INVESTIGATION OF READING SKILL DEVELOPMENT OF ENGLISH LANGUAGE LEARNERS: A TWO-YEAR LONGITUDINAL STUDY

by

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A DISSERTATION

Presented to the Department of Educational Methodology, Policy, and Leadership
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

September 2015

DISSERTATION APPROVAL PAGE

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Title: Investigation of Reading Skill Development of English Language Learners: A Two-Year Longitudinal Study

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Doctor of Philosophy

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September 2015

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The reading achievement of approximately 12,250 third- and fourth-grade students, measured by multiple reading curriculum-based measures, was tracked for two school years and used for longitudinal growth analyses. The current study builds on prior research regarding the achievement gap between English language learners (ELLs) and non-ELLs in two major ways: (a) comparing literacy growth, as measured by multiple reading curriculum-based measures, of both ELLs and former ELLs with non-ELLs, and (b) investigating variability in literacy growth and reading profiles among ELLs, former ELLs, and non-ELLs. Results of this study suggested that reading development patterns were not homogeneous across ELLs, former ELLs, and non-ELLs. However, struggling readers demonstrated similar reading development profiles regardless of their English proficiency. The implications for instruction and future research are discussed.

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ACKNOWLEDGMENTS

I could not have completed this dissertation without tremendous support from everyone I know. I wish to express sincere appreciation to my committee: Dr. Gina Biancarosa for her endless support and guidance in the preparation of this manuscript, Dr. Akihito Kamata for his scholarly advice and feedback, Dr. Gerald Tindal for his support and mentorship, and Dr. Audrey Lucero for her insightful questions and feedback. Special thanks to Dr. Julie Alonzo for guiding and helping me through the doctoral program for me to grow as a better educator and researcher, Dr. Jessica Saven for providing constructive feedback and endless emotional support, and Dr. Terry Salinger for providing endless support and having faith in me. I also thank my colleagues at Behavioral Research and Teaching for demonstrating inspiration, passion, and friendship. Lastly, I am grateful to have my parents, Adam, love of my life, family and friends who never stopped believing in me, loving me, and encouraging me.

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CHAPTER I

STATEMENT OF THE PROBLEM

The number of school-age children in the United States who speak a language other than English at home has rapidly increased over the last three decades (National Center for Education Statistics [NCES], 2011). Although there have been growing efforts to better understand the reading development of English language learners (ELLs) Al Otaiba, Petscher, Pappamihiel, Willilams, Dyrlund, & Connor, 2009; Betts, Bolt, Decker, Muyskens, & Marston, 2009; Chiappe, Siegel, & Gottardo, 2002; Chiappe, Siegel, & Wade-Wolley, 2002; Crosson & Lesaux, 2010; Geva & Zadeh, 2006; Gutiérrez & Vanderwood, 2013; Kieffer, 2008; Lesaux & Kieffer, 2010; Lesaux, Rupp, & Siegel, 2007), current findings are limited in two major ways: (a) studied samples tend to be limited and lack generalizability, and (b) normative growth expectations have not been established for ELLs in reading. As a result, providing timely, appropriate, and effective interventions to ELLs remains challenging for teachers (Guitérrez & Vanderwood, 2013; Lesaux et al., 2007; Quirk & Beem, 2012; Richards-Tutors, Solari, Leasfstedt, Gerber, Fillippini, & Aceves, 2013). The current study sets out to address these limitations and inform teacher decision-making.

To illustrate the extent to which these issues impact ELL education and frame the current study, the following topics are discussed in this chapter: (a) shifts in U.S. demographics, (b) the achievement gap between ELLs and non-ELLs, (c) previous research on ELL reading development, and (d) limitations of previous ELL research.

Classification and Definition of English Language Learners

Although the term ELL is widely used across the country, how students are actually classified as ELL varies widely across states and districts (Abedi, 2004; Linquanti & Bailey, 2014). Abedi (2004) reported that states and districts often have different definitions of ELL and use various measures to classify students as ELLs. For example, the home language survey (HLS) is used by more than 80% of state education agencies (Kindler, 2002) to classify ELLs. The HLS, which may differ in terms of format and types of questions across states and districts, is administered to parents by schools to identify what language students primarily speak at home. Students whose primary home language is not English are generally classified as ELLs. However, research findings show that the HLS may not be a valid, reliable indicator of students' English language proficiency, as parents may not give accurate information for various reasons including their concerns for opportunity equity, legal status issues, and/or their limited proficiency in English (Abedi, 2004; Linquanti & Bailey, 2014). As a result of these issues, one study found that home languages obtained from these surveys significantly varied from students' actual primary home languages and, moreover, did not reflect students' English language proficiency (Kindler, 2002).

Another common method of identifying ELLs is to use either English proficiency tests, such as Language Assessment Scales (LAS) and the IDEA Language Proficiency Tests (IPT), or achievement tests such as the Stanford Achievement Test (SAT9) and the Iowa Tests of Basic Skills (ITBS). Although the use of assessment data is a more objective method than the HLS to classify ELLs, it has its own set of concerns. One concern is that there are more than 20 different assessments used across state education

agencies (Kindler, 2002). It is highly likely that these assessments vary in terms of their framework or standards (Cook & Linquanti, 2015). In addition, the relationship between English language proficiency tests and actual student ELL classification was not strong (Abedi, 2004). Furthermore, evidence suggests that English language proficiency tests have a weak relation ($r = 0.22$) with students' actual ELL classification (Abedi, 2004). These findings suggest inconsistency and unreliability in ELL classifications practice; this limits the generalizability of studies regarding ELL students' academic performance.

Another challenge in ELL research is how to define the ELL population. It is common to group students on the basis of their primary home language. Students who primarily speak a language other than English at home are often referred to as Language Minority (LM) students (Kieffer, 2008; Lesaux & Kieffer, 2010). Another frequently used approach is to group students on the basis of their actual English proficiency. Students are often defined as ELL if they need additional support to gain full access to instruction in mainstream classes because of their limited English proficiency (Al Otaiba et al., 2009; Betts et al., 2009; Gutiérrez & Vanderwood, 2013). Although LM status is conceptualized as a fixed variable, meaning that it does not change over time, ELL status is considered changeable as students continue their academic careers.

Although the definition of ELL may not seem confusing, the real challenge is when these definitions are operationalized in various ways in research. For example, Kieffer (2008) classified students into three groups: language minority (LM) students (i.e., those who speak a language other than English at home) with limited English proficiency, LM without limited English proficiency, and native speakers of English. Lesaux and Kieffer (2010) classified students into two groups: LM (without considering

English proficiency levels) and native speakers of English (NS). National Assessment of Educational Progress (NAEP) defined ELLs as students who lack English proficiency and are in the process of acquiring English language skills and knowledge, which is similar to Kieffer's (2008) LM students with limited English proficiency. Chiappe, Siegal, and Wade-Woolley (2002) and Lesaux et al. (2007) classified students into two groups: native speakers of English, and English as a Second Language (ESL) students, which included students who spoke a language other than English with their parents regardless of their English proficiency levels. In other words, ESL is used similarly to LM in Kieffer's study (2008). Al Otaiba et al. (2009) classified students into three groups: (a) those who never needed additional ESL services, which may include NS and LM students without limited English proficiency; (b) those who were receiving ESL services at the time of the study, which include LM students with limited English proficiency; and (c) those who had already exited ESL services, which included LM students but represented a population different from LM students who never received ESL services. As the definition of ELL varies across studies, it is difficult to generalize findings from these studies to all ELL students.

Given the inconsistency of the ELL definitions used in the field, it seems necessary to provide a clear definition of how ELL is defined in this study to better support a synthesis of previous research. To represent a more complete spectrum of students' English proficiency levels, three ELL statuses are utilized in this study: ELL, former ELL, and non-ELL. First, ELL is defined as students whose primary home language is not English and who are currently receiving additional academic support due to their limited English proficiency. Second, former ELL students are defined as those

whose primary home language is not English and who have ceased receiving additional academic support services related to their limited English proficiency. Third, non-ELL students are defined as (a) those whose native language is English or (b) those whose English proficiency is equivalent to native speakers of English regardless of their primary home language and who never received additional academic support related to limited English proficiency. Lastly, students are defined as Language Minority (LM) if they are classified based solely on their primary home language, without any indication of their English proficiency levels in the original research reports (see Table 1).

Demographic Shifts in the United States

During the last decade, the demographic characteristics of students enrolled in U.S. schools changed dramatically. Language minority (LM) students represent one of the fastest growing subgroups of students in U.S. schools (Abedi, 2004). According to the National Center for Education Statistics (NCES, 2012), the number of LM children increased from approximately 8.5 million to 11.2 million since the year 2000. As of 2011, approximately 10% of students enrolled in U.S. public schools were LM students who spoke a language other than English at home (NCES, 2012). Of these LM students, approximately 3 million students were ELLs receiving additional ESL services during the 2010–2011 school year (NCES, 2010–2011). This is approximately a 13% increase compared to the 1998–1999 school year (NCES, 1998-1999).

Dramatic Demographic Shifts in Oregon

While some states (e.g., California, Florida, Texas) have historically served a large number of LM students, other states (e.g., Colorado, North Carolina, Oregon, Utah) that historically had small LM populations have recently experienced unprecedented

shifts in student demographics (Aud, Wilkinson-Flicker, Kristapovich, Rathbun, Wang, & Zhang, 2013; Oregon Department of Education, 2011, November). By 2004–2005, approximately 61% of ELLs inhabited one of six states (Arizona, California, Florida, Illinois, New York, and Texas); however, in recent years the number of ELLs has rapidly increased in other states as well (Payán & Nettles, 2008).

Oregon, where students investigated in the current study attended school, has been experiencing an unprecedented demographic change. Whereas there were about 44,000 ELLs (i.e., those whose primary home language is not English and who receive ESL services) in Oregon schools 10 years ago, this number increased to more than 65,600 for the 2010–2011 school year. This was a 48% increase in the number of Oregon ELL students, and the number of ELL students continues to grow (Oregon Department of Education, 2011, November). In addition, 11.5% of all students enrolled in Oregon schools received ESL services in 2011. Given the increasing numbers of ELL students in states historically serving small numbers of ELLs, such as Oregon, it is important to focus on the academic performance of ELLs in these regions because there is very limited understanding of how ELLs in these regions perform academically.

Achievement Gap between ELLs and Non-ELLs

The proportion of ELL students participating in large-scale assessments such as the National Assessment of Educational Progress (NAEP) has increased alongside the growing numbers of ELL students in U.S. schools (Aud et al. 2011). In 2004, approximately 76% to 78% of ELLs participated in the NAEP Long-Term Trend Reading Assessment (LTTRA). There was also an increase of approximately 5% to 7% in the number of ELLs tested in 2008 (Wilde, 2010). In addition, there have been growing

efforts to understand the academic performance of ELLs (Al Otaiba et al., 2009; Betts et al., 2009; Gutiérrez & Vanderwood, 2013; Kieffer & Lesaux, 2012; Lesaux, Lipka, & Siegel, 2006; Lesaux et al., 2007; Richards-Tutor et al., 2013) as well as to provide more effective instruction to ELLs (August, Estrada, & Boyle, 2012; Gersten, Baker, Shanahan, Linan-Thompson, Collins, & Scarcella, 2007; Kieffer & Lesaux, 2012).

Achievement gap on the National Assessment of Educational Progress. Although a growing body of research focuses on understanding the academic performance of ELLs, the achievement gap between ELLs and non-ELLs has not decreased. According to the 2013 main NAEP report, although 72% of third-grade non-ELL students were at or above the basic proficiency level in reading, only 31% of ELLs were at this level. The gap is larger for older students: 79% of eighth-grade non-ELLs students were at or above the basic proficiency level, yet only 30% of ELL students were at this level. When comparing the main NAEP reading assessment scores for 2003 and 2013, it is clear that the achievement gap between ELLs and non-ELLs has not narrowed. The average NAEP reading scores for fourth-grade ELLs were 186 and 187 in years 2003 and 2013, respectively, while the average scores for non-ELLs were 221 and 226 for the same years (see Figure 1; NCES, 2003–2013).

Such a gap is also observed on the NAEP Long-Term Trend Reading Assessment (LTTRA). The NAEP LTTRA scores reveal that the achievement gap between ELLs and non-ELLs is persistent over time. The gap in the NAEP reading tests between 9-year-old ELLs and non-ELLs in 2004 (average scale scores of 187 and 218, respectively) did not narrow in 2008 (when the average scale score was 193 for ELLs and 223 for non-ELLs),

nor in 2012 (when the average scale score was 191 for ELLs and 225 for non-ELLs) (see Figure 2; NCES, 2004–2012).

Achievement gap in the development of specific reading skills. Similar to trends on the national assessments, previous research findings also repeatedly demonstrate the achievement gap between ELLs and non-ELLs across many domains of reading, including fluency and comprehension (August & Shanahan, 2006; Chiappe, Siegel, & Gottardo, 2002; Kieffer, 2008; Lesaux, 2006; Lesaux & Kieffer, 2010; Quirk & Beem, 2012). In the executive summary report of the National Literacy Panel on Language-Minority Children and Youth, August and Shanahan (2006) concluded that although ELLs perform comparably to their non-ELL peers in word-level reading skills (i.e. decoding, word recognition, and spelling), performance of ELLs on text-level skills (i.e. reading comprehension and writing) is significantly lower than that of non-ELL students.

In a 5-year longitudinal study that took place in Canada, Lesaux, Rupp, and Siegel (2007) followed 135 language minority (LM) students and 689 non-LM students from kindergarten through fourth grade and assessed them on their word reading, spelling, phonological processing, syntactic awareness, working memory, and word reading and comprehension skills. In this study, the authors reported that although kindergarten LM students scored lower than non-LM students on early literacy measures, such a difference was no longer observed by the fourth grade. Also, word reading development patterns over time for both groups were both nonlinear and very similar to each other. In addition, the predictive validity of early literacy measures administered in kindergarten for the fourth-grade reading tests was similar for the two groups.

Table 1
Definition of English Language Learner (ELL) Status Used in This Study

ELL Definition	Primary Home Language	ESL Services	English Language Proficiency	Examples from Previous Research	
				First Author (Year)	Terms Used
ELL	Not English	Currently receiving	Limited	Al Otaiba et al. (2009)	English as a second language (ESL) students
				Betts et al. (2009)	ELL
				Gutiérrez et al. (2013)	English learners
				NAEP (n.d.)	LM with limited English proficiency
				Quirk et al. (2012)[1]	ELL
Former ELL	Not English	Previously received	Not limited (proficient)	Al Otaiba et al. (2009)	ESL-exited students
				Quirk et al. (2012)[1]	ELL reclassified
Non-ELL	Not English	Never received	Not limited (proficient)	Al Otaiba et al. (2009)	Latino students
				Kieffer (2008)	LM with full English proficiency
Non-ELL	English	Not applicable	Not limited (proficient)	Chiappe, et al. (2002)	native English speakers
				Kieffer (2008)	native English speakers
				Lesaux et al. (2007)	native English-speaking children (L1)
				Lesaux et al. (2010)	native English speakers
Language Minority (LM)	Not English	Includes all of the above	Includes those with and without limited English proficiency	Chiappe, et al. (2002)	English as a second language (ESL) students
				Lesaux et al. (2007)	ELL
				Lesaux et al (2010)	LM

[1] Approximately 86% of study participants were ELL and 14% were former ELL; however, the groups were combined for the analysis, and their achievement was not compared.

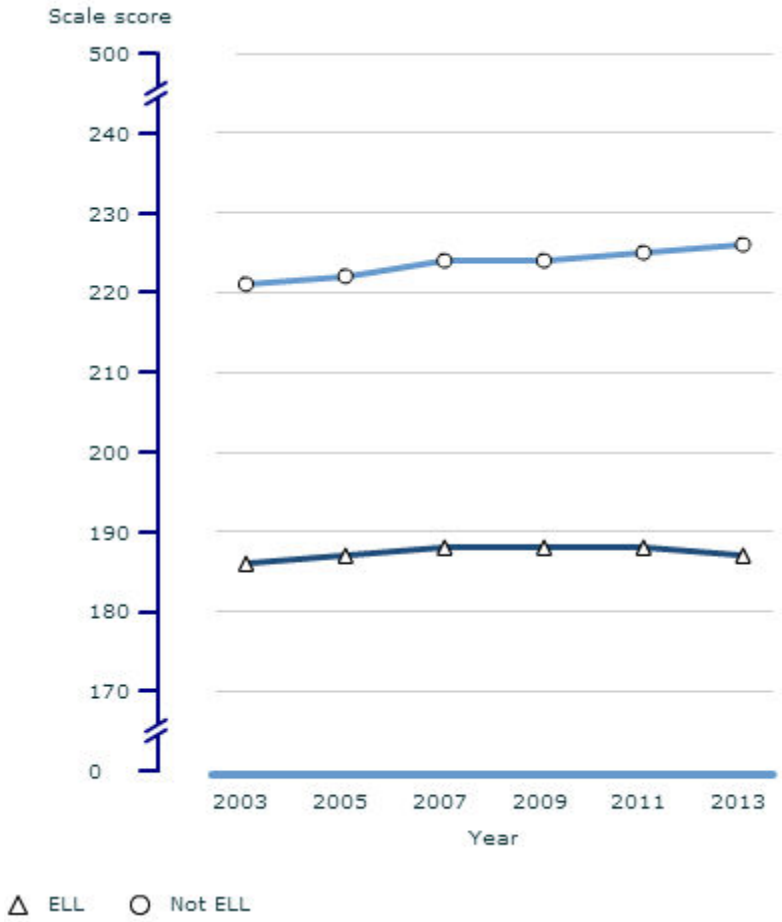


Figure 1. Achievement gap between English Language Learners (ELLs) and non-ELLs on the Main NAEP Reading Assessment.

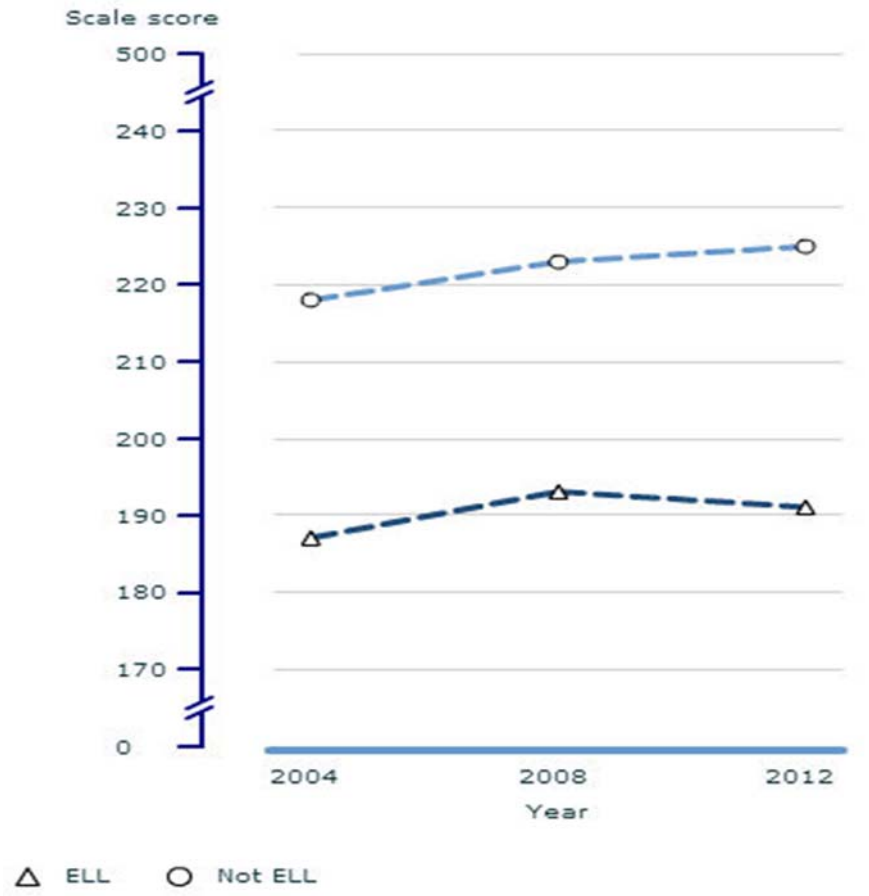


Figure 2. Achievement gap between English Language Learners (ELLs) and non-ELLs on the NAEP Long-Term Trend Reading Assessment.

Other evidence suggests that a gap can be observed as early as kindergarten and first grade for basic literacy skills such as letter knowledge and phonological processing skills, as well as for word-level skills such as decoding (Al Otaiba et al., 2009; Baker, Baker, Katz, & Otterstedt, 2009; Chiappe, Siegel, & Wade-Woolley, 2002; Gutiérrez & Vanderwood, 2013). Chiappe, Siegel, and Wade-Wolley (2002) investigated the development of early reading skills for 131 language minority (LM) students and 727 non-LMs in kindergarten and first grade; they reported that although LM students acquired basic literacy skills in a similar order and at a similar rate compared with their non-LM peers, LM students consistently scored lower than non-LMs on phonological and linguistic processing measures. Baker, Baker, Katz, and Otterstedt (2009) reported a similar finding, stating that although ELLs made consistent growth from the first grade to the third grade, the growth was not enough to close the gap between ELLs and non-ELLs on curriculum-based measurement (CBM) in reading, nor on standardized reading assessments.

Although ELLs seem to develop basic literacy skills at a rate similar to their non-ELL peers, the discrepancy in reading skills between the two groups does not fade in upper grades. Kieffer (2008) compared growth in reading skills between ELLs (i.e., LM students with limited English proficiency), LM students without limited English proficiency, and native English speakers from kindergarten to fifth grade using a national Early Childhood Longitudinal Study dataset. In this study, he reported that LM students entering kindergarten without limited English proficiency demonstrated similar growth trajectories as their native English-speaking peers, while ELLs exhibited a gap in

performance compared to their native English-speaking peers. Furthermore, the gap enlarged over time.

A study by Lesaux and Kieffer (2010) explored sources of reading difficulties for middle school students using latent class analysis; it examined whether the sources of such difficulties varied for LM and non-LM students. In the study findings, LM students on average scored lower than non-LM students on a battery of reading assessments; however, the sources of reading difficulties for all struggling readers, regardless of whether they were LM or non-LM, were similar. Moreover, all struggling readers exhibited very low vocabulary knowledge.

While these studies compared the growth of LM students (with and without limited English proficiency, depending on the studies) and non-LM students, other studies examined the reading development of ELLs and former ELLs. Al Otaiba et al. (2009) evaluated the growth of approximately 5,000 second- and third-grade students on oral reading fluency based on their English proficiency levels (ELLs, former ELLs, and non-ELLs who are LM). Non-ELL students demonstrated growth of 1.19 to 1.23 words per week for second and third grades, respectively, whereas researchers observed slower growth rates in former ELL students (0.93 to 1.08 words per week) and ELL students (0.75 to 1.10 words per week).

Gutiérrez and Vanderwood (2013) also compared growth in reading among second-grade ELLs based on their English proficiency level (i.e. beginning, early intermediate, intermediate, early advanced, and advanced). All ELLs demonstrated growth in reading, as measured by Dynamic Indicators of Basic Early Literacy Skills (DIBELS) reading measures (phoneme segmenting, nonsense words, and oral reading

fluency), regardless of initial English proficiency level. The only significant difference in growth rates among the five groups was between the beginning and advanced ELL groups. The advanced ELL group showed a much higher rate on ORF (1.13 words per week) than the beginning-level group (0.82 words per week).

Previous research on ORF growth for non-ELL students (i.e. native speakers of English) suggests that the expected weekly growth on ORF for third graders is approximately one word per week (Christ, Silberglitt, Yeo, & Cormier, 2010; Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993; Tindal, 2013). Based on the previous CBM research on ORF growth, it appears that the reading growth of ELLs is comparable to their non-ELL peers. However, it is important to note that (a) the achievement gap between ELLs and non-ELLs has been repeatedly observed, and (b) there is wide variation in reading development among ELLs depending on their English proficiency levels. As currently available research in this field is shallow and limited (Lesaux, 2006), more replication of previous research and investigation of ELL reading development should be conducted.

Heterogeneity in Reading Performance Among ELLs

Although most research on the ELL population has focused on investigating the achievement gap between ELLs and non-ELLs, a few studies compared reading performance among ELLs. In addition to the comparison between language minority (LM) and non-LM students, Kieffer (2008) compared the reading growth trajectories among LM students, based on their English proficiency, from kindergarten to fifth grade using the large scale dataset (i.e. Early Childhood Longitudinal Study-Kindergarten Cohort; ECLS-K). In this study, he reported that all students demonstrated similar growth

on reading regardless of their English proficiency, but LM students with lower English proficiency scored significantly lower on reading tests compared to LM students with higher English proficiency. For example, LM students who became eligible to take the reading test sooner (e.g., in the spring of first grade) because of their improved English proficiency performed better than other LM students who became eligible to take the test later (e.g., in the spring of third grade).

Using the same dataset, Hafner, Ulanoff, and Schlackman (2008) compared the reading development profiles between non-ELLs and ELLs from kindergarten to fifth grade. Findings from the growth mixture modeling, a technique used to capture unobserved clusters of students sharing similar growth trajectories, identified five distinct growth trajectories for the total sample, combining non-ELLs and ELLs. Three of the five groups exhibited low performance in kindergarten while the remaining two groups exhibited high performance. Of the three *low starting* groups, the first group made gradual progress from kindergarten to fifth grade, while the second group made steady progress only until third grade. The third group made the steepest growth from kindergarten to third grade among all five groups. Both *high starting* groups made gradual progress until first grade, demonstrating different growth patterns after first grade. One group slowed down in their reading growth after first grade, whereas the other group continued to grow steadily until fifth grade. When the same analysis was conducted only with ELL students, researchers observed the same number of distinct growth trajectories, as was the case for the total sample analysis. However, the difference between the total sample and subsample (i.e. ELLs only) analysis is that two of the low starting groups caught up with the high starting group by the end of fifth grade.

These findings seem to suggest that reading development patterns are heterogeneous even among ELLs. If the reading growth trajectories among ELLs vary significantly, instructional support designated for ELLs may need to differ to meet the needs of ELLs depending on their growth trajectories. Given the limited amount of research regarding this matter, replication should be conducted to explore the heterogeneity in reading development among ELLs.

Limited Generalizability of Previous Findings

Although efforts to better understand the reading development of ELLs have been increasing, findings from previous research are limited in their generalizability. Lesaux (2006) argued that while the breadth of research on ELL reading development is wide, it lacks depth; thus, the findings are not robust enough to be generalized. The current study attempts to address some of the major limitations of previous research, including the sample bias present in previous ELL research as well as the use of limited reading indicators in previous ELL research.

Definition of ELLs. Although some studies suggest that LM students demonstrate reading development patterns similar to non-ELLs (Al Otaiba et al., 2009; Gutiérrez & Vanderwood, 2013; Kieffer, 2008; Lesaux & Kieffer, 2010), many studies failed to differentiate LM students with and without limited English proficiency (Chiappe, Siegel, & Gottardo, 2002; Chiappe, Siegel, & Wade-Wolley, 2002; Lesaux & Kieffer, 2010; Lesaux et al., 2007; Quirk & Beem, 2012). Because the LM status is based solely on students' primary home language, findings from these studies may represent students whose English proficiency is not limited, and therefore the studies may not be generalized to ELLs whose English proficiency is limited.

Another concern regarding the definitions of ELLs used in previous research is that it is often unclear how former ELLs are classified. If studies use primary home language as an indicator of ELLs (which is referred to as LM students in the current study), former ELL students are classified as ELLs (LM students in the current study). For example, Quirk and Beem (2012) classified former ELLs as ELLs; they defined ELLs as students who had been classified as ELL at some point in their educational career. In contrast, if studies determine student ELL status based on whether students are currently receiving ESL services, former ELLs are classified as non-ELL students, as used in NAEP Reading Assessment. As Lesaux (2006) pointed out, without studying former ELLs as a group separate from ELLs and non-ELL students, it is difficult to understand the growth continuum of ELL reading skills.

To address this concern, students included in the current study are classified into three groups: ELLs who were receiving state ESL services during the data collection periods, former ELLs who exited the state ESL services, and non-ELLs who were not eligible or not served by the state ESL services. Although there may be students in the non-ELL group whose primary home language is not English, the current study still classifies them as non-ELL based on their ESL service records provided by state departments. More information on the state ELL classifications is discussed in the following chapter.

Regional and grade-level bias. Another reason that the generalizability of previous findings is limited is that most published studies were conducted in areas with a history of having large numbers of ELL and LM students in schools, such as California, Florida, Texas, and Vancouver, British Columbia (Abedi, 2004; Al Otaiba et al., 2009;

Chiappe, Siegel, & Gottardo, 2002; Gutiérrez & Vanderwood, 2013; Lesaux & Kieffer, 2010; Lesaux et al., 2006; Richards-Tutor et al., 2013). While studies conducted in these regions can provide useful information about the performance of ELLs and LM students, such findings may not generalize to those who reside in other states lacking a long history of serving a large ELL population, such as Oregon.

In addition to regional bias, the grade levels studied in most ELL research are also somewhat limited. Based on the preceding review of 14 published studies examining reading performance in ELLs and/or LM students, eight studies included participants from kindergarten to third grade, two studies followed students from kindergarten to fourth grade, two studies included students in middle school (see Table 2), and two studies included only fourth-grade students. As students transition from *learning to read* to *reading to learn,* and as text complexity increases, the transition from third grade to fourth grade can be particularly challenging for ELLs and former ELLs. Irrespective of reading difficulty, there is not enough empirical evidence to describe ELLs at these grade levels. To address both regional and grade-level biases in previous ELL research, students in Oregon were followed for two school years, from third grade (2011–2012 school year) to fourth grade (2012–2013 school year), in the current study.

Measuring reading skills using a single indicator. Most previous studies examining the reading performance of ELLs used measures of basic literacy such as phonological processing, and measures of fluency such as oral reading fluency (see Table 2). While findings from these studies help educators understand the development of basic reading skills in early grades, they do not provide useful information about how ELLs and former ELLs develop comprehension and vocabulary skills over time. It is critical to

understand the development of such domains because (a) although oral reading fluency is an important indicator of students' later reading comprehension, the relation between fluency and comprehension changes over time, and (b) there is a greater demand for comprehension as students continue their schooling (Nese, Park, Alonzo, & Tindal, 2011; Yovanoff, Duesbery, Alonzo, & Tindal, 2005). Furthermore, ELLs are especially likely to lack vocabulary knowledge and to experience challenges with comprehension as required texts increase in complexity (August, Carlo, Dressler, & Snow, 2005).

Unfortunately, even LM students entering kindergarten without limited English proficiency tend to lag behind in reading as the demand of reading increases in upper grades. Many ELLs and LM students, including U.S.-born ELLs, lack the vocabulary essential for academic success (Lesaux, 2006). Therefore, it is important to understand how ELLs perform not only on fluency measures, but also on other domains of reading such as comprehension and vocabulary (Lesaux & Kieffer, 2010). By doing so, ELLs who may be excluded from receiving additional instructional supports due to their high fluency (e.g., former ELLs) can receive adequate supports to develop their comprehension and vocabulary skills.

Because previous empirical evidence is limited in generalizability, we cannot make robust statements either about how ELLs develop in reading, or about whether it is reasonable to assume that ELLs' growth norms are comparable to those of non-ELLs (Kieffer, 2008; Lesaux et al., 2007). Thus, more research, especially longitudinal studies, should be conducted to better understand how ELLs develop in reading over time (August & Shanahan, 2006). To address this concern, the current study includes three reading curriculum-based measures (CBMs): oral reading fluency, reading

Table 2
Review of Published Research on the Reading Performance of English Language Learners (ELLs) and/or Language Minority (LM) Students

First author	Second author	Year	*n* size	Grade level	Region	Measures used
Al Otaiba, S.	Petscher, Y.	2009	2,182 ELLs 965 former ELLs 1,857 non-ELLs	2-3[a]	Florida	Oral reading fluency Receptive vocabulary
Alonzo, J.		2007	110 ELLs with low English proficiency 110 ELLs with advanced English proficiency 214 non-ELLs	3-4	Oregon	Early literacy measures (letter naming, letter sound, phoneme segmenting) Fluency measures (word reading, sentence reading, passage reading) Reading comprehension
Baker, D.	Baker, S.	2009	Approximately 750 ELLs and 2,300 non-ELLs in each grade	1-3	Oregon	Fluency measures (nonsense words, oral reading) Standardized reading assessment
Baker, D.	Park, Y.	2012	Approximately 160 ELLs in each grade	1-3	Oregon	Fluency measures (pseudoword reading and oral reading in Spanish; pseudoword reading and oral reading in English) Standardized reading assessment English language proficiency test
Betts, J.	Bolt, S.	2009	303 ELLs	3	Minnesota	Oral reading fluency State reading assessment
Chiappe, P.	Siegel, L.	2002	59 non-ELLs who are LM 60 ELLs 540 non-ELLs who are NS	K	Vancouver, B.C.	Early literacy measures (letter identification, spelling, sound mimicry, rhyme detection, syllable and phoneme identification, phoneme detection, word retrieval, syntactic awareness, verbal memory)
Chiappe, P.	Siegel, L.	2002	131 LM 727 non-ELLs who are NS	K-1[a]	Vancouver, B.C.	Early literacy measures (letter identification, spelling, pseudoword repetition, phonological awareness, syllable identification, phoneme identification, phoneme deletion, word retrieval, syntactic awareness, verbal memory, print awareness)
Gutiérrez, G.	Vanderwood, M.	2013	260 ELLs	2	California	English language proficiency test Fluency measures (oral reading fluency, phoneme segmenting fluency, nonsense word fluency)

Table 2
Review of Published Research on the Reading Performance of English Language Learners (ELLs) and/or Language Minority (LM) Students (Continued)

First author	Second author	Year	*n* size	Grade level	Region	Measures used
Kieffer, M.		2008	746 ELLs 1,134 non-ELLs who are LMs without limited English proficiency 15,362 non-ELLs who are NS	K-5[a]	National dataset	Reading composite IRT-based scaled scores
Kieffer, M.	Lesaux, N.	2012	90 LM	4-7[a]	California	Vocabulary Morphological awareness Fluency measures (word reading, nonsense word reading, sight word reading) Phonological awareness Standardized reading assessment
Lesaux, N.	Kieffer, M.	2010	399 LM 182 non-ELLs who are NS	6	California	Fluency measures (word reading, pseudoword reading, passage reading) Vocabulary measures (general and academic vocabulary measures)
Lesaux, N.	Lipka, O.	2006	85 LM 395 non-ELLs who are NS	4	Vancouver, B.C.	Early literacy measures (phonological processing, syntactic awareness) Fluency measures (word reading, word identification, pseudoword reading) Standardized reading assessment
Lesaux, N.	Rupp, A.	2007	153 LM 689 non-ELLs who are NS	K-4[a]	Vancouver, B.C.	Early literacy measure (letter identification, working memory, sound mimicry, rhyme detection, syllable detection, syllable identification, phoneme identification, phoneme deletion, oral cloze, spelling) Fluency measure (word reading, pseudoword reading) Standardized reading assessment
Richards-Tutor, C.	Solari, E.	2013	114 LM	K	California	Early literacy measures (onset and rime detection, segmentation, and blending) Fluency measures (word identification, word reading, phoneme segmenting, nonsense words)

a = longitudinal study
Note. NS = Native speakers of English.

comprehension, and vocabulary. Participants were administered each of these measures three times a year for two years, which allowed the author to analyze growth in each of the three domains of reading across two years.

Research Questions of the Current Study

The lack of comprehensive findings on ELL literacy growth has often been noted as a major challenge for teachers in providing effectively targeted instruction to ELLs. As a result, ELLs identified as having reading disabilities are significantly overrepresented (Lesaux, 2006). The literacy growth of ELLs may differ from their non-ELL peers, making understanding the literacy growth of ELLs especially critical in early grades. This knowledge can help educators provide more appropriate and timely academic support to ELLs. To address the aforementioned limitations in the research base, and to expand our knowledge of the reading development of ELLs, the following research questions will be answered:

Research Question 1: To what extent do literacy growth trajectories across third and fourth grade differ based on whether students are non-ELLs, ELLs, or former ELLs, as measured by curriculum-based measures of oral reading fluency (ORF), reading comprehension (RC), and vocabulary (VOC)?

Research Question 2: Do distinct patterns of literacy growth exist? If so, how are these patterns related to students' ELL status?

Research Question 3: Do ELLs and former ELLs demonstrate literacy development profiles that are distinct from those of their non-ELL peers?

CHAPTER II

METHODS

Extant easyCBM data from third and fourth grade was used to create a cohort of students in Oregon, with measurement occasions ranging from the fall of 2011 to the spring of 2013. Students' tri-annual reading CBM scores (oral reading fluency, reading comprehension, and vocabulary) were analyzed to investigate these students' literacy growth trajectories and reading profiles.

Participants and Settings

The initial sample included 15,475 students from the 51 districts in Oregon that administered the easyCBM benchmark assessment during the 2011–2012 and 2012–2013 school years. These students were in third grade in the 2011–2012 school year and in fourth grade in the 2012–2013 school year.

As the primary purpose of this study was to compare growth rates between ELLs and non-ELLs (e.g., native speakers of English; students who exited the ELD program), 386 students without a 2011–2012 school year ELL status indicator reported by the Oregon Department of Education were excluded from analyses. Students with the ELL indicator scored significantly higher on most measures, including all six oral reading fluency (ORF) tests, four reading comprehension (RC) tests, and four vocabulary tests across the two years (see Table 3).

Table 3
Mean Comparisons Between Students With and Without English Language Learner (ELL) Status Indicator[1]

Test	Season	ELL indicator			Without ELL indicator			Mean difference
		n	*M*	*SD*	*n*	*M*	*SD*	
Oral Reading Fluency	Fall Y1	7987	84.93	39.98	265	76.54	38.04	8.39*
	Winter Y1	7815	116.39	45.14	259	107.94	47.32	8.45*
	Spring Y1	7975	114.06	43.70	283	107.18	46.68	6.89*
	Fall Y2	7254	108.97	38.31	259	94.49	37.04	14.48*
	Winter Y2	6059	133.60	38.81	47	112.32	48.36	21.28*
	Spring Y2	6683	140.20	44.25	208	127.66	44.68	12.54*
Reading Comprehension	Fall Y1	8871	10.24	3.99	298	9.60	4.18	0.63*
	Winter Y1	8603	10.05	3.34	303	9.76	3.39	0.29
	Spring Y1	7277	13.32	4.35	296	12.57	4.07	0.76*
	Fall Y2	7315	11.83	4.44	257	10.40	4.17	1.43*
	Winter Y2	7004	13.40	4.07	45	12.58	4.40	0.82
	Spring Y2	5574	13.73	4.15	202	12.00	4.36	1.73*
Vocabulary	Fall Y1	7860	14.47	4.52	259	14.12	4.44	0.35
	Winter Y1	7562	15.76	4.01	257	14.29	4.61	1.47*
	Spring Y1	6792	16.95	3.30	265	16.17	3.82	0.78*
	Fall Y2	7667	15.47	3.98	283	14.48	4.09	0.99*
	Winter Y2	6782	16.62	3.42	71	16.30	3.97	0.32
	Spring Y2	6185	17.06	3.25	227	15.96	3.83	1.10*

[1] ELL status indicator is based on the 2011–2012 school year record.
Note. Independent Samples *t*-test with unequal variance assumption was conducted. Y1=2011–2012 school year. Y2=2012–2013 school year.
* $p < .05$

Of the 15,089 students with a valid ELL indicator, 2,844 students had no easyCBM data at any time point, and these students were excluded from analyses. A greater percentage of students removed from the analytic sample due to lack of CBM scores (approximately 19%) were ELL students compared with the group of all students with a valid ELL indicator (approximately 15%). Also, students with at least one CBM score performed significantly higher on the Oregon Assessment of Knowledge and Skills (OAKS) reading assessment, which was Oregon's high-stakes assessment at the time, compared to students without any CBM scores (see Table 4).

Table 4
Proportion of English Language Learners (ELLs) Between Students With and Without CBM Score

	At least 1 CBM score	No CBM score	Total[1]
Non-ELL	10,181 83.1%	2,165 76.1%	12,346 81.8%
Former ELL	435 3.6%	126 4.4%	561 3.7%
ELL	1,629 13.3%	553 19.4%	2,182 14.5%
OAKS score[2]	214.13	210	213.54
Total	12,245	2,844	15,089

[1] The information is based on the students with a valid ELL indicator.
[2] The mean difference of 3.14 for the 2011–2012 school year OAKS reading assessment between students with at least one CBM score and students without any CBM score was significant, $p < .05$.
Note. CBM=Curriculum based measurement.

The final analytic sample included a total of 12,245 students with a valid ELL indicator and at least one CBM score, representing 48 districts. Approximately 83.1% of these students were non-ELL; 13.3% were ELL; and 3.6% were former ELL. There were slightly more males (*n*=856, 52.5% of ELLs) in the ELL group and more females in the former ELL group (*n*=230, 52.9% of former ELLs). A large proportion of ELLs (*n*=1240, 76.1% of ELLs) and former ELLs (*n*=262, 60.2% of former ELLs) were Hispanic students. About half of non-ELLs were eligible for free and/or reduced-priced lunch (FRL), while more than 90% of ELLs and 79% of former ELLs were eligible for FRL. One interesting note is that former ELLs performed as well as non-ELLs on the 2011–2012 school year OAKS, while ELLs scored much lower than these two groups. Table 5 displays a detailed description of the sample included in the analysis. It is important to note that results from this study were interpreted with caution, as students included in the analysis may have had different characteristics of reading performance than students excluded from analyses.

Table 5
Description of Analytic Sample

Percent distribution		Non-ELL n=10,181 (83.1%)	ELL n=1,629 (13.3%)	Former ELL n=435 (3.6%)	Total n=12,245 (100%)
Gender	Male	5,144 (50.5%)	856 (52.5%)	205 (47.1%)	6,205 (50.7%)
	Female	5,037 (49.5%)	773 (47.5%)	230 (52.9%)	6,040 (49.3%)
Race/ Ethnicity	American Indian/Alaska native	195 (1.9%)	5 (0.3%)	0 (0.0%)	200 (1.6%)
	Asian/Pacific Islander	400 (3.9%)	169 (10.4%)	93 (21.4%)	662 (5.4%)
	Black/African American	268 (2.6%)	38 (2.3%)	9 (2.1%)	315 (2.6%)
	Hispanic	999 (9.8%)	1,240 (76.1%)	262 (60.2%)	2,501 (20.4%)
	White	7,627(74.9%)	162 (9.9%)	67 (15.4%)	7,856 (64.2%)
	Multi-ethnic/Multi-racial	692 (6.8%)	15 (0.9%)	4 (0.9%)	711 (5.8%)
IEP	Participated	1,626 (16.0%)	275 (16.9%)	14 (3.2%)	1,915 (15.6%)
	Not participated	8,555 (84.0%)	1,354 (83.1%)	421 (96.8%)	10,300 (84.4%)
FRL	Eligible	5,312 (52.2%)	1,505 (92.4%)	347 (79.8%)	7,164 (58.5%)
	Not eligible	4,869 (47.8%)	124 (7.6%)	88 (20.2%)	5,081 (41.5%)
OAKS reading score		215.8	203.0	217.1	214.1
OAKS	Did not pass	2,228 (21.9%)	1,060 (65.1%)	43 (9.9%)	3,331 (27.2%)
	Passed	5,200 (51.1%)	538 (33.0%)	327 (75.2%)	6,065 (49.5%)
	Exceeded	2,753 (27.0%)	31 (1.9%)	65 (14.9%)	2,849 (23.3%)

Note. ELL=English language learner. IEP=Individualized education program. FRL= Free and/or reduced priced lunch. OAKS=Oregon Assessment of Knowledge and Skills. The third-grade achievement standards of the OAKS reading assessment for the *meets* and *exceeds* category were 211 and 224, respectively, for the 2011–2012 school year.

English Language Learner (ELL) Status

The key covariate used in this study is students' ELL status, as reported by the Oregon Department of Education for the 2011–2012 academic year. In Oregon, there are two main ways—Home Language Survey and teacher referral—to identify students who are potentially eligible for English language development (ELD) services, which are often referred to as ESL services in research. These students are assessed on their academic English proficiency in four language domains (reading, writing, speaking, and listening) using one of the four state-approved English language proficiency assessments (ELPAs) to determine the students' eligibility for ELD. The four state-approved ELPAs are the IDEA Language Proficiency Test (IPT) (Ballard, Tighe, & Dalton, 1979), the Language Assessment Scales (LAS) (De Avila & Duncan, 1989), the Stanford English Language Proficiency test (SELP) (Harcourt Assessment, Inc., 2003), and the Woodcock-Muñoz Language Survey (Muñoz-Sandoval, Ruef, & Alvarado, 2005). All students classified as ELL based on their ELPA results receive ELD services unless parents refuse the services for their child. The ELPA is administered annually to all identified ELLs, including all students who have completed a waiver to refuse ELD services (Oregon Department of Education, 2015).

The state classified students into 10 categories to indicate students' ELL status for the 2011–2012 school year: (a) students not eligible or not served by ELD services, (b) first-year ELL students without English Language Proficiency Assessments (ELPA), (c) first-year ELL students with ELPA, (d) students receiving ELD services between 2 and 5 years, (e) experienced ELL students (more than 5 years), (f) monitored students, (g) transitioning students (exited ELD services 1 to 2 years ago), (h) students who exited

ELD services on or before May 1, 2012 (during the 2011–2012 school year), (i) students who exited ELD services after May 1, 2012 (at the end of the 2011–2012 school year), and (j) students eligible for but not served by ELD services.

Given the small numbers of students in some of these categories (see Table 6), and for the sake of parsimony, these ten categories were collapsed into three (non-ELLs, current ELLs, and former ELLs), and used as a covariate to capture the heterogeneity of ELLs. This ELL status indicator variable was used to compare literacy growth rates of non-ELLs, current ELLs, and former ELLs. Therefore, among the 12,245 students included in the analytic sample, 1,629 students were ELLs (those who were receiving additional academic support due to their limited English proficiency), 435 former ELLs (those who formerly received additional academic support due to their limited English proficiency but were reclassified as English proficient either before, during, or by the end of third grade), and 10,181 were non-ELLs.

As mentioned in an earlier section, one of the major limitations of previous research is that the definition of ELL varies across studies. Although it would have been preferable to include students' ELPA scores, the actual ELPA scores were not accessible; thus, they were not available for analysis. In addition, it is important to note that ELL status in this study was treated as a fixed variable even though students may have been reclassified as non-ELL during the 2012–2013 school year, as the 2012–2013 school year ELL classification data were not available when data were provided for this research.

Table 6
The Number of Students in Each English Language Learner (ELL) Status Category

Original classification	# of students	New category	# of students
(1) Not eligible for nor served by ELD services	10,181	Non-ELLs	10,181
(2) first-year ELD students without ELPA	3	ELLs	1,629
(3) first-year ELD students with ELPA	47		
(4) students in ELD program between 2 and 5 years	1,578		
(5) experienced ELD students (more than 5 years)	1		
(6) monitored	0	Former ELLs	435
(7) transitioning (exited ELD services in prior year or 2 years ago)	282		
(8) students who exited ELD services on or before 5/1/2012	22		
(9) students who exited ELD services after 5/1/2012	131		
(10) students eligible but not served by ELD services	0	--	0

Note. ELD=English language development. ELPA=English language proficiency assessments.

Measures

The easyCBM benchmark and progress monitoring assessment system (Alonzo, Tindal, Ulmer, & Glasgow, 2006) was designed to provide technically adequate benchmark and progress monitoring measures to teachers and educators, and to help them make better instructional decisions based on student performance data. As of 2015, over 303,500 teachers actively use the system to monitor more than 2 million students. For each measure, there are 3 benchmark and an additional 10 to 17 progress-monitoring forms of equivalent difficulty available to measure students' literacy and reading skills for kindergarten through eighth grade, depending on the grade and measure type. Oral reading fluency (ORF), comprehension (RC), and vocabulary (VOC) are available for third and fourth grades as benchmarks and for progress monitoring (see Appendix B for correlations among the measures included in the analysis).

easyCBM passage reading fluency (ORF). The easyCBM ORF assessment is an individually administered and timed measure of oral reading fluency designed to assess a

student's ability to read connected narrative text aloud accurately and fluently. During 60 seconds, the student reads aloud a narrative passage written on single-sided paper while a trained assessor follows along and marks as errors any words the student misreads or skips. If a student hesitates for more than three seconds, the assessor provides the word and marks it as an error. If a student self-corrects any errors, they are counted as correctly read words. If student finishes the passage before 60 seconds, then he or she returns to the beginning of the passage and continues to read it aloud. At the end of 60 seconds, the assessor calculates the total number of words read correctly in one minute by subtracting the number of errors from the total number of words read.

All ORF forms were developed to be at mid-grade reading level for each grade, and they are comparable in difficulty within each grade. To increase the equivalence of difficulty across alternate forms, extensive systematic review and pilot studies were conducted, and necessary changes were made during the revision process (see Alonzo & Tindal, 2007, for details). The passages administered for this study were approximately 250 words in length for both third and fourth grade.

Test-retest reliability coefficients ranged from .84 to .94 and .86 to .96 for third and fourth grade, respectively. Alternate form reliability coefficients ranged from .91 to .95 and .83 to .98 for third and fourth grade, respectively (Alonzo, Lai, Anderson, Park, & Tindal, 2012; Park, Anderson, Alonzo, Lai, & Tindal, 2012). Correlations between ORF and state reading assessments ranged from .66 to .67 and from .64 to .67 for third and fourth grade, respectively (Sáez, Park, Nese, Jamgochian, Lai, Anderson, Kamata, Alonzo, & Tindal, 2010). A previous study reported that reliability of slope based on the second and third grade easyCBM progress monitoring ORF measures

ranged from .81 to .87 (Patarapichayatham, Anderson, Irvin, Kamata, Alonzo, & Tindal, 2011).

easyCBM multiple choice reading comprehension (RC). The easyCBM RC assessment is typically group-administered online. Students read an original fictional narrative passage (approximately 1,500 words long for third and fourth grade), then answer 20 multiple-choice questions based on the story. Each passage was written to be at mid-grade level readability. Of the 20 question items on each form, 7 assess students' literal comprehension skills, 7 measure inferential comprehension, and 6 test evaluative comprehension skills. Each item consists of a question stem and three possible answer choices: the correct answer, and two incorrect distractors. All RC items were analyzed using a Rasch model during the instrument development process and were found to function appropriately for grade-level students, with a wide range of difficulty (Alonzo & Tindal, 2008). Although this measure is not timed, most students complete the test in approximately 30 minutes.

Internal consistency reliability ranged from .55 to .78 and from .73 to .78 for third and fourth grade, respectively (Sáez et al., 2010). There were no statistical differences across the forms for either grade (Alonzo et al., 2012; Park et al., 2012). Correlations between RC and state reading assessments ranged from .54 to .61 and from .55 to .67 for third and fourth grade, respectively (Sáez et al., 2010).

easyCBM vocabulary (VOC). The easyCBM VOC assessment is also typically group-administered online. There are 20 multiple-choice questions followed by three answer choices: a correct synonym, and two incorrect but plausible distractors. All vocabulary words were drawn from a word list developed by researchers at The Ohio

State University. Similar to RC items, all VOC items were analyzed using a Rasch model and were found to function appropriately for the targeted grade level. Although this measure is not timed, most students complete the test in approximately 10 to 15 minutes. Internal consistency reliability ranged from .82 to .84 and from .81 to .82 for third and fourth grade, respectively (Wray, Alonzo, & Tindal, 2014). The correlations between VOC and state reading assessments ranged from .61 to .70 and from .69 to .71 for third and fourth grade, respectively (Sáez et al., 2010).

It is important to note that the easyCBM reading measures were not vertically scaled across grades during development. In other words, students' scores from different grades should not be used to determine growth across grades. Therefore, students' within-year growth on each of the three measures (ORF, RC, and VOC) for each year, obtained from six benchmark administrations (at the beginning, middle, and end of each academic year) was calculated separately for each grade level although they were modeled together.

Surprisingly, former ELL students scored significantly higher than non-ELL students on all six ORF tests. For RC, mean differences between non-ELLs and former ELLs were not statistically significant except in the fall of Year 2 (the 2012–2013 school year), when non-ELLs scored significantly higher than former ELLs. For VOC, mean differences between non-ELLs and former ELLs were not statistically significant except in the spring of Year 1 (the 2011–2012 school year), when former ELLs scored significantly higher than non-ELLs. Current ELLs performed significantly lower on all measures compared to their non-ELL and former ELL peers (see Table 7).

Table 7

Descriptive Statistics for easyCBM Reading Measures Collected During the 2011–2013 School Years

Test	Season	Non-ELL			ELL			Former ELL			Total		
		n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*[a]	*M*	*SD*
ORF	Fall Y1	6654	88.58	40.15	1059	57.97	28.97	274	100.47	28.76	7987	84.93	39.98
	Winter Y1	6499	120.36	45.15	1051	87.40	35.60	265	133.91	32.35	7815	116.39	45.14
	Spring Y1	6633	117.79	43.79	1076	86.58	34.24	266	132.36	31.33	7975	114.06	43.70
	Fall Y2	6020	112.16	38.53	968	85.22	29.61	266	123.10	27.58	7254	108.97	38.31
	Winter Y2	5222	136.52	38.49	669	107.51	33.68	168	146.71	24.93	6059	133.60	38.81
	Spring Y2	5540	144.09	43.90	897	111.13	37.24	246	158.60	31.65	6683	140.20	44.25
	FW Y1	6148	32.79	19.27	994	29.48	17.43	254	35.20	19.37	7396	32.43	19.07
	WS Y1	6211	-1.98	18.46	1020	-0.81	16.51	259	-1.51	19.40	7490	-1.80	18.25
	FW Y2	4892	23.71	19.00	630	22.21	16.17	161	24.82	19.20	5683	23.58	18.72
	WS Y2	4366	8.08	18.52	567	2.76	16.15	133	8.22	17.53	5066	7.49	18.32
RC	Fall Y1	7523	10.57	3.98	1049	7.63	3.18	299	10.98	3.12	8871	10.24	3.99
	Winter Y1	7214	10.36	3.31	1078	7.86	2.72	311	10.45	3.01	8603	10.05	3.34
	Spring Y1	6355	13.71	4.22	726	9.95	4.08	196	13.42	3.91	7277	13.32	4.35
	Fall Y2	6347	12.28	4.38	759	8.16	3.22	209	11.47	3.98	7315	11.83	4.44
	Winter Y2	6067	13.72	3.97	727	10.56	3.96	210	14.00	3.42	7004	13.40	4.07
	Spring Y2	4789	14.06	4.05	615	11.06	3.98	170	14.23	4.06	5574	13.73	4.15
	FW Y1	6425	-0.16	3.48	895	-0.01	3.46	258	-0.65	3.68	7578	-0.16	3.49
	WS Y1	5654	3.37	3.49	611	2.39	3.77	180	3.59	3.82	6445	3.29	3.54
	FW Y2	5343	1.38	3.73	630	2.60	3.73	173	2.27	3.54	6146	1.53	3.75
	WS Y2	4337	0.22	3.43	552	0.55	3.73	152	0.43	3.53	5041	0.27	3.47
VOC	Fall Y1	6730	14.93	4.42	888	10.73	3.74	242	15.51	3.20	7860	14.47	4.52
	Winter Y1	6465	16.25	3.77	881	12.04	4.04	216	16.56	2.43	7562	15.76	4.01
	Spring Y1	5981	17.22	3.11	636	14.13	3.95	175	17.82	1.90	6792	16.95	3.30
	Fall Y2	6487	15.98	3.79	923	11.80	3.60	257	15.90	2.81	7667	15.47	3.98
	Winter Y2	5912	17.00	3.17	679	13.18	3.77	191	17.02	2.47	6782	16.62	3.42
	Spring Y2	5150	17.48	3.03	805	14.26	3.49	230	17.46	2.39	6185	17.06	3.25
	FW Y1	5688	1.38	3.09	706	1.44	3.43	177	1.03	2.58	6571	1.37	3.12
	WS Y1	5210	0.93	2.57	502	1.91	3.11	143	1.36	2.17	5855	1.03	2.63
	FW Y2	5208	0.93	2.68	593	1.42	3.19	149	1.01	2.65	5950	0.98	2.74
	WS Y2	4301	0.47	2.22	517	1.05	2.94	135	0.39	2.20	4953	0.53	2.32

a. Although the sample size for each measure does not add up to 12,245, the descriptive analysis was conducted using the full analytic sample size. ORF=easyCBM Passage Reading Fluency. RC=easyCBM Multiple Choice Reading Comprehension. VOC=easyCBM Vocabulary. Y1=2011–2012 school year. Y2=2012–2013 school year. FW=change between fall and winter. WS=change between winter and spring.

Data Analysis

In this section, the data structure, a brief summary of preliminary analysis results, the analytic approach, and the analytic procedures are described.

Data structure and preliminary analysis. The data used for this study had a nested structure, where individual easyCBM reading measures were nested within students, and students were nested within districts. Despite this hierarchical relationship, the data were structured to address only the multiple testing occasions nested within students, without accounting for the nested structure of students within districts, because of model convergence problems during the preliminary analysis phase. Such problems may have been due to the wide variation in numbers of students and the percentage of non-ELLs, ELLs, and former ELLs (see Appendix A). Although failure to address this nested structure could have yielded misleading results because students from the same district might have had correlated residuals, which would have violated the assumption of independence of observations, this decision was necessary for model convergence.

Analytic approach and procedure. A piecewise growth model was fitted to investigate the developmental patterns of reading skills for students in the early elementary grades based on their tri-annual benchmark assessment data. Then the multiple-group piecewise growth model analysis was conducted to examine differences in growth trajectories between non-ELLs, ELLs, and former ELLs. In addition, Latent Class Growth Analysis (LCGA) was conducted to capture groups of students sharing similar growth trajectories (Wang & Wang, 2012) over the course of two school years.

Because the easyCBM reading measures were not vertically scaled across grades (Alonzo & Tindal, 2007), it was not appropriate to model student growth across the six

measurement occasions (three benchmark administrations per year over two school years) with one growth trajectory (i.e. intercept and slope). Therefore, a separate growth trajectory was examined to represent within-year growth on each of the three easyCBM reading measures, even though they were modeled together. This way, it was possible to estimate correlations among the intercepts and slopes from the growth trajectories representing within-year growth on the three easy CBM measures from each of the two school years. This allowed examination of not only growth patterns, but also the relationships among the three measures for each of the three groups (non-ELLs, ELLs, and former ELLs). Analyses were conducted separately for each measure type using Mplus version 5 (Muthén & Muthén, 1998–2007), using Maximum Likelihood estimation.

Piecewise growth modeling. To examine the patterns of students' literacy growth, conventional piecewise growth modeling (PGM) was performed. PGM is often used to model the non-linearity of within-year growth using three time points (Christ, Silberglitt, Yeo, & Cormier, 2010; Kamata, Nese, Patarapichayatham, & Lai, 2013; Wang & Wang, 2012). While a conventional linear growth model assumes one linear growth rate from fall to spring, two growth parameters are estimated for the piecewise growth modeling to represent change from fall to winter and from winter to spring. Visual inspection of the observed mean at fall, winter, and spring for each year on all three easyCBM reading measures (ORF, RC, and VOC) indicated that their within-year literacy growth may not have been linear (see Figure 3). In ddition, within-year mean growth was observed to be non-linear when graphed separately for non-ELLs, ELLs, and former ELLs (see Figure 4). Such non-linearity of within-year growth has been noted multiple times in recent

years (e.g., Ardoin & Christ, 2008; Nese et al., 2012).

PGM does not assume one linear growth trajectory across all three time points (from fall to spring). Instead, it estimates two linear growth components, from fall to winter and from winter to spring, which made it ideal for these purposes. To represent non-linear within-year growth on each of the three easyCBM reading measures for both years, six intercepts (third and fourth grade from each of 3 measures) and 12 slope parameters (two slopes representing the changes from fall to winter and from winter to spring on each of the three measures for both years) were modeled together to examine the relationship among the three measures over time.

The piecewise growth model presented in Figure 4 can be described using the following equations.

$$y_{\mathrm{ti}} = \eta_{0\mathrm{i}} + \eta_{1\mathrm{i}}\lambda_{\mathrm{t}} + \eta_{2\mathrm{i}}\lambda_{t} + \varepsilon_{\mathrm{ti}}, \quad (1)$$

$$\eta_{0\mathrm{i}} = \eta_{0} + \varsigma_{0\mathrm{i}}, \quad (2)$$

$$\eta_{1\mathrm{i}} = \eta_{1} + \varsigma_{1\mathrm{i}}, \text{ and} \quad (3)$$

$$\eta_{2\mathrm{i}} = \eta_{2} + \varsigma_{2\mathrm{i}}, \quad (4)$$

y_{iti} was the observed score on a particular measure (i.e. easyCBM ORF, RC, or VOC) of student *i* at time point *t*. $\eta_{0\mathrm{i}}$ was the intercept, $\eta_{1\mathrm{i}}$ was the slope from fall to winter for student *i*, $\eta_{2\mathrm{i}}$ was the slope from winter to spring for student *i*, λ_t was the associated time score; and ε_{i}, was the residual term for student *i*. Equations (2), (3), and (4) are the between-student models, where η_0 represents the estimated overall mean of the fall score, η_1 is the average change in the CBM scores from fall to winter, η_2 is the average change in the CBM scores from winter to spring, and $\varsigma_{0\mathrm{i}}$, $\varsigma_{1\mathrm{i}}$, and $\varsigma_{2\mathrm{i}}$ are between-subject variations in the growth trajectories (i.e. intercept and two growth parameters).

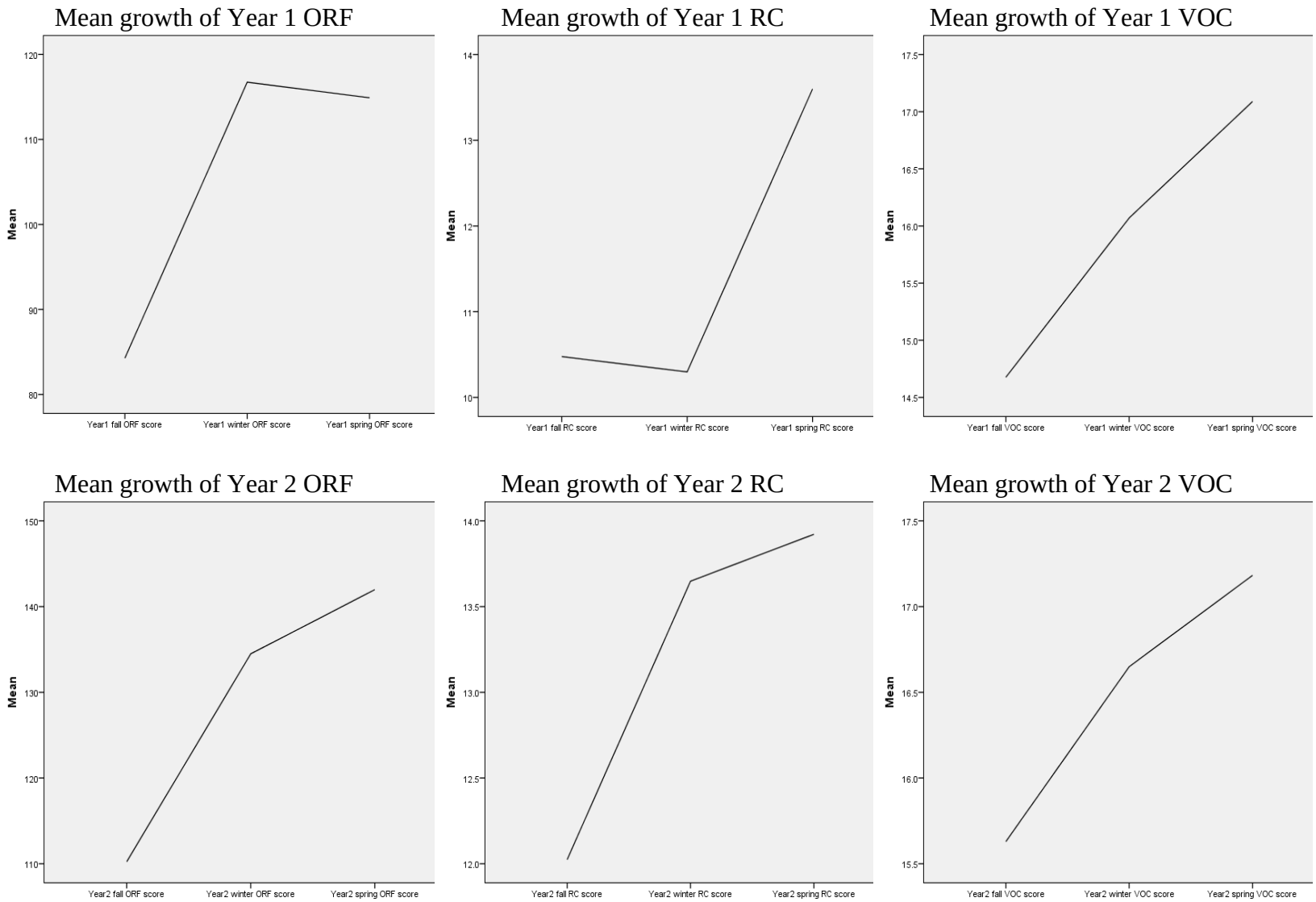


Figure 3. Mean growth patterns across the three easyCBM reading measures for all students.

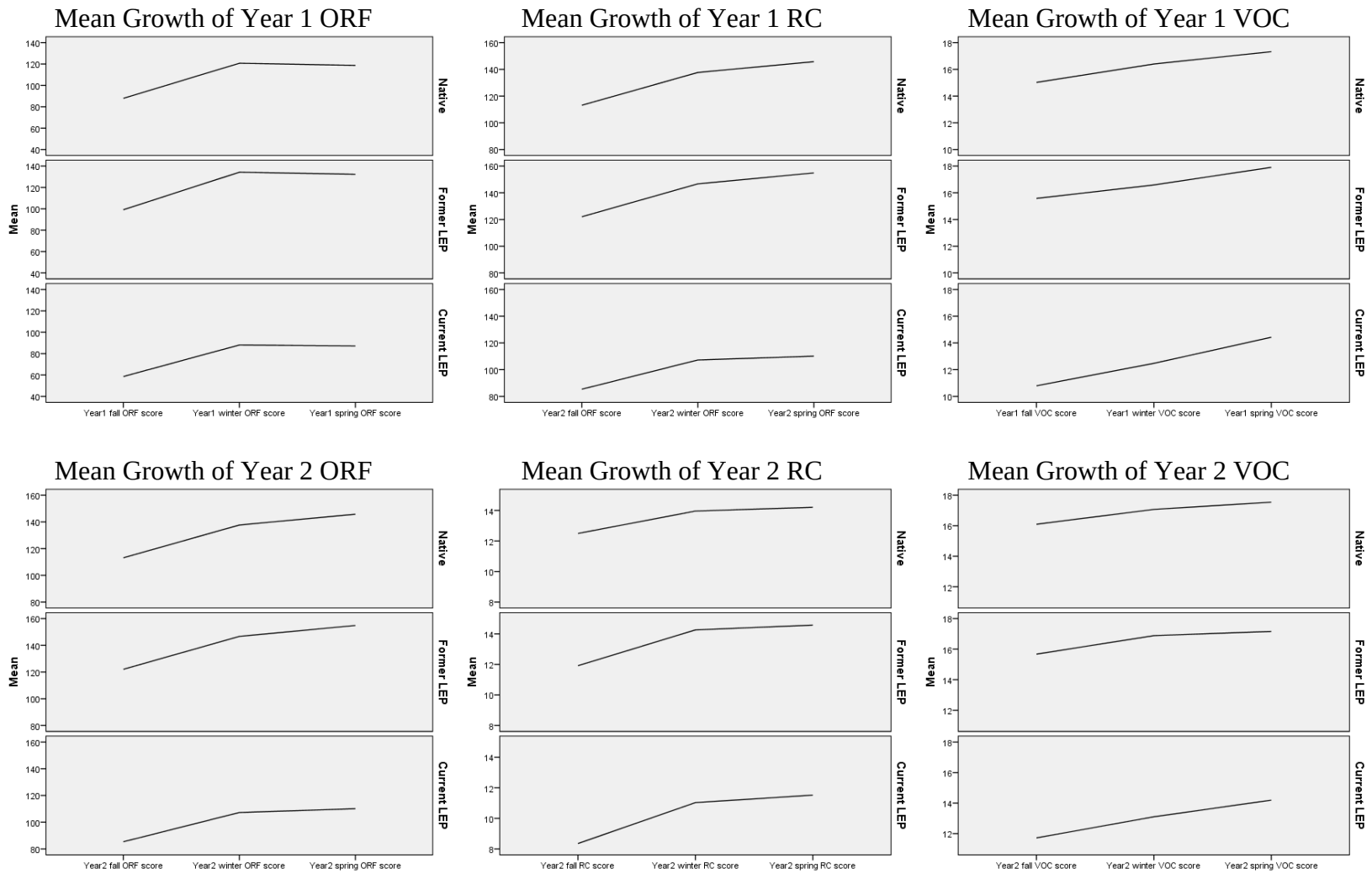


Figure 4. Mean growth patterns across the three easyCBM reading measures by ELL status.

The model depicted in Figure 5 was implemented for both years (see Figure 6 for the full unconditional piecewise growth model). Several constraints, such as fixing slope variance to be zero and constraining error variances to be equal for each of the same measure types during the same school year, were applied to the model for model identification. In addition, error terms for the same measure type (e.g., ORF third grade and ORF fourth grade), as well as error terms for measures from the same school year (e.g., ORF third grade, RC third grade, VOC third grade), were correlated to resolve model convergence problems.

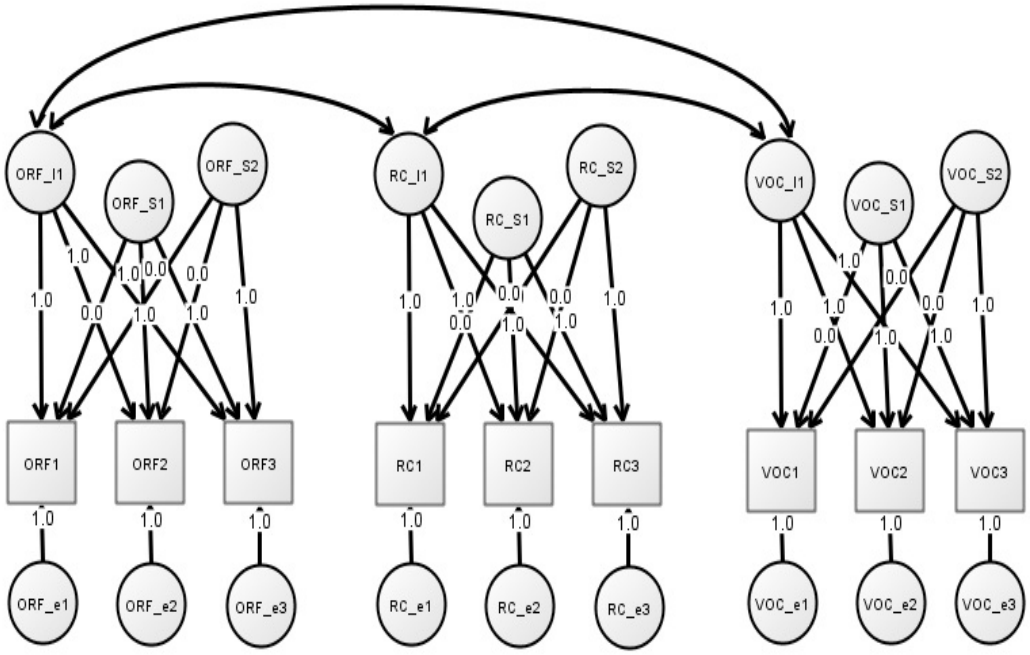


Figure 5. Unconditional piecewise growth model with factor loadings: Year 1.

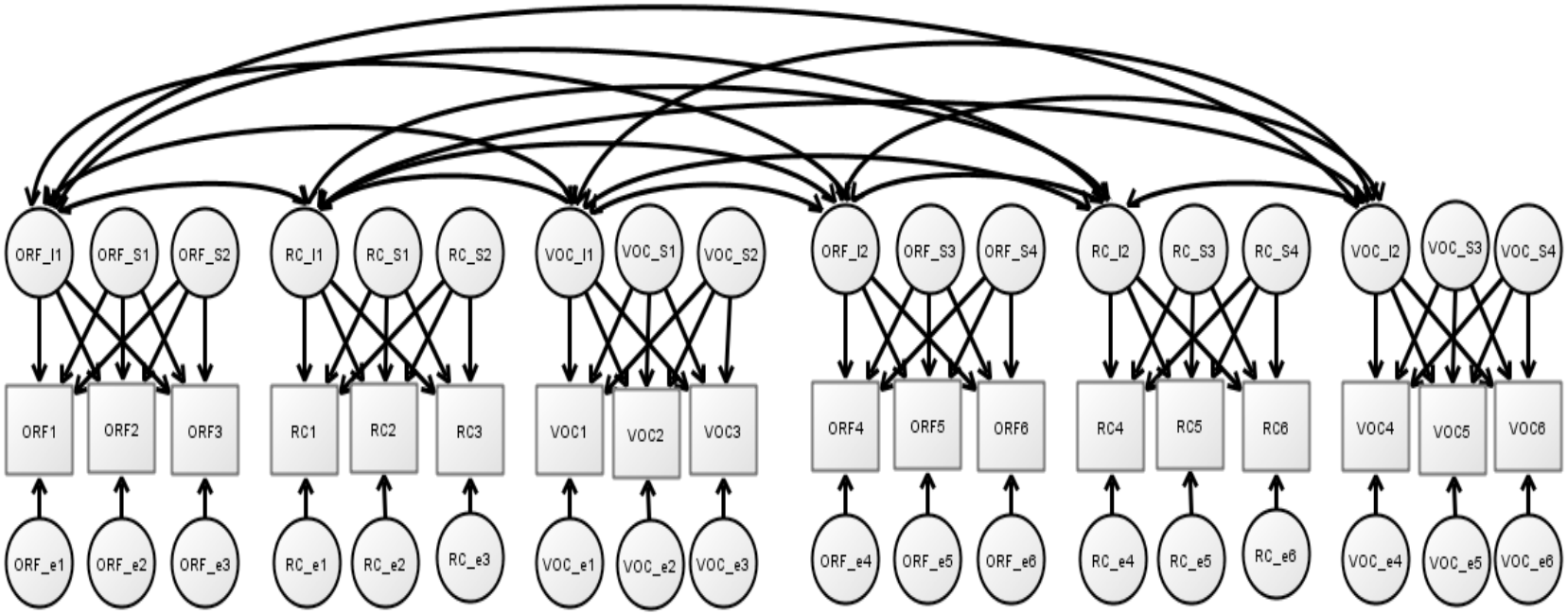


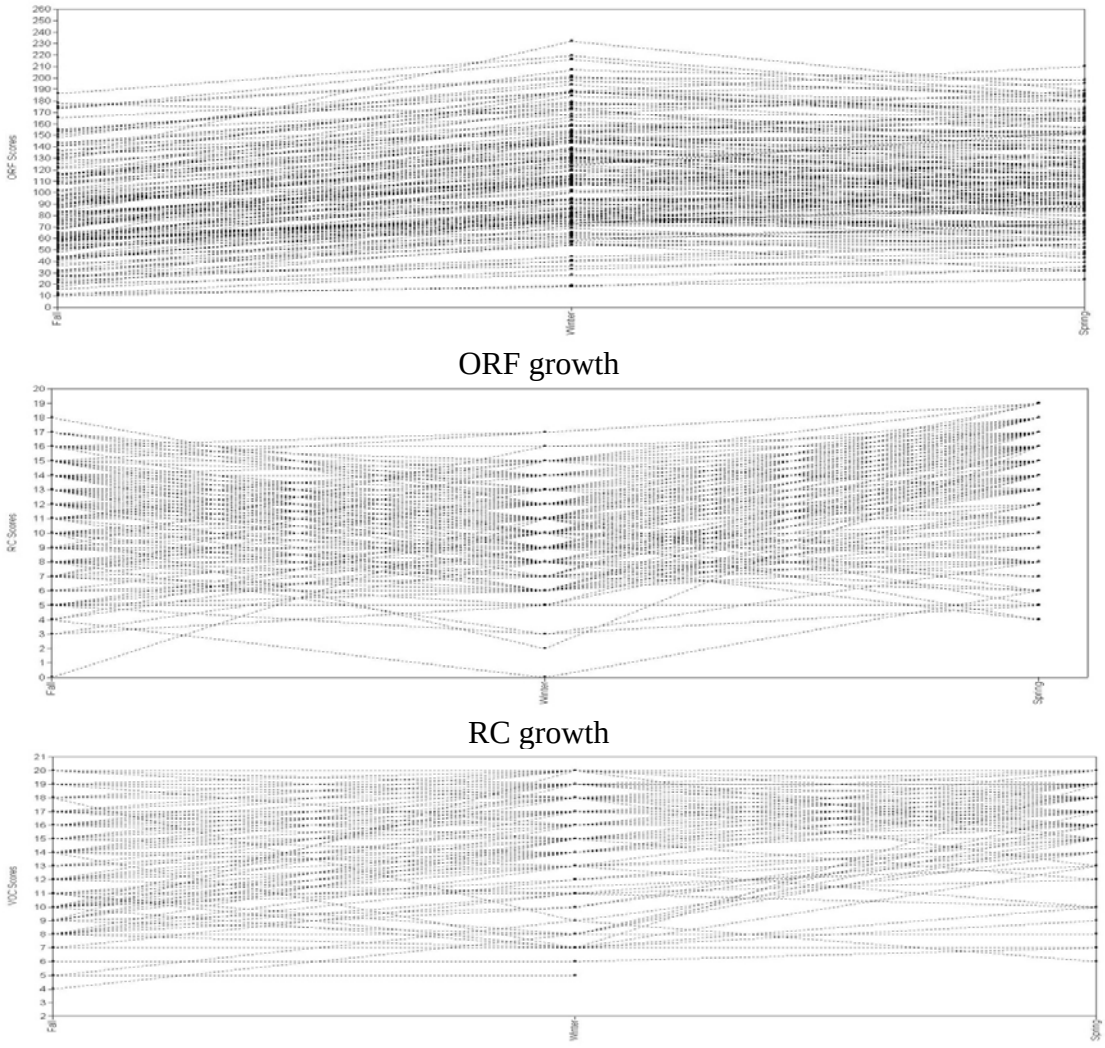
Figure 6. Full unconditional piecewise growth model.

To examine whether growth trajectories varied depending on students' ELL status (non-ELL, ELL, or former ELL), a multiple-group piecewise growth model was conducted, and the estimated growth parameters were compared across the three groups. Multiple-group latent growth analysis is a useful technique to compare growth trajectories across predefined groups, such as students' ELL status in this study, because it applies the same growth model simultaneously to each of the groups and estimates the growth parameters (i.e. intercept and two slopes) separately for each group (Wang & Wang, 2012).

Latent class growth analysis. Unconditional latent class growth analysis (LCGA) was conducted to evaluate the heterogeneity of growth patterns in the data. Visual inspection of 150 randomly selected students' growth patterns on the three CBM reading measures during the first school year (see Figure 7) suggested that the range of intercepts (fall benchmark scores) as well as their growth trajectories varied noticeably, indicating that students' within-year growth trajectories may have been heterogeneous.

Such heterogeneity in growth trajectories may be due to non-homogeneous populations, such that subgroups of students demonstrate different growth trajectories. Because piecewise growth modeling assumes homogeneous populations of students, making inferences based on results of these analyses may not be appropriate when heterogeneity in growth trajectories is suspected (Jung & Wickrama, 2008). In some cases, the source of heterogeneity is known (for example, student demographic information), and subgroups of students can be identified using the known source of heterogeneity (Nylund, Asparouhov, & Muthén, 2007). When the source of heterogeneity is unknown, however, subgroups of students cannot be identified based on information

obtained by researchers; instead, such subgroups are represented by latent classes inferred from the data in LCGA (Muthén & Muthén, 2007). Students classified in each latent class share homogeneous growth trajectories, and all latent classes are mutually exclusive.



ORF growth

RC growth

VOC growth

Figure 7. Display growth patterns of 150 randomly selected students: Year 1.

The LCGA model conducted in this study can be described using the following equation.

$$y_{ti} | (C_i = c) = \eta_{0i} + \eta_{1i}\lambda_t + \eta_{2i}\lambda_t + \varepsilon_{ti}, \quad (5)$$

$$\eta_{0i} = \eta_0 \quad (6)$$

$$\eta_{1i} = \eta_1, \text{ and} \quad (7)$$

$$\eta_{2i} = \eta_2 \quad (8)$$

y_{ti} was the observed score on a particular measure (easyCBM ORF, RC, or VOC) of student *i* at time point *t*. Unlike the conventional piecewise growth models, y_{ti} was conditioned on each individual student's latent class membership C_i. η_{0i} was the intercept, η_{1i} was the change from fall to winter, η_{2i} was the change from winter to spring for student *i*, ε_{ti} was the residual value for student *i* in class *c*, $\varepsilon_i \sim N(0, \sigma^2_\varepsilon)$, and λ_t was the time score as presented in Equation 5. One notable difference from the conventional piecewise growth model (Equations 2 to 4) and the LCGA (Equations 6 to 8) was that there were no error terms for the LCGA because the intercept and slopes were fixed effects within each latent class.

As one of the purposes of conducting LCGA for this study was to explore whether ELLs and former ELLs formed their own unique classes, and if so, to what degree those classes were different, the relationship between students' latent class memberships and ELL status were examined descriptively. Multiple-group LCGA using the *known classes* command in Mplus was also conducted to examine latent classes separately for each of the three ELL status groups.

Model fit evaluation and determining the number of latent classes. To examine goodness of fit, a χ^2 test was used for the exact fit test. A nonsignificant χ^2 test indicates

good model fit, as it suggests the estimated model does not significantly depart from the data. However, because χ^2 is sensitive to sample size, which penalizes a model with a large sample size (such as in this study), other model fit criteria are recommended for use in conjunction with a χ^2test. The Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) were used to evaluate the model fit. According to Hu and Bentler (1999), values for CFI and TLI above 0.95 and RMSEA values smaller than 0.05 indicate a good model fit.

To select the best LCGA model, the three information criteria (Akaike information criterion (AIC), Bayesian information criterion (BIC), and Adjusted Bayesian information criterion (ABIC)) were used (Jung & Wickrama, 2008). Models with lower information criteria values suggested better model fit. In addition, the Lo-Mendell-Rubin Likelihood Ratio (LMR) Test was conducted to compare model fits between *k* class and *k*-1 class models (Nylund et al., 2007). The entropy values were also evaluated to determine the accuracy of classification (Nylund et al., 2007), with entropy closer to 1 indicating more accurate classification.

In addition to statistical indicators, the practical implications and interpretability of each latent class were also considered before determining the number of latent classes. This was particularly important because some statistical tests such as LMR were not available for the multiple-group LCGA.

CHAPTER III

RESULTS

A series of analyses was conducted to determine the best fitting model. Using the best fitting model, multiple-group analysis was conducted to compare growth trajectories across ELLs, non-ELLs, and former ELLs. Then, Latent Class Growth Analysis (LCGA) was conducted to examine the heterogeneity in growth trajectories. Results from the analyses are presented in the order of research questions.

In this study, ELLs referred to students whose primary home language was not English and who were receiving additional academic support due to their limited English proficiency during the 2011–2012 school year. Former ELLs referred to students whose primary home language was not English and who ceased receiving additional academic support services prior to or during the 2011–2012 school year. Non-ELLs referred to native speakers of English or students whose English proficiency was equivalent to native speakers of English regardless of their primary home language and who never received such additional academic support.

Growth Model Comparison

Visual inspection of observed means suggested non-linear growth for ORF and RC for all three ELL status groups across both school years. On the other hand, the observed patterns of VOC included a combination of linear and non-linear growth (see Figures 3 and 4). Therefore, three models were compared: (a) linear growth model for all three measures, (b) piecewise growth (two slope parameters representing changes from fall to winter and from winter to spring) for all three measures, and (c) piecewise growth for ORF and RC and linear growth for VOC.

Both linear and piecewise growth models had two intercept parameters for each measure type, representing the fall scores in Years 1 and 2. For linear growth models, two parameters for each measure type were estimated to represent the growth in Years 1 and 2. For piecewise growth models, four slope parameters for each measure type were analyzed to model non-linear growth, with the first slope parameter representing the change from fall to winter during Year 1 (2011–2012 school year), the second slope parameter representing the change from winter to spring during Year 1, the third slope parameter representing the change from fall to winter during Year 2 (2012–2013 school year), and the fourth slope parameter representing the change from winter to spring during Year 2. All analyses were conducted using the full analytic sample, and results were evaluated based on the appropriate information criteria (AIC, BIC, and ABIC) and model fit indices (CFI, TLI, and RMSEA).

Results from the three growth model analyses suggest that the second (piecewise growth for all measures) and the third (piecewise growth for ORF and RC and linear growth for VOC) model fit the data equivalently well (see Tables 8 and 9 for model fit information and growth parameter estimates), suggesting that the third model was more parsimonious. However, the observed mean growth patterns suggested that there might be differences in the changes from fall to winter and from winter to spring depending on students' ELL status. Therefore, to observe potential differences in the within-year VOC growth across the ELL groups, all subsequent analyses were conducted using the piecewise growth model for all three measure types.

Table 8
Model Fit Comparison Between Three Growth Models

	All Linear	All Piecewise	ORF and RC Piecewise & VOC Linear
Fit Indices			
CFI	0.872	0.948	0.948
TLI	0.861	0.941	0.941
RMSEA	0.097	0.063	0.063
90% C.I lower bound	0.096	0.062	0.062
90% C.I upper bound	0.099	0.065	0.065
Information Criteria			
AIC	825038.816	815298.246	815371.377
BIC	825394.634	815698.541	815756.847
ABIC	825242.096	815526.935	815591.597
R-Square			
ORF1	0.86	0.91	0.91
ORF2	0.86	0.91	0.91
ORF3	0.86	0.91	0.91
ORF4	0.88	0.89	0.89
ORF5	0.88	0.89	0.89
ORF6	0.88	0.89	0.89
RC1	0.50	0.55	0.55
RC2	0.50	0.55	0.55
RC3	0.50	0.55	0.55
RC4	0.61	0.61	0.61
RC5	0.61	0.61	0.61
RC6	0.61	0.61	0.61
VOC1	0.71	0.71	0.71
VOC2	0.71	0.71	0.71
VOC3	0.71	0.71	0.71
VOC4	0.74	0.74	0.74
VOC5	0.74	0.74	0.74
VOC6	0.74	0.74	0.74

Note. For model identification and convergence issues, slope variances were fixed to be zero and the within-year error variances of the same measure type were fixed to be the same. ORF1=Oral Reading Fluency (ORF) in fall of Year 1. ORF2=ORF in winter of Year 1. ORF3=ORF in spring of Year 1. ORF4=ORF in fall of Year 2. ORF5=ORF in winter of Year 2. ORF6=ORF in spring of Year 2. RC1= Reading Comprehension (RC) in fall of Year 1. RC2=RC in winter of Year 1. RC3=RC in spring of Year 1. RC4=RC in fall of Year 2. RC5=RC in winter of Year 2. RC6=RC in spring of Year 2. VOC1= Vocabulary (VOC) in fall of Year 1. VOC2=VOC in winter of Year 1. VOC3=VOC in spring of Year 1. VOC4=VOC in fall of Year 2. VOC5=VOC in winter of Year 2. VOC6=VOC in spring of Year 2.

Table 9
Comparison of Estimated Growth Parameters Between Three Growth Models

	All Linear	All Piecewise	ORF and RC Piecewise & VOC Linear
Fixed Effects			
ORF			
Y1 Intercept	89.06	83.00	83.04
Y1 Slope1	14.67	32.11	32.08
Y1 Slope2		-1.95	-1.94
Y2 Intercept	109.72	106.32	106.33
Y2 Slope1	15.07	23.37	23.36
Y2 Slope2		8.07	8.08
RC			
Y1 Intercept	9.52	10.03	10.04
Y1 Slope1	1.46	-0.14	-0.15
Y1 Slope2		3.19	3.19
Y2 Intercept	11.66	11.48	11.49
Y2 Slope1	0.95	1.54	1.52
Y2 Slope2		0.33	0.33
VOC			
Y1 Intercept	14.32	14.26	14.31
Y1 Slope1	1.18	1.34	1.19
Y1 Slope2		1.04	
Y2 Intercept	15.34	15.27	15.33
Y2 Slope1	0.80	1.01	0.80
Y2 Slope2		0.58	
Random Effects: Intercept Variance			
ORF Y1	1720.18	1756.21	1755.84
ORF Y2	1567.23	1566.04	1565.70
RC Y1	8.13	8.68	8.68
RC Y2	14.45	11.50	11.51
VOC Y1	12.13	12.16	12.15
VOC Y2	10.15	10.15	10.16
Random Effects: Correlation among ORF, RC, & VOC Intercepts			
ORF Y1 & ORF Y2	0.99	0.98	0.98
RC Y1 & RC Y2	0.97	0.94	0.94
VOC Y1 & VOC Y2	0.96	0.96	0.96
RC Y1 & ORF Y1	0.87	0.83	0.83
RC Y1 & ORF Y2	0.85	0.83	0.83
RC Y2 & ORF Y1	0.78	0.77	0.77
RC Y2 & ORF Y2	0.79	0.78	0.79
VOC Y1 & ORF Y1	0.87	0.86	0.86
VOC Y1 & ORF Y2	0.85	0.84	0.84
VOC Y1 & RC Y1	0.92	0.90	0.90
VOC Y1 & RC Y2	0.87	0.86	0.86
VOC Y2 & ORF Y1	0.80	0.79	0.79
VOC Y2 & ORF Y2	0.81	0.81	0.81
VOC Y2 & RC Y1	0.90	0.88	0.88
VOC Y2 & RC Y2	0.90	0.90	0.90

Note. ORF=Oral Reading Fluency. RC=Reading comprehension. VOC=Vocabulary. Y1=Year 1. Y2=Year 2. Slope1=changes from fall to winter. Slope2=changes from winter to spring.

Growth Trajectories and ELL Status

To investigate the first research question regarding the extent of variation in growth trajectories across third- and fourth-grade students depending on ELL status, a multiple-group piecewise growth model was constructed to examine the growth trajectories for the three ELL status groups. The multiple-group piecewise growth model fit the data well (see Table 10), supported by the fit indices of CFI (0.941), TLI (0.935), and RMSEA (0.064; 90% Confidence Interval ranging from 0.063 to 0.065) as well as three information criteria, AIC (812399.019), BIC (813510.950), and ABIC (813034.267).

Growth trajectories of non-ELLs. The intercepts (fall scores from Years 1 and 2) for ORF were approximately 87 words correct per minute (WCPM) and 110 WCPM for Years 1 (third grade) and 2 (fourth grade), respectively; both scores were slightly higher than the 50th percentile based on the easyCBM's national norm for the fall of the 2012–2013 school year (Riverside, n.d.). On the other hand, the intercepts for RC (10.42 for Year 1 and 12.01 for Year 2) and VOC (14.80 for Year 1 and 15.82 for Year 2) for both years are between the 20th and 50th percentiles, based on the easyCBM's national norm for the fall of the 2012–2013 school year (see Figures 8, 9, and 10).

For ORF, the changes from fall to winter for both years were large (32.47 and 23.51 WCPM for Years 1 and 2, respectively), whereas the changes from winter to spring were not as large, including a slight drop in Year 1 (-2.13 and 8.62 WCPM for Years 1 and 2, respectively).

Table 10
Model Fit Information: Multiple Group Latent Piecewise Growth Analysis

Fit Indices			
CFI	0.941		
TLI	0.935		
RMSEA	0.064		
90% C.I upper bound	0.063		
90% C.I lower bound	0.065		
Information Criteria			
AIC	812399.019		
BIC	813510.950		
ABIC	813034.267		
R-Square	Non-ELL	ELL	Former ELL
ORF1	0.91	0.85	0.82
ORF2	0.91	0.85	0.82
ORF3	0.91	0.85	0.82
ORF4	0.89	0.85	0.79
ORF5	0.89	0.85	0.79
ORF6	0.89	0.85	0.79
RC1	0.54	0.35	0.37
RC2	0.54	0.35	0.37
RC3	0.54	0.35	0.37
RC4	0.60	0.48	0.52
RC5	0.60	0.48	0.52
RC6	0.60	0.48	0.52
VOC1	0.68	0.69	0.32
VOC2	0.68	0.69	0.32
VOC3	0.68	0.69	0.32
VOC4	0.71	0.73	0.50
VOC5	0.71	0.73	0.50
VOC6	0.71	0.85	0.50

Note. For model identification and convergence issues, slope variances were fixed to be zero and the within-year error variances of the same measure type were fixed to be the same. ELL=English language learners. ORF1=Oral Reading Fluency (ORF) in fall of Year 1. ORF2=ORF in winter of Year 1. ORF3=ORF in spring of Year 1. ORF4=ORF in fall of Year 2. ORF5=ORF in winter of Year 2. ORF6=ORF in spring of Year 2. RC1=Reading Comprehension (RC) in fall of Year 1. RC2=RC in winter of Year 1. RC3=RC in spring of Year 1. RC4=RC in fall of Year 2. RC5=RC in winter of Year 2. RC6=RC in spring of Year 2. VOC1=Vocabulary (VOC) in fall of Year 1. VOC2=VOC in winter of Year 1. VOC3=VOC in spring of Year 1. VOC4=VOC in fall of Year 2. VOC5=VOC in winter of Year 2. VOC6=VOC in spring of Year 2.

For RC, the change from winter to spring (3.31) was large in Year 1 compared to the change from fall to winter (-0.17), while the change from fall to winter (1.40) was larger in Year 2 relative to the change from winter to spring (0.31). For VOC, the changes from fall to winter (1.36 and 0.95 for Year 1 and Year 2, respectively) for both years were larger compared to the changes from winter to spring (0.90 and 0.52 for Year 1 and Year 2, respectively).

Growth trajectories of ELLs. The fall scores (intercepts) for ORF were approximately 56 WCPM and 83 WCPM for Years 1 and 2, respectively; both scores were around the 20th percentile based on the easyCBM's national norm for the fall of the 2012–2013 school year. For RC, the intercepts for Year 1 and 2 were 7.45 and 7.95, respectively, which were between the 10th and 20th percentiles. The VOC intercepts for both years were also between the 10th and 20th percentiles (10.41 for Year 1 and 11.62 for Year 2).

Similar to the results for non-ELLs, the changes in ORF from fall to winter for both years were large (29.21 and 22.43 WCPM for Year 1 and Year 2, respectively). In contrast, the change in ORF from winter to spring in Year 1 (-0.87 WCPM) was not statistically significant. The change for Year 2 was much smaller (3.64 WCPM) for ELLs compared to non-ELLs. For RC, the change from winter to spring was 2.10 in Year 1, and the change from fall to winter in Year 1 (0.18) was not statistically significant. For Year 2, the change from fall to winter was 2.43, whereas the change from winter to spring was 0.51. For VOC, the change from winter to spring (2.08) was larger than the change from fall to winter (1.34) in Year 1. For Year 2, the changes from fall to winter and from winter to spring were steady (1.41 and 1.10 for Year 1 and Year 2, respectively).

Growth trajectories of former ELLs. Former ELLs scored the highest among the three ELL status groups on most measures across all time points. The ORF intercept was approximately 98 WCPM in Year 1, which is slightly above the 50th percentile based on the easyCBM's national norm for the fall of the 2012–2013 school year; for Year 2, it was approximately 121 WCPM, which is closer to the 75th percentile. The RC intercepts

for both years were slightly below the 50th percentile (10.85 and 11.42 for Years 1 and 2, respectively). The VOC intercepts were close to the 50th percentile for both years (15.50 and 15.84, respectively).

Similar to the results for the previous two groups, the changes in ORF from fall to winter for both years were quite large (34.66 and 25.68 WCPM for Years 1 and 2, respectively) for former ELLs. The change from winter to spring in Year 1 was not statistically significant, and the change from winter to spring for Year 2 was approximately 10 WCPM, which was the largest among the three groups. There was a slight decrease in RC from fall to winter (-0.54), but the change from winter to spring was 3.13 in Year 1. In Year 2, the change from fall to spring was 2.35, while the change from winter to spring was not statistically significant. The changes in VOC from fall to winter and from winter to spring were quite steady (1.08 and 1.28 respectively) in Year 1. In Year 2, the change from fall to winter was larger (1.08) than the change from winter to spring (0.44).

Comparison of growth parameter correlations. The correlations among the intercepts estimated for each measure (ORF, RC, and VOC) across both years were analyzed to examine whether the relationships among the intercepts for three measures varied across the three groups (non-ELLs, ELLs, and former ELLs). The correlations between Year 1 and Year 2 of the same measure type (e.g., intercepts of Year 1 ORF and Year 2 ORF) for non-ELLs were high, ranging from 0.94 to 0.98. The correlations between Year 1 and Year 2 ORF for ELLs (r=0.98) and for former ELLs (r=0.94) were also high. On the other hand, for ELLs, the correlation between Year 1 and Year 2 RC was lower (r=0.72) than for the other two groups (r=0.94 and 0.85 for non-ELLs and

former ELLs, respectively). Similar findings were observed for VOC (see Table 11).

The correlations between ORF and RC ranged from 0.76 to 0.83 for non-ELLs; these were higher than the other two groups (ranging from 0.65 to 0.69 and from 0.46 to 0.64 for ELLs and non-ELLs, respectively). Similarly, the correlations between RC and VOC were higher for non-ELLs (ranging from 0.87 to 0.91) than for ELLs (ranging from 0.68 to 0.78) and former ELLs (ranging from 0.71 to 0.83). On the other hand, the correlations between ORF and VOC were similar across the three groups, ranging from 0.65 to 0.85 (see Table 11). Slope variances were fixed to be zero for model identification purposes; thus, correlations involving slope parameters were not estimated.

Summary of growth trajectory comparison across ELL status. Growth trajectories of non-ELLs and former ELLs were similar on all three measures across both years, whereas ELLs' growth pattern was quite different from the other two groups. For ORF, both non-ELLs and former ELLs performed around or above the 50th percentile, based on the easyCBM's norm for the fall of the 2012–2013 school year for both years. For RC and VOC, non-ELLs and former ELLs performed below the 50th percentile but above the 20th percentile, demonstrating consistent growth in Years 1 and 2. In contrast, ELLs scored significantly lower than the other two groups on all three measures across both years. For ORF, ELLs performed around the 20th percentile in Year 1 and slightly above the 20th percentile in Year 2. For RC, ELLs scored lower than the 20th percentile in Year 1 but scored around the 20th percentile in the spring of Year 2, demonstrating fast growth from winter to spring in Year 1 and from fall to winter in Year 2. For VOC, ELLs performed well below the 20th percentile across both years, and their growth was not fast enough to reach the 20th percentile by the end of Year 2 (see Figure 11).

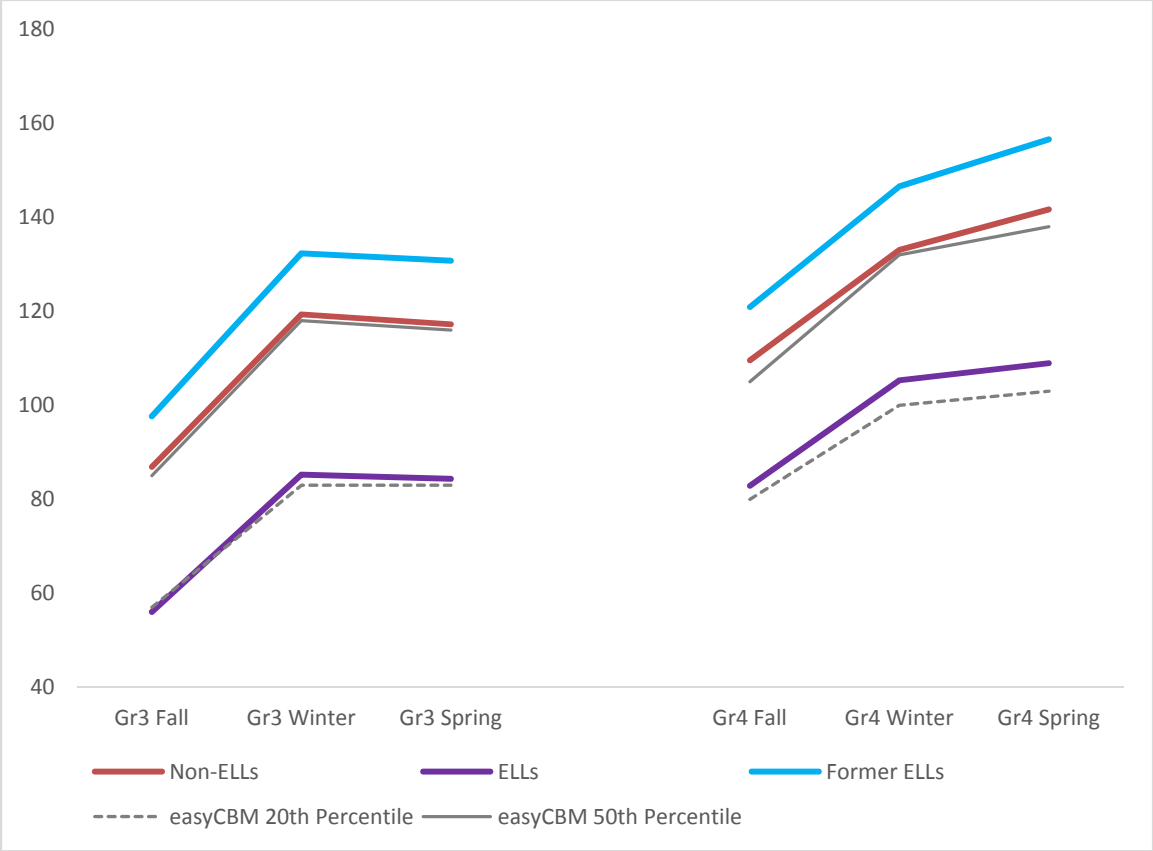


Figure 8. Comparison of ORF growth trajectories.

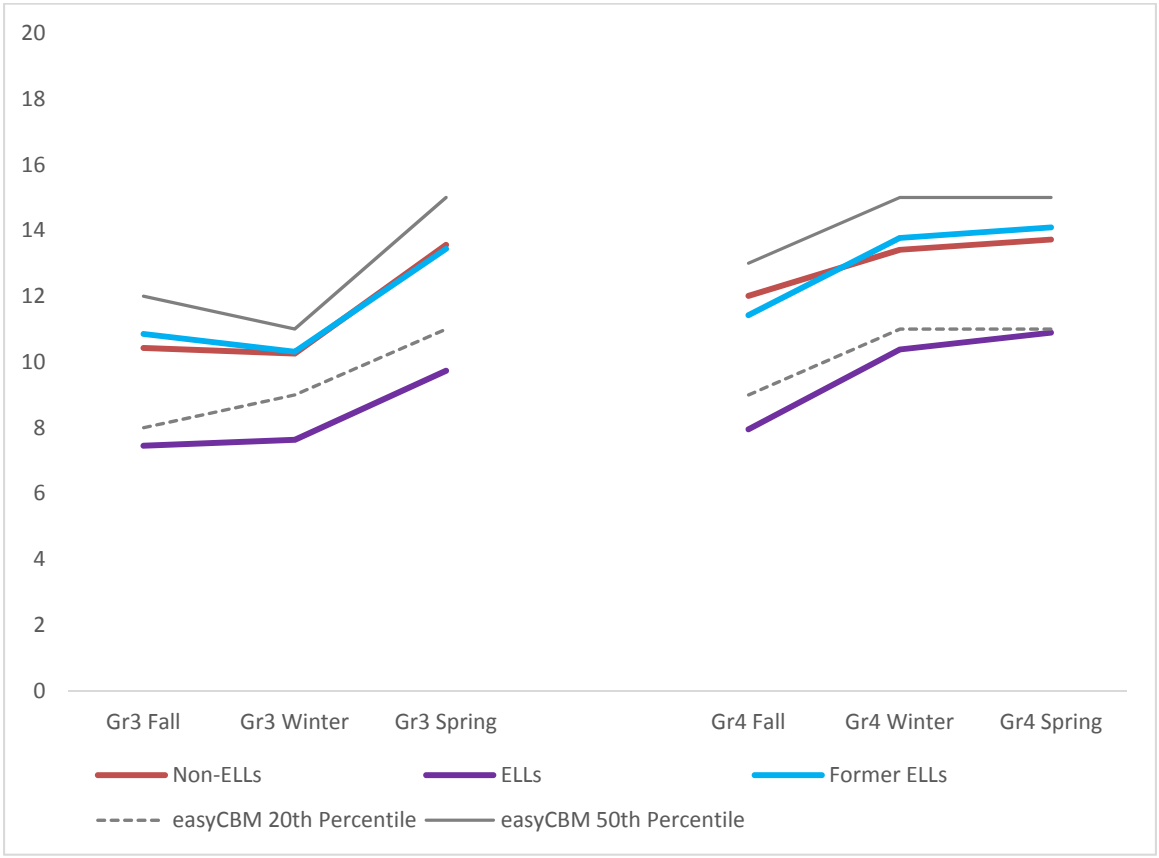


Figure 9. Comparison of RC growth trajectories.

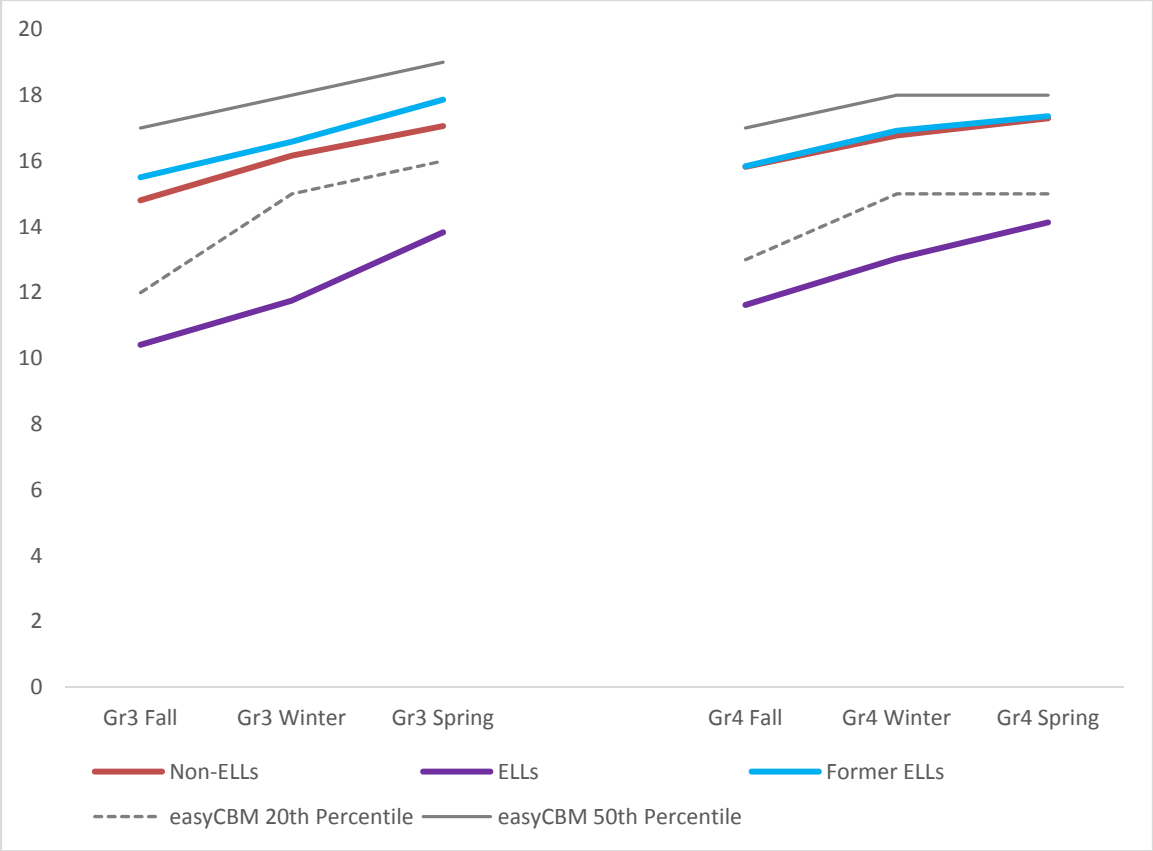


Figure 10. Comparison of VOC growth trajectories.

Table 11
Comparison of Estimated Growth Parameters Across Three English Language Learner (ELL) Status Groups

	Non-ELL	ELL	Former ELL
Fixed Effects			
ORF			
Y1 Intercept	86.88[a]	56.01[b]	97.64[c]
Y1 Slope1	32.47[a]	29.21[b]	34.66[a]
Y1 Slope2	-2.13[a]	*-0.87*[b]	*-1.57*[ab]
Y2 Intercept	109.55[a]	82.88[b]	120.91[c]
Y2 Slope1	23.51[ab]	22.43[a]	25.68[b]
Y2 Slope2	8.62[a]	3.64[b]	10.01[a]
RC			
Y1 Intercept	10.42[a]	7.45[b]	10.85[c]
Y1 Slope1	-0.17[ab]	*0.18*[a]	-0.54[b]
Y1 Slope2	3.31[a]	2.10[b]	3.13[a]
Y2 Intercept	12.01[a]	7.95[b]	11.42[c]
Y2 Slope1	1.40[a]	2.43[b]	2.35[b]
Y2 Slope2	0.31 [a]	0.51[a]	*0.32*[a]
VOC			
Y1 Intercept	14.80[a]	10.41[b]	15.50[c]
Y1 Slope1	1.36[a]	1.34[a]	1.08[a]
Y1 Slope2	0.90[a]	2.08[b]	1.28[a]
Y2 Intercept	15.82[a]	11.62[b]	15.84[a]
Y2 Slope1	0.95[a]	1.41[b]	1.08[ab]
Y2 Slope2	0.52[a]	1.10[b]	0.44[a]
Random Effects: Intercept Variance			
ORF Y1	1742.64	1001.27	840.14
ORF Y2	1544.46	1044.10	693.74
RC Y1	8.24	3.75	4.08
RC Y2	10.86	6.62	7.95
VOC Y1	10.56	10.90	2.33
VOC Y2	8.63	9.56	3.52
Random Effects: Correlation among ORF, RC, & VOC Intercepts			
ORF Y1 & ORF Y2	0.98	0.98	0.94
RC Y1 & RC Y2	0.94	0.72	0.85
VOC Y1 & VOC Y2	0.97	0.85	0.94
RC Y1 & ORF Y1	0.83	0.69	0.62
RC Y1 & ORF Y2	0.83	0.69	0.64
RC Y2 & ORF Y1	0.76	0.65	0.46
RC Y2 & ORF Y2	0.78	0.68	0.46
VOC Y1 & ORF Y1	0.85	0.85	0.83
VOC Y1 & ORF Y2	0.84	0.81	0.79
VOC Y1 & RC Y1	0.90	0.78	0.80
VOC Y1 & RC Y2	0.87	0.68	0.72
VOC Y2 & ORF Y1	0.78	0.76	0.65
VOC Y2 & ORF Y2	0.80	0.78	0.66
VOC Y2 & RC Y1	0.88	0.69	0.83
VOC Y2 & RC Y2	0.91	0.75	0.71

Note. Italicized font=not statistically significant, $p > .05$.ORF=Oral Reading Fluency. RC=Reading comprehension. VOC=Vocabulary. Y1=Year 1. Y2=Year 2. Slope1=changes from fall to winter. Slope2=changes from winter to spring.

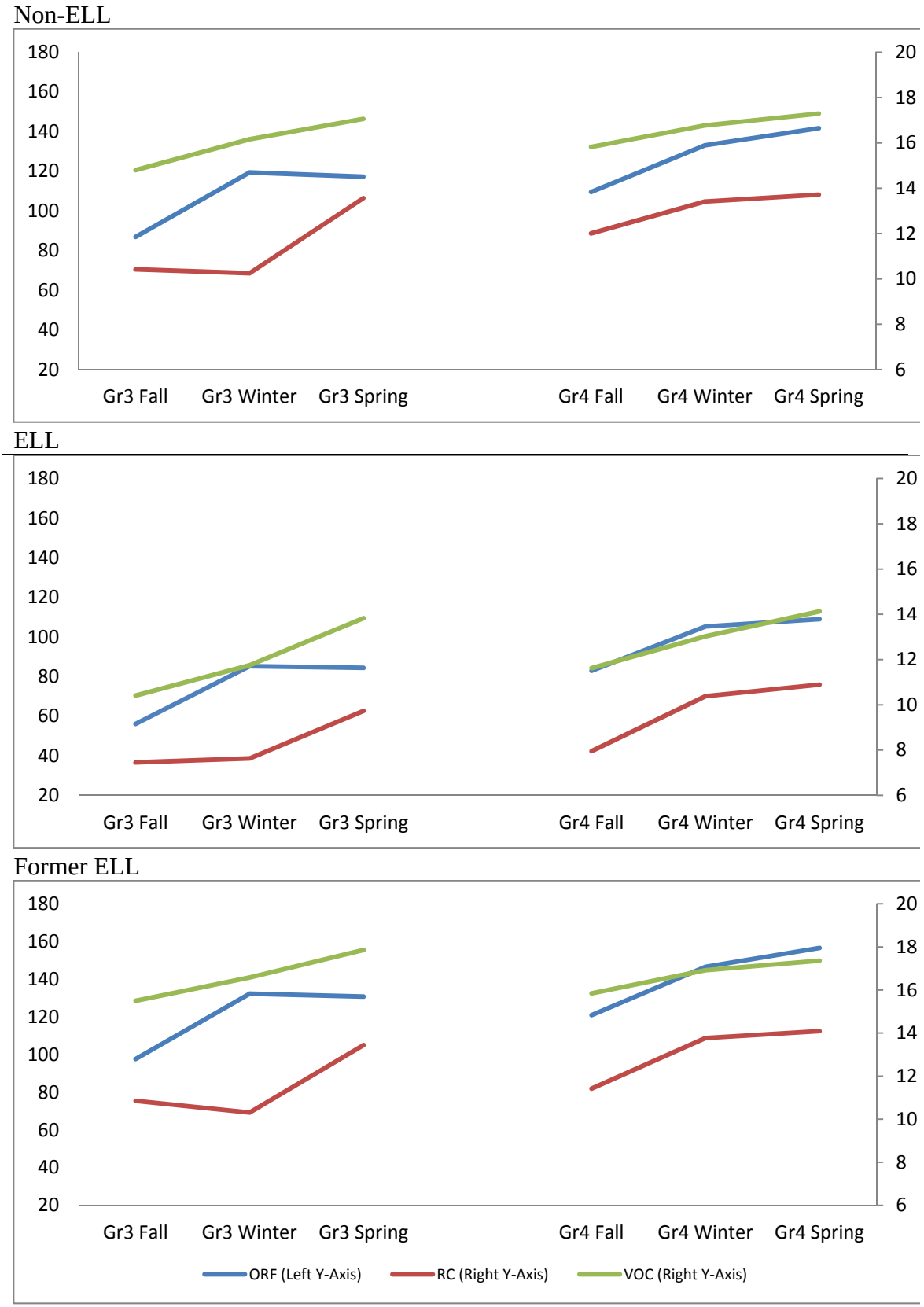


Figure 11. Comparison of growth trajectories by ELL status.

Heterogeneity of Growth Trajectories

To explore the second research question regarding the heterogeneity of growth trajectories, an unconditional Latent Class Growth Analysis with a piecewise model was conducted using the full analytic sample. An evaluation of model fit statistics, entropy, and a Vuong-Lo-Mendell-Rubin likelihood ratio (LMR) test identified that a 3-class model best fit the data. The proportion of non-ELLs, ELLs, and former ELLs in each of the three latent classes were compared descriptively, with results discussed below (see Appendix C for complete model results).

Unconditional LCGA. Model fit was evaluated based on the three information criteria (AIC, BIC, and ABIC), entropy, and the LMR test. The information criteria values were smallest for the 4-class model, indicating that the 4-class model best fit the data; however, the LMR test was not statistically significant, which suggested that the 4-class model did not improve the model fit significantly beyond the 3-class model. Although entropy was the highest for the 2-class model, the LMR test results suggested that the 3-class model provided a better fit to the data than the 2-class model. Based on the overall evidence from the three information criteria, entropy, the LMR test, and the proportion and interpretation of the latent classes, the 3-class solution was identified as the best-fitting model (see Table 12).

Table 12
Fit Statistics for Latent Class Growth Analysis

Fit Statistics	1 Class	2 Class	3 Class	4 Class
AIC	815298.246	809603.358	805164.303	803696.090
BIC	815698.541	810144.497	805846.287	804518.919
ABIC	815526.935	809912.511	805553.921	804166.173
Entropy		0.808	0.792	0.718
LMR p-value		< 0.01	< 0.01	0.261

Note. LMR=Vuong-Lo-Mendell-Rubin Likelihood Ratio Test for k versus k-1 classes.

The unconditional piecewise LCGA results suggested that students' growth trajectories on the three easyCBM reading measures were not homogeneous. In fact, there are three groups of students sharing similar growth patterns. Students with the highest probability to be in Class 1 (approximately 24%) scored close to the 20th percentile on ORF and lower than the 20th percentile on RC and VOC in Year 1, based on the easyCBM's national norm for the 2012–2013 school year. These students showed steep growth throughout both years on all three measures; however, they performed under the 50th percentile throughout both years. Students with highest probability to be in Class 2 (approximately 11% of students) performed much lower than the 20th percentile throughout both years on all measures, staring with a low intercept (approximately 30 WCPM, 6.56, and 7.51 for Year 1 ORF, RC, and VOC, respectively) in the fall and displaying much less growth compared to students in the other two classes. In fact, the RC slope parameters were not statistically significant, except for the change from fall to winter in Year 2. Students with highest probably to be in Class 3 (approximately 65% of students) performed the highest among the three groups. Students in this class consistently performed above the 50th percentile on ORF across both years, suggesting that their decoding skills were stable and fluent. Conversely, they scored lower than or close to the 50th percentile on RC and VOC, suggesting that their comprehension and vocabulary were not as strong as their fluency skills (see Tables 13 and 14 as well as Figures 12, 13, 14, and 15).

Proportions of non-ELL, ELL, and former ELL students. The LCGA result supported the heterogeneity of student growth trajectories on the three easyCBM reading measures, suggesting three distinctive groups of students. As a next step, the proportion

of non-ELL, ELL, and former ELL students in each of the three latent classes were compared. A majority of non-ELLs (approximately 70%) and former ELLs (approximately 83%) had the highest probability to be categorized into Class 3, characterized as *average readers*, while only 27% of ELLs had the highest probability to be classified in this group. In contrast, almost half of ELLs were classified into Class 1, characterized as *vocabulary driven growers*, whereas only 21% of non-ELLs and 14% of former ELLs were classified into this group. Approximately 28% of ELLs, 8% of non-ELLs, and 3% of former ELLs were classified into Class 2 (*struggling readers with global needs*) (see Table 15 and Figures 16 and 17).

Table 13
Estimated Growth Parameters for Each of the Three Latent Classes

		Class 1	Class 2	Class 3
% of Student Classification		24.09	10.84	65.07
Number of students		2,950	1,327	7,968
Probability	In Class 1	0.82	0.06	0.12
	In Class 2	0.10	0.89	0.01
	In Class 3	0.06	<0.01	0.93
ORF	Y1 Intercept	57.42	29.95	102.90
	Y1 Slope1	29.92	18.47	35.13
	Y1 Slope2	*-0.31*	*0.51*	-2.99
	Y2 Intercept	85.45	51.56	124.57
	Y2 Slope1	24.27	15.82	24.18
	Y2 Slope2	3.32	2.69	10.69
RC	Y1 Intercept	7.22	6.56	11.77
	Y1 Slope1	0.98	*0.13*	-0.61
	Y1 Slope2	2.66	*0.23*	3.81
	Y2 Intercept	8.32	6.91	13.53
	Y2 Slope1	3.24	0.76	1.02
	Y2 Slope2	0.37	*0.34*	0.31
VOC	Y1 Intercept	9.84	7.51	17.14
	Y1 Slope1	3.89	*-0.23*	0.64
	Y1 Slope2	2.39	1.59	0.47
	Y2 Intercept	12.70	8.20	17.50
	Y2 Slope1	2.53	1.01	0.45
	Y2 Slope2	0.84	1.19	0.38

Note. For model identification and convergence purposes, slope variances were fixed to be zero and the within-year error variances of the same measure type are fixed to be the same. Italicized font=not statistically significant, $p > .05$. ORF=Oral Reading Fluency. RC=Reading comprehension. VOC=Vocabulary. Y1=Year 1. Y2=Year 2. Slope1=changes from fall to winter. Slope2=changes from winter to spring.

Table 14

Defining Characteristics of Growth Trajectory for Each of the Three Latent Classes

	Year 1		Year 2		Final status (Spring, Year 2)	Overall Characteristics
	Intercept (Fall)	Within-Year Growth	Intercept (Fall)	Within-Year Growth		
Class 1: Vocabulary driven growers						
ORF	Strategic	Slightly faster than typical from fall to winter	Strategic	Slightly faster than typical from fall to winter	Strategic	Catching up slowly
RC	Intensive	Slightly faster than typical from winter to spring	Intensive	Slightly faster than typical from fall to winter	Strategic	Catching up slowly
VOC	Intensive	Fast	Intensive	Slightly faster than typical from winter to spring	Strategic	Accelerated growth
Class 2: Struggling readers with global needs						
ORF	Intensive	Typical	Intensive	Typical	Intensive	Maintaining the gap
RC	Intensive	No growth	Intensive	Almost no growth	Intensive	Lagging behind
VOC	Intensive	Slightly faster than typical from winter to spring	Intensive	Slightly faster than typical	Intensive	Slightly catching up
Class 3: Average readers						
ORF	Core	Typical	Core	Slightly faster than typical from winter to spring	Core	Getting ahead slightly
RC	Strategic	Typical	Core	Little growth	Strategic	Barely keeping up
VOC	Core	Almost no growth	Core	Almost no growth	Core	No VOC growth

Note. ORF=Oral Reading Fluency. RC=Reading comprehension. VOC=Vocabulary. Y1=Year 1. Y2=Year 2. Intensive=Below the 20th percentile based on the easyCBM's national norm for the fall of the 2012–2013 school year. Strategic=Between the 20th and 50th percentiles. Core=Above the 50th percentile.

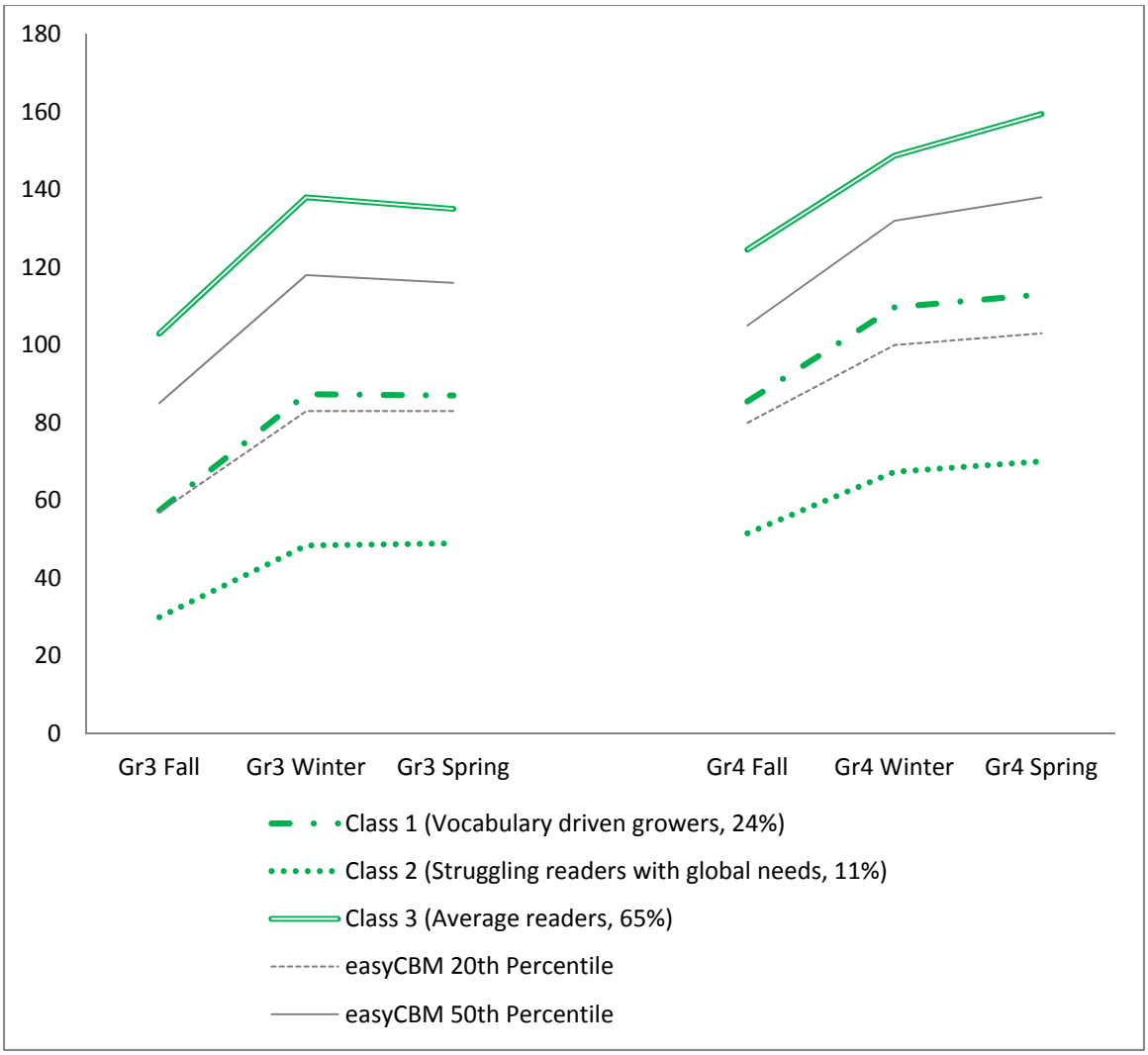


Figure 12. Comparison of ORF growth trajectories of the three latent classes.

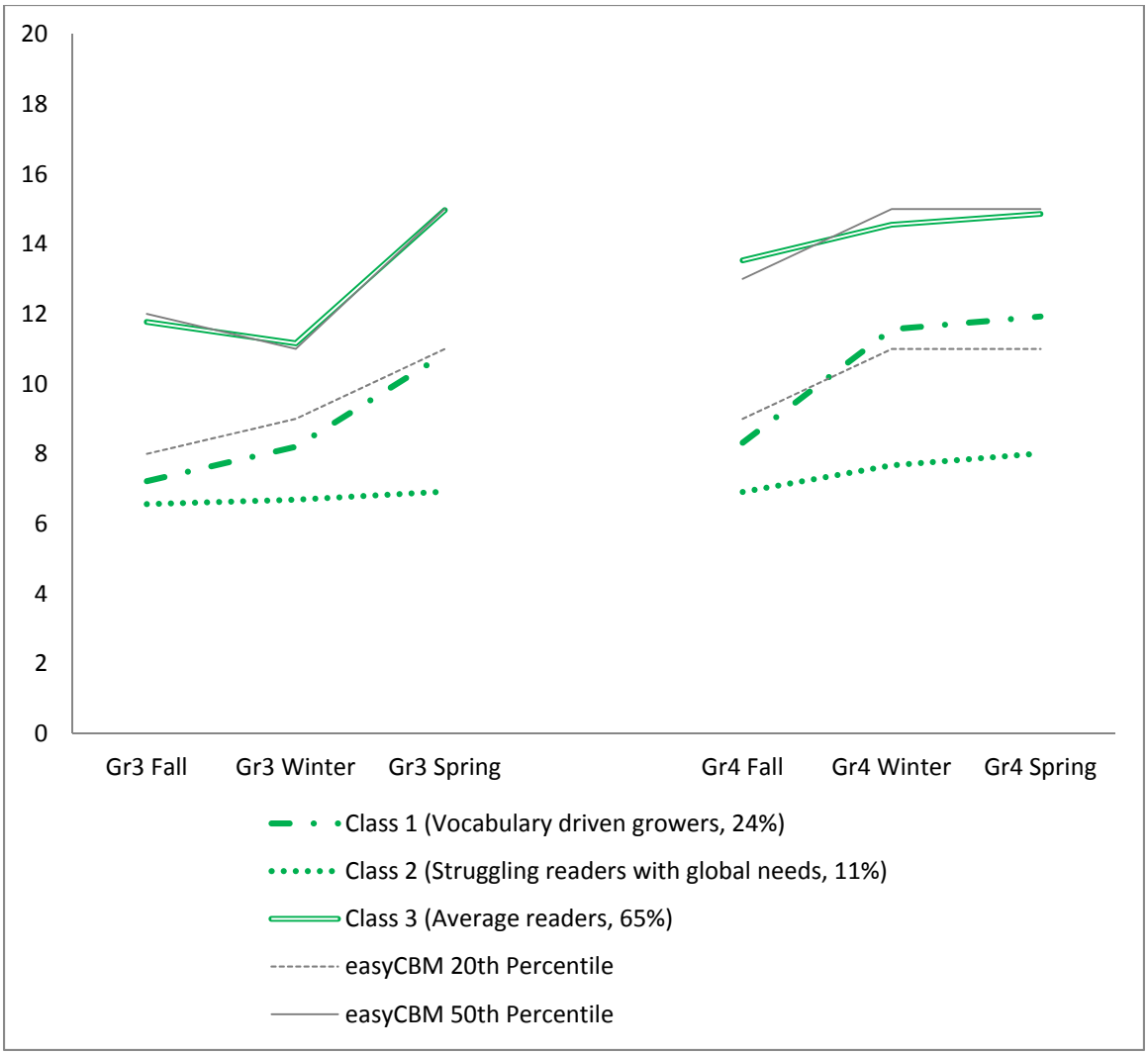


Figure 13. Comparison of RC growth trajectories of the three latent classes.

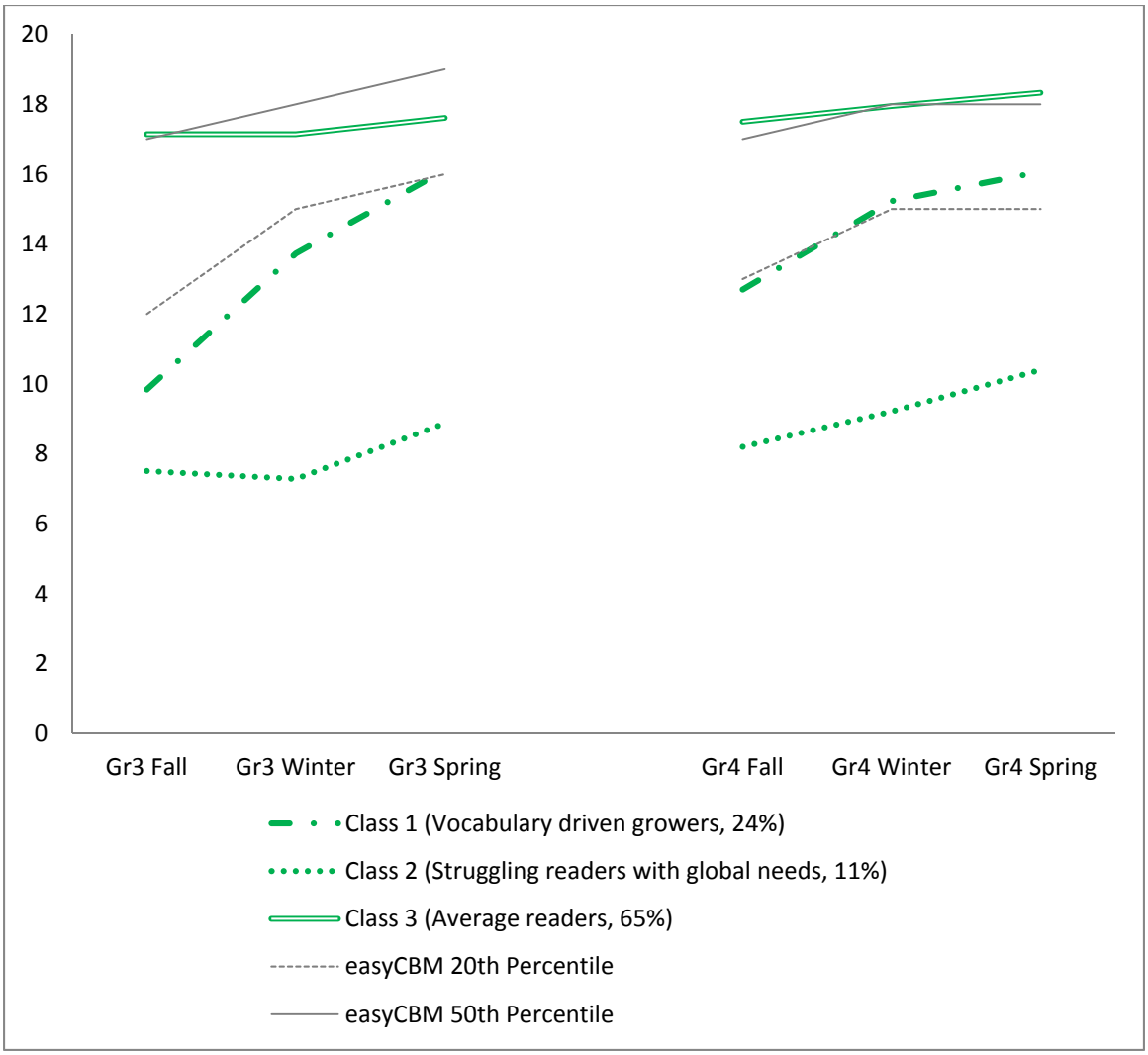
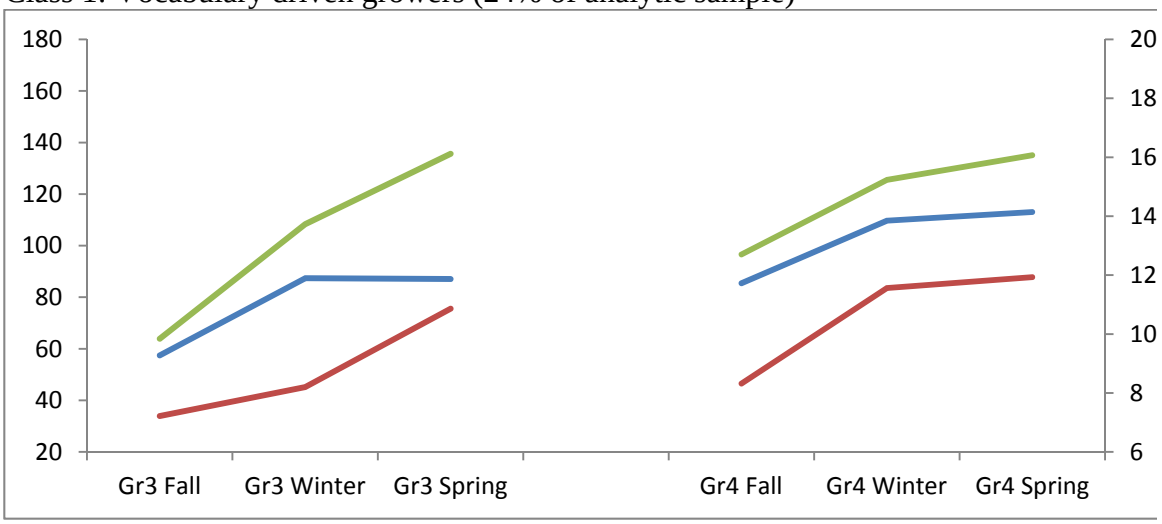
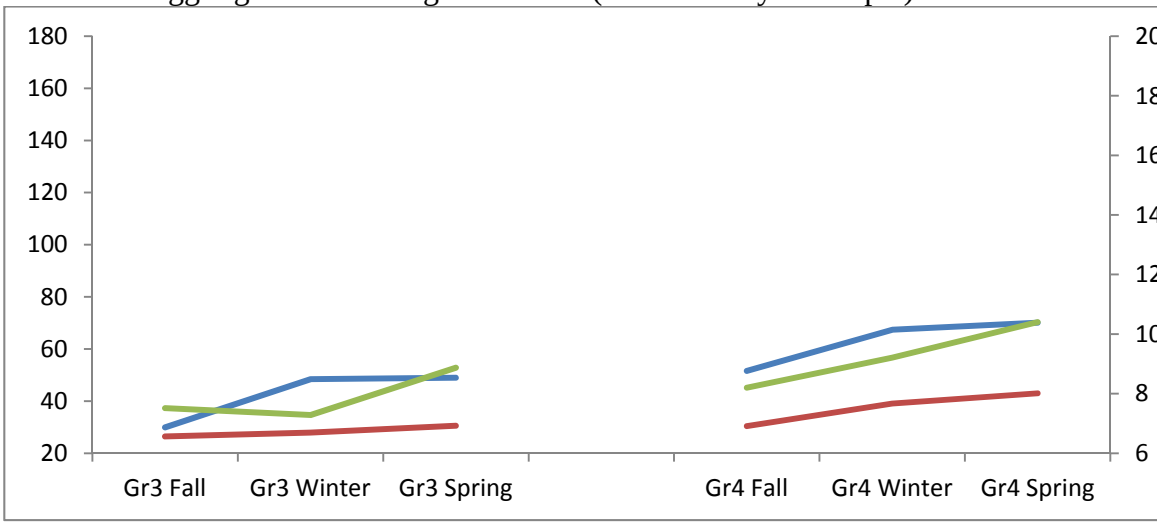


Figure 14. Comparison of VOC growth trajectories of the three latent classes.

Class 1: Vocabulary driven growers (24% of analytic sample)



Class 2: Struggling readers with global needs (11% of analytic sample)



Class 3: Average readers (65% of analytic sample)

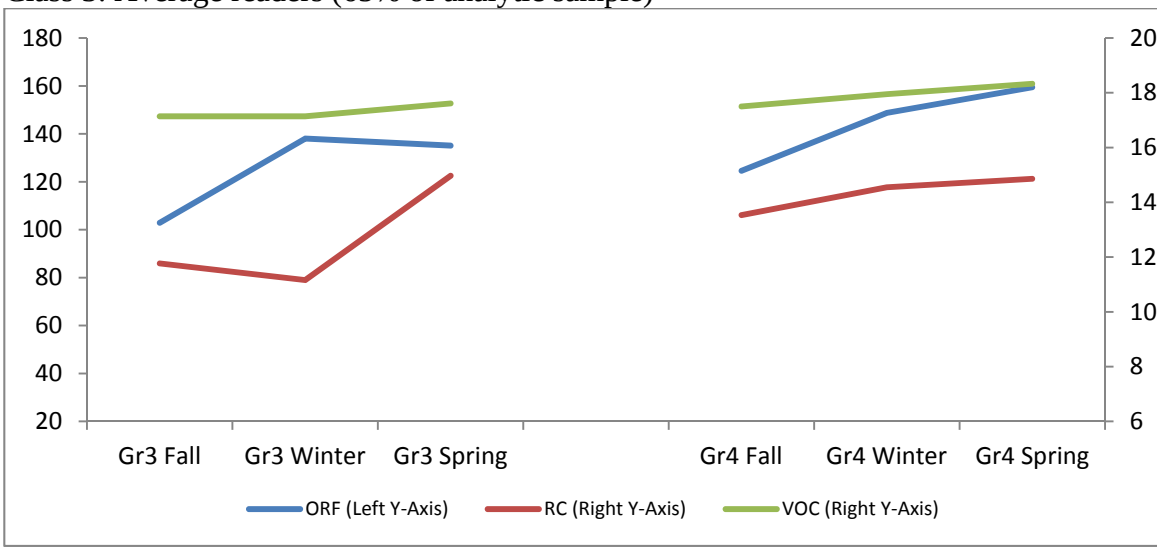


Figure 15. Comparison of growth trajectories by latent class.

Table 15
Proportion of Non-ELLs, ELLs, and Former ELLs in LCGA Classes

		LCGA Class			Total
		Vocabulary driven growers	Struggling readers with global needs	Average readers	
Non-ELL	Count	2,153	860	7,168	10,181
	% within ELL status	21.10	8.40	70.40	100.0
	% within LCGA class	73.00	64.80	90.00	83.10
ELL	Count	738	453	438	1,629
	% within ELL status	45.30	27.80	26.90	100.0
	% within LCGA class	25.00	34.10	5.50	13.30
Former ELL	Count	59	14	362	435
	% within ELL status	13.60	3.20	83.20	100.0
	% within LCGA class	2.00	1.10	4.50	3.60
Total	Count	2,950	1,327	7,968	12,245
	% Total	24.10	10.80	65.10	100.00

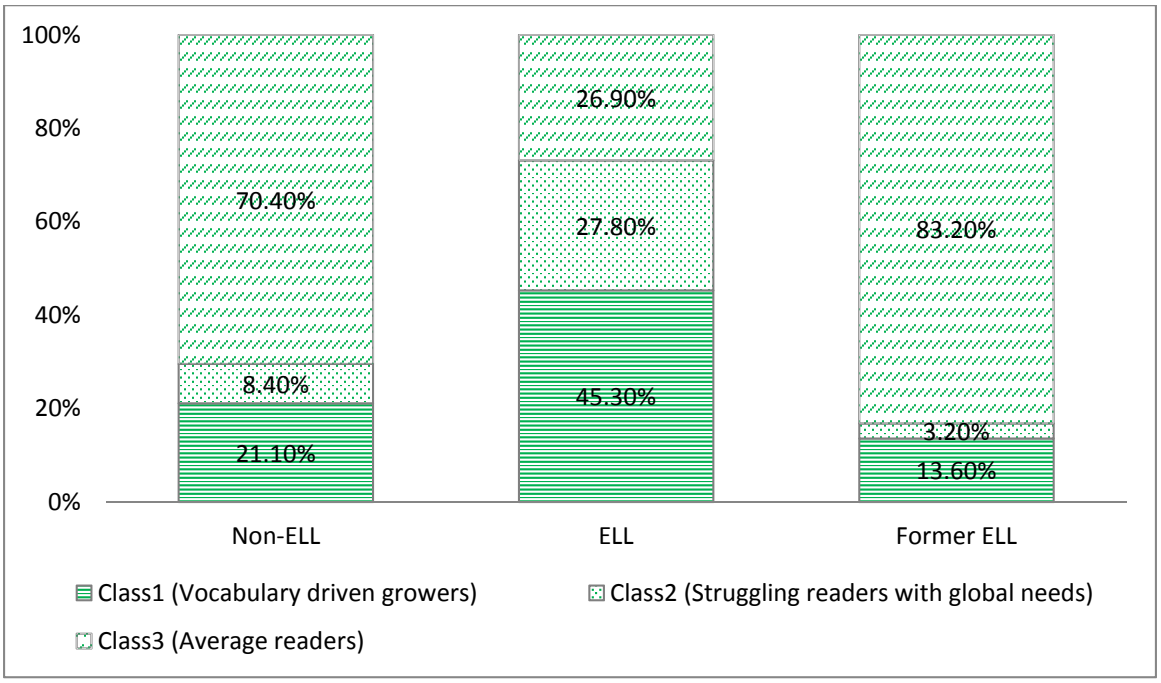


Figure 16. Proportion of students in each latent class by ELL status.

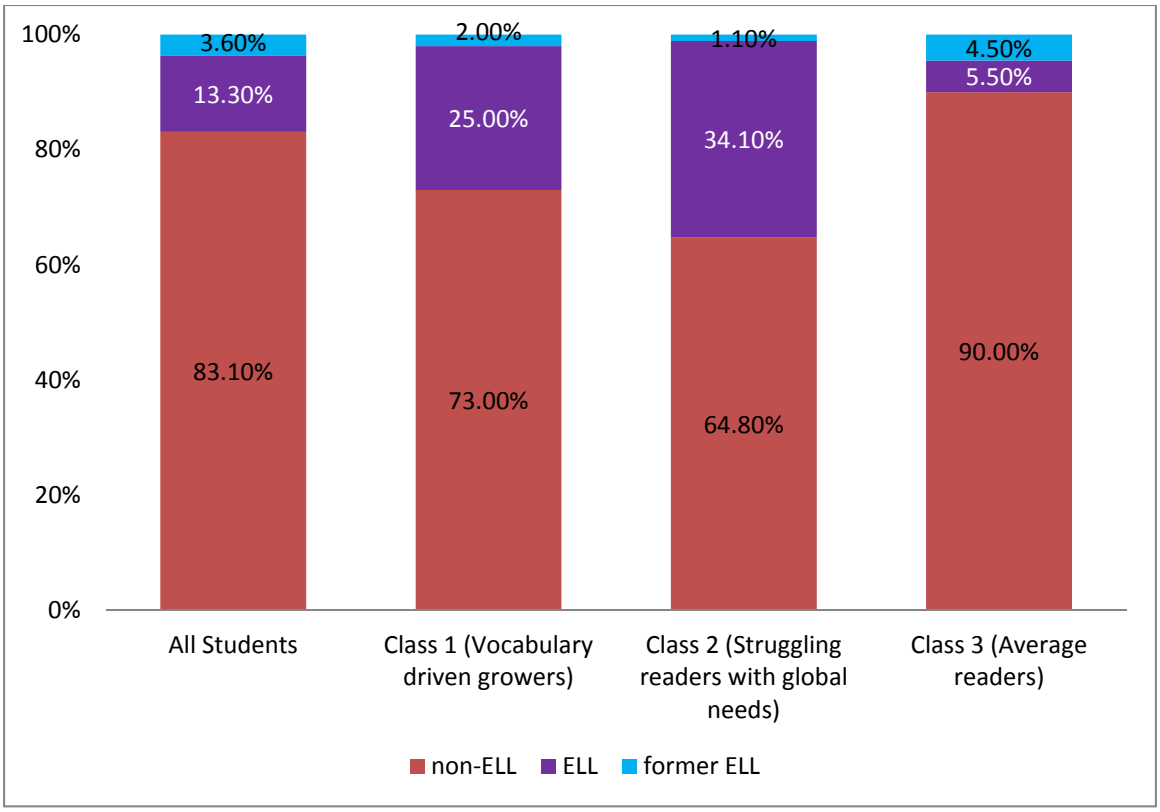


Figure 17. Proportion of non-ELLs, ELLs, and former ELLs in each latent class.

Comparisons of Literacy Development Profiles by ELL Status Groups

To investigate the third research question regarding the extent of variation in literacy development profiles depending on ELL status, a multiple-group unconditional piecewise Latent Class Growth Analysis (LCGA) was run, with ELL status group as the grouping variable, using the "Knownclass" command in Mplus and with fixed class probabilities (0.23, 0.66, and 0.11 for classes 1, 2, and 3, respectively). An evaluation of model fit statistics and entropy value identified that a 3-class model fits the data well. Characteristics of three literacy growth profiles for each of the three ELL status groups (non-ELLs, ELLs, and former ELLs) were compared. In addition, students' latent class memberships from unconditional LCGA, identified by the highest class probability using the full analytic sample, were compared with their latent class classifications from the multiple-group LCGA.

Multiple-group LCGA. Similar to the unconditional LCGA, model fit was evaluated using the three information criteria and entropy values. The entropy was higher for the 2-class model, while the information criteria values were smallest for the 4-class model (see Table 16). However, because the primary purpose of the multiple-group LCGA was to evaluate whether the three distinct patterns of literacy growth captured from the initial unconditional LCGA would exist in each of the three ELL status groups, the 3-class model was interpreted.

Table 16
Fit Statistics of Latent Class Growth Analysis

Fit Statistics	1 Class	2 Class	3 Class	4 Class
AIC	826215.751	820157.704	816147.630	814420.584
BIC	826897.735	821247.396	817645.030	816325.692
ABIC	826605.369	820780.246	817003.096	815508.974
Entropy		0.929	0.896	0.839

Note. Vuong-Lo-Mendell-Rubin Likelihood Ratio (LMR) Test was not available in Mplus for mixture modeling analysis with more than one categorical latent variable.

The multiple-group LCGA results suggested that students' growth trajectories on the easyCBM reading measures varied across the three ELL status groups. For non-ELLs, approximately 21.6% had the highest probability to be in Class 1. Among non-ELLs, about 69.1% and 9.3% had the highest probability to be in Class 2 and Class 3, respectively. Students classified in Class 1 scored either below or close to the 20th percentile on all three measures in the fall of Year 1, with steady growth throughout both years; however, they were still below the 50th percentile on all three measures at the end of Year 2. Students grouped in Class 2 scored well above the 50th percentile across both years on ORF, but their performance on RC and VOC was not as high; they scored slightly below or above the 50th percentile throughout both years. Students in Class 3 consistently performed well below the 20th percentile on all measures.

For ELLs, though the proportions of ELLs were similar to the proportions of non-ELLs in each of the three classes, the characteristics of literacy development profiles were somewhat different. The first class among ELLs, consisting of 24.6% of ELLs, scored slightly below the 50th percentile on ORF in Year 1 but performed at the 50th percentile throughout Year 2. In contrast, their performance on RC and VOC was between the 20th and 50th percentile throughout both years. The second class included 60.3% of ELLs; despite their steep growth in RC and VOC, they performed consistently below or close to the 20th percentile on all three measures. The third class, consisting of 15.1% of ELLs, scored consistently well below the 20th percentile on all measures, similar to Class 3 for non-ELLs. However, unlike non-ELLs, ELLs in Class 3 showed almost no growth in RC and VOC.

For former ELLs, approximately 9.9% had the highest probability to be in Class 1. About 82.8% and 7.4% of former ELLs had the highest probability to be in Class 2 and Class 3, respectively. Students in Class 1 scored consistently well above the 50th percentile on ORF across both years, with very little growth in RC and VOC; in fact, there was a large drop in RC from winter to spring in Year 2. Students in Class 2 scored above or slightly below the 50th percentiles on all three measures, displaying steady growth on all measures across both years. While students in Class 3 scored above the 20th percentile on ORF across both years, their performance on RC and VOC was consistently below the 20th percentile in spite of a steep growth in VOC during Year 1 (see Table 17 and Figures 18, 19, and 20). It should be noted that several growth parameters were not statistically significant for latent classes with a small number of students, such as Classes 1 and 3 for former ELLs, which consisted of 0.4% and 0.3% of the total analytic sample, respectively.

Latent class membership between LCGA and MG LCGA. In general, literacy development patterns of the three classes captured from the multiple-group LCGA (MG LCGA) for each of the three ELL status groups were similar to the development profiles captured from the unconditional LCGA using the full analytic sample. For example, almost all non-ELLs who were classified as *Average readers* and *Struggling readers with global needs* from the unconditional LCGA were also classified similarly in the MG LCGA (see Table 18-a). Furthermore, the characteristics of literacy development profiles for non-ELLs were similar to the ones from the unconditional LCGA. However, the literacy development profiles captured from the MG LCGA for ELLs and former ELLs differed from the ones for non-ELLs. For example, approximately 77% of ELLs

classified as *Average readers* from the unconditional LCGA were classified in Class 1, showing stable growth and adequate performance in ORF but concerning performance in RC and VOC. Also, more than 54% of ELLs classified as *Struggling readers with global needs* performed well below the 20th percentile and showed almost no growth in RC and VOC (see Table 18-b). For former ELLs, most students classified as *Average readers* from the unconditional LCGA were also classified in Class 2 (see Table 18-c).

LCGA by ELL Status. To examine whether the same number of latent classes exist in each ELL group, the unconditional piecewise LCGA was conducted for each ELL group separately. Evaluation of information criteria and entropy suggested that the 3-class model fit the data best for all three ELL groups. However, the LMR test results and latent class proportions suggested that the 3-class model fit the data best for non-ELLs, while the 2-class and 1-class model fit the data best for ELLs and former ELLs (see Tables 19a–c). The variation in the best-fitting model across the ELL groups may be due to the sample size differences across the three groups. Or it may suggest that assuming similar heterogeneity in reading development profiles across three ELL groups may not be reasonable.

Table 17

Comparison of Growth Trajectory by English Language Learner (ELL) Status for Each Latent Class (3-class model)

Measure	Growth Parameters	Non-ELL			ELL			Former ELL		
		Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
	% within ELL	21.6	69.1	9.3	24.6	60.3	15.1	9.9	82.8	7.4
	% Total	18.0	57.4	7.8	3.3	8.0	2.0	0.4	2.9	0.3
	Number of students	2,199	7,031	951	401	982	246	43	360	32
ORF	Y1 Intercept	58.24	104.96	30.20	78.03	54.55	22.76	103.11	100.67	62.36
	Y1 Slope1	29.64	35.24	17.93	34.97	29.86	15.98	44.17	33.65	33.53
	Y1 Slope2	*-0.55*	-3.02	*0.69*	-2.77	*-0.38*	*0.77*	*-5.30*	*-1.65*	*4.66*
	Y2 Intercept	85.16	126.44	50.67	103.63	84.14	43.11	121.43	123.61	97.06
	Y2 Slope1	24.85	23.97	15.96	27.12	22.40	14.49	39.45	24.52	19.72
	Y2 Slope2	3.56	10.90	2.93	6.79	2.27	2.97	*18.63*	9.20	*8.93*
RC	Y1 Intercept	7.28	12.03	6.58	8.88	6.99	6.51	8.99	11.43	8.78
	Y1 Slope1	1.20	-0.66	*0.12*	*-0.20*	0.43	*0.01*	*1.22*	-0.96	*0.94*
	Y1 Slope2	2.79	3.84	0.40	3.32	2.09	*-0.21*	*-3.01*	3.83	*2.17*
	Y2 Intercept	8.61	13.85	7.05	9.40	7.71	6.41	8.80	12.30	7.16
	Y2 Slope1	3.19	0.90	0.82	2.60	2.87	*0.52*	4.92	2.04	*3.28*
	Y2 Slope2	*0.30*	0.33	*0.06*	*-0.13*	0.77	*0.71*	-12.29	0.76	*2.45*
VOC	Y1 Intercept	10.05	17.37	7.51	14.51	9.55	6.92	16.29	16.11	7.94
	Y1 Slope1	4.24	0.60	*0.09*	0.94	2.10	*-0.67*	*-0.29*	0.97	4.04
	Y1 Slope2	2.18	0.40	1.70	1.32	2.82	*0.88*	*0.95*	1.06	3.90
	Y2 Intercept	13.29	17.70	8.30	15.19	11.10	7.57	16.57	16.23	11.10
	Y2 Slope1	2.41	0.41	1.49	0.70	2.22	*-0.23*	*-1.96*	1.14	3.26
	Y2 Slope2	0.79	0.38	0.95	0.61	1.24	1.39	*2.17*	*0.30*	*1.33*

Note. For model identification and convergence issues, slope variances were fixed to be zero and the within-year error variances of the same measure type are fixed to be the same. Italicized font=not statistically significant, $p > .05$. ORF=Oral Reading Fluency. RC=Reading comprehension. VOC=Vocabulary. Y1=Year 1. Y2=Year 2. Slope1=changes from fall to winter. Slope2=changes from winter to spring.

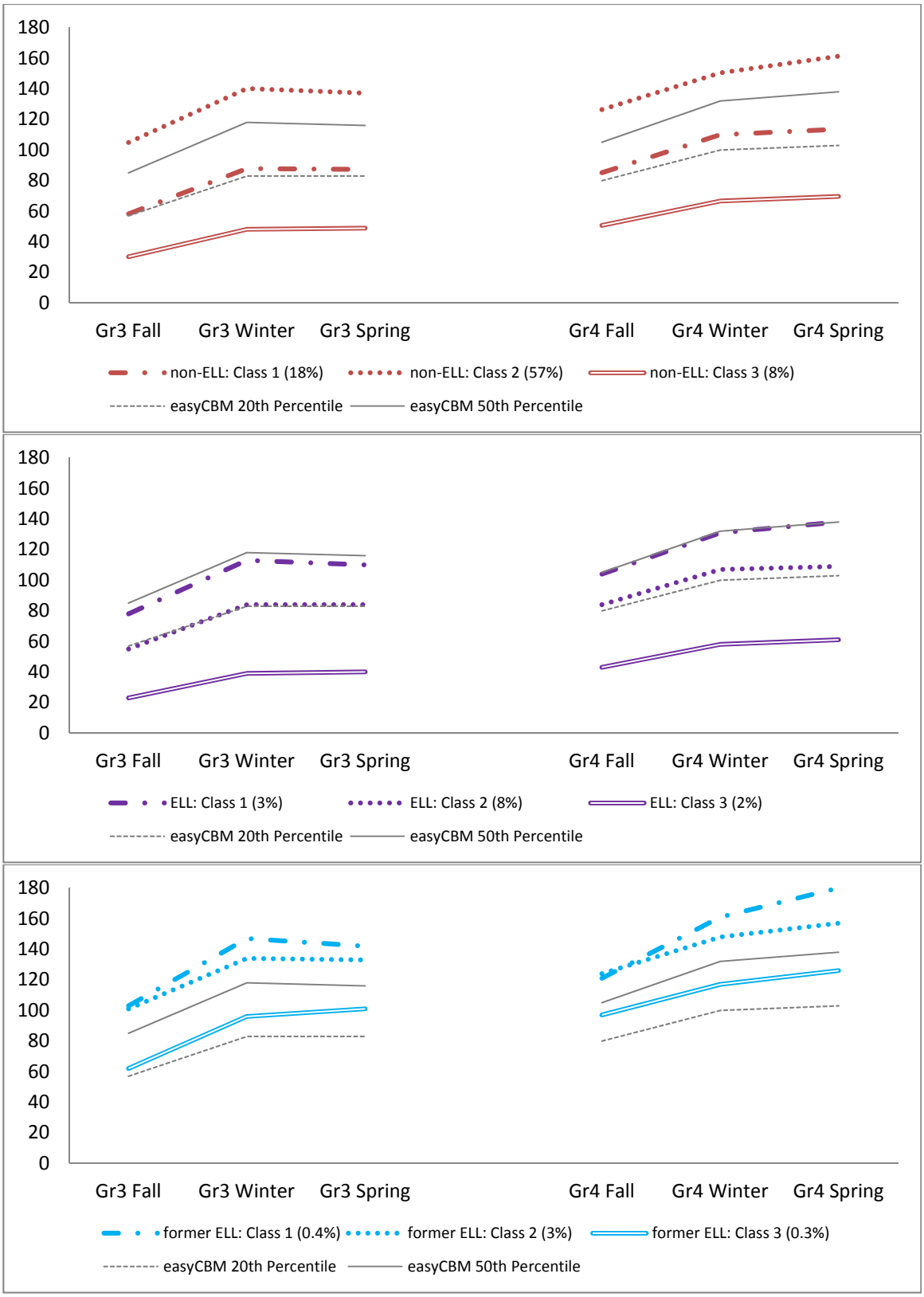


Figure 18. Comparison of ORF growth trajectories between non-ELLs, ELLs, and former ELLs: Multiple-group LCGA.

Figure 19. Comparison of RC growth trajectories between non-ELLs, ELLs, and former ELLs: Multiple-group LCGA.

Figure 20. Comparison of VOC growth trajectories between non-ELLs, ELLs, and former ELLs: Multiple-group LCGA.

Table 18
Comparison Between Unconditional Latent Class Growth Analysis (LCGA) and Multiple-Group (MG) LCGA for (a) Non-English Language Learners, (b) English Language Learners, and (c) Former English Language Learners

a

Unconditional LCGA		Multiple-group LCGA			Total
		Class 1	Class 2	Class 3	
Vocabulary driven growers	Count	2,055	5	93	2,153
	% within unconditional LCGA	95.4	0.2	4.3	100.0
	% within MG LCGA	93.5	0.1	9.8	21.1
Struggling readers with global needs	Count	1	1	858	860
	% within unconditional LCGA	0.1	0.1	99.8	100.0
	% within MG LCGA	<0.1	<0.1	90.2	8.4
Average readers	Count	143	7025	0	7168
	% within unconditional LCGA	2	98.0	0.0	100.0
	% within MG LCGA	6.5	99.9	0.0	70.4
Total	Count	2,199	7,031	951	10,181
	% within unconditional LCGA	21.6	69.1	9.3	100.0

b

Unconditional LCGA		Multiple-group LCGA			Total
		Class 1	Class 2	Class 3	
Vocabulary driven growers	Count	65	673	0	738
	% within unconditional LCGA	8.8	91.2	0.0	100.0
	% within MG LCGA	16.2	68.5	0.0	45.3
Struggling readers with global needs	Count	1	206	246	453
	% within unconditional LCGA	0.2	45.5	54.3	100.0
	% within MG LCGA	0.2	21.0	100.0	27.8
Average readers	Count	335	103	0	438
	% within unconditional LCGA	76.5	23.5	0.0	100.0
	% within MG LCGA	83.5	10.5	0.0	26.9
Total	Count	401	982	246	1,629
	% within unconditional LCGA	24.6	60.3	15.1	100.0

c

Unconditional LCGA		Multiple-group LCGA			Total
		Class 1	Class 2	Class 3	
Vocabulary driven growers	Count	4	33	22	59
	% within unconditional LCGA	6.8	55.9	37.3	100.0
	% within MG LCGA	9.3	9.2	68.8	13.6
Struggling readers with global needs	Count	5	0	9	14
	% within unconditional LCGA	35.7	0.0	64.3	100.0
	% within MG LCGA	11.6	0.0	28.1	3.2
Average readers	Count	34	327	1	362
	% within unconditional LCGA	9.4	90.3	0.3	100.0
	% within MG LCGA	79.1	90.8	3.1	83.2
Total	Count	43	360	32	435
	% within unconditional LCGA	9.9	82.8	7.4	100.0

Table 19

Fit Statistics for Latent Class Growth Analysis for (a) Non-English Language Learners, (b) English Language Learners, and (c) Former English Language Learners

a

Fit Statistics	1 Class	2 Class	3 Class	4 Class
AIC	687876.898	682394.016	678442.981	677092.242
BIC	688267.225	682921.680	679107.983	677894.581
ABIC	688095.621	682689.697	678815.620	677541.839
Entropy		0.840	0.823	0.781
LMR p-value		< 0.01	< 0.01	0.589

Note. LMR = Vuong-Lo-Mendell-Rubin Likelihood Ratio Test for k versus k-1 classes.

b

Fit Statistics	1 Class	2 Class	3 Class	4 Class
AIC	98296.780	97848.238	97645.981	97461.600
BIC	98588.149	98242.126	98142.387	98060.525
ABIC	98416.600	98010.217	97850.119	97707.897
Entropy		0.671	0.768	0.670
LMR p-value		< 0.01	0.173	0.334

Note. LMR = Vuong-Lo-Mendell-Rubin Likelihood Ratio Test for k versus k-1 classes.

c

Fit Statistics	1 Class	2 Class	3 Class[a]	4 Class[a]
AIC	26015.293	25828.986	25720.448	25638.775
BIC	26235.361	26126.487	26095.380	26091.138
ABIC	26063.994	25894.824	25803.421	25738.884
Entropy		0.957	0.929	0.840
LMR p-value		0.388	0.777	0.499

[a] Model did not converge properly.

Note. LMR = Vuong-Lo-Mendell-Rubin Likelihood Ratio Test for k versus k-1 classes.

CHAPTER IV

DISCUSSION

The purpose of this study was to compare literacy growth trajectories and literacy development profiles empirically classified from the Latent Class Growth Analysis (LCGA) between non-ELLs, ELLs, and former ELLs. Results from the study suggested that despite a steady growth, ELLs consistently performed lower than their non-ELL and former ELL peers across all three reading measures (oral reading fluency, reading comprehension, and vocabulary). In addition, results from LCGA suggest that there were three unique patterns of literacy growth for each of the non-ELL, ELL, and former ELL groups.

Comparison of Growth Trajectories

Non-linear growths were also observed across all three measures, as previous research has demonstrated (Ardoin & Christ, 2008; Nese et al., 2011; Nese et al., 2012). Overall, students showed greater growth from fall to winter than from winter to spring in Oral Reading Fluency (ORF) for both years regardless of their ELL status (i.e. non-ELLs, ELLs, and former ELLs). In Reading Comprehension (RC), a greater growth was observed from winter to spring compared to growth from fall to winter in Year 1, while there was more growth from fall to winter than from winter to spring in Year 2. For vocabulary (VOC), while ELLs and former ELLs demonstrated a steady growth across both years, there was almost no growth observed from winter to spring in Year 2 for non-ELLs.

Literacy achievement of non-ELLs, ELLs, and former ELLs. Although the growth patterns of ELLs were similar to the patterns for non-ELLs and former ELLs,

ELLs scored consistently lower on all three measures compared to non-ELLs and former ELLs across all assessment periods. Such a performance gap has been noted in the literature (Baker et al. 2009; Chiappe, Siegel, & Gottardo, 2002). Examining each measure more closely, for ORF, ELLs performed close to the 20th percentile in Year 1 and began to perform slightly above the 20th percentile in Year 2, displaying growth patterns similar to the other two groups (see Figure 8). For RC, ELLs performed below the 20th percentile throughout Year 1, showing almost no growth from fall to winter. In contrast, ELLs demonstrated a steep growth from fall to winter in Year 2, which was significantly larger than that of both non-ELLs and former ELLs. Despite a large growth in Year 2, ELLs still scored around the 20th percentile by the end of Year 2 (see Figure 9). For VOC, ELLs showed steady growth across both years. In fact, their growth from winter to spring in both Years 1 and 2 was significantly larger than that of their non-ELL and former ELL peers (see Figure 10). However, even with their consistent growth, ELLs scored well below the 20th percentile throughout both years, and certainly could not close the achievement gap with peers.

While the achievement gap between ELLs and non-ELLs was expected given previous findings, literacy growth trajectories of former ELLs were somewhat surprising. For example, the intercepts for all three measures across both years were significantly higher for former ELLs compared to non-ELLs. Also, former ELLs significantly outperformed ELLs on all three measures for both Years 1 and 2. Although only a few studies have done an empirical comparison of the academic performance between former ELLs and non-ELLs (Keller-Margulis, Clemens, Im, Kwok, & Booth, 2012), some studies show similar results. For instance, approximately 85% of fifth grade former ELLs

from low-income families met the achievement standards on the State of Texas Assessments of Academic Readiness in the 2013–2014 school year, while only 65% of non-ELLs from low-income families met the standards (E^3Alliance, 2015). A similar finding was observed in Connecticut, where former ELLs who had exited from ELL status based on the state-designated English language proficiency test performed as well as or better than non-ELLs on the Connecticut Master Test in the 2007–2008 school year (Connecticut State Department of Education Data Bulletin, July 2008).

Comparisons of slope parameters. Regarding the slope parameters, for ORF, most comparisons between ELLs and former ELLs as well as ELLs and non-ELLs were significant across measures, with a few exceptions (e.g., the change from winter to spring in Year 1 and from fall to winter in Year 2). None of the comparisons between former ELLs and non-ELLs were significant. The average weekly growth on ORF ranged from 1.18 to 1.38 words per week in Year 1 (third grade) and from 1.09 to 1.49 words per week in Year 2 (fourth grade) across all groups, which is similar to previous research (Christ et al., 2010; Fuchs et al., 1993; Tindal, 2013). The average weekly growth for non-ELLs and ELLs was also similar to that reported by Al Otaiba et al. (2009), ranging from 1.26 to 1.34 words per week and 1.18 to 1.09 words per week in Years 1 and 2, respectively. However, the weekly growth for former ELLs observed in this study was higher (1.38 and 1.49 words per week in Years 1 and 2, respectively) than the growth reported in the study conducted by Al Otaiba et al., which ranged from 0.93 to 1.08 words per week.

All three groups demonstrated similar growth trajectories on RC, showing a large growth from winter to spring in Year 1 and from fall to winter in Year 2. While the

growth was higher for non-ELLs and former ELLs in Year 1, ELLs saw significantly higher growth in Year 2 compared to non-ELLs. For VOC, ELLs exhibited consistent and significant growth in both years; in particular, the change from winter to spring in Year 1 was significantly greater (2.08) than the change for non-ELLs (0.90) and former ELLs (1.28). While most contrasts of slope parameters between ELLs and non-ELLs as well as between ELLs and former ELLs were significant, the only significant comparison between non-ELLs and former ELLs was the change from fall to winter in Year 2 RC (1.40 to 2.35 for non-ELLs and former ELLs, respectively).

Relationship between ORF, RC, and VOC. The relationship between oral reading fluency (ORF) and reading comprehension (RC) has been well documented in the literature (Ardoin & Christ, 2008; Fuchs, Fuchs, & Maxwell, 1988; Fuchs & Vaughn, 2005; Jenkins, Fuchs, van den Broek, Epsin, & Deno, 2003); however, there have been mixed findings related to the relationship between ORF and RC for ELLs (De Ramirez & Shapiro, 2006;Quirk & Beem, 2012; Riedel, 2007). Results from this study indicate that the relationship between ORF and RC, ORF and VOC, and RC and VOC differs for non-ELLs, ELLs, and former ELLs. For example, the correlations between intercepts of ORF and RC across two years for non-ELLs were much higher (ranging from 0.76 to 0.83) compared to the correlations for ELLs (ranging from 0.65 to 0.69) and former ELLs (ranging from 0.46 to 0.64). Though the differences are not as large, the relationship between ORF and VOC as well as between RC and VOC also varied between non-ELLs, ELLs, and former ELLs (see Table 11). These findings suggest that literacy performance and progress of ELLs and former ELLs should be evaluated using various measures assessing different subskills of reading instead of assuming that one measure would

provide adequate information about these students' literacy achievement.

Heterogeneity in Literacy Development

Results from the unconditional piecewise Latent Class Growth Analysis (LCGA) suggested that there were three groups with distinct patterns of literacy development, which can be characterized as *Vocabulary driven growers, Struggling readers with global needs,* and *Average readers*. There is limited research investigating distinct patterns of students' literacy development using multiple reading CBM measures (i.e. ORF, RC, and VOC) combined (Boscardin, Muthén, Francis, & Baker, 2008; Compton, Fuchs, Fuchs, Elleman, & Gilbert, 2008; Hafner et al., 2008). A few exploratory studies identified similar reading development profiles using student performance on a single measure (e.g., ORF only), employing similar analytic techniques (Lai, 2012; Lesaux & Kieffer, 2010; Park, Betts, Alonzo, & Tindal, 2013).

When comparing the students in the *Vocabulary driven growers* and the *Average readers* group, students in both groups showed steep growth on ORF and RC across both years; in particular, the changes from fall to winter were quite large (e.g., 29.92 WCPM and 35.13 WCPM for Year 1 and 24.27 WCPM and 24.018 WCPM in Year 2, respectively, for ORF). In contrast, students in the *Vocabulary driven growers* group showed steeper growth than those in the *Average readers* group on VOC, suggesting that students in the *Vocabulary driven growers* group improved on all three domains of reading skills, including fluency, reading comprehension, and vocabulary.

Although students in the *Vocabulary driven growers* group consistently performed below the 50th percentile, which is often considered a "safe" zone, their growth patterns seem promising. For example, in the fall of Year 1 (when these students

were in third grade), they scored close to or below the 20th percentile on all three measures. By the end of Year 2 (their fourth grade year), they scored above the 20th percentile on all measures. Consistent growth observed on all three measures throughout both years suggest that these students are improving in all three domains of reading, including fluency, reading comprehension, and vocabulary, and that they are working toward closing the achievement gap. Another finding worth noting related to this group is that about half (approximately 45%) of ELLs were classified as *Vocabulary driven growers*, implying that a large of portion of ELLs make progress toward closing the gap with their peers during their school years.

Literacy Development Profiles: Non-ELLs, ELLs, and Former ELLs

The multiple-group LCGA was an exploratory effort, which attempted to identify and examine the three unique literacy development patterns within each of the three ELL status groups. The three unique development profiles were identified for each of the three ELL groups, and the profiles' characteristics differed between non-ELLs, ELLs, and former ELLs. For example, the three development profiles identified for non-ELLs were similar to what was captured from the unconditional LCGA. Also, for both ELLs and former ELLs, there was a group of students who demonstrated steady growth, but still performed below the 20th percentile throughout both years.

Regarding the development patterns identified among ELLs and former ELLs, some groups displayed growth patterns that were not captured among non-ELLs. For instance, among ELLs, about 25% of students performed around or slightly below the 50th percentile on ORF, while their performance on RC and VOC were close to or slightly above the 20th percentile, suggesting they are fluent decoders without adequate

reading comprehension skills (see Figures 18, 19, and 20). Interestingly, approximately 77% of ELLs classified as *Average readers* from the unconditional LCGA were grouped together, demonstrating adequate fluency skills but poor comprehension and vocabulary skills. Similarly, about 10% of former ELLs performed significantly higher than the 50th percentile on ORF while scoring below the 50th percentile on RC and VOC. In fact, their performance on RC was below or close to the 20th percentile, indicating that they struggle with comprehension. This serves as one example illustrating the importance of assessing multiple subskills of reading when identifying ELLs for additional academic support. If these students are identified solely based on ORF, it is likely that they would not receive additional help given their satisfactory performance on ORF even though their RC and VOC skills clearly demand it.

Although it is evident that literacy development profiles vary depending on students' ELL status, some students seem to share similar growth patterns regardless of their ELL classification. For example, one group, characterized as *Struggling readers with global needs*, was identified in both non-ELLs and ELLs. Almost all non-ELLs and more than 54% of ELLs who were classified as *Struggling readers with global needs* from the unconditional LCGA were also captured in the group presenting similar development patterns in the multiple-group LCGA. Although ELLs grouped in the *Struggling readers with global needs* class scored lower than non-ELLs in the similar category, they both scored significantly lower than the 20th percentile on all measures. In addition, they demonstrated very small growth on ORF and almost no growth on RC and VOC. This suggests that struggling readers may share similar reading development profiles regardless of their ELL classification, which aligns with previous research. For

example, results from a latent class analysis of young adolescent struggling readers showed that students' ELL classification was not a significant predictor of latent classes exhibiting distinct reading skill profiles identified based on multiple reading measures (Lesaux & Kieffer, 2010). In other words, sources of reading difficulties for struggling readers were similar whether students were ELL or not. These findings suggest that interventions designed to address challenges shared among struggling readers may benefit all students, instead of having separate approaches for subgroups such as ELLs and non-ELLs.

Limitations

It must be noted that there are several limitations in this study that restrict the generalizability of its findings. First, this study did not account for district variation. During the preliminary analysis, two-level growth models (which were equivalent to three-level longitudinal modeling in the Hierarchical Linear Modeling (HLM) framework) were conducted to account for the nested structure of the data, as repeated measures were nested within students, and students were nested within districts; however, because of model convergence problems, results from the two-level growth models could not be reported. This could be due to the wide variation in numbers of students per district (ranging from 1 to 1,942 students; see Appendix A). Even though removing the district level from the analysis was necessary in order to have the model converge, interpretation and generalization of the findings from this study should be made carefully because students' educational experiences and the types of academic support provided to ELLs might have differed by district.

Second, although the total number of students included in the analytic sample was over 12,000, the number of students with valid CBM scores for each of the three measure types (ORF, RC, and VOC) across the two school years varied, ranging from 4,789 (RC, spring of Year 2) to 7,523 (RC, fall of Year 1). The smallest proportion of data coverage was 0.35 (RC in spring of Year 2 and VOC in spring of Year 1), and the largest proportion of data coverage was 0.72 (RC in fall of Year 1). This was based on the Mplus generated data covariance coverage matrix, which illustrates the proportion of valid data (i.e. non-missing data) for each measure included in the analysis as well as the proportion of valid data for paired measures (see Appendix D). In other words, the proportion of missing data across the 16 CBM measures was quite large, often more than 50% for any combination of two given measures. Although Maximum Likelihood estimation was utilized to handle missing data, as often recommended in the literature (Enders, 2010; Muthén & Muthén, 2007), results should be carefully interpreted because it is not clear if data was missing at random.

Third, despite an accurate representation of Oregon's student sample, the number of ELLs (approximately 13% of the analytic sample) and former ELLs (about 4%) was extremely small compared to non-ELLs (about 83%). One issue that could be raised because of the large imbalance of sample size between the groups is that growth functions, slope parameters, and latent class memberships might have been largely driven by non-ELLs, which may not accurately represent ELLs and former ELLs. Related to this issue, some growth parameters were not statistically significant; this could be due to the small sample size of ELLs and former ELLs, which lacked the statistical power to detect significance.

Fourth, the multiple-group LCGA may have not been the best approach to examine whether the three distinct reading development patterns identified from the full analytic sample unconditional LCGA existed in each of the three ELL groups. Even though the overall model fit for the 3-class multiple-group LCGA was acceptable, some of the estimated growth parameters were difficult to interpret, especially for one of the former ELL latent classes. For example, the second slope parameter (representing change from winter to spring) for RC in Year 2 was -12.29. This strange result could be due to a combination of small sample size and a large proportion of missing data among the students classified in this group, or it could be due to a poor model specification. The current multiple-group LCGA model forced the number of latent classes to be equal across all three ELL groups even though there might be a different number of latent classes for ELLs and former ELLs. Therefore, multiple-group LCGA may not be the best approach to model and compare heterogeneity across known groups (i.e. observed group variable) when (a) there is a large imbalance in the number of students in each known group and (b) the assumption of the same number of latent class across known groups may not be reasonable.

Fifth, ELLs' and former ELLs' English proficiency test scores and information related to intervention and instructional activities were not available for this study and thus could not be included in the analysis. For the same reason, students' ELL status was based on their classification in Year 1 and treated as a fixed variable even though it is possible that some students might have been reclassified in Year 2. Knowing actual English proficiency test scores for ELLs and former ELLs would have been useful when interpreting the latent classes identified from the multiple-group LCGA. In addition, data

related to interventions and instructions students received during academic years would have enhanced the interpretation of latent classes and potentially provided helpful information for practitioners. For example, students who demonstrated consistent growth in all three domains (ORF, RC, and VOC) may have received particular instruction or support, and such information could help teachers to make more informed instructional decisions.

Implications for Instruction

Findings from this study have several potential implications for instruction. First, struggling readers should be assessed and monitored on multiple domains of reading, including comprehension and vocabulary in addition to ORF. As results from the multiple-group LCGA show, struggling readers demonstrate some growth in ORF and very little growth in comprehension and vocabulary. Challenges with reading comprehension and vocabulary have been noted in the literature as one of the most commonly observed characteristics for struggling readers (Lesaux & Kieffer, 2010). Given these findings, instructional decisions made solely based on students' ORF skills may not address students' needs adequately. On a related note, struggling readers demonstrated similar development profiles and sources of reading difficulties (e.g., lack of growth in comprehension and vocabulary) regardless of their ELL classification status. This may suggest that interventions tailored to address the needs of struggling readers, such as a strong emphasis in comprehension and vocabulary, may benefit all struggling readers, whether they are ELLs or non-ELLs.

Second, former ELLs should be carefully monitored on their growth in comprehension and vocabulary in particular. Although former ELLs scored higher than

non-ELLs on most reading measures, there were some former ELLs who performed well and showed consistent growth on ORF but presented serious challenges with comprehension and vocabulary skills. As students continue their educational careers, complexity and length of text increases, which demands higher skills in reading comprehension for academic success. Therefore, it is important to not overly rely on ORF assessment to make instructional decisions, especially when former ELLs are involved.

Lastly, differential development profiles among ELLs can enhance the identification accuracy for special education eligibility. Some research reported that ELLs are more likely to be identified as having learning disabilities than their non-ELL peers (Sullivan, 2011). Careful examination of differential reading development profiles in ELLs may help teachers to distinguish students with linguistic challenges from those with learning disabilities.

Directions for Future Research

Similar studies should be conducted to replicate findings from this study. The replication study can focus on validating reading development patterns across multiple years and using multiple reading measures, including fluency, comprehension, and vocabulary. In addition, differential reading development profiles observed in ELLs and former ELLs should be replicated with a greater number of sample sizes for stronger statistical power. More importantly, future research should fully account for the nested structure of data to evaluate the effects on students' reading development associated with district and/or school level.

One unexpected finding from this study is that former ELLs performed better than non-ELLs on all three reading measures. Although no empirical evidence can be

provided at this point, one can hypothesize that English proficiency of former ELLs is adequate not only to perform daily tasks successfully, but also to succeed academically. This is because among ELLs, only those who demonstrate solid readiness for academic success through various forms of evidence, including high scores on English language proficiency assessments (ELPA), other assessment results, or teacher evaluations, can be reclassified (Oregon Department of Education, 2015). Including English proficiency scores of ELLs and former ELLs (from previous years) in the analysis can confirm this hypothesis. In addition, multiple-group latent class growth analysis can be conducted using ELLs' proficiency levels based on their ELPA performance to identify distinct development patterns, which may have not been captured in this study.

Lastly, because students' academic performance and development is highly related to interventions and instructions they receive, collecting and including such information in the data analysis will be very useful for researchers and practitioners. For example, some students exhibited consistent growth throughout both Years 1 and 2 on all three domains. If this was a result of a particular intervention or instructional practice, having such data could have provided useful information to teachers and researchers.

This study compares reading achievement between non-ELLs, ELLs, and former ELLs. Findings from this study indicate that students' reading development patterns are not homogenous even within ELLs and former ELLs. In contrast, struggling readers all seem to share similar characteristics of reading development profiles, suggesting that the sources of reading difficulties for struggling readers are similar regardless of students' English language proficiency. As ELL populations continue to grow in U.S. schools, teachers and schools must do their homework and address the achievement gap between

ELLs and their non-ELL peers. Empirical investigation of academic performance of ELLs and former ELLs, such as this study, can help teachers and practitioners to make better-informed decisions, which can enhance their instructional practices.

APPENDIX A

PERCENTAGE OF NON-ELLS, ELLS, AND FORMER ELLS BY DISTRICT

	Non-ELL		ELL		Former ELL		District Total
	n	% within district	n	% within district	n	% within district	
District 1	483	89.0	43	7.9	17	3.1	543
District 2	1,202	96.3	42	3.4	4	.3	1,248
District 3	240	88.2	22	8.1	10	3.7	272
District 4	264	68.8	100	26.0	20	5.2	384
District 5	155	99.4	1	.6	0	0.0	156
District 6	659	94.0	23	3.3	19	2.7	701
District 7	389	89.8	32	7.4	12	2.8	433
District 8	1,550	79.8	314	16.2	78	4.0	1,942
District 9	250	96.2	9	3.5	1	.4	260
District 10	50	78.1	9	14.1	5	7.8	64
District 11	40	80.0	8	16.0	2	4.0	50
District 12	68	98.6	1	1.4	0	0.0	69
District 13	6	85.7	1	14.3	0	0.0	7
District 14	457	57.1	253	31.6	90	11.3	800
District 15	1	100.0	0	0.0	0	0.0	1
District 16	253	64.9	119	30.5	18	4.6	390
District 17	1	100.0	0	0.0	0	0.0	1
District 18	88	64.2	32	23.4	17	12.4	137
District 19	25	67.6	12	32.4	0	0.0	37
District 20	90	82.6	16	14.7	3	2.8	109
District 21	223	94.5	12	5.1	1	.4	236
District 22	36	87.8	2	4.9	3	7.3	41
District 23	31	83.8	4	10.8	2	5.4	37
District 24	198	85.7	23	10.0	10	4.3	231
District 25	266	96.7	8	2.9	1	.4	275
District 26	254	95.8	9	3.4	2	.8	265
District 27	167	96.5	5	2.9	1	.6	173
District 28	55	57.3	29	30.2	12	12.5	96
District 29	57	82.6	12	17.4	0	0.0	69
District 30	170	98.8	1	.6	1	.6	172
District 31	2	100.0	0	0.0	0	0.0	2
District 32	13	50.0	11	42.3	2	7.7	26
District 33	462	87.3	53	10.0	14	2.6	529
District 34	3	75.0	1	25.0	0	0.0	4
District 35	1	100.0	0	0.0	0	0.0	1
District 36	143	71.9	37	18.6	19	9.5	199
District 37	152	60.3	81	32.1	19	7.5	252
District 38	184	54.0	136	39.9	21	6.2	341
District 39	67	98.5	1	1.5	0	0.0	68
District 40	32	97.0	1	3.0	0	0.0	33
District 41	20	95.2	1	4.8	0	0.0	21
District 42	171	92.9	11	6.0	2	1.1	184
District 43	720	90.1	64	8.0	15	1.9	799
District 44	93	98.9	1	1.1	0	0.0	94
District 45	202	97.6	3	1.4	2	1.0	207
District 46	10	71.4	3	21.4	1	7.1	14
District 47	35	97.2	0	0.0	1	2.8	36
District 48	143	60.6	83	35.2	10	4.2	236

Total	10,181	83.1	1,629	13.3	435	3.6	12,245

APPENDIX B

CORRELATION MATRIX OF MEASURES INCLUDED IN THE ANALYSIS

	ORF1	ORF2	ORF3	ORF4	ORF5	ORF6	RC1	RC2	RC3	RC4	RC5	RC6	VOC 1	VOC 2	VOC 3	VOC 4	VOC 5	VOC 6
ORF1	1.00																	
ORF2	0.91	1.00																
ORF3	0.90	0.92	1.00															
ORF4	0.89	0.89	0.90	1.00														
ORF5	0.86	0.88	0.90	0.89	1.00													
ORF6	0.85	0.88	0.89	0.88	0.91	1.00												
RC1	0.63	0.63	0.62	0.61	0.59	0.59	1.00											
RC2	0.54	0.56	0.56	0.55	0.54	0.53	0.55	1.00										
RC3	0.59	0.61	0.62	0.61	0.61	0.60	0.57	0.58	1.00									
RC4	0.62	0.62	0.63	0.64	0.62	0.62	0.59	0.58	0.64	1.00								
RC5	0.52	0.55	0.55	0.54	0.56	0.56	0.49	0.49	0.59	0.61	1.00							
RC6	0.53	0.54	0.55	0.55	0.56	0.57	0.48	0.49	0.58	0.60	0.63	1.00						
VOC 1	0.75	0.75	0.73	0.71	0.71	0.70	0.63	0.56	0.61	0.64	0.54	0.54	1.00					
VOC 2	0.66	0.69	0.68	0.65	0.68	0.66	0.55	0.55	0.63	0.61	0.58	0.54	0.74	1.00				
VOC 3	0.62	0.65	0.65	0.63	0.66	0.63	0.49	0.48	0.62	0.55	0.55	0.53	0.66	0.75	1.00			
VOC 4	0.67	0.69	0.69	0.68	0.68	0.68	0.57	0.56	0.65	0.67	0.62	0.60	0.72	0.74	0.71	1.00		
VOC 5	0.62	0.65	0.65	0.63	0.67	0.66	0.51	0.52	0.62	0.60	0.62	0.60	0.67	0.72	0.72	0.75	1.00	
VOC 6	0.60	0.63	0.63	0.63	0.65	0.64	0.49	0.50	0.62	0.58	0.59	0.63	0.65	0.70	0.71	0.73	0.77	1.00

Note. ORF1=Oral Reading Fluency (ORF) in fall of Year 1. ORF2=ORF in winter of Year 1. ORF3=ORF in spring of Year 1. ORF4=ORF in fall of Year 2. ORF5=ORF in winter of Year 2. ORF6=ORF in spring of Year 2. RC1=Reading Comprehension (RC) in fall of Year 1. RC2=RC in winter of Year 1. RC3=RC in spring of Year 1. RC4=RC in fall of Year 2. RC5=RC in winter of Year 2. RC6=RC in spring of Year 2. VOC1=Vocabulary (VOC) in fall of Year 1. VOC2=VOC in winter of Year 1. VOC3=VOC in spring of Year 1. VOC4=VOC in fall of Year 2. VOC5=VOC in winter of Year 2. VOC6=VOC in spring of Year 2.

APPENDIX C

UNCONDITIONAL LCGA MODEL COMPARISON: GROWTH PARAMETERS

			1-Class Model	2-Class Model	3-Class Model	4-Class Model
Class 1	% of students		100.00	76.45	24.09	30.00
	Number of students		12,245	9,361	2,950	3,672
	Probability	Class 1	1.00	0.96	0.82	0.75
		Class 2	--	0.04	0.10	0.10
		Class 3	--	--	0.06	0.01
		Class 4	--	--	--	0.14
	ORF	Y1 Intercept	83.00	96.70	57.42	74.41
		Y1 Slope1	32.11	34.69	29.92	31.02
		Y1 Slope2	-1.95	-2.67	*-0.31*	-2.10
		Y2 Intercept	106.32	119.27	85.45	97.75
		Y2 Slope1	23.37	24.49	24.27	27.09
		Y2 Slope2	8.07	9.81	3.32	4.75
	RC	Y1 Intercept	10.03	11.11	7.22	8.44
		Y1 Slope1	-0.14	-0.36	0.98	0.72
		Y1 Slope2	3.19	3.74	2.66	3.07
		Y2 Intercept	11.48	12.79	8.32	9.67
		Y2 Slope1	1.54	1.40	3.24	2.97
		Y2 Slope2	0.33	0.29	0.37	*0.14*
	VOC	Y1 Intercept	14.26	16.30	9.84	14.15
		Y1 Slope1	1.34	1.07	3.89	1.98
		Y1 Slope2	1.04	0.65	2.39	1.19
		Y2 Intercept	15.27	16.97	12.70	15.32
		Y2 Slope1	1.01	0.66	2.53	1.23
		Y2 Slope2	0.58	0.44	0.84	0.57
Class 2	% of students		--	23.55	10.84	14.77
	Number of students		--	2,884	1,327	1,809
	Probability	Class 1	--	0.10	0.06	0.12
		Class 2	--	0.90	0.89	0.80
		Class 3	--	--	<0.01	0.07
		Class 4	--	--	--	0.01
	ORF	Y1 Intercept	--	41.20	29.95	50.89
		Y1 Slope1	--	23.76	18.47	28.80
		Y1 Slope2	--	0.36	*0.51*	*0.43*
		Y2 Intercept	--	66.88	51.56	80.33
		Y2 Slope1	--	19.69	15.82	22.33
		Y2 Slope2	--	2.32	2.69	3.11
	RC	Y1 Intercept	--	6.72	6.56	7.02
		Y1 Slope1	--	0.56	*0.13*	0.72
		Y1 Slope2	--	1.27	*0.23*	2.44
		Y2 Intercept	--	7.39	6.91	8.09
		Y2 Slope1	--	2.02	0.76	2.63
		Y2 Slope2	--	0.47	*0.34*	0.56
	VOC	Y1 Intercept	--	7.90	7.51	8.27
		Y1 Slope1	--	2.20	*-0.23*	3.94
		Y1 Slope2	--	2.49	1.59	3.01
		Y2 Intercept	--	9.93	8.20	11.34
		Y2 Slope1	--	2.25	1.01	3.02
		Y2 Slope2	--	1.04	1.19	0.95

Class 3	% of students		--	--	65.07	9.54
	Number of students		--	--	7,968	1,168
	Probability	Class 1	--	--	0.12	0.02
		Class 2	--	--	0.01	0.10
		Class 3	--	--	0.93	0.88
		Class 4	--	--	--	<0.01
	ORF	Y1 Intercept	--	--	102.90	27.96
		Y1 Slope1	--	--	35.13	17.20
		Y1 Slope2	--	--	-2.99	*0.49*
		Y2 Intercept	--	--	124.57	48.02
		Y2 Slope1	--	--	24.18	15.39
		Y2 Slope2	--	--	10.69	2.72
	RC	Y1 Intercept	--	--	11.77	6.43
		Y1 Slope1	--	--	-0.61	*0.19*
		Y1 Slope2	--	--	3.81	*0.00*
		Y2 Intercept	--	--	13.53	6.79
		Y2 Slope1	--	--	1.02	0.64
		Y2 Slope2	--	--	0.31	*0.26*
	VOC	Y1 Intercept	--	--	17.14	7.62
		Y1 Slope1	--	--	0.64	*-0.58*
		Y1 Slope2	--	--	0.47	1.18
		Y2 Intercept	--	--	17.50	8.06
		Y2 Slope1	--	--	0.45	0.67
		Y2 Slope2	--	--	0.38	1.10
Class 4	% of students		--	--	--	45.70
	Number of students		--	--	--	5,596
	Probability	Class 1	--	--	--	0.11
		Class 2	--	--	--	0.01
		Class 3	--	--	--	<0.01
		Class 4	--	--	--	0.88
	ORF	Y1 Intercept	--	--	--	113.42
		Y1 Slope1	--	--	--	36.86
		Y1 Slope2	--	--	--	-3.17
		Y2 Intercept	--	--	--	134.88
		Y2 Slope1	--	--	--	22.91
		Y2 Slope2	--	--	--	12.71
	RC	Y1 Intercept	--	--	--	13.01
		Y1 Slope1	--	--	--	-1.05
		Y1 Slope2	--	--	--	4.06
		Y2 Intercept	--	--	--	14.92
		Y2 Slope1	--	--	--	0.45
		Y2 Slope2	--	--	--	0.37
	VOC	Y1 Intercept	--	--	--	17.93
		Y1 Slope1	--	--	--	0.38
		Y1 Slope2	--	--	--	0.28
		Y2 Intercept	--	--	--	18.18
		Y2 Slope1	--	--	--	0.27
		Y2 Slope2	--	--	--	0.35

Note. For model identification and convergence issues, slope variances were fixed to be zero and the within-year error variances of the same measure type are fixed to be the same. Italicized font=not statistically significant, $p > .05$. ORF=Oral Reading Fluency. RC=Reading comprehension. VOC=Vocabulary. Y1=Year 1. Y2=Year 2. Slope1=changes from fall to winter. Slope2=changes from winter to spring.

APPENDIX D

COVARIANCE MATRIX OF DATA COVERAGE

	ORF1	ORF2	ORF3	ORF4	ORF5	ORF6	RC1	RC2	RC3	RC4	RC5	RC6	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6
ORF1	0.65																	
ORF2	0.60	0.64																
ORF3	0.59	0.61	0.65															
ORF4	0.54	0.53	0.54	0.59														
ORF5	0.44	0.42	0.44	0.46	0.50													
ORF6	0.47	0.47	0.48	0.50	0.41	0.55												
RC1	0.60	0.57	0.56	0.51	0.43	0.44	0.72											
RC2	0.56	0.58	0.56	0.50	0.42	0.44	0.62	0.70										
RC3	0.48	0.49	0.51	0.44	0.40	0.38	0.52	0.53	0.59									
RC4	0.45	0.45	0.46	0.48	0.44	0.41	0.49	0.48	0.46	0.60								
RC5	0.42	0.41	0.42	0.44	0.46	0.39	0.47	0.45	0.43	0.50	0.57							
RC6	0.37	0.36	0.37	0.39	0.37	0.39	0.38	0.38	0.37	0.42	0.41	0.46						
VOC1	0.54	0.52	0.51	0.46	0.40	0.40	0.62	0.56	0.49	0.46	0.43	0.36	0.64					
VOC2	0.51	0.52	0.51	0.45	0.39	0.40	0.55	0.59	0.48	0.44	0.41	0.36	0.54	0.62				
VOC3	0.45	0.46	0.49	0.42	0.38	0.37	0.48	0.48	0.52	0.43	0.40	**0.35**	0.48	0.48	0.56			
VOC4	0.49	0.49	0.50	0.52	0.43	0.45	0.53	0.53	0.46	0.55	0.48	0.40	0.49	0.47	0.44	0.63		
VOC5	0.41	0.39	0.41	0.43	0.44	0.39	0.46	0.44	0.42	0.48	0.53	0.39	0.43	0.40	0.40	0.49	0.55	
VOC6	0.41	0.41	0.42	0.43	0.36	0.43	0.43	0.43	0.37	0.41	0.39	0.43	0.39	0.38	0.35	0.46	0.40	0.51

Note. ORF1=Oral Reading Fluency (ORF) in fall of Year 1. ORF2=ORF in winter of Year 1. ORF3=ORF in spring of Year 1. ORF4=ORF in fall of Year 2. ORF5=ORF in winter of Year 2. ORF6=ORF in spring of Year 2. RC1=Reading Comprehension (RC) in fall of Year 1. RC2=RC in winter of Year 1. RC3=RC in spring of Year 1. RC4=RC in fall of Year 2. RC5=RC in winter of Year 2. RC6=RC in spring of Year 2. VOC1=Vocabulary (VOC) in fall of Year 1. VOC2=VOC in winter of Year 1. VOC3=VOC in spring of Year 1. VOC4=VOC in fall of Year 2. VOC5=VOC in winter of Year 2. VOC6=VOC in spring of Year 2.

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