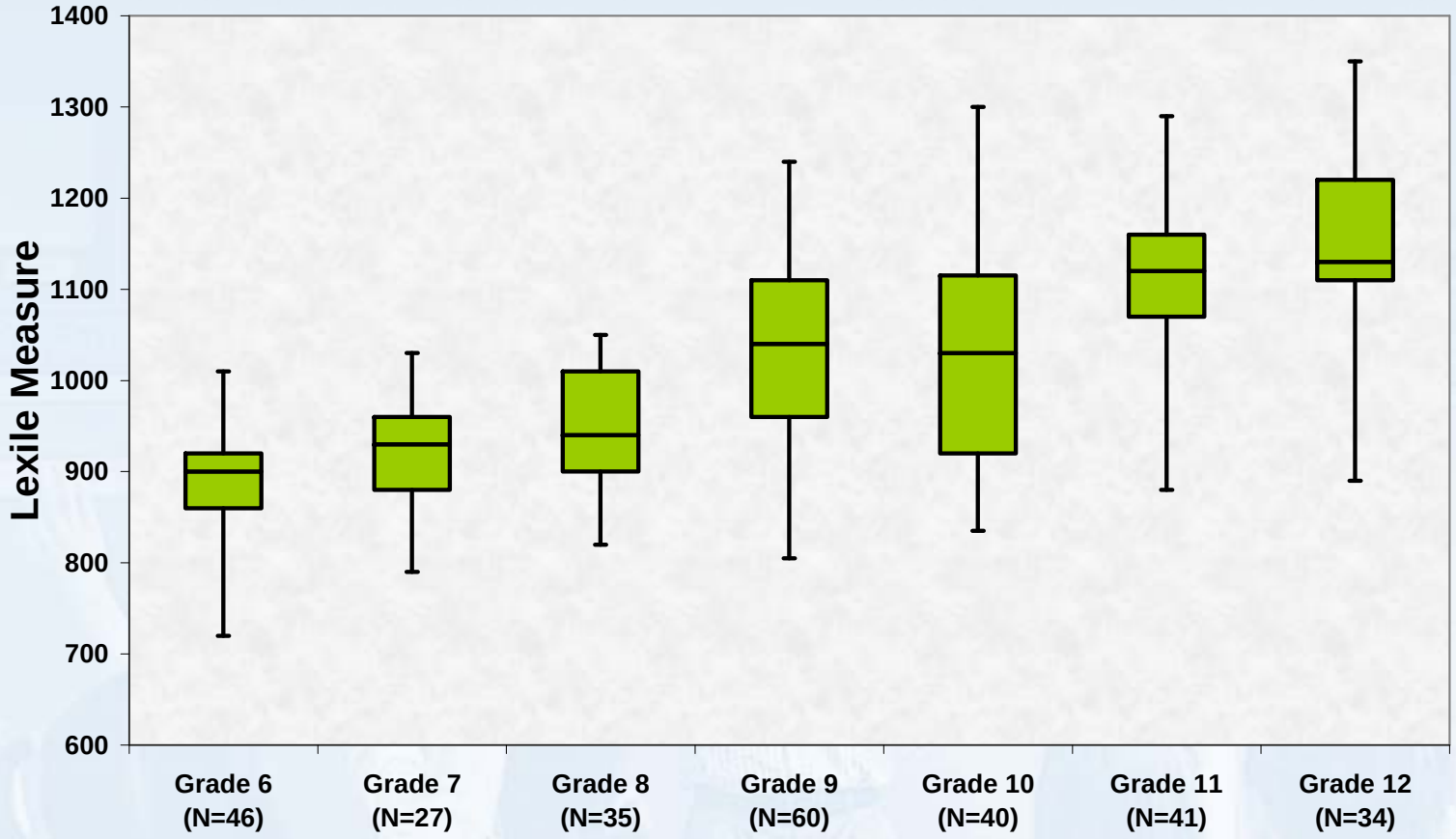
Text Distributions by Grade (6-12)

Texts With a Single Grade Designation



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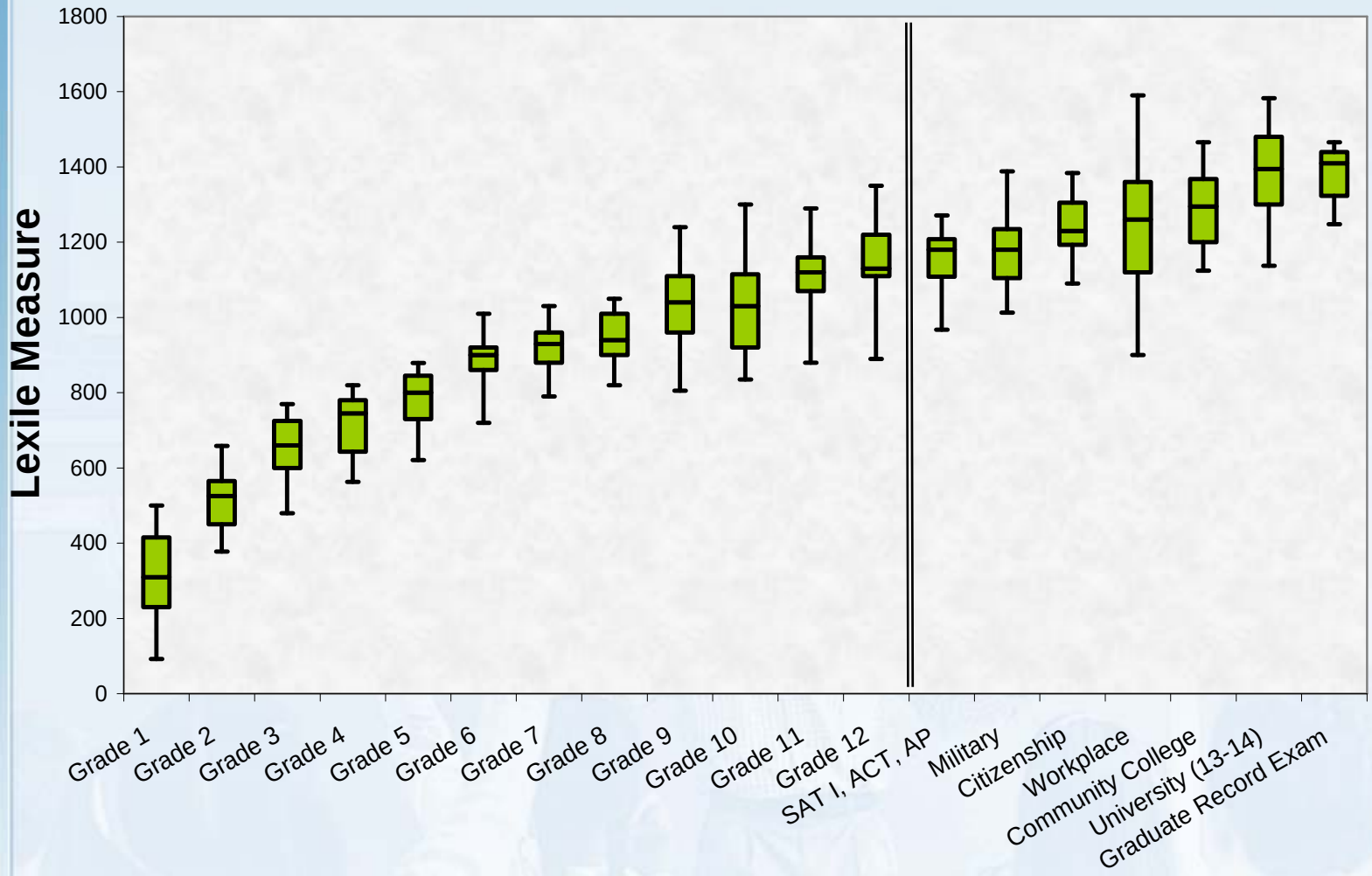
Lexile Framework

The Text Continuum in 2008



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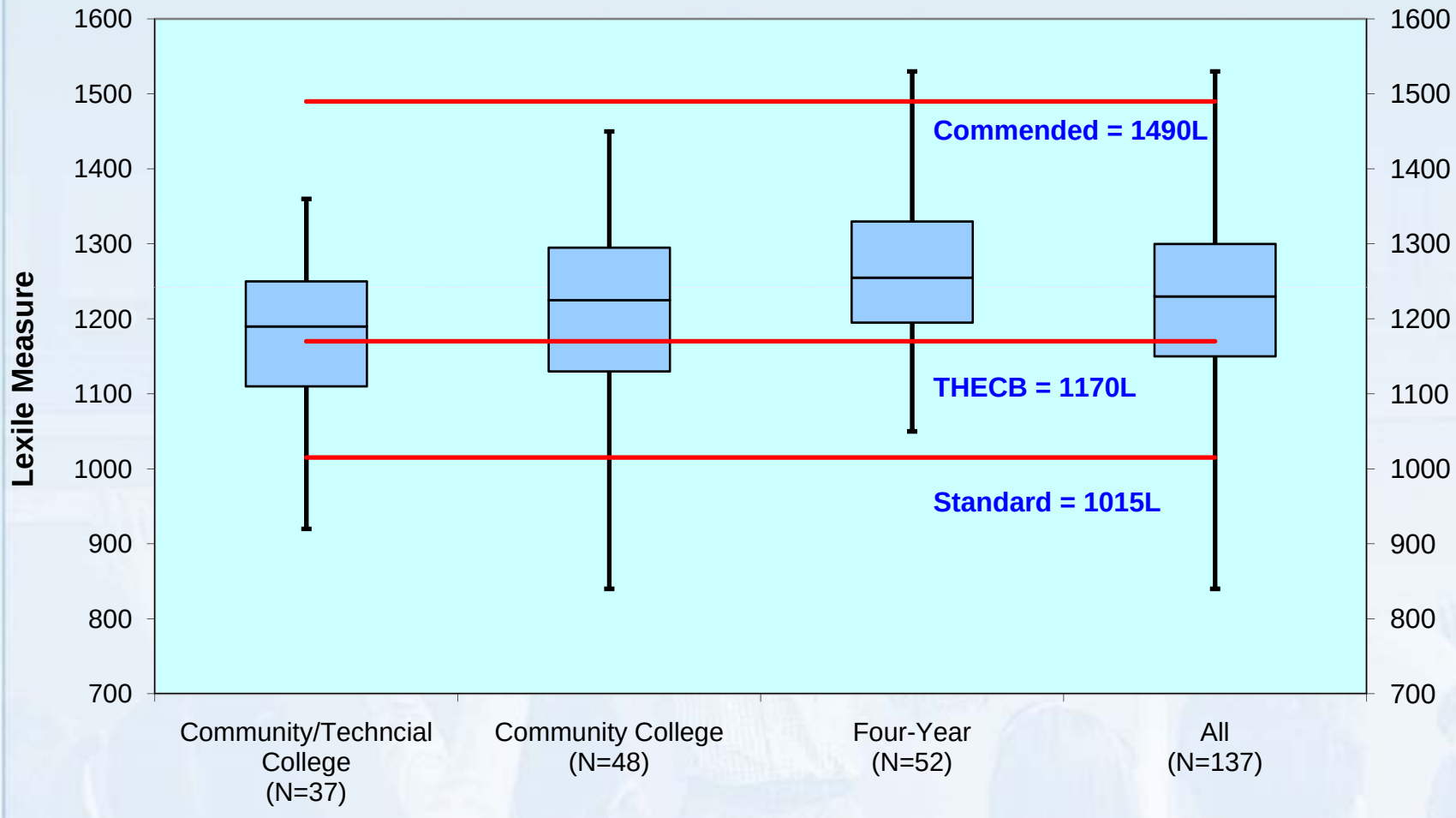
Distribution of Text Readability Measures for the Texas Higher Education Coordinating Board
(Box Plots: min, 25th, 50th, 75th, max)



Commissioned by the Texas Higher Education Coordinating Board

www.thecb.state.tx.us/collegereadiness/MetaMetrics-Technical-Report-Update.pdf

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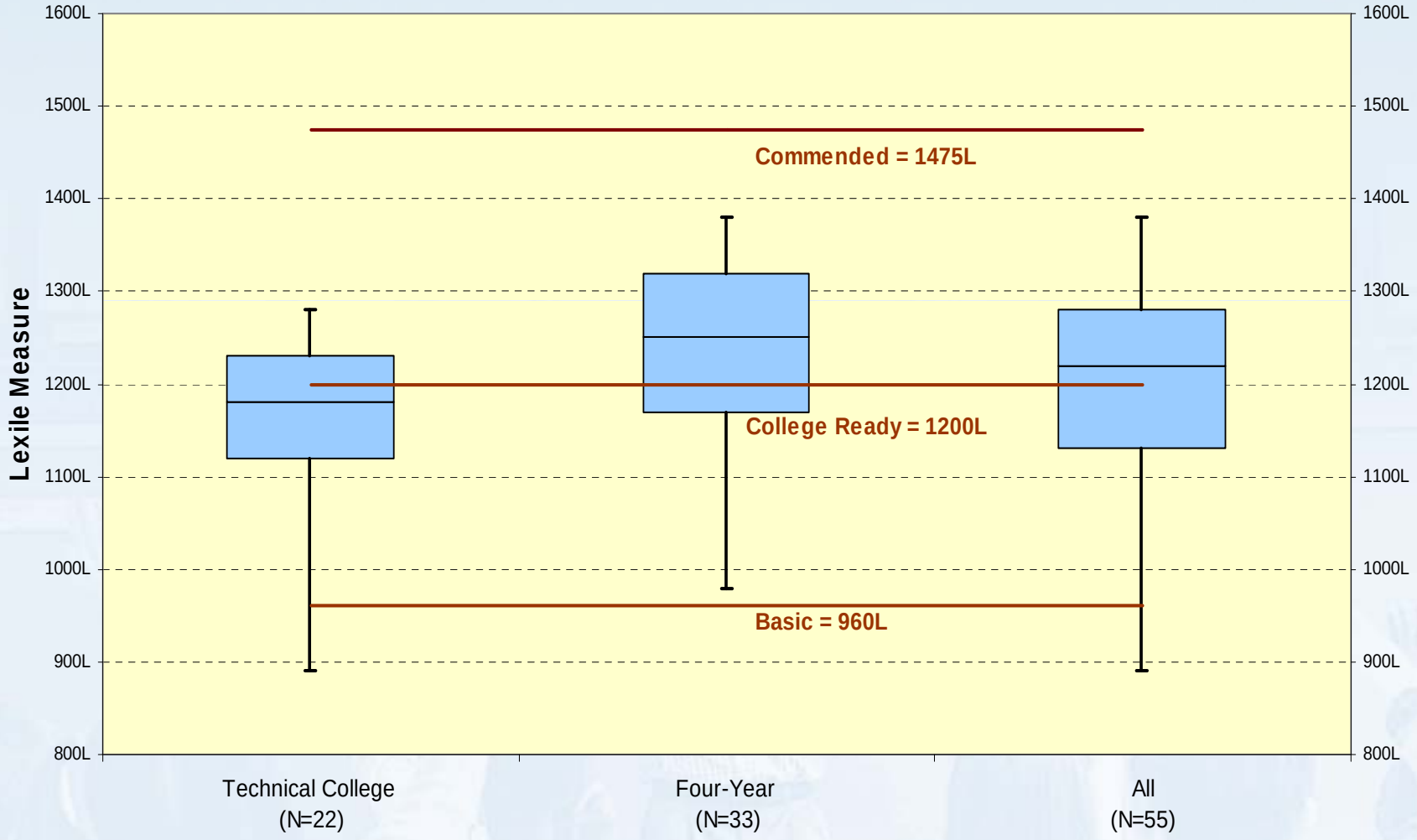
College Readiness Standard in Relation to Textbooks and Performance Level Cut Points



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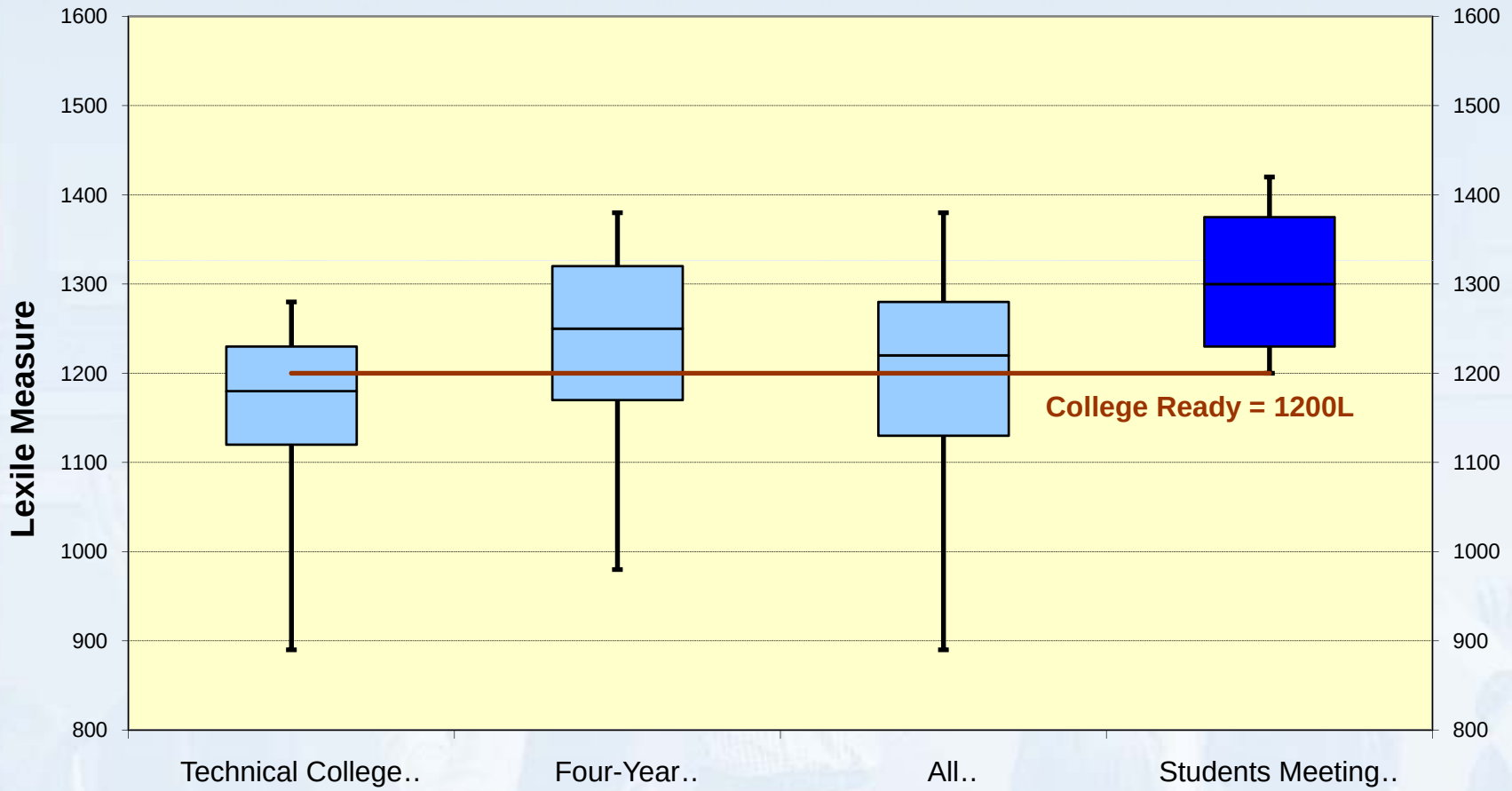
College Readiness Standard in Relation to Textbooks and Student Achievement



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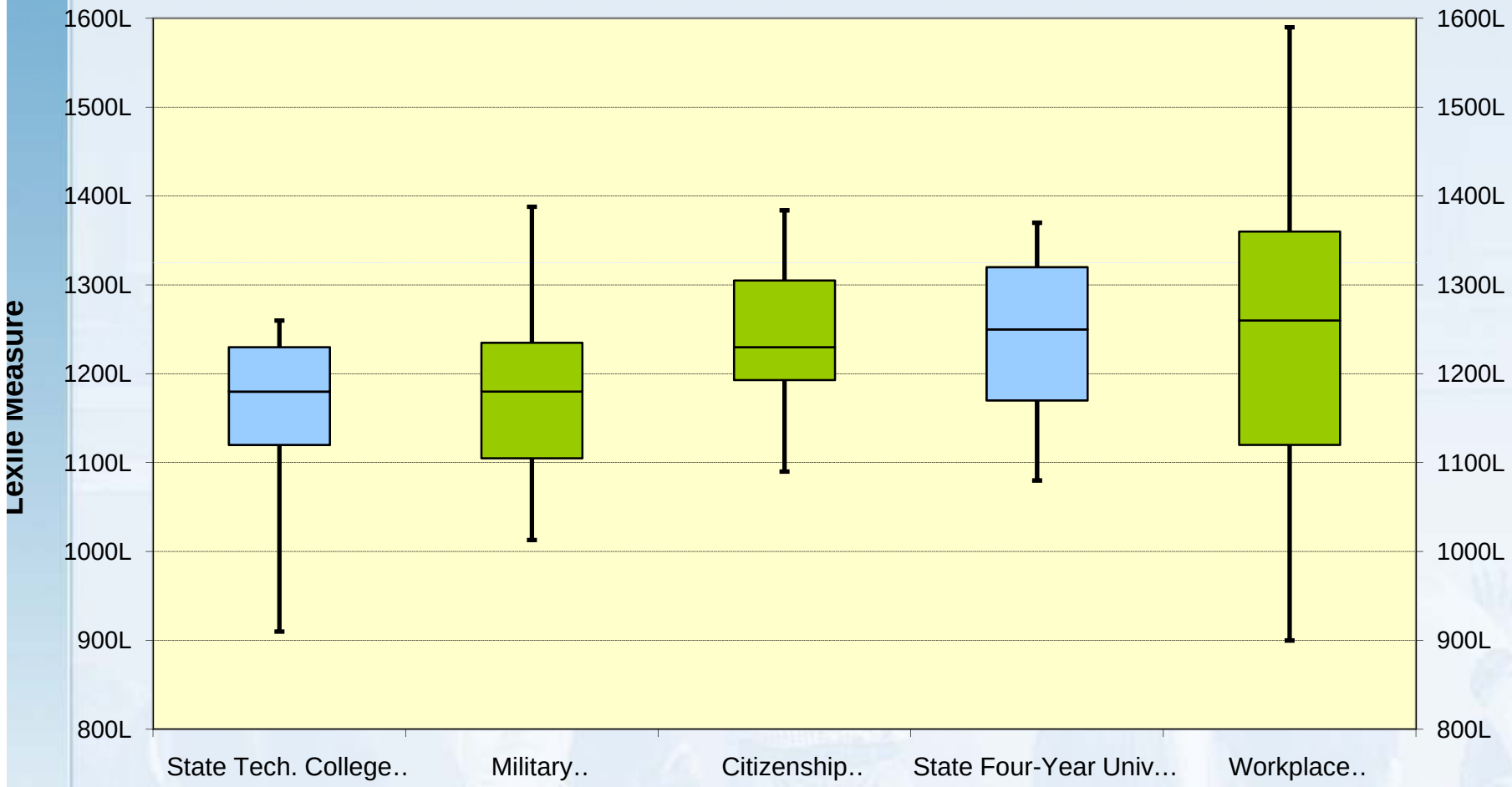
Post Secondary Text Difficulty



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- One in five U.S. workers reads at a lower skill level than their job requires.
- Approximately 40% of workers reading at the "basic" level reported that their reading level limited their job prospects.

  – Higher Education Research Institute (2007)

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- "If we can dramatically increase high school graduation rates, if we can dramatically increase the number of graduates who are **college and career ready**, that's what this is about. Everything's a means to that end. That's the Holy Grail here. **Are our students being prepared to be successful?**" – Arne Duncan
  - Klein, A. (2009). New ESEA may sport incentives. *Education Week, 29*(14), p.17.

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Schoolbook Simplification and Its Relation to the Decline in SAT-Verbal Scores

Hayes, D.P., Wolfer, L.T., Wolfe, M.E. (1996). American Educational Research Journal, 33(2) 489-508.

- Analyzed text of 800 elementary, middle, and high school reading books published between 1919 – 1991.
  - 1919-1945, 1946-1962, 1963-1991
- Found a pervasive decline in the difficulty of schoolbooks 1945+
  - LEX - words
  - Sentence length

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Mean LEX levels for school readers: 1919-1945, 1963-1991

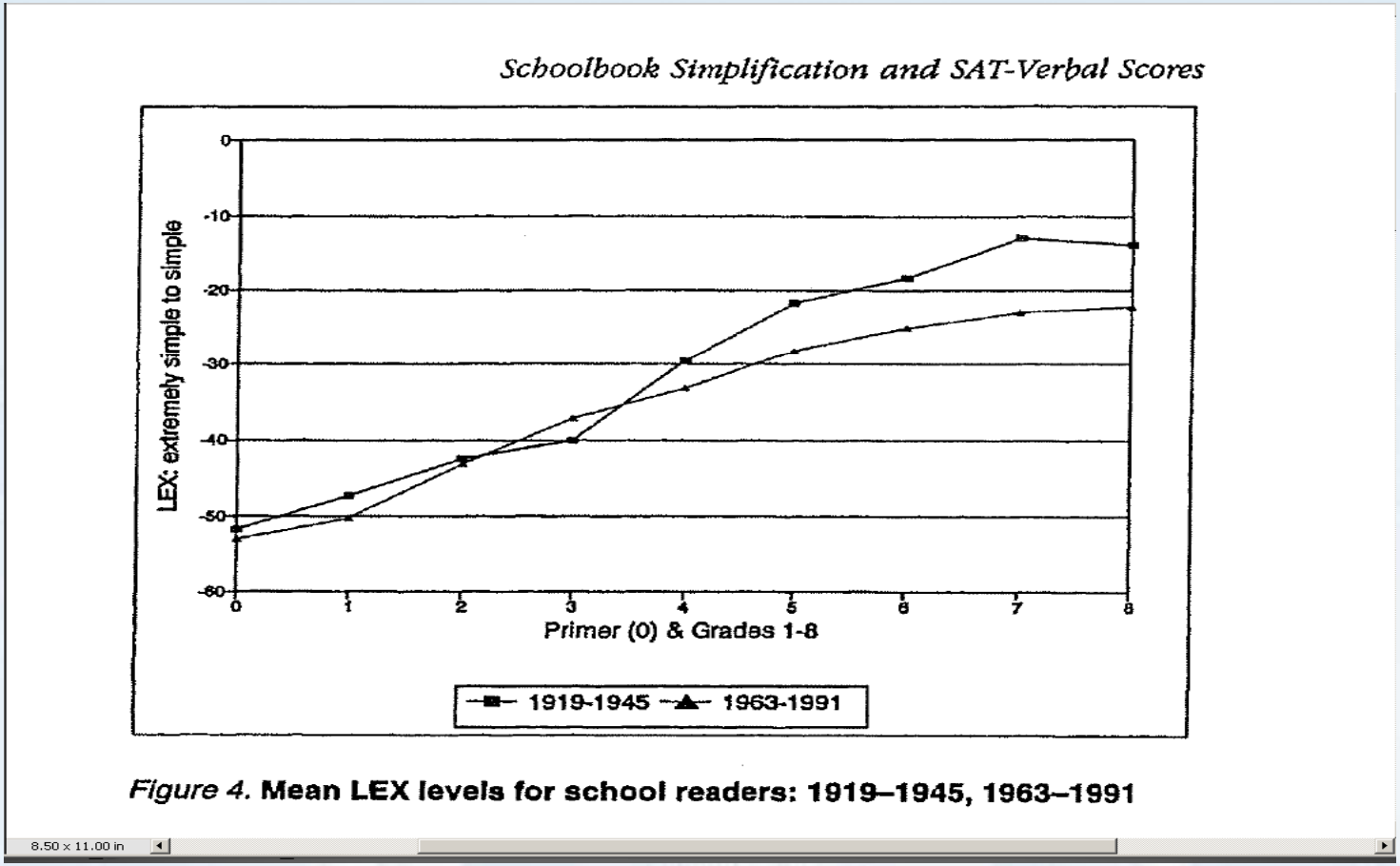

Figure 4. **Mean LEX levels for school readers: 1919–1945, 1963–1991**

8.50 x 11.00 in

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Mean length of sentence for school readers: 1919-1991

Hayes, Wolfer, and Wolfe

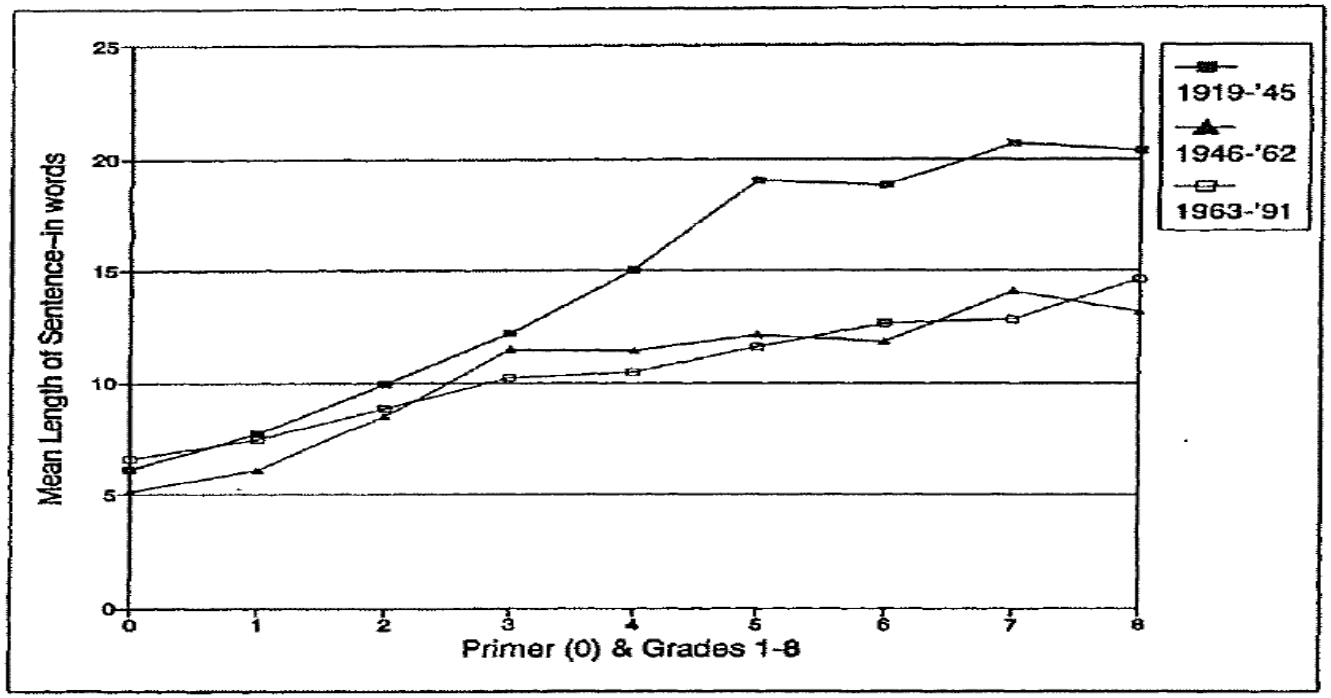

Figure 5. **Mean length of sentence in school readers: 1919–1991**

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- The mean 6th, 7th , and 8th grade 1963+ reading texts are simpler than 5th grade reading texts were before 1945.

- 12th grade texts 1963+ are simpler than 7th grade reading texts were before 1945.

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- SAT scores remained high for all cohorts whose entire education was with pre 1945 texts.
- Scores declined as cohorts had more time with simplified text.
- Scores declined until cohort had 100% experience with simple text and then flattened out.

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Reanalysis of the Hayes Study Text

- Grades 4 and 8
- Determined Lexile measure for the text

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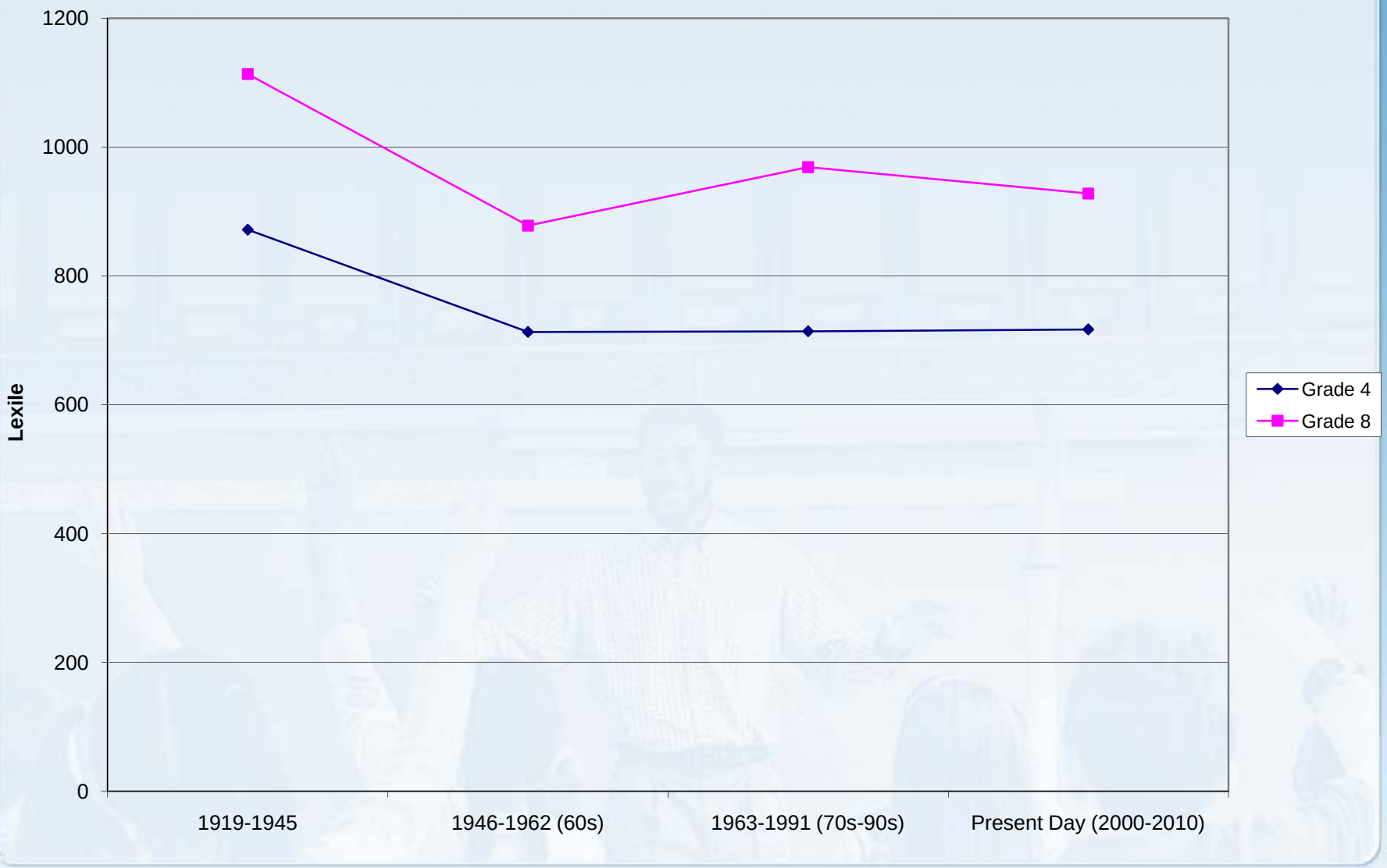
Change in Text Complexity in Textbooks over the Last Century



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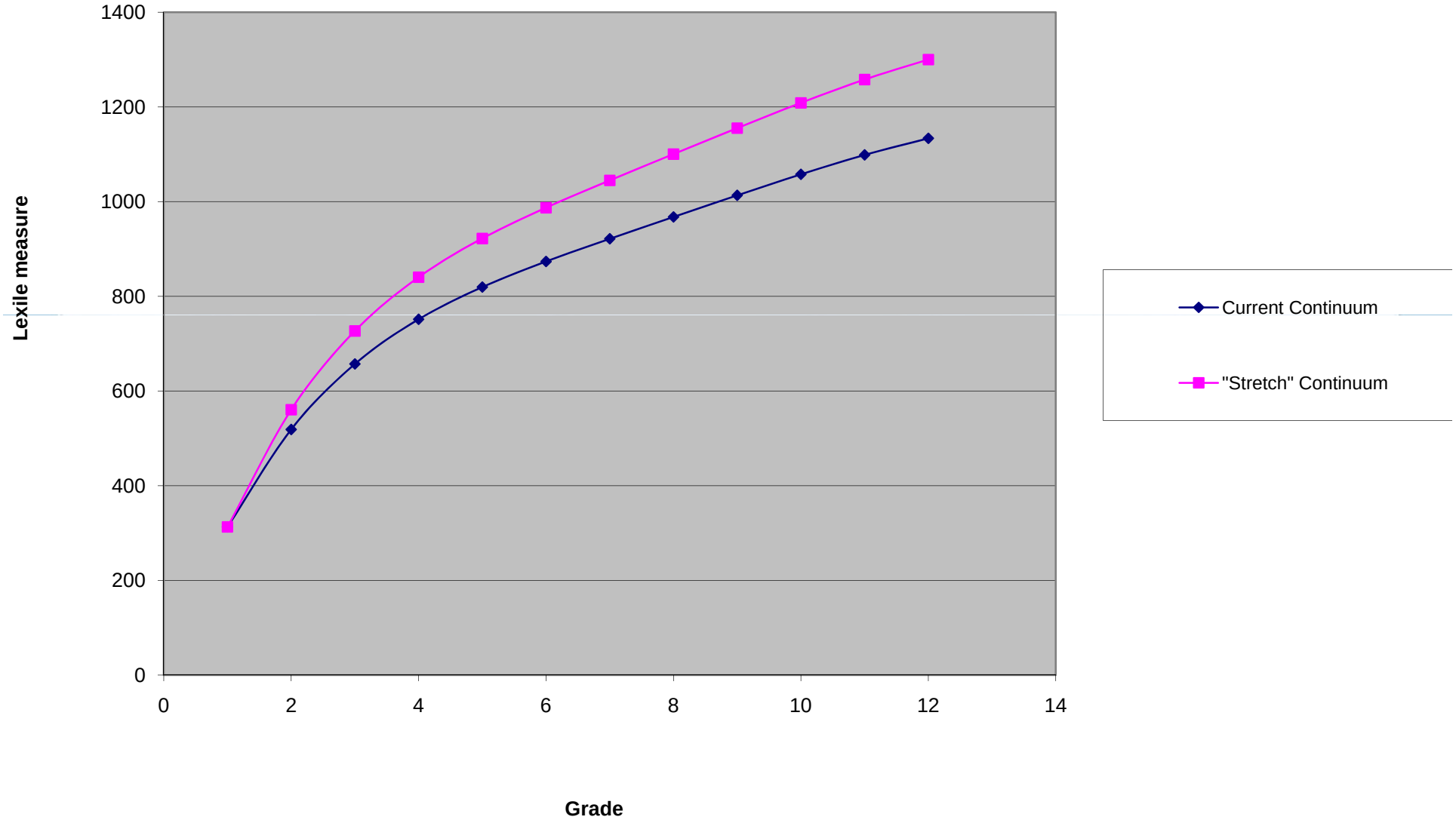
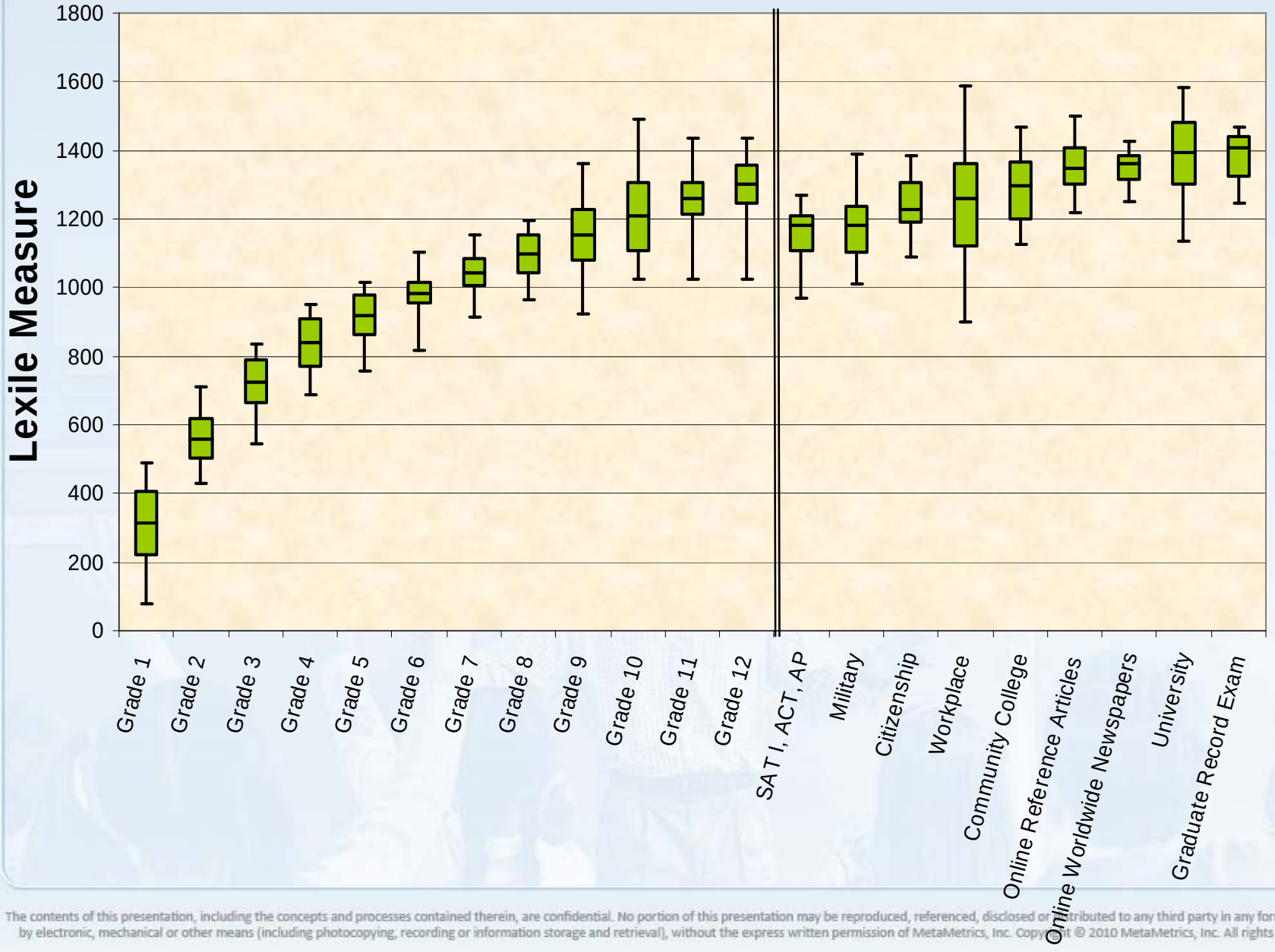

1400
1200
1000
800
600
400
200
0
Lexile measure
0
2
4
6
8
10
12
14
Grade
Current Continuum
"Stretch" Continuum

Text Difficulty "Stretch" Continuum for Grades 1-12

(Percentiles: 5th, 25th, 50th, 75th, 95th)



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What's Ahead?

- Extend the Hayes reanalysis work to all grades
- Expand the sample size of textbooks for both 1-12 and postsecondary arenas
- Add information from trade books and other commonly-taught texts
- Incorporate more information from state textbook studies

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Contact:

A. Jackson Stenner

jstenner@Lexile.com

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