



Expert Review of Vermont's Early Childhood Kindergartner's Readiness Survey

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1006_01/14

Acknowledgments

This report was compiled in cooperation with the following entities:

Building Bright Futures State Advisory Council, Inc.
Vermont Department for Children and Families
Vermont Department of Health
Vermont Agency of Human Services
Vermont Agency of Education

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Executive Summary

Recent attention to early childhood policies and funding, including the Race to the Top—Early Learning Challenge application process, has led to an increased focus on gauging school readiness skills as students enter kindergarten. In response to this focus, the Vermont Agency of Education (AOE) and Agency of Human Services developed and implemented the Kindergarten’s Readiness Survey (KRS). The KRS is a 30-item questionnaire completed for all public school kindergarten students by their teachers approximately six weeks into the academic year (see item list in Appendix A).

Implemented since 2000, the KRS had not undergone an external content review of its items and psychometric properties. This report includes the findings from (1) an expert review, (2) alignment of the items with the Vermont Early Learning Standards (VELS) and Common Core State Standards, (3) a psychometric study to examine item quality, and (4) a fairness review to screen for item bias. All tasks were conducted under subcontract to the American Institutes for Research (AIR) by Building Bright Futures State Advisory Council, Inc. in the fall of 2013. The report also includes recommendations about the further use and development of the KRS and is supplemented with a scoring rubric to guide teachers’ use of ratings on the assessment.

Key findings from the external review and psychometric analysis include:

- Most KRS items are appropriate developmentally and serve as a threshold for assessing kindergarten readiness of young children as they start school.
- KRS items aligned well to some domains on the VELS. More than 80.0 percent of the Approaches to Learning; Social and Emotional Development; and Language, Literacy, and Communication Developmental domains on the VELS were aligned to KRS items. Only 50.0 percent of the VELS Mathematics standards aligned to KRS items, only 33 percent of VELS Science standards, and 20 percent of Physical Development and Health. Social Studies or Creative Expression VELS standards were not covered by KRS items.
- Reliability, the consistency across teachers’ KRS use, was high.
- Nearly all KRS items fit together statistically on the intended underlying construct. Only five items did not statistically fit with the others: three learning inhibitor items¹, one item about separating from a caregiver, and one item about knowing 10 or more letters.
- Statistical screening for item bias, or construct irrelevant differential performance, for children of from different language or special education statuses indicated that seven items required further review in the English language learner status comparison and two items required further review in the special education status comparison.

¹ Signs of Illness, Fatigue, Hunger

Overall, this independent review of the KRS found that the item properties were strong, and the KRS is an appropriate measure of school readiness. However, AIR suggests some changes such as item modifications, scoring changes, and providing teachers a rubric for scoring the items.

Introduction

High-quality early childhood education programs, and parents and families, regard children's school readiness as they enter kindergarten as an important goal. School readiness was underscored by the first National Education Goals Panel, which aimed for all children in the United States to start school ready to learn by the year 2000 (Kagan, 1990). The work of the Goals Panel sparked the idea that measurable standards of school readiness were needed, against which children could be assessed, and that meeting such standards would predict future academic success. For example, the Vermont Agency of Education (AOE) and Agency of Human Services developed and implemented the KRS in 2000. Consequentially, over the last two decades, states have rapidly developed standards to define what children are expected to know to be ready for kindergarten and later schooling (Council of Chief State School Officers, 2010; Daily, Burkhauser, & Halle, 2010; Howard & Wiley, 2007; Scott-Little, Lesko, Martella, & Milburn, 2007). Even with the development of learning standards, however, measuring and assessing children's progress aligned with these standards remains a complicated undertaking (National Research Council, 2008a; Council of Chief State School Officers, 2010).

Vermont KRS

The KRS includes 30 items in six main domains: Social and Emotional Development, Approaches to Learning, Communication, Cognitive, Health, and Learning Inhibitors (see item list in Appendix A). These domains map onto the National Education Goals Panel school readiness elements² (Social and emotional development, Approaches to learning, Language development, Cognition and general knowledge and Physical well-being and motor development).³

Although the measure has been in large-scale implementation in the state of Vermont since 2001, an external review of its items and psychometric properties was needed. The state of Vermont contracted with American Institutes for Research (AIR) to conduct an expert review, alignment of the items to the Vermont Early Learning Standards (VELS) and Common Core State Standards, and psychometric analysis to examine item quality and screen for item bias. AIR is a nonpartisan, not-for-profit organization headquartered in Washington, D.C. AIR conducts behavioral and social science research, early childhood education research, evaluation, consultation, and technical assistance services by using rigorous mixed-method strategies.

² http://www.first5sacramento.net/About-Us/Documents/sac_020020.pdf

³ NEGP also includes two elements: (1) Schools' readiness for children and (2) Family and community supports and services that contribute to children's readiness for school success – these are important but separate constructs that should be measured and scored outside a global score for children's abilities.

Research Questions

A complete psychometric analysis of a large-scale instrument like the KRS is an important method to provide evidence of a scale's validity and reliability and also to provide an empirical basis for further refinement of the assessment tool. An established framework to gather research-based evidence about the KRS includes the following:

- **Content Validity:** This includes face validity and developmentally appropriate items and wording, based on theoretical or empirical knowledge about the topic the KRS scale is measuring.
- **Construct Validity:** KRS items and scores are predictive of related constructs, such as those outlined in state standards documents.
- **Reliability:** The KRS is being used consistently across teachers and schools, and the items demonstrate internal consistency.
- **Internal Consistency:** Items produce reliable scores, and items measure their intended constructs (not unintended or irrelevant constructs).

This framework to provide evidence of internal validity and reliability leads to five research questions that guided AIR's review of the KRS.

1. Do the Kindergarten's Readiness Survey items measure the intended constructs in a developmentally appropriate approach?
2. Do the Kindergarten's Readiness Survey items align with the Vermont Early Learning Standards and the Common Core State Standards?
3. Do the Kindergarten's Readiness Survey items demonstrate internal consistency?
4. Do the Kindergarten's Readiness Survey items measure the constructs based on ability the same way for all children regardless of nonrelevant characteristics (ELL, special education status, gender and attended an early childhood program program)?
5. Based on the findings of the project, what recommended revisions of the assessment items and changes to the processes used to analyze the Kindergarten's Readiness Survey results would be beneficial to the state of Vermont?

To address these five research questions, we conducted five key tasks:

1. **Expert Review:** A panel of four experts in early childhood education at AIR reviewed the KRS items for their developmental appropriateness and threshold for kindergarten readiness on Likert scales and added comments about their ratings. The expert review

also led to development of an item-specific rubric to guide teachers in rating their students on the KRS.

2. **Alignment Study:** The items on the KRS were aligned with the goals on the VELs, and the goals were cross-walked to the KRS items and aligned with the Common Core.
3. **Psychometric Analysis:** Item response theory (IRT), in particular a two-parameter polytomous model, was used to examine item properties and the spread of item “difficulty,” as well as how that distribution mapped onto IRT-based student scores.
4. **Fairness Review:** Statistical methods were used to test for subgroup differences on four comparisons: gender, English language learner (ELL) status, special education, and attendance in an early childhood program.
5. **Conclusions and Recommendations:** We synthesized and summarized findings into recommendations such as item modifications and next steps.

This report is organized by these five tasks to present the methods and findings of the study that address the key research questions.

Expert Review

To address the first research question—*Do the Kindergarten’s Readiness Survey items measure the intended constructs in a developmentally appropriate approach?*—AIR conducted an expert review.

Expert Review Methods

AIR convened a content review panel composed of four early childhood development and assessment experts. The expert review panel conducted an initial review of the KRS items to determine their developmental appropriateness, to determine their ability to measure threshold for school readiness (whether the items measure the constructs they intend to measure at the point of kindergarten expectations), and to provide feedback on clarity. Each expert individually reviewed each item to determine whether it measures a specific skill and aligns to certain constructs. Then the panel convened to discuss the independent reviews and to come to a consensus on the content and skills measured in the KRS items.

For the individual review of items, each AIR expert reviewer on the panel received an Excel worksheet that listed the items and questions about each item.

Developmental Appropriateness: First, reviewers focused on whether the items were developmentally appropriate, whether mastery of this skill is a threshold for school readiness for that concept, and whether the wording of the item is clear. For the first question for each separate item, using a five-point Likert scale, the experts provided ratings ranging from 1, indicating the item is not appropriate, to 5, indicating the item is appropriate.

Threshold for Kindergarten Readiness: Second, experts were again instructed to rate each item on a five-point Likert scale ranging from 1, indicating they strongly disagree, to 5, indicating they strongly agree that the skill is a threshold for school readiness. In addition to the rating, experts were instructed to explain their choice.

Item Clarity: Finally, the experts were asked to evaluate the clarity of wording to make sure the items were clear, correct, and easily interpretable by all educators. Reviewers then suggested ways of standardizing or clarifying the response categories. Results from this review focused on making sure that the item exemplifies the construct it intends to measure. To establish stronger clarity and standardization across the items, AIR developed a rubric that serves as guidance for teacher ratings for each KRS item and overall domain ratings. For each item, at least two experts described behaviors and skills, including specific examples where appropriate, at each rating level. Then the authors synthesized and revised the descriptions to be clear and concise.

After each expert reviewer independently rated the items, the AIR reviewers convened to discuss the independent reviews. This meeting facilitated discussion of the items and allowed the panel to reconcile differences in opinions.

Expert Review Findings

Overall, experts' opinions were consistent across the reviewers in support of the current KRS items, as evidenced by high ratings of items for their developmental appropriateness, usefulness as a threshold indicator for kindergarten readiness, and clarity. Some exceptions on items to clarify or modify are noted in this section of the report and additional details in the *Recommendations* section.

Developmental Appropriateness

Reviewers unanimously rated 22 of the 30 items with a score of 5 as developmentally appropriate. No items were rated 1 or 2. The eight KRS items that had review ratings of 3 for “neutral” or 4 for “agree the item is developmentally appropriate” from at least one of the reviewers were among two domains: Social and Emotional Development and Approaches to Learning. The eight items included:

- Uses problem-solving skills in social situations (item 3)
- Appropriately expresses feelings and needs (item 4)
- Adapts to transitions within the school day (item 5)
- Uses a variety of learning strategies in the classroom (item 9)
- Is able to pay attention during teacher-directed group activities (item 10)
- Knows when and how to use adults as a resource (item 11)
- Initiates activities in classroom (item 12)
- Shows curiosity (asks questions, probes, tries new things, etc. (item 13)

The *Recommendations* section of this report provides possible revisions for some of these items (4 and 11), and the “Rubric for Ratings on the Kindergarten’s Readiness Survey” provides clarity on ratings to include a variety of developmentally appropriate examples.

Threshold for Kindergarten Readiness

The KRS is used to measure a child's readiness for kindergarten. The intention is that each KRS item should measure a level of skill that children are expected to have at kindergarten entry to succeed in elementary school setting. In other words, children should achieve a point or threshold, at which they are "ready". When asked to evaluate the extent to which each item established a threshold for kindergarten readiness, reviewers rated 25 of the 30 items as 5 (strongly agree it serves as a threshold), except for five items. Reviewers provided specific reasons they felt the five items could not be uniformly applied for all children in terms of a threshold for readiness:

- **Adapts to Transitions Within the School Day (Item 5):** Reviewers expressed concern over variation in whether children have had prior experience in early care and education settings. However, others expressed that having had a well-planned early childhood experience, whether in a center or family care setting, ideally should prepare children for adapting to transitions in the classroom.
- **Appears Enthusiastic and Interested in Classroom Activities (Item 8):** Qualifying reactions to classroom activities as "enthusiastic" might make interpretations hard for teachers of kindergartners. The definition of an enthusiastic reaction may depend on individual definitions and interpretations that are based on cultural and contextual experiences, and vary by children's personalities.
- **Knows When and How to Use Adults as a Resource (Item 11):** Some reviewers expressed that ecological and cultural variation among children might limit this item as a threshold for kindergarten readiness.
- **Initiates Activities in the Classroom (Item 12):** Children have different personalities or behavioral styles, so this may not be neutrally indicative of kindergarten readiness if teachers consider initiates for only group activities or also for individual activities.
- **Engages in Imaginative Play (Item 21):** Although most children engage in imaginative play, some may not prefer this type of activity. For example, some children may prefer to engage in puzzles, blocks, and so on.

In summary, reviewers raised concerns about variability in prior experiences for these specific items leading to discussions about serving as a threshold for kindergarten readiness. Other reviewers asserted that, taken together, the list represents basic skills kindergartners should have at least at the practicing level regardless of their background. If kindergartners are coming without some of these basic skills, this signals lack of preparation rather than too rigorous expectations applied across environments and contexts.

In some cases, reviewers thought personality would result in varied levels of skill ratings rather than preparedness for kindergarten. However, other reviewers asserted that despite variation in

prior experiences affecting children’s performance and rating, the item was still an appropriate expectation for kindergarten entry for most children and that *performing* and *practicing* were acceptable bars for that skill; a child could start kindergarten without it, but ideally the child should be coming into kindergarten with at least a *beginning* level of that skill.

These five items could be revisited for potential revision. The *Recommendations* section of this report provides possible revisions for some of these items (11 and 21), and the separate “Rubric for Ratings on the Kindergartner’s Readiness Survey” provides clarifications for rating these five and all other items. Some of the concerns raised by reviewers related to the diversity in background and experiences of children, or their assessors, will be addressed in the next section.

Item Clarity

Results from the expert review focused on making sure that the item exemplifies the construct it intends to measure. Expert panel reviewers found five items that should be considered for editing the wording of the items stem.

- *Plays cooperatively with different children* (item 1)
- *Appropriately expresses feelings and needs* (item 4)
- *Interacts positively with adults in the classroom* (item 6)
- *Knows when and how to use adults as a resource* (item 11)
- *Uses scribbles, symbols, or letters to write or represent words or ideas* (item 24)

AIR presents suggestions for clarifications for five of these items in the *Recommendations* section of this report.

Rubric

During the expert review panel discussions about the items and improving clarity and applicability to diverse children, the experts decided the most helpful approach would be to create a consistent scoring rubric for all items. To establish stronger clarity and standardization across the items, AIR developed a rubric that serves as guidance for teachers ratings for each KRS item and overall domain ratings. This rubric will also help address concerns for developmental appropriateness and setting thresholds for kindergarten readiness that can be applied to a diverse population. The rubric would be available to guide teachers about the intention of the items and what those child behaviors or skills looks like in the classroom for each rating level, including examples that aim to cover diverse backgrounds and personalities.

Please see the separate “Rubric for Ratings on the Kindergartner’s Readiness Survey” document that provides clarity on ratings that are developmentally appropriate.

Alignment Study

To address the second research question—*Do the KRS items align with the Vermont Early Learning Standards and the Common Core State Standards?*—AIR conducted an alignment study and cross-walk.

Alignment Methods

For each set of standards—VELS, Common Core for English Language Arts, and Common Core for Mathematics—AIR created a spreadsheet table to list the standards, goals, or College and Career Readiness anchor statuses, where appropriate. Item numbers from the Vermont KRS that matched in the construct were entered into the rows of each standard. AIR then calculated the proportion of standards in each domain or strand that was covered by an item. Next, the aligned were cross-walked with the KRS items so that in a list of items in the KRS, the rows were filled in with the associated standards by using a short code for the domain or strand. Below are descriptions of the three alignment tables (see Table 1 and detailed tables in Appendix B).

KRS Alignment to Vermont Early Learning Standards

The Vermont KRS items were evaluated against the eight domains included in the VELs. The KRS items were aligned to the domains and standards of the VELs and reported in percentage of standards covered by at least one item. Some standards applied to more than one item (see Table B.1 in Appendix B). Overall, the KRS items align to 21 of the 42 VELs standards (50 percent coverage).

Approaches to Learning: KRS items align to five of the six (83 percent) goals of the Approaches to Learning domain: Play, Curiosity and Initiative, Persistence, Self-Organization, and Reasoning. The KRS does not cover the Application goal.

Social and Emotional Development: KRS items align to four of the five (80 percent) of the Social and Emotional Development domain goals: Play, Self-Concept, Self-Control, and Interactions With Others. No KRS items aligned to the Sense of Community goal of the VELs.

Language, Literacy, and Communication: KRS items align to eight of ten⁴ constructs (80 percent) of the Language, Literacy, and Communication domain—Play, Listening and Understanding, Speaking and Communication, and Early Writing goals—and three of the four Early Reading subgoals—Phonemic and Phonological Awareness, Book

⁴ We counted the six learning goals and definitions and four subgoals of the Language, Literacy, and Communication domain of the VELs as 10 standards in total, and eight of 10 were met in the KRS.

Knowledge and Appreciation, and Alphabet Knowledge. No KRS items aligned to the Vocabulary goal or the Print Awareness and Concepts subgoal within the Early Reading goal.

Mathematics: KRS items align to 50 percent of the Mathematics domain, including the Numbers and the Operations and Geometry and Spatial Sense goals. No KRS items aligned to the Play or the Patterns and Measurement goals.

Science: KRS items aligned to 33 percent of the Science domain, including the Play goal. No KRS items aligned to Scientific Knowledge and Scientific Skills and Measurement.

Social Studies: No KRS items aligned to any of the five Social Studies domain goals: Play, Spaces and Geography, People and How They Live, People and Their Environment, and People and the Past.

Creative Expression: No KRS items aligned to any of the four goals in the Creative Expression domain: Play, Creative Expression, Tools, and Appreciation of the Arts.

Physical Development and Health: KRS items aligned to 20 percent of the Physical Development and Health domain, including only the Healthy Habits goal. No KRS items aligned to the Play, Gross Motor, Fine Motor, or Senses goals.

KRS Alignment to Common Core State Standards for Kindergarten English Language Arts

The Common Core Standards for English Language Arts (Common Core English Standards) are divided into six strands (or domains), each with a number of items referencing the College and Career Readiness anchor standards. Reviews determined that about 75 percent of the items on the KRS were in alignment with the Common Core English Standards (see Table B.2 in Appendix B).

Reading—Literature: KRS items aligned to 77.8 percent of the nine standards in the Reading—Literature strand. This alignment included all of the College and Career Readiness Craft and Structure standards, two of three standards in the College and Career Readiness Key Ideas and Details, one of the three standards of the Integration and Knowledge of Ideas, and the one standard in the College and Career Readiness Range of Reading and Level of Text Complexity.

Reading—Informational Text: KRS items align to 90.0 percent of the 10 standards in the Reading—Informational Text strand. No items align to the College and Career Readiness Integration of Knowledge and Ideas standard.

Reading—Foundational Skills: KRS items align to 100 percent of the College and Career Readiness in the Reading—Foundational Skills strand: Print Concepts, Phonological Awareness, Phonics and Word Recognition, and Fluency standards.

Writing: KRS items align to three (43 percent) of the seven kindergarten-appropriate⁵ items in the Writing strand. The aligned standards all came from the College and Career Readiness Test Types and Purposes. No KRS items align with the other kindergarten-appropriate College and Career Readiness in the Writing strand: Production and Distribution of Writing, Research to Build and Present Knowledge, and the Range of Writing.

Speaking and Listening: KRS items align to 67 percent of the Speaking and Listening strand, including all of the items under the College and Career Readiness Comprehension and Collaboration and one standard under the College and Career Readiness Presentation of Knowledge and Ideas standards.

Language: KRS items align to 8 of 10⁶ (80 percent) kindergarten-relevant College and Career Readiness based standards in the Language Strand, including the College and Career Readiness Vocabulary Acquisition and Use and Conventions of Standard English.

KRS Alignment to Common Core State Standards for Kindergarten Mathematics

The KRS was reviewed and evaluated for alignment with the Common Core State Standards for Mathematics. Reviewers found that the 22.7 percent of the KRS was in alignment with the Common Core Math. The Common Core Math is separated into five domains: Counting and Cardinality, Operations and Algebraic Thinking, Number and Operations in Base Ten, Measurement and Data, and Geometry. (See Table B.3 in Appendix B).

⁵ Although the Writing strand is composed of four CCR anchor standards further categorized into 10 standards, three standards were not appropriate for kindergarten and, therefore, were not included in the total count for this strand: (1) W.K.4 *With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose*, (2) W.K.9 *Draw evidence from literary or informational texts to support analysis, reflection, and research*, and (3) W.K.10 *Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences*.

⁶ Although the Language strand is composed of three CCR anchor standards further categorized into six standards, two were not appropriate for kindergarten and, therefore, was not included in the total count for this strand. In the Language strand (1) L.K.3 *Use knowledge of language and its conventions when writing, speaking, reading, or listening* and (2).

Counting and Cardinality: KRS items align to two of the seven (28.6 percent) Counting and Cardinality domain standards. These two aligned items are under the standard Count to tell the number of objects. No KRS items align to the other five clusters within the Know Names and Count Sequence standard and the Compare Numbers standards.

Operations and Algebraic Thinking: No KRS items align with the Operations and Algebraic Thinking domain of the Common Core Math.

Number and Operations in Base Ten: No KRS items align with the Number and Operations in Base Ten domain of the Common Core Math.

Measurement and Data: No KRS items align with the Measurement and Data domain of the Common Core Math.

Geometry: KRS items align to 33.3 percent of the Geometry domain. The KRS aligns to two of the three items of the standard Identify and Describe Shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, and spheres). No KRS items align to the standard Analyze, Compare, Create, and Compose Shapes.

Vermont Early Learning Standards and Common Core State Standards Crosswalk Alignment to KRS

Among the KRS items, 50.0 percent aligned to the Vermont Early Learning Standards, 75.6 percent to the Common Core State Standards for English Language Arts, and 22.7 percent to the Common Core State Standards for Mathematics (see Table B.4 in Appendix B).

Table 1 summarizes the KRS items coverage of the Vermont Early Learning Standards and Common Core State Standards by KRS items.

Overall, we found the KRS to be aligned to Approaches to Learning; Social and Emotional Development; and Language, Literacy, and Communication Developmental standards. Less aligned to Mathematics and Science domains. The KRS did not align to Social Studies or Creative Expression. The *Recommendations* section of this report provides suggestions for revision and improved alignment of the KRS to these learning standards. The *Recommendations* section of this report addresses suggestions for items based on this alignment study.

Table 1. Number and Percentage of Items on the KRS Aligned to the Vermont Early Learning Standards and Common Core State Standards for English Language Arts and Mathematics

Standards	Number of Standards	Number of Standards Aligned with KRS	Percentage of Items Aligned with KRS
Vermont Early Learning Standards	42	21	50.0%
Approaches to Learning	6	5	83.3%
Social and Emotional Development	5	4	80.0%
Language, Literacy, and Communication	10	8	80.0%
Mathematics	4	2	50.0%
Science	3	1	33.3%
Social Studies	5	0	0.0%
Creative Expression	4	0	0.0%
Physical Development and Health	5	1	20.0%
Common Core State Standards for English Language Arts	41	31	75.6%
Reading—Literature	9	7	77.8%
Reading—Informational Text	10	9	90.0%
Reading—Foundational Skills	4	4	100.0%
Writing	7	3	42.9%
Speaking and Listening	6	4	66.7%
Language	5	4	80.0%
Common Core State Standards for Mathematics	22	5	22.7%
Counting and Cardinality	7	2	28.6%
Operations and Algebraic Thinking	5	1	20.0%
Number and Operations in Base Ten	1	0	0.0%
Measurement and Data	3	0	0.0%
Geometry	6	2	33.3%

Psychometric Analysis

To address the third research question—*Do the KRS items demonstrate internal consistency?*—we used both Rasch analysis and polytomous two-parameter IRT.⁷ In the Rasch, or one-parameter IRT framework, a *difficulty* parameter was estimated for each KRS item. In the two-parameter IRT framework, a *difficulty* parameter and a *discrimination* parameter was used that estimated the distinction between the likelihood of endorsement as practicing or performing among different trait levels of the trait being measured (Furr & Bacharach, 2013).

Data Sources

AIR used extant KRS data collected by the Vermont AOE from four cohorts of kindergarten children: (1) children in kindergarten in 2010–11, (2) children in kindergarten in 2011–12, (3) children in kindergarten in 2012–13, and (4) children in kindergarten in 2013–14. Except for the method of data collection, the same KRS were administered across these four cohorts and minimal differences found in initial IRT analyses; therefore, AIR pooled data from these four separate cohorts together to conduct the analyses. This section presents the sample demographics and the findings from the psychometric analyses.

Student Sample

The data files for the four cohorts (fall 2010-2013) included KRS data for 17,904 children. Data records were eliminated for 270 children whose teachers did not complete at least 90 percent of the KRS survey items. Therefore, the final analytic sample included 17,634 children. Among this sample of children, 49.0 percent were female, 11.5 percent were designated as special education, and 2.4 percent were designated as ELL. Only a minority of children, 15.5 percent, were designated by their teachers as not having attended an early childhood program. See Table 2 for details on each cohort.

⁷ Rasch and IRT take into account the different likelihood of endorsement on each item rather than considering all items equal, as in classical test theory. IRT relates a child's underlying ability in the subject matter to his or her responses on an assessment. IRT can estimate the difficulty and discrimination parameters of the KRS items and provide a more accurate item reliability.

Table 2. Child Demographics Overall and for Each Year of Data 2010–11 to 2013–14

Year	Demographic Subgroups		Total
English Language Learner (ELL) Status			
	ELL (%)	Non-ELL	
2010	40 (1.7%)	2254	2,294
2011	110 (2.4%)	4434	4,544
2012	127 (2.4%)	5183	5,310
2013	142 (2.6%)	5344	5,486
Overall	419 (2.4%)	17215	17,634
Special Education Status			
	Special Education	Non-Special Education	
2010	275 (12%)	2,019	550
2011	520 (11.4%)	4,024	1,040
2012	580 (10.9%)	4,730	1,160
2013	659 (12.0%)	4,827	1,318
Overall	2,034 (11.5%)	15,600	17,634
Participation in an Early Childhood Program			
	Not Attended	Attended	
2010	567 (24.7%)	1,727	2,294
2011	886 (19.5%)	3,658	4,544
2012	509 (10.6%)	4,280	4,789
2013	617 (12.3%)	4,388	5,005
Overall	2,579 (15.5%)	14,053	16,632 ^a
Gender			
	Female	Male	
2010	1,082 (47.7%)	1,185	2,267
2011	2,239 (49.3%)	2,305	4,544
2012	2,610 (49.2%)	2,700	5,310
2013	2,672 (49.0%)	2,780	5,452
Overall	8,603 (49.0%)	8,970	17,573 ^a

^a Missing data for attendance and gender resulted in totals less than 17,634.

Teacher Sample

Data on teachers was provided separately and was not necessarily for the same teachers who completed the surveys for the 17,634 students with completed KRS assessments. However, to provide context about the target demographic for rating the KRS items, the sample is described based on 379 teachers in Vermont’s records in 2007 as provided by the AOE.⁸ A large majority

⁸ Establishing an exact time frame overlap is not necessary because the teachers are not linked to students for any analyses. The teacher demographic data are described to illustrate the population of those completing the surveys about their students’ abilities.

of the kindergarten teachers were female (96 percent). The teachers had an average of seven years of teaching experience, with a majority (55.4 percent) teaching for seven or more years (see Table 3). A large majority of teachers had a bachelor of arts or science (95.0 percent), 17 teachers had associate's degrees, and only two teachers had a master's degree (see Table 4).

Table 3. Number and Percentage of Vermont Kindergarten Teachers With Each Level of Years of Experience, 2007–13

Number of Years	Number of Teachers	Percentage of Teachers
1	23	6.1%
2	23	6.1%
3	11	2.9%
4	16	4.2%
5	52	13.7%
6	44	11.6%
7 or more	210	55.4%
Overall	379	

Table 4. Number and Percentage of Vermont Kindergarten Teachers With Each Degree at First Licensure, 2007–13

Degree at First Licensure	Number of Teachers	Percentage of Teachers
Associate's Degree (Arts)	11	2.9
Associate's Degree (Science)	6	1.6
Bachelor of Arts (BA)	153	40.4
Bachelor of Science (BS)	207	54.6
Master of Education (M.Ed.)	1	0.3
Master of Arts (MA)	1	0.3
Overall	379	

Polytomous Rasch Modeling

The data were first analyzed by using the Rasch model (Rasch, 1980; Wright & Masters, 1982; Wright & Stone, 1979) in Winsteps.⁹ In Rasch modeling, each KRS rating level in each item has a difficulty parameter that is an estimated likelihood of a teacher endorsing that response for each student. The item and ability levels are on the same metric (i.e., logit scale), where the mean is 0 and the standard deviation is 1. For example, on KRS, a child with an ability level of 0.85

⁹ Software for Rasch modeling developed by Linacre (2004).

would have a 50 percent chance of an endorsement as *performing independently* on an item, with a likelihood of 0.85 for endorsement of *performing independently*, whereas a child with an ability level of .32 would have a much lower chance of *performing independently*, on the same item¹⁰. The polytomous Rasch models accounted for the scoring of multiple responses such as KRS’s three ordinal categories: *beginning*, *practicing*, and *performing independently*. The *don’t know/missing* values were considered as missing data. This model estimated two difficulty parameters per item—one for the likelihood of being endorsed *performing independently* over *practicing* and one for being endorsed *practicing* over *beginning*.

Internal Consistency

Before pooling the data into a single analytic sample, we reviewed the KRS items for each cohort to evaluate whether year-to-year differences in item properties exist. Results for item properties, reliability, and item fit were similar across years (see Tables 5 and 6), so all data were pooled together for the remaining analyses.

Item reliability for the KRS was high, although it was higher when excluding extreme cases. Extreme cases are students with all the lowest ratings and students with all highest ratings. In the study sample, extreme cases include 3,067 children who had perfect scores of all *performing* for items 1–27 and *no* for items 28–30; five children had all *beginning* for items 1–27 and *always* for items 28–30. When the sample included the extreme cases, reliability was .84, and when they were excluded the reliability was .91. See Table 5.

Table 5. Item and Person Reliability

Year	Item Reliability	Person Reliability (Nonextreme)	Person Reliability (Extreme and Nonextreme)
2010–11	.99	.92	.83
2011–12	.99	.91	.83
2012–13	1.00	.91	.83
2013–14	1.00	.92	.87
Overall	1.00	.91	.84

¹⁰ Responses for items 1-27 were recoded for analyses where 0 was *beginning*, 1 was *practicing* and 2 was *performing*; and for items 28-30 where 0 was *always*, 1 was *often*, 2 was *sometimes* and 3 was *never*.

Item Fit in Rasch Modeling

Outlier items, or atypical data, will influence the mean difference between observed and expected values. Outliers are detected by using infit and outfit statistics. The outfit statistic (outlier-sensitive fit statistic) reflects large differences between observed and expected endorsements for items that are far from the child's ability. The infit statistic (information-weighted fit statistic) emphasizes residuals for items that are close to the person's ability (Bond & Fox, 2001). A value of 1 is desired; thus, values outside .7 to 1.3 are flagged for review.

According to Rasch modeling item fit tests, the majority of items were within the recommended range. The very high outfit for items 2, and 28–30 indicated that ratings on these items are higher than expected given the overall lower ratings on the other items and overall scale score. See Table 6. These three items also had high infit values. The low infit in item 9 indicated that ratings are lower on that item given the higher ratings on the other items and overall scale score, however the values were just below the threshold and this item was not addressed further.

Table 6. Item Fit Statistics for Out of Range Items on the Full 30 Item Scale

Item		Infit	Outfit
2	Separates easily from parent/caregiver	1.79	3.59
9	Uses a variety of learning strategies in the classroom	.69	.68
23	Recognizes 10 or more letters of the alphabet	1.49	1.38
28	This student's ability to learn appears to be inhibited by: Illness	2.14	3.49
29	This student's ability to learn appears to be inhibited by: Fatigue	1.87	2.94
30	This student's ability to learn appears to be inhibited by: Hunger	2.03	3.22

If items 28–30 were removed from the scale, in the Rasch models analysis, the infit and outfit for item 2 would increase as shown in Table 7, and item 27 would then show out of range outfit. This pattern is logical given that self-help skills would be mastered by children by kindergarten before some of the learning, communication and cognitive skills. Given that developmental theory and the in range infit, this item was not further addressed. Further, reliability estimates remained at .92 (without extreme cases) and .84 (with extreme cases).

Table 7. Item Fit Statistics for Out of Range Items When Items 28-30 Were Removed

Item		Infit	Outfit
2	Separates easily from parent/caregiver	1.86	3.89
23	Recognizes 10 or more letters of the alphabet	1.52	1.42
27	Demonstrates age-appropriate self-help skills (e.g., dressing, toileting, wiping nose, washing hands)	1.30	1.88

If item 2 were also removed from the scale for the Rasch model analysis, the fit for all items was within range. Items 23 and 27 were not removed from the scale because they otherwise performed well. Uses problem solving skills in social situations (item 3) and Uses scribbles, symbols or letters to write or represent words or ideas (item 24) had fit values slightly out of range however based on their strong item performance in other analyses they were retained (e.g., good discrimination, no DIF, reviewer ratings).

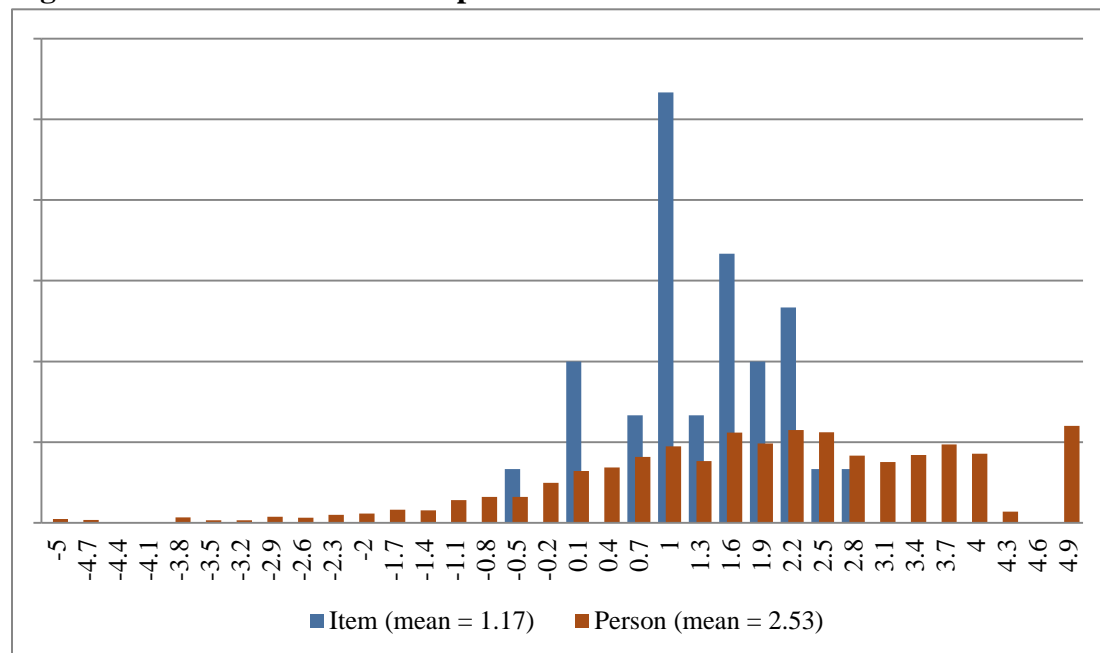
See Appendix C for detailed item properties.

Mapping item difficulties and ability levels

The range of likelihood of teacher endorsement across items and the congruency with the range of children's school readiness ability provided information about whether the level of the items is appropriate for kindergarten-entry children. The extent of this congruency has implications for internal consistency and reliability because items are most reliable when they are relatively aligned with the ability of the population being evaluated. This spread was examined for alignment by using the item maps provided by Winsteps.

The range of likelihoods of endorsement and the congruency with the range of ability levels on the KRS according to Rasch estimates were generally well aligned. This congruency is evidence for internal consistency because items are most reliable when they are relatively aligned with the ability of the population being evaluated. Items (blue bars) cover the range of ability levels for Vermont's kindergartners (red bars). For use as a threshold test, the large number of students who outperform all the items is expected (see Figure 1). Figure C.1 in Appendix C has additional detail of item mapping. For use as a formative assessment, more hard items would be needed (see *Recommendations* section).

Figure 1. Rasch Person-Item Map of KRS items



Polytomous Two-Parameter IRT Model Results

Polytomous IRT also accounts for the scoring of multiple responses such as KRS’s three ordinal categories: *beginning*, *practicing*, and “performing independently,” as in polytomous Rasch. However, this model estimated one discrimination parameter per item. Discrimination values (in Table 7, the *a* parameters) are between zero and one, and the higher the value, the stronger the item in distinguishing among ability levels relative to their responses on other items; generally want a discrimination larger than .5 is desired. The polytomous partial credit IRT models were run in the iAM program¹¹.

In the IRT models, three items (28–30) demonstrated low discrimination (*a* parameter was less than .5). In other words, with respect to overall ratings on all other items, these items do not help the scale to distinguish between rating levels. The chance of being rated in any category is relatively equal among all levels of school readiness. Discrimination for item 2 was about .5 and demonstrated moderate discrimination (see Table 8).

The *b1* column presents the likelihood of being endorsed practicing over beginning and the *b2* column presents the likelihood of being endorsed performing over practicing.

¹¹ iAM is a software for IRT models developed by AIR staff.

Table 8. Items With Low Discrimination Properties

Item		<i>a</i> (SE)	<i>b1</i> (SE)	<i>b2</i> (SE)	<i>b3</i> (SE)
2	Separates easily from parent/ caregiver	0.48 (0.01)	-2.03 (0.05)	-2.28 (0.06)	-
28	This student's ability to learn appears to be inhibited by: Illness	0.166 (0.01)	-1.89 (0.20)	-0.95 (0.18)	-10.22 (0.49)
29	This student's ability to learn appears to be inhibited by: Fatigue	0.228 (0.01)	-2.73 (0.12)	0.35 (0.11)	-6.46 (0.23)
30	This student's ability to learn appears to be inhibited by: Hunger	0.19 (0.01)	-1.332 (0.18)	-0.551 (0.17)	-9.629 (0.44)

Note: *a* represents the discrimination parameter; *b1* represents the likelihood of rating 1 over a 0; *b2* represents the likelihood of rating 2 over a 1; and, for items 28–30, *b3* represents the likelihood of rating 3 over a 2. SE = standard error.

After items 28–30 were removed from the scale and the IRT models were run again, the discrimination for item 2 increased to .55, and the remaining items retained higher discrimination values. See Table C.1 in Appendix C for detailed item properties. After item 2 was also removed from the scale and the IRT models were run again, the remaining items retained higher discrimination values.

Psychometric Analysis Summary

For its intended use as a threshold for kindergarten readiness, the items are well aligned. In the Rasch analyses, five items had meaningful out of range statistics. In the two parameter IRT analysis, four items had low discrimination. Items 2, 28-30 were highlighted by both analyses. The *Conclusions* and *Recommendations* sections of this report provide guidance about revisiting these items for revisions.

Fairness Review

To address the fourth research question—*Do the KRS items measure the constructs based on ability the same way for all children regardless of nonrelevant characteristics?*—AIR conducted a fairness review of the assessment tool. Cultural and linguistic diversity among children makes evaluating items for neutrality and fairness important. Items should not be biased in how they measure skills for different subgroups of children defined by gender, ELL status, special education status, and attendance in an early childhood program. When an item is biased, children of otherwise equal ability on the trait (such as school readiness) being measured perform differently on the item because of their gender, cultural or linguistic background and not because of their general ability. Fairness is especially important when evaluating a measure for which the respondent is providing a third-party assessment of the child, including making sure the items function the same way among subgroups so that scores can be interpreted the same way and that they do not measure any unintended constructs. The measure of such unintended constructs produces scores that are not meaningful for their intended purpose.

For the fairness review, AIR first conducted a differential item functioning (DIF) study, which uses statistical tests to evaluate whether items functioned the same way across subgroups. Then AIR reviewed the content of the flagged items, along with information from the other analyses in the report, to suggest next steps for those items.

Subgroup Samples

AIR used the same pooled extant KRS data as were examined within the IRT analyses to produce the DIF models (2010–2013 cohorts of the KRS administration). AIR examined four subgroup comparisons. Vermont AOE requested comparisons for the first two key groups: English Language Learner (ELL) status and special education status. AIR also compared on gender and compared children who attended any preschool and those who did not, as reported by the teacher.

The percentage of ELL was 2.4 percent, special education was 11.6 percent, and those who did not attend was 15.5 percent. Because equal subgroups are recommended for DIF, equivalent subsamples of students who were non-ELL, non-special education, and attended prekindergarten were randomly selected. We used stratified random sampling by cohort to selected equivalent subsamples of the non-ELL, non-special education students, and those who attended prekindergarten. See Table 9 for all subsample sizes.

Table 9. Subsample sizes for DIF and Differential Step Functioning (DSF) Analyses

Year	Focal Group	Reference Group	Total
English Language Learner (ELL)			
	ELL	Non-ELL^a	
2010	40	40	80
2011	110	110	220
2012	127	127	254
2013	142	142	284
Overall	419	419	2453
Status and Special Education			
	Special Education	Non-Special Education^a	
2010	275	275	550
2011	520	520	1,040
2012	580	580	1,160
2013	659	659	1,318
Overall	2,034	2,034	4,068
Participation in an Early Childhood Program			
	Not Attended	Attended^a	
2010	567	567	1,134
2011	886	886	1,772
2012	509	509	1,018
2013	617	617	1,234
Overall	2,579	2,579	5,158
Gender			
	Female	Male	
2010	1,082	1,185	2,267
2011	2,239	2,305	4,544
2012	2,610	2,700	5,310
2013	2,672	2,780	5,452
Overall	8,603	8,970	17,573

^a Non-English Language Learner, non-Special Education, and Attended Prekindergarten subsamples were randomly selected from the wider population to create equal subsample sizes for statistical comparisons.

Differential Item Functioning (DIF) Methods

Examining DIF is a two-step process to identify potential bias is warranted (Camilli & Shepard, 1994). The first step is the statistical tests. The second step is expert review. Statistical tests alone do not necessarily indicate bias. Statistical tests simply indicate potential difference by subgroup. Research has shown that such tests are helpful to support expert review because panel review alone has been shown to overreport potential bias (Sandoval & Miille, 1980; Camilli & Shepard, 1994). However, expert review is needed to better understand statistical bias.

Statistical tests of DIF and an extension, differential step functioning (DSF) were used to determine whether, after adjusting for individual abilities, the probability of attaining each rating level was statistically equivalent across known groups of test takers (e.g., males and females) (Wright & Stone, 1979).¹² In items with more than two options, DSF helps identify the source of any DIF, such as whether the differential “jump” (or difference in likelihood of endorsement) from a certain rating category to the next was contributing to the overall item DIF (or a weighted aggregate across DSF effects). Items that were flagged by the tests were then reviewed by experts and assessment developers to evaluate whether the statistical differences are supported by the content and context of the item, its intended purpose, and its role in the overall assessment.

Both DIF and DSF used Mantel-Haenszel log odds ratio procedures. The results for the DIF analyses were evaluated based on established effect size and statistical significance by using criteria commonly used by Educational Testing Service. These criteria were chosen so that results could be compared with those from other studies in which investigators have used or will use Mantel-Haenszel log odds ratio procedures. Items that had an effect size greater than 0.64 and that were statistically significant (different from zero) were considered among the flagged or studied items and were further reviewed for content.

Differential Item Functioning Results

This section presents the results of the DIF analyses and summarizes the magnitude and direction for the significant DIF and DSF effects. Details are presented in Appendix D.

¹² We used a nonparametric Mantel-Haenszel log odds ratio (Dorans & Holland, 1992; Holland & Thayer, 1988), which controls for ability by using a total score approach (we recoded responses to 0, 1, 2). Total score ability was calculated by summing the values of the recoded responses. For DIF, the Mantel-Haenszel log odds ratio compares the odds of rating a child as *beginning* to odds of rating a child as *practicing* and odds of rating *beginning* to odds of rating “performing independently,” and then aggregating across the two ratios. Comparing the odds between groups creates an odds ratio. For ease of interpretation, the odds ratio is transformed to the log odds ratio, where zero is no difference and positive favors the reference group (often considered the “majority”) and negative favors the focal group (often considered the “minority”). DSF tests this odds ratio at each level of rating. Both DIF and DSF analyses were conducted in the DIFAS computer program (Penfield, 2012).

English Language Learners and Non-English Language Learners

In the comparison of ELLs and non-ELLs, seven items demonstrated DIF. Three favored the ELL group, and four favored the non-ELL group (Table 10):

- *Adapts to transitions within the school day* (item 5) favored the non-ELL subgroup.
- *Communicates needs, wants, or thoughts in his/her primary language* (item 15) favored the non-ELL subgroup.
- *Engages in conversation (e.g. complete sentences, turn-taking etc.)* (item 16) favored the ELL subgroup.
- *Can recall and explain a sequence of events* (e.g. can tell about a recent activity, can retell a story) (item 19) favored the non-ELL subgroup.
- *Uses scribbles, symbols or letters to write or represent words or ideas* (item 24) favored the ELL subgroup.
- *Can identify several basic geometric shapes* (e.g. circle, square, rectangle, triangle) item 26) favored the non-ELL subgroup.
- *This student's ability to learn appears to be inhibited by: Illness* (item 28) favored the ELL subgroup.

For the seven items that displayed DIF, a DSF, analysis examined the source of the DIF. For items 5, 15, 16, 19, and 26, the DIF appears to stem more from the difference in likelihood of being rated *practicing* over *beginning*. In item 24, the difference between the two groups in the likelihood of being rated *practicing* over *beginning*, or “performing” over *practicing*, was relatively the same. For item 28, the source of DIF appears to be from the difference in likelihood of being rated *performing independently* over *practicing*.

After the first step of flagging items based on statistical findings, the next step was reviewing. The expert reviewers then examined items that were flagged for content. For the items that had DIF in the ELL and non-ELL comparison, the experts determined that the constructs were related to language comprehension and expression and, therefore, differences in ratings were construct relevant. Therefore, the differences are not necessarily due to bias but rather may be valid detected differences in these items by ELL versus non-ELL. Consequently, these items should not be removed from the scale because of DIF alone. One exception might be item 28, *This student's ability to learn appears to be inhibited by: Illness* because this item also demonstrated poor properties in other parts of this study.

Table 10. English Language Learner DIF Results

	Item	MH-LOR (SE)	DSF 0 to 1 (SE)	DSF 1 to 2 (SE)	Favors
5	Adapts to transitions within the school day	-0.69 (.21)	-0.66 (.39)	-0.49 (.24)	ELL
15	Communicates needs, wants, or thoughts in his/her primary language	.97 (.21)	1.27 (.5)	.75 (.22)	Non-ELL
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	1.27 (.22)	1.31 (.41)	1.02 (.24)	Non-ELL
19	Can recall and explain a sequence of events	0.82 (.20)	1.2 (.37)	0.56 (.23)	Non-ELL
24	Uses scribbles, symbols or letters to write or represent words or ideas	-0.74 (.2)	-0.54 (.31)	-0.60 (.23)	ELL
26	Can identify several basic geometric shapes	0.73 (.20)	1.47 (.43)	.32 (.21)	Non-ELL
28	This student's ability to learn appears to be inhibited by: Illness	-0.77 (.30)	-0.22 (1.17)	-0.83 (.35)	ELL

Note: 0 is beginning, 1 is practicing and 2 is performing; MH-LOR = Mantel Haenzel log odds ratio, SE = Standard error of the DIF effect size;

DIF analyses were run again after removing items 28-30 and DIF effects remained for items 5, 15, 16, and 19.

Special Education Comparison

In the comparison of special education and non-special education sub-groups, two items demonstrated statistical DIF (table 11):

- *Separates easily from parent/caregiver* (item 2): favored of the Special-Education subgroup.
- *Engages in conversation (e.g. complete sentences, turn-taking etc.)* (item 16): favored of the non-special education subgroup.

These two items were flagged for further review for DSF, an extension of DIF appropriate for Likert scale surveys to test whether the likelihood of being rated at each successive response is dependent on subgroup.

For the two items that displayed DIF, a DSF analysis examined the source of the DIF. In both items, the difference between the two groups in the likelihood of being rated *practicing* over *beginning*, or *performing independently* over *practicing*, was relatively the same. However for item 2, only the difference between the two groups in the likelihood of being rated *performing independently* over *practicing* was a large or meaningful effect.

The first step is to flag items statistically, and the next step is expert review. In examining the two items statistically flagged for potential DIF, reviewers determined that the constructs the items were measuring were related to behavior and social emotional development, which are often notably delayed in early childhood Special Education students and which often relate to social emotional skills (e.g., attention deficits, listening skills, secure attachment, and behavioral concerns). Therefore, the differences are not necessarily due to bias, but they may be valid detected differences in these items. Consequently, the expert recommendation is that these items should not be removed from the scale based on the DIF alone.

Table 11. Special Education DIF Results

Item		MH-LOR (SE)	DSF 0 to 1 (SE)	DSF 1 to 2 (SE)	Favors
2	Separates easily from parent/caregiver	-0.70 (.11)	-0.59 (.24)	-.65 (.11)	special education
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	0.89 (.10)	0.83 (.18)	.80 (.10)	Non-special education

Note: 0 is *beginning*, 1 is *practicing*, and 2 is *performing independently*; MH-LOR = Mantel Haenzel log odds ratio, SE = Standard error of the DIF effect size

Attended Prekindergarten Program

In the comparison of children who attended an early childhood program and children who did not, no items demonstrated DIF. Items functioned the same way for children who attended an early childhood program and children who did not attend an early childhood program.

Gender Comparisons

No items demonstrated DIF in the gender comparison. Items functioned the same way for both groups and are considered fair to male and female kindergartners.

Overall, eight items of the 30 KRS items were statistically flagged for potential DIF (two items for special education and seven for ELL, including one that was flagged in both analyses). On further content review, AIR found that the items had construct-relevant differences for the two subgroups and recommends retaining all items. Some modifications could help with clarity on language of responses that are acceptable (items 5, 19, and 26). We do recommend removing item 28, because the item was flagged in multiple analyses. (See more in the *Recommendations* section).

Conclusions

In this section, AIR presents conclusions and initial suggestions that address the first four research questions of the study. Potential approaches to addressing the suggestions based on the findings from the research questions are discussed *Recommendations* section.

- 1. Do the Kindergarten’s Readiness Survey items measure the intended constructs in a developmentally appropriate approach?**
 - Yes, overall the KRS is appropriate for its purpose as a threshold test for kindergarten readiness.
 - However, several items should be revisited for revisions and further clarity.
- 2. Do the Kindergarten’s Readiness Survey items align with the Vermont Early Learning Standards (VELS) and the Common Core State Standards?**
 - Somewhat: Many of the KRS items aligned well to the VELS and Common Core, especially for Social Emotional and Approaches to Learning Domains and the VELS for early Literacy domain.
 - However, the KRS lacks alignment to some mathematics concepts, such as patterns and relative size, to social studies and creative arts, and physical development (gross and fine motor skills).
- 3. Do the Kindergarten’s Readiness Survey items demonstrate internal consistency?**
 - Yes, the reliability, fit, DIF, and other statistics generally indicate the KRS demonstrates internal consistency.
 - Reliability was high, and most items had good fit and discrimination.
 - However, some items had out-of-range item fit statistics, low discrimination, and large DIF effects for some items.
 - Three items as a screener for health-related concerns and a fourth about separating from a parent or caregiver stood out as not fitting with the remaining items for scoring the KRS.
- 4. Do the Kindergarten’s Readiness Survey items measure the constructs based on ability the same way for all children regardless of nonrelevant characteristics?**
 - Yes, most of the items on the KRS measure key constructs the same way for both male and female kindergartners and those who attended an early childhood program and those who did not.
 - However, seven items were statistically flagged for potential DIF in the ELL comparison and two in the Special Education comparison (with one item in common), however, the subgroup differences appear to be relevant to the constructs in the items rather than irrelevant.

Recommendations

In this section, AIR addresses the fifth research question by providing actionable recommendations based on the answers to the first four research questions, as summarized in the previous section:

5. Based on the findings of the project, what recommended revisions of the assessment items and changes to the processes used to analyze the KRS results would be beneficial to the state of Vermont?

These recommendations include:

- Add New Math Items
- Add New Physical Development Items
- Separate Two Items to Measure Four Different Skills
- Combine Two Items to Measure the Same Skill
- Clarify Language in Item Stems
- Add Difficult-Range Items
- Consider Additional Recommended Changes for the KRS

Described below and summarized in Table 12.

Add New Math Items

Based on the alignment to Common Core State Standards for Mathematics, KRS items were limited in matching to all domains and subdomains (see Alignment Study section on pages 8-11), although a perfect alignment would require too many items for the time available to collect KRS data, certain domains could be expanded. For example, we identified the two math constructs that the expert review panel felt could be added to the KRS to create a more complete profile of kindergarten readiness: patterns and measuring. If these two items were added, then the mathematics domain would align to additional mathematics standards:

- VELS: “Children show an interest in recognizing, creating, and predicting patterns; comparing objects; and measuring time and quantity.”
- Common Core—Mathematics: “Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.”
- Common Core—Mathematics: “Directly compare two objects with a measurable attribute in common, to see which object has ‘more of’/‘less of’ the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.”

Add New Physical Development Items

Based on the limited alignment to the VELS Physical Development domain, items could be added to measure gross motor, fine motor and senses.

- Children increasingly move their bodies in ways that demonstrate control, balance, and coordination.
- Children use their fingers and hands in ways that develop handeye coordination, strength, control, and object manipulation.
- Children increase their understanding of the use of their eyes, ears, fingers, nose, and mouth, and how the senses work together.

Separate Two Items to Measure Four Different Skills

Two of the items in the Cognitive Development and General Education domain were ambiguous in the developmental construct they intend to measure, and separating the items would allow for measuring the two skills separately.

Shows ability to discriminate and identify speech sounds (item 22)

This item can be separated to measure the ability to discriminate speech sounds in an auditory or an expressive sense. For example:

- *Shows ability to discriminate and identify auditory speech sounds*
- *Shows ability to produce discriminate speech sounds*

If the focus is purely on auditory skills, reword the item to *Shows ability to discriminate and identify auditory speech sounds*.

Shows awareness of how books are organized or used (item 18),

The item can be divided into two items: one about knowing about parts of a book, and one about knowing how to hold the book upright, “read,” and otherwise handle books appropriately:

- Shows awareness and knowledge of how books are organized (e.g., title, pages)
- Shows awareness of how books are used (e.g., holds upright, “reads”)

If kept as one item, some of the expert panel reviewers suggested rewording to “Shows awareness of how parts of books are organized and used.” Expert panel reviewers also suggested that descriptions in a rubric might help. Adding examples, such as “identifies the cover,” “identifies the title,” “reads left to right,” or “holds in correct position,” may add clarity. Reviewers’ further suggestions for examples at each rating level are provided in the rubric.

Combine Two Items to Measure the Same Skill

Two items in the Communications domain were similar in the constructs they measure, and combining these would resolve repetitiveness. The rating of *practicing* or *beginning* would recognize that the skill may be present but “with reminders.” These two items are:

- Item 14: *Follows simple classroom rules and instructions with reminders*
- Item 17: *Understands simple directions, requests, and information*

These items could be combined to:

- Understands and follows simple classroom rules, directions, and requests

Clarify Language in Item Stems

To support clarity on rating skills and behaviors, developers should consider rewording items and provide teachers with a rubric (see Guidance for Scoring the KRS). Expert panel reviewers at AIR suggested the following five clarifications and modifications to the Vermont KRS. A brief narrative for each noted item explains the recommendations, and a table summarizes specific wording clarifications.

Social and Emotional Development Domain

Plays cooperatively with different children (item 1)

Some expert reviewers suggested removing the word *different* and simply using the plural *children* or rephrasing to *other children*. For example, *Plays cooperatively with other children*. Teachers may also need examples to interpret the item and the extent to which *plays* or *cooperatively* is the key word. Reviewers’ further suggestions for examples at each rating level are provided in the rubric.

Appropriately expresses feelings and needs (item 4)

Some expert reviewers thought defining the word *appropriately* would be helpful. Others suggested rewording the item to: *Expresses feelings and needs in age-appropriate ways*. Some of the expert reviewers suggested that a child’s ability to express his or her feelings and needs at this age may not be fully developed by the start of kindergarten, thus they suggested providing guidance by defining and giving examples for appropriate behaviors in the rubric.

Interacts positively with adults in the classroom (item 6)

Some experts suggested rewording to *Consistently and positively interacts with adults in the classroom*. Reviewers suggested clarifying how this item intends to measure both the quantity and quality of interactions between adults and children in the classroom. Reviewers’ further suggestions for examples at each rating level are provided in the rubric.

Approaches to Learning Domain

Knows when and how to use adults as a resource (item 11)

Reviewers suggested rewording the item to *Knows when to ask adults for help with a task or problem*. Reviewers' further suggestions for examples at each rating level are provided in the rubric.

Cognitive Development and General Knowledge

Uses scribbles, symbols, or letters to write or represent words or ideas (item 24)

For simplicity, reviewers suggested rewording to “*Uses symbols or letters to write or represent words or ideas.*”

Clarify Language in Rating Levels

Social and Emotional Development Domain

Uses problem solving skills in social situations (item 3)

Some of the expert reviewers suggested that a children's abilities and approaches to problem solving vary by personality and background experiences. Examples of different age-appropriate examples that apply to diverse backgrounds could range from “attempts to explain solutions to peers” to “seeks out adults for help as needed.” Reviewers' further suggestions for examples at each rating level are provided in the rubric.

Approaches to Learning Domain

Initiates activities in the classroom (item 12)

Some reviewers suggested that the word *activities* was broad and that examples should be added to help clarify the intention of the item. Examples could include the types of activities: “encourages others to play,” “reads books,” “engages in exploration of classroom activities.” Consensus was that this item needs clear examples of what is meant in order to distinguish it from subsequent questions.

Communications

Engages in conversation (e.g., complete sentences, turn-taking, etc.) (item 16)

Reviewers suggested that the item may need further clarification that *turn-taking* refers to conversation and not to playing with a toy or in a game. Also, based on the DIF statistical analysis, the developers should clarify to teachers if conversations must be in English or can be in a different language (as in item 15), including non-verbal communication for children with special education status. Reviewers' further suggestions for examples at each rating level are provided in the rubric.

Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story) (item 19)

Based on the DIF statistical analysis, the developers should clarify to teachers if explanations and recall must be in English or can be in a different language (as in item 15).

Cognitive Development and General Knowledge

Engages in imaginative play (item 21)

Level of complexity can greatly vary for this skill and can continue to be developed in kindergarten, expert reviewers suggested adding specific examples to clarify the developmentally appropriate range for this item. Reviewers' suggestions are provided in the guidance to teachers in the rubric.

Recognizes 10 or more letters of the alphabet (item 23) and

Shows the ability to count 5 or more objects using one-to-one correspondence (item 25)

These two items have quantified thresholds that do not have any scientific basis. For these two items, we recommend making a more general item stem and defining three research-based thresholds that are more research based in the rubric. For example, the stem in item 23 could be "Recognizes letters of the alphabet," which would then increase in difficulty across the three rating levels.

Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle) (item 26)

Based on the DIF statistical analysis, the developers should clarify to teachers if explanations and recall must be in English or can be in a different language (as in item 15).

Health

Demonstrates age-appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands) (item 27)

If item is retained, expert reviewers suggested defining age-appropriate self-help with clearer examples. Reviewers' suggestions are provided in the guidance to teachers in the rubric.

Add Difficult-Range Items

The KRS currently serves the purpose of meeting a minimum threshold for kindergarten readiness. Relative to the intended use of the current KRS as a measure of a threshold for readiness, the large percentage of students with high ratings indicate that children in Vermont are entering Kindergarten with the expected skills. However, if another goal of the KRS is to give kindergarten teachers a snapshot of their students' abilities at school entry, adding more challenging but age-appropriate items for high-performing children would improve the accuracy

(i.e., reliability) of scores at higher ranges, “raise the bar” for developmental expectations at kindergarten entry, and better inform teacher instruction.

Consider Additional Recommended Changes for the KRS

Five other KRS items warrant recommendations for changes such as considering removing the item from administration or from calculating scores.

Separates easily from parent/caregiver (item 2)

This item is conceptually relevant to the social emotional domain, but it does not work well statistically and conceptually with the other items. The item has out-of-range item fit. The construct is related to the very early experiences at home with caregivers more than to experience in early childhood program experiences or more recent learning as compared to the most other items. Discrimination is still moderate. It could be retained on the scale. It could also be collected for screening purposes and not included in the calculation of an overall score based on the remainder of the items. Based on the small percentage of *beginning* (3.5 percent) or *practicing* (14 percent) ratings, the collection of this information for screening purposes could be revised to a dichotomous item (yes/no).

Demonstrates age-appropriate self-help skills (e.g., dressing, toileting, wiping nose, washing hands) (item 27)

This item is the easiest item (i.e., the item most likely for children to be endorsed by teachers as *performing independently*), and the discrimination is moderate. The VELS includes several other constructs that represent this domain. Given that self-help skills are part of the physical development domain in VELS, the Head Start Child Development and Early Learning Framework, and the school readiness criteria in the National Education Goals Panel, it could be kept.

This student’s ability to learn appears to be inhibited by: Illness (item 28),

This student’s ability to learn appears to be inhibited by: Fatigue (item 29), and

This student’s ability to learn appears to be inhibited by: Hunger (item 30)

These three items have low discrimination and out-of-range item fit values. AIR recommends that Vermont continue to administering the three items to collect this important information on the individual and aggregate levels; however, the ratings should not be included in the calculation of an overall score based on the remainder of the items. Conceptually, the items are not related to the rest of the KRS, and they are less specific to the kindergarten transition (illness, fatigue, and hunger could occur at any age) and less related to preschool experiences than are the other items. Based on the statistical findings of low discrimination, the collection of this information for screening purposes could be revised to dichotomous items (yes/no).

Table 12. Summary of Recommendations

Item		Conceptual Concerns	Statistical Concerns	Recommendation
1	Plays cooperatively with different children	Reword for clarity	-	Reword to “Plays cooperatively with other children”
2	Separates easily from parent/caregiver	Fits into social emotional domain but related to home more than to prior school learning experience	Moderate discrimination Out-of-range item fit	Consider the utility of the item
3	Uses problem solving skills in social situations	Behaviors may vary by personality, background, and experiences		Define diverse examples for rating levels
4	Appropriately expresses feelings and needs	Reword for clarity	-	Reword to “Expresses feelings and needs in age-appropriate ways”
6	Interacts positively with adults in the classroom	Reword for clarity	-	Reword to “Consistently and positively interacts with adults in the classroom.”
11	Knows when and how to use adults as a resource	Reword for clarity	-	Reword to “Knows when to ask adults for help with a task or problem”
12	Initiates activities in the classroom	Some reviewers suggested that the word <i>activities</i> was broad		Define examples for rating levels
14	Follows simple classroom rules and instructions with reminders	Overlaps with item 17	-	Combined with item 17
16	Engages in conversation (e.g., complete sentences, turn-taking, etc.	Definition of turn-taking may be unclear; how to rate conversations that are not in English	DIF study for ELL	Clarify “turn-taking” and language of conversation; Define possibly language of response
17	Understands simple directions, requests, and information	Overlaps with item 14	-	Combined with item 17

Item		Conceptual Concerns	Statistical Concerns	Recommendation
18	Shows awareness of how books are organized or used	Confounds several book skills	-	Separate into two items If keep one item, reword: “Shows awareness of how parts of books are organized and used.”
21	<i>Engages in imaginative play</i>	Developmental appropriateness is unclear		Define examples for rating levels
22	Shows ability to discriminate and identify speech sounds	Confounds receptive and expressive communication skills	-	Create two distinct items
23	Recognizes 10 or more letters of the alphabet	Determine whether 10 is correct threshold	-	Reword and make three levels in rubric
24	Uses scribbles, symbols, or letters to write or represent words or ideas	Reword for simplicity		For simplicity, reviewers suggested rewording to “Uses symbols or letters to write or represent words or ideas.”
25	Shows the ability to count 5 or more objects using one-to-one correspondence	Determine whether five is correct threshold	-	Reword to “Shows the ability to count objects using one-to-one correspondence” and revise three levels in rubric
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)		DIF for ELL study	Define possibly language of response
27	Demonstrates age-appropriate self-help skills (e.g., dressing, toileting, wiping nose, washing hands)	Fits into fine motor skills domain but related to home more than to prior school learning experience	Easiest item	Consider the utility of the item Add other items for physical development and motor skills.

Item		Conceptual Concerns	Statistical Concerns	Recommendation
28	This student's ability to learn appears to be inhibited by: Illness	Does not fit with rest of items, related to learning but not unique to kindergarten readiness	Low discrimination Out-of-range item fit Flagged for fairness review in ELL comparison	Administer for the individual and aggregate data and as a screener but do not include in global scoring Could be a dichotomous variable
29	This student's ability to learn appears to be inhibited by: Fatigue	Does not fit with rest of items, related to learning but not unique to kindergarten readiness	Low discrimination Out-of-range item fit	Administer for the individual and aggregate data and as a screener but do not include in global scoring Could be a dichotomous variable
30	This student's ability to learn appears to be inhibited by: Hunger	Does not fit with rest of items, related to learning but not unique to kindergarten readiness	Low discrimination Out-of-range item fit	Administer for the individual and aggregate data and as a screener but do not include in global scoring Could be a dichotomous variable

Next Steps

Vermont's early childhood stakeholders should consider the above suggestions. If they make any changes, they should pilot the new version and will need to update the Rubric. Vermont AOE should also explore external, concurrent, and predictive validity with measures currently recommended in the field [e.g., The Learning Express (McDermott et al, 2009) for at-risk preschoolers' academic skills and Individualized Classroom Assessment Scoring System (inCLASS; Downer, Booren, Lima, Luckner, & Pianta, 2010) for preschool classroom behavior)]. This step would involve collecting new data during the beginning of the Kindergarten year (concurrent validity) and in first grade and beyond (predictive validity).

Test-retest reliability should be conducted by an independent assessor within a short time frame, preferably within one to two weeks, to reduce confounding factors for any changes in scores.

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Appendix A. KRS Item Stems

KRS items 1–27 are rated *beginning*, *practicing*, and *performing independently*. Items 28–30 are rated *no*, *seldom*, *sometimes*, and *often*.

KRS Item	
1	Plays cooperatively with different children
2	Separates easily from parent/caregiver
3	Uses problem solving skills in social situations
4	Appropriately expresses feelings and needs
5	Adapts to transitions within the school day
6	Interacts positively with adults in the classroom
7	Can persist in a self-directed activity for at least 15 minutes
8	Appears enthusiastic and interested in classroom activities
9	Uses a variety of learning strategies in the classroom
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes
11	Knows when and how to use adults as a resource
12	Initiates activities in classroom
13	Shows curiosity (asks questions, probes, tries new things, etc.)
14	Follows simple classroom rules and instructions with reminders
15	Communicates needs, wants, or thoughts in his/her primary language
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)
17	Understands simple directions, requests, and information
18	Shows awareness of how books are organized and used
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)
20	Recognizes his/her most commonly used name in print
21	Engages in imaginative play
22	Shows ability to discriminate and identify speech sounds
23	Recognizes 10 or more letters of the alphabet
24	Uses scribbles, symbols or letters to write or represent words or ideas
25	Shows the ability to count 5 or more objects using one-to-one correspondence
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)
28	This student's ability to learn appears to be inhibited by: Illness
29	This student's ability to learn appears to be inhibited by: Fatigue
30	This student's ability to learn appears to be inhibited by: Hunger

Appendix B. Alignment Tables

Table BA.1. Alignment of Kindergarten Readiness Survey (KRS) Items to Vermont Early Learning Standards (VELS)

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
I. Approaches to Learning	1. Play	Children engage in play as a means to develop their individual approach to learning.	a. Initiate play with peers that is engaging and long lasting.	1, 12, 21	3	1
			b. Enter into and play cooperatively with other children.			
			c. Choose from a variety of play activities.			
	2. Curiosity and Initiative	Children demonstrate curiosity and a willingness to participate in tasks and challenges.	a. Demonstrate an eagerness and interest in learning through questioning and adding ideas	8, 9, 12, 13	4	1
			b. Initiate questions about people, things, and the world around them.			
			c. Choose to participate in an increasing variety of activities, tasks, and play areas.			
			d. Engage in activities that are new and unfamiliar.			
	3. Persistence	Children demonstrate an increased ability to show initiative, accept help, take risks, and work towards completing tasks.	a. Invest time in an activity and pursue it for a meaningful period of time despite distractions and interruptions	7, 10, 11, 13	4	1
			b. Seek and/or accept help from another child or adult when encountering a problem.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	4. Self-Organization	Children demonstrate an increased ability to establish goals, develop and follow through with plans.	a. Increase their ability to understand a task as a series of steps.	5, 10	2	1
			b. Increase their ability to organize themselves and materials.			
			c. Follow through to complete tasks and activities.			
	5. Reasoning	Children demonstrate an increased ability to identify, evaluate and provide possible solutions to problems.	a. Increase ability to generate several approaches to carry out a task.	9	1	1
			b. Pursue alternative approaches to problem-solving.			
	6. Application	Children use their prior experiences, senses, and knowledge to learn in new ways.	a. Reflect upon events and experiences.	-	-	-
			b. Use prior knowledge to understand new experiences.			
Number of Approaches to Learning Standards Covered						5
Percent of Approaches to Learning Standards Covered						83.3%
II. Social and Emotional Development	1. Play	Children use play as a vehicle to build relationships and to develop an appreciation for their own abilities and accomplishments.	a. Participate in a variety of individual and group play experiences.	1, 3, 4, 9, 12	5	1
			b. Play cooperatively with others by developing rules, solving problems, and dealing with frustrations and limitations.			
			c. Explore and understand new experiences and differences among people.			
			d. Discover unique abilities and preferences through play.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	2. Self Concept	Children demonstrate and express a positive awareness of self and confidence in their capabilities.	a. Identify self according to such things as: gender, ethnicity and family membership. b. Separate from familiar people, places, or things. c. Demonstrate confidence in their range of abilities and express pride in accomplishments.	2, 12	2	1
	3. Self-Control	Children increase their capacity for self-control and for dealing with frustrations, and increase their awareness of their own capabilities.	a. Understand, accept and follow rules and routines within the learning environment. b. Begin to accept the consequences of their behavior. c. Use materials purposefully, respectfully, and safely. d. Effectively manage transitions between activities. e. Progress in expressing feelings, needs and opinions f. Begin to cope with frustration and disappointment.	4, 14, 17	3	1

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	4. Interactions with Others	Children develop successful relationships with other members of their learning community.	a. Play, work and interact easily with one or more children and/or adults. b. Develop friendships with peers. c. Demonstrate empathy and caring for others. d. Develop ability to take turns and to interact without being overly submissive or directive. e. Participate in resolving conflicts and disagreements with others.	1, 6	2	1
	5. Sense of Community	Children increasingly demonstrate a sense of belonging to the classroom/program, family and community.	a. Begin to understand the rights of others. b. Demonstrate a growing understanding and appreciation of the relationships, people and places that make up their communities. c. Participate in the maintenance of the classroom environment. d. Demonstrate progress toward an understanding and valuing of similarities and differences among people, including gender, race, culture, special needs, language and family membership. e. Recognize the needs of others and offer help.	-	-	-
Number of Social Emotional Standards Covered						4
Percent of Social Emotional Standards Covered						80.0%

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
III. Language, Literacy, and Communication	1. Play	Children engage in play as a means to develop their receptive and expressive language skills.	a. Develop and experiment with conversation during daily activities and interactions.	4, 16	2	1
			b. Represent stories and experiences through play.			
			c. Think and talk about play experiences.			
			d. Create play ideas that come from favorite stories, poems, rhymes, songs and conversation.			
			e. Use symbols and forms of early writing to create more complex play.			
	1. Play	Children engage in play as a means to develop early reading and writing skills.	a. Use writing tools and materials in all areas of the learning environment.	24	1	1
	2. Listening and Understanding	Children develop skills in listening and in understanding language.	a. Listen to and understand stories, songs, and poems.	14, 15, 16, 17, 19	5	1
			b. Listen and increasingly understand directions, conversations, and questions.			
			c. Follow directions that involve multiple steps.			
			d. Learn to wait and take turns during conversations.			
			e. Progress in listening and understanding English while maintaining home language.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	3. Speaking and Communicating	Children will use verbal and non-verbal language to express and to communicate information.	a. Communicate needs or thoughts through non-verbal gestures, actions, expressions or words.	4, 15, 16	3	1
			b. Participate in communication around a topic.			
			c. Use more complex and longer sentences.			
			d. Speak clearly enough to be understood by unfamiliar listeners.			
			e. Begin a conversation with other children and adults.			
			f. Understand an increasingly complex and varied vocabulary.			
			g. Progress in communicating and using English while maintaining home language.			
			h. Communicate with familiar and unfamiliar adults and children.			
	4. Vocabulary	Children will acquire and use new words to increase their understanding and express ideas.	a. Increases the number of words understood.	-	-	-
			b. Uses new vocabulary and grammatical constructions.			
			c. Responds appropriately to open-ended questions.			
			d. Chooses words to convey intended messages with increasing detail and specificity.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	5. Early Writing	Children demonstrate an interest in and ability to use symbols to represent words and ideas.	a. Begin to print letters in own name and some other meaningful letters. b. Understand that writing and pictures convey messages. c. Experiment with a variety of writing tools and materials. d. Use scribbles, shapes, letter-like symbols and/or letters to write or represent words or ideas. e. Begin to dictate ideas, sentences, and stories.	24	1	1
	6a. (Early Reading) Phonemic and Phonological Awareness	Learning that language is comprised of distinct sounds and the combination of these sounds; discriminating sound and sound patterns.	a. Show increasing ability to discriminate and identify the sounds of language. b. Demonstrate growing awareness of the beginning sounds of words. c. Show growing ability to hear and discriminate separate syllables in words. d. Begin to associate sounds with words. e. Recognize and generate rhymes.	22	1	1

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	6b. (Early Reading) Book Knowledge and Appreciation	Understanding and appreciating that books and other forms of print have a purpose.	a. Choose to read books for enjoyment without prompting.	19	1	1
			b. Begin to read or tell a story and predict what happens next in stories.			
			c. Listen to and talk about a variety of types of literature.			
			d. Retell parts of a story using props.			
			e. Take care of and handle books in a respectful manner.			
	6c. (Early Reading) Print Awareness and Concepts	Recognizing the association between spoken and written words by following print as it is read aloud.	a. Show curiosity about letters and words.	-	-	-
			b. Explore and investigate books and other forms of print.			
			c. Understand that print carries a message.			
			d. Show an increasing awareness of how books are organized and used.			
			e. Show an interest and recognize some letters and words captured in books and in the environment.			
			f. Recognize own name in print.			
	6d. (Early Reading) Alphabet Knowledge	Recognizing that symbols are associated with letters of the alphabet and that they form words.	a. Know the names of some letters and words.	20, 23	2	1
			b. Identify some letters in print.			
			c. Know the names of most letters in own name.			
Number of Language, Literacy, and Communication Standards Covered						8
Percent of Language, Literacy, and Communication Standards Covered						80.0%

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
IV. Mathematics	1. Play	Children engage in play to develop and add to their mathematical thinking and problem solving.	a. Begin to group and match objects indicating an understanding of same and different	-	-	-
			b. Use counting and number vocabulary as a natural part of play.			
			c. Experiment with patterns and shapes.			
			d. Explore measurement, number, and quantity with various materials.			
	2. Numbers and Operations	Children show interest and curiosity in counting and grouping objects and numbers.	a. Match, sort, put in a series, and regroup objects according to one characteristic.	25	1	1
			b. Begin to use numbers and counting as a means for solving problems and measuring quantity.			
			c. Use one-to-one correspondence in counting objects and matching groups of objects.			
			d. Begin to associate a number of objects with the names and symbols for numbers.			
			e. Use such words as “more than/ less than” and “add/subtract” to express some number concepts.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	3. Geometry and Spatial Sense	Children show an interest in recognizing and creating shapes and an awareness of position in space.	a. Describe and name common shapes found in the natural environment.	26	1	1
			b. Use language to understand the arrangement, order, and position of objects such as: behind, on top of, next to, bottom, underneath, beside, and in front of, etc.			
			c. Group objects according to their shape and size.			
	4. Patterns and Measurement	Children show an interest in recognizing, creating, and predicting patterns; comparing objects; and measuring time and quantity.	a. Group and name a number of similar objects into simple categories.	-	-	-
			b. Begin to understand the concepts of time in terms of past, present, and future.			
			c. Begin to order, compare or describe objects according to size, length, height, and weight using standard or non-standard forms of measurement.			
			d. Place events in a logical sequential order.			
Number of Physical Development and Health Standards Covered						2
Percent of Physical Development and Health Standards Covered						50.0%

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
V. Science	1. Play	Children engage in play as a means to develop their scientific skills.	a. Ask questions based upon discoveries made while playing.	13	1	1
			b. Use play to discover, question, and understand the natural and physical world.			
			c. Use scientific tools as props in their play.			
			d. Investigate different natural habitats.			
	2. Scientific Knowledge	Children learn about the development of the natural and physical worlds, including: Space, Time and Matter; The Living World; The Human Body; The Universe, Earth, and Environment; and Technology.	a. Collect, describe and learn to record information through discussion, drawings and charts.	-	-	-
			b. Use tools and their senses to make observations, gather and record information, and make predictions of what might happen.			
			c. Investigate changes in materials and cause-effect relationships.			
			d. Answer questions through simple investigations.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	3. Scientific Skills and Methods	Children begin to use scientific tools and methods to learn about their world, including design and technology.	a. Explore and describe the natural processes of growing, changing and adapting to the environment.	-	-	-
			b. Make simple observations, predictions, explanations and generalizations based on real life experiences.			
			c. Explore describe time, temperature, and cause-effect relationships based on everyday experiences.			
Number of Science Standards Covered						1
Percent of Science Standards Covered						33.3%
VI. Social Studies	1. Play	Children engage in play as a means to develop an understanding of social studies.	a. Engages in play as a means of discovering and experimenting with their relationship to the environment, other people within the community, and the customs and traditions of people throughout the world and across time.	-	-	-

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	2. Spaces and Geography	Children will demonstrate an understanding of and appreciation for their physical environment.	a. Matches objects to their usual geographic location (e.g., dishes go in the sink, cars go on the street, cows live in the barn).	-	-	-
			b. Begins to create simple representations of their physical environment (e.g., making “maps” of buildings, murals of the neighborhoods, shoebox houses).			
			c. Begins to use words to indicate spatial relationships (e.g., behind, near, far).			
			d. Begins to understand how people can move from place to place.			
			e. Describes different features of the Vermont landscape.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	3. People and How They Live	Children demonstrate skills related to understanding, communication, sharing, cooperation, and participation with others in a community.	a. Begins to understand family structure and roles.	-	-	-
			b. Begins to have an awareness of technology and how it affects us.			
			c. Begins to have awareness of money and how it is used to buy things.			
			d. Describes some jobs and what is required to perform them.			
			e. Begins to understand rules, why they exist, how they are made, and who enforces them.			
			f. Recognizes own characteristics and similarities and differences to others.			
	4. People and Their Environment	Children demonstrate an awareness of and appreciation for people's relationship to the environment.	a. Shows an interest in the environments where they live (e.g., classroom, neighborhoods, play yards, state)	-	-	-
			b. Participates in activities that demonstrate care and respect for their environment.			
			c. Demonstrates an understanding of roles played by people within the community.			
			d. Describes the reciprocal relationship between people and the environment.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	5. People and the Past	Children demonstrate an understanding of past events and their connection to the present and future.	a. Begins to understand that there are different stages of time (e.g., yesterday, today, tomorrow, past, present, future,)	-	-	-
b. Begins to be aware of how we measure time (e.g., clocks, calendars)						
c. Is aware of changes in self and others over time						
d. Describes basic similarities and differences of people’s lives throughout time.						
Number of Social Studies Standards Covered						0
Percent of Social Studies Standards Covered						0.0%
VII. Creative Expression	1. Play	Children engage in play as a means of self expression and creativity.	a. Engage in pretend play using a variety of materials to dramatize stories and experiences.	-	-	-
			b. Use movement, a variety of media, and music to represent stories, moods, and experiences while playing.			
			c. Bring musical instruments and tools from various art forms as props into dramatic play.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	2. Creative Expression	Children engage in individual or group activities that represent real-life experiences, ideas, knowledge, feelings and fantasy.	a. Explore various roles in dramatic play through the use of props, language, and fantasy roles with others.	-	-	-
b. Use movement and a variety of musical styles to express feelings, understand and interpret experiences.						
c. Participate in musical activities using a variety of materials for expression and representation.						
d. Plan and work cooperatively to create drawings, paintings, sculptures, and other art projects.						
e. Demonstrate care and persistence when involved in art projects.						
	3. Tools	Children use a variety of tools and art media to creatively express their ideas.	a. Experiment with different tools to creatively express and present ideas.	-	-	-
b. Select and use a variety of tools to accomplish tasks.						
	4. Appreciation of the Arts	Children express interest in and begin to build a knowledge base in the arts.	a. Begin to understand and to develop a vocabulary to share opinions about artistic creations and experiences.	-	-	-
b. Enjoy participating in a variety of art experiences.						
c. Appreciate and demonstrate respect for the work of others.						
d. Enjoy looking at works of art from different cultures.						
Number of Creative Expression Standards Covered						0
Percent of Creative Expression Standards Covered						0.0%

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
VIII. Physical Development and Health	1. Play	Children engage in play as a means to understand healthy behavior and develop their physical bodies.	a. Participate in games, outdoor play, and other forms of play that enhance physical fitness.	-	-	-
			b. Use their senses to explore materials and experience activities.			
			c. Begin to practice safe and healthy behaviors.			
			d. Initiate activities that challenge their bodies in new ways.			
	2. Gross Motor	Children increasingly move their bodies in ways that demonstrate control, balance, and coordination.	a. Build strength and stamina in movement activities.	-	-	-
			b. Demonstrate body and space awareness to move and stop with control over speed and direction.			
			c. Develop coordination and balance with a variety of playground equipment.			
	3. Fine Motor	Children use their fingers and hands in ways that develop hand-eye coordination, strength, control, and object manipulation.	a. Build strength and stamina to perform fine motor tasks.	-	-	-
			b. Use eye-hand coordination to perform fine motor tasks with a variety of manipulative materials.			
			c. Show increased awareness and control of tools for various learning activities.			

Domain	Goal	Definition	Examples	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	4. Senses	Children increase their understanding of the use of their eyes, ears, fingers, nose, and mouth, and how the senses work together.	a. Discriminate between a variety of sights, smells, sounds, textures, and tastes.	-	-	-
			b. Explore and learn to manage a wide variety of sensory input.			
			c. Combine and use different senses depending on the activity.			
	5. Healthy Habits	Children begin to understand how daily activity and healthy behavior promote overall personal health and safety.	a. Demonstrate safety awareness when purposefully using materials.	27	1	1
			b. Increasingly perform self-care skills independently when eating, dressing, toileting, and washing hands.			
			c. Care for many personal belongings.			
			d. Begin to understand that some foods have more nutritional value than others.			
Number and Percent of Physical Development and Health Standards Covered						1
Number and Percent of Physical Development and Health Standards Covered						20.0%
Number and Percent of Total of all VELS Standards Covered					21	50.0%

Table B.2 Alignment of KRS Items to the Kindergarten Common Core State Standards for English Language Arts

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
Reading: Literature	Key Ideas and Details	1. With prompting and support, ask and answer questions about key details in a text.		11, 13, 19	3	1
		2. With prompting and support, retell familiar stories, including key details.		19	1	1
		3. With prompting and support, identify characters, settings, and major events in a story.				
	Craft and Structure	4. Ask and answer questions about unknown words in a text.		9, 11, 13	3	1
		5. Recognize common types of texts (e.g., storybooks, poems).		18	1	1
		6. With prompting and support, name the author and illustrator of a story and define the role of each in telling the story.		18, 19	2	1
	Integration of Knowledge and ideas	7. With prompting and support, describe the relationship between illustrations and the story in which they appear (e.g., what moment in a story an illustration depicts).		18	1	1

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
		8. (Not applicable to literature)		-		
		9. With prompting and support, compare and contrast the adventures and experiences of characters in familiar stories.				
	Range of Reading and Level of Text Complexity	10. Actively engage in group reading activities with purpose and understanding.		1, 8, 9	3	1
Number of Reading: Literature Standards Covered						7
Percent of Reading: Literature Standards Covered						77.8%
Reading: Informational Text	Key Ideas and Details	1. With prompting and support, ask and answer questions about key details in a text.		19	1	1
		2. With prompting and support, identify the main topic and retell key details of a text.		19	1	1
		3. With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.		19	1	1
	Craft and Structure	4. With prompting and support, ask and answer questions about unknown words in a text.		9, 11, 13	3	1
		5. Identify the front cover, back cover, and title page of a book.		18	1	1

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
		6. Name the author and illustrator of a text and define the role of each in presenting the ideas or information in a text.		18	1	1
	Integration of Knowledge and ideas	7. With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).		18	1	1
		8. With prompting and support, identify the reasons an author gives to support points in a text.		-		
		9. With prompting and support, identify basic similarities in and differences between two texts on the same topic (e.g., in illustrations, descriptions, or procedures).		18	1	1
	Range of Reading and Level of Text Complexity	10. Actively engage in group reading activities with purpose and understanding.		1, 8, 10	3	1
Number of Reading: Informational Text Standards Covered						9
Percent of Reading: Informational Text Standards Covered						90.0%

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
Reading: Foundational Skills	Print Concepts	1. Demonstrate understanding of the organization and basic features of print.		18, 20, 23	3	1
			a. Follow words from left to right, top to bottom, and page by page.	18	1	
			b. Recognize that spoken words are represented in written language by specific sequences of letters.	-		
			c. Understand that words are separated by spaces in print.	-		
			d. Recognize and name all upper- and lowercase letters of the alphabet.	-		
	Phonological Awareness	2. Demonstrate understanding of spoken words, syllables, and sounds (phonemes).		22	1	1
			a. Recognize and produce rhyming words.	-		
			b. Count, pronounce, blend, and segment syllables in spoken words.	-		
			c. Blend and segment onsets and rimes of single-syllable spoken words.	-		

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
			d. Isolate and pronounce the initial, medial vowel, and final sounds (phonemes) in three-phoneme (consonant-vowel-consonant, or CVC) words.* (This does not include CVCs ending with /l/, /r/, or /x/.)	-		
			e. Add or substitute individual sounds (phonemes) in simple, one-syllable words to make new words.	-		
	Phonics and Word Recognition	3. Know and apply grade-level phonics and word analysis skills in decoding words.		22	1	1
			a. Demonstrate basic knowledge of one-to-one letter-sound correspondences by producing the primary sound or many of the most frequent sounds for each consonant.	-		
			b. Associate the long and short sounds with common spellings (graphemes) for the five major vowels.	-		
			c. Read common high-frequency words by sight (e.g., the, of, to, you, she, my, is, are, do, does).	-		

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
			d. Distinguish between similarly spelled words by identifying the sounds of the letters that differ.	-		
		4. Read emergent-reader texts with purpose and understanding.		20, 23	2	1
Number of Reading: Foundational Skills Standards Covered						4
Percentage of Reading: Foundational Skills Standards Covered						100.0%
Writing	Text Types and Purposes	1. Use a combination of drawing, dictating, and writing to compose opinion pieces in which they tell a reader the topic or the name of the book they are writing about and state an opinion or preference about the topic or book (e.g., My favorite book is . . .).		24	1	1
		2. Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.		24	1	1

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
		3. Use a combination of drawing, dictating, and writing to narrate a single event or several loosely linked events, tell about the events in the order in which they occurred, and provide a reaction to what happened.		24	1	1
	Production and Distribution of Writing	4. (Begins in grade 3)				
		5. With guidance and support from adults, respond to questions and suggestions from peers and add details to strengthen writing as needed.		-		
		6. With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.		-		
	Research to Build and Present Knowledge	7. Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).		-		
		8. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.		-		
		9. (Begins in grade 4)				

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	Range of Writing	10. (Begins in grade 3)				
Number of Writing Standards Covered						3
Percentage of Writing Standard Covered						42.9%
Speaking and Listening	Comprehension and Collaboration	1. Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.		16	1	1
			a. Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).	16	1	
			b. Continue a conversation through multiple exchanges.	16	1	
		2. Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.		19	1	1
		3. Ask and answer questions in order to seek help, get information, or clarify something that is not understood.		13	1	1

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
	Presentation of Knowledge and Ideas	4. Describe familiar people, places, things, and events and, with prompting and support, provide additional detail.		-		
		5. Add drawings or other visual displays to descriptions as desired to provide additional detail.		-		
		6. Speak audibly and express thoughts, feelings, and ideas clearly.		15	1	1
Number of Speaking and Listening Standards Covered						4
Percentage of Speaking and Listening Standards Covered						66.7%
Language	Conventions of Standard English	1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.		13, 15, 16, 24	4	1
			a. Print many upper- and lowercase letters.	24	1	
			b. Use frequently occurring nouns and verbs.	-		
			c. Form regular plural nouns orally by adding /s/ or /es/ (e.g., dog, dogs; wish, wishes).	-		
			d. Understand and use question words (interrogatives) (e.g., who, what, where, when, why, how).	13	1	

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
			e. Use the most frequently occurring prepositions (e.g., to, from, in, out, on, off, for, of, by, with).	-		
			f. Produce and expand complete sentences in shared language activities.	15, 16	2	
		2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.		-		
			a. Capitalize the first word in a sentence and the pronoun I.	-		
			b. Recognize and name end punctuation.	-		
			c. Write a letter or letters for most consonant and short-vowel sounds (phonemes).	-		
			d. Spell simple words phonetically, drawing on knowledge of sound-letter relationships.	-		
	Knowledge of Language	3. (Begins in Grade 2)		-		
	Vocabulary Acquisition and Use	4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on kindergarten reading and content.		9	1	1

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
			a. Identify new meanings for familiar words and apply them accurately (e.g., knowing duck is a bird and learning the verb to duck).	-		
			b. Use the most frequently occurring inflections and affixes (e.g., -ed, -s, re-, un-, pre-, -ful, -less) as a clue to the meaning of an unknown word.	-		
		5. With guidance and support from adults, explore word relationships and nuances in word meanings.		9, 11	2	1
			a. Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent.	-		
			b. Demonstrate understanding of frequently occurring verbs and adjectives by relating them to their opposites (antonyms).	-		
			c. Identify real-life connections between words and their use (e.g., note places at school that are colorful).	-		

Strand	College and Career Readiness Anchor Status	Number	Letter	Kindergarten Readiness Survey		
				Item #	# of items aligned	Covered = 1
			d. Distinguish shades of meaning among verbs describing the same general action (e.g., walk, march, strut, prance) by acting out the meanings.	-		
		6. Use words and phrases acquired through conversations, reading and being read to, and responding to texts.		16	1	1
Number of Language Standards Covered						4
Percentage of Language Standards Covered						80.0%
Number and Percent of Total of all Common Core State Kindergarten Standards for English Language Arts & Literacy					31	75.6%

Table B.3 Alignment of KRS items to the Kindergarten Common Core State Standards for Mathematics

Domain	Standard	Cluster		Kindergarten Readiness Survey		
				Item #	# items	Covered = 1
Counting and Cardinality	Know number names and count sequence	1. Count to 100 by ones and by tens.		-		
		2. Count forward beginning from a given number within the known sequence (instead of having to begin at 1).		-		
		3. Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).		-		
	Count to tell the number of objects	4. Understand the relationship between numbers and quantities; connect counting to cardinality.		25	1	1
		a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.		25	1	

			b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.	25	1	
			c. Understand that each successive number name refers to a quantity that is one larger.	-		
		5. Count to answer “how many?” questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.		25	1	1
	Compare Numbers	6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies. (Include groups with up to ten objects)		-		
		7. Compare two numbers between 1 and 10 presented as written numerals.		-		
Number of Counting and Cardinality Standards Covered						2
Percentage of Counting and Cardinality Standards Covered						28.6%

Operations and Algebraic Thinking	Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.	1. Represent addition and subtraction with objects, fingers, mental images, drawings (need not show details but should show the mathematics in the problem), sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.		-		
		2. Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.		-		
		3. Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).		-		
		4. For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.		-		
		5. Fluently add and subtract within 5.		25	1	1
Number of Operations of Algebraic Thinking Standards Covered						1
Percentage of Operations of Algebraic Thinking Standards Covered						20.0%

Number and Operations in Base Ten	Work with numbers 11-19 to gain foundation for place value	1. Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., $18 = 10 + 8$); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.		-		
Number of Numbers and Operations in Base Ten Standards Covered						0
Percentage of Numbers and Operations in Base Ten Standards Covered						0.0%
Measurement and Data	Describe and compare measurable attributes	1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.		-		
	Classify objects and count the number of objects in each category.	2. Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.		-		

		3. Classify objects into given categories; count the numbers of objects in each category and sort the categories by count. (Limit category counts to be less than or equal to 10)		-		
Number of Measurement and Data Standards Covered						0
Percentage of Measurement and Data Standards Covered						0.0%
Geometry	Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).	1. Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.		26	1	100.0%
		2. Correctly name shapes regardless of their orientations or overall size.		26	1	1
		3. Identify shapes as two-dimensional (lying in a plane, “flat”) or three-dimensional (“solid”).		-		

	Analyze, compare, create, and compose shapes.	4. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/“corners”) and other attributes (e.g., having sides of equal length).		-		
		5. Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.		-		
		6. Compose simple shapes to form larger shapes. For example, “Can you join these two triangles with full sides touching to make a rectangle?”		-		
Number of Geometry Standards Covered						2
Percentage of Geometry Standards Covered						33.3%
Number and Percent of Total of all Common Core State Standards for Mathematics - Kindergarten					5	22.7%

Table B.4 Cross walk alignment of VELs and Common Core State Standards to the KRS

		Vermont Early Learning Standards					Common Core State Standards for English Language & Literacy										Common Core State Standards for Mathematics		
KRS Item		Domain.Goal				Total	Strand.Number								Total	Domain. Cluster			Total
1	Plays cooperatively with different children	ATL.1	SED.1	SED.4		3	Lit.10	Info.10							2				0
2	Separates easily from parent/caregiver	SED.2				1									0				0
3	Uses problem solving skills in social situations	SED.1				1									0				0
4	Appropriately expresses feelings and needs	SED.1	SED.3	LLC.1a	LLC.3	4									0				0
5	Adapts to transitions within the school day	ATL.4				1									0				0
6	Interacts positively with adults in the classroom	SED.4				1									0				0
7	Can persist in a self-directed activity for at least 15 minutes	ATL.3				1									0				0
8	Appears enthusiastic and interested in classroom activities	ATL.2				1	Lit.10	Info.10							2				0
9	Uses a variety of learning strategies in the classroom	ATL.2	ATL.5	SED.1		3	Lit.4	Lit.10	Info.4	Lang.4	Lang.5				5				0
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes	ATL.3	ATL.4			2	Info.10								1				0
11	Knows when and how to use adults as a resource	ATL.3				1	Lit.1	Lit.4	Info.4	Lang.5					4				0
12	Initiates activities in classroom	ATL.1	ATL.2	SED.1	SED.2	4									0				0
13	Shows curiosity (asks questions, probes, tries new things, etc.)	ATL.2	ATL.3	Sci.1		3	Lit.1	Lit.4	Info.4	SLS.3	Lang.1				5				0
14	Follows simple classroom rules and instructions with reminders	SED.3	LLC.2			2									0				0
15	Communicates needs, wants, or thoughts in his/her primary language	LLC.2	LLC.3			2	SLS.6	Lang.1							2				0

		Vermont Early Learning Standards				Common Core State Standards for English Language & Literacy										Common Core State Standards for Mathematics				
KRS Item		Domain.Goal			Total	Strand.Number										Total	Domain. Cluster			Total
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	LLC.1a	LLC.2	LLC.3		3	SLS.1	Lang.1	Lang.6						3				0	
17	Understands simple directions, requests, and information	SED.3	LLC.2			2									0				0	
18	Shows awareness of how books are organized and used					0	Lit.5	Lit.6	Lit.7	Info.5	Info.6	Info.7	Info.9	Print.1	8				0	
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)	LLC.2	LLC.6b			2	Lit.1	Lit.2	Lit.6	Info.1	Info.2	Info.3	SLS.2		7				0	
20	Recognizes his/her most commonly used name in print	LLC.6d				1	Print.1	Print.4							2				0	
21	Engages in imaginative play	ATL.1				1									0				0	
22	Shows ability to discriminate and identify speech sounds	LLC.6a				1	Phono.2	Phono.3							2				0	
23	Recognizes 10 or more letters of the alphabet	LLC.6d				1	Print.1	Print.4							2				0	
24	Uses scribbles, symbols or letters to write or represent words or ideas	LLC.1b	LLC.5			2	Wrtg.1	Wrtg.2	Wrtg.3	Lang.1					4				0	
25	Shows the ability to count 5 or more objects using one-to-one correspondence	Math.2				1									0	Count.4	Count.5	Oper.5	3	
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)	Math.3				1									0	Geo.1	Geo.2		2	
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)	Phys.5				1									0				0	
28	This student's ability to learn appears to be inhibited by: Illness					0									0				0	
29	This student's ability to learn appears to be inhibited by: Fatigue					0									0				0	
30	This student's ability to learn appears to be inhibited by: Hunger					0									0				0	

Table B.5 Key to Abbreviations in Crosswalk Table A.4

Abbreviation	Standard/Section
Vermont Early Learning Standards	
ATL	Approaches to Learning
SED	Social and Emotional Development
LLC	Language, Literacy, and Communication
Sci	Science
Math	Mathematics
PD	Physical Development and Health
Common Core State Standards for English Language & Literacy	
Lit	Reading: Literature
Info	Reading: Informational Text
Print	Reading: Foundational Skills (Print Concepts)
Phono	Reading: Foundational Skills (Phonological Awareness)
Writing	Writing
SLS	Speaking and Listening
Lang	Language
Common Core State Standards for Mathematics	
Count	Counting and Cardinality
OAT	Operations and Algebraic Thinking
Geo	Geometry

Appendix C. Psychometric Analysis Figure and Tables

Figure C.1. Item-Person map for all 30 items

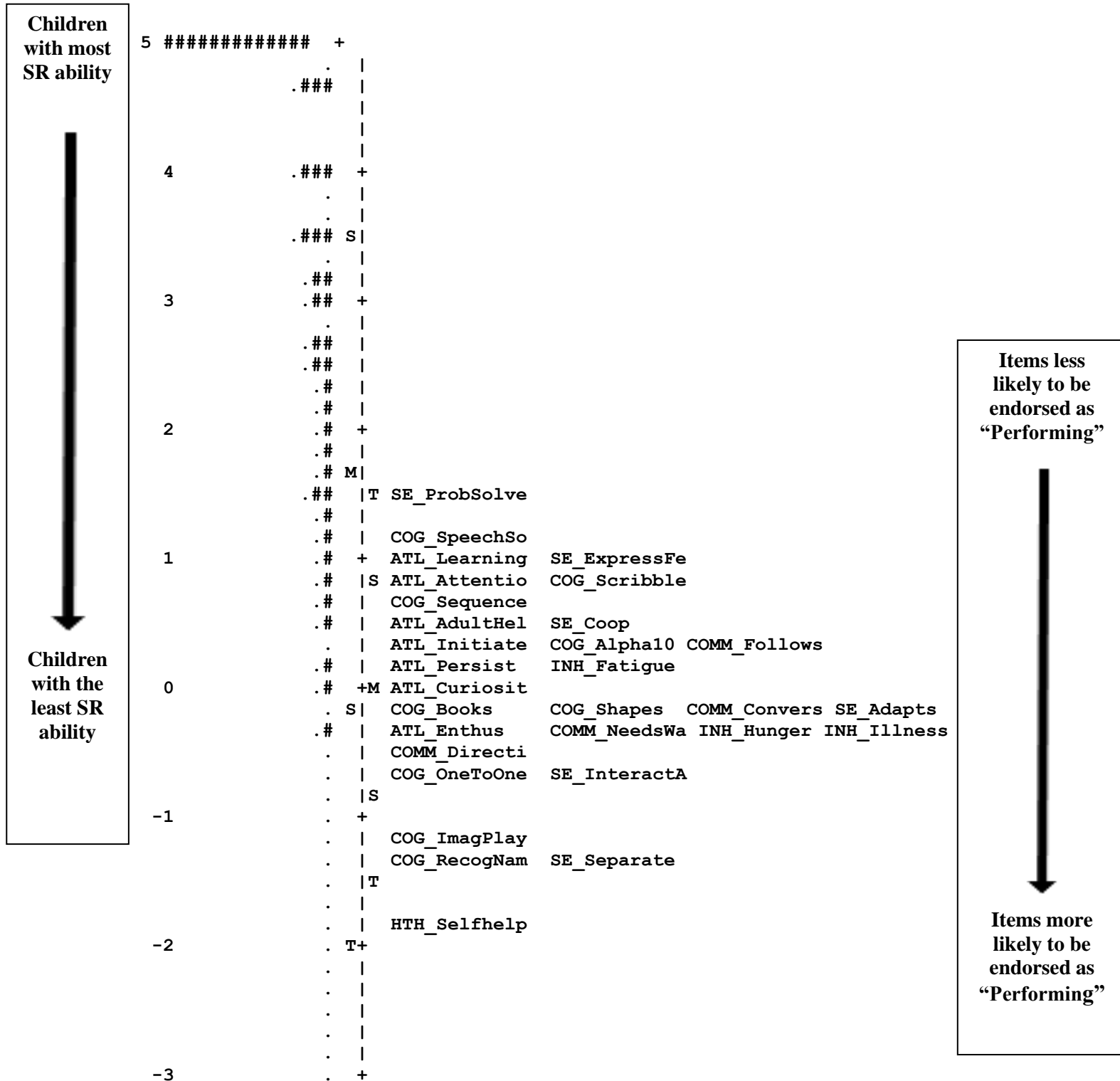


Table C.1 Item properties for the full 30 item scale using the Partial Credit IRT model

Item		<i>a</i>	SE	<i>b1</i>	SE	<i>b2</i>	SE	<i>b3</i>	SE
1	Plays cooperatively with different children	1.29	0.02	-1.50	0.02	-0.31	0.01	--	--
2	Separates easily from parent/caregiver	0.48	0.01	-2.03	0.05	-2.28	0.06	--	--
3	Uses problem solving skills in social situations	1.70	0.03	-1.11	0.01	0.19	0.01	--	--
4	Appropriately expresses feelings and needs	1.54	0.03	-1.20	0.02	-0.10	0.01	--	--
5	Adapts to transitions within the school day	1.49	0.03	-1.53	0.02	-0.62	0.01	--	--
6	Interacts positively with adults in the classroom	1.35	0.03	-1.84	0.02	-0.80	0.02	--	--
7	Can persist in a self-directed activity for at least 15 minutes	1.76	0.03	-1.34	0.02	-0.49	0.01	--	--
8	Appears enthusiastic and interested in classroom activities	1.83	0.04	-1.58	0.02	-0.65	0.01	--	--
9	Uses a variety of learning strategies in the classroom	2.29	0.04	-1.12	0.01	-0.09	0.01	--	--
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes	1.81	0.03	-1.11	0.01	-0.20	0.01	--	--
11	Knows when and how to use adults as a resource	2.04	0.04	-1.33	0.02	-0.27	0.01	--	--
12	Initiates activities in classroom	1.84	0.03	-1.32	0.02	-0.42	0.01	--	--
13	Shows curiosity (asks questions, probes, tries new things, etc.)	1.75	0.03	-1.43	0.02	-0.49	0.01	--	--
14	Follows simple classroom rules and instructions with reminders	1.56	0.03	-1.37	0.02	-0.37	0.01	--	--
15	Communicates needs, wants, or thoughts in his/her primary language	1.73	0.04	-1.53	0.02	-0.71	0.01	--	--
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	2.09	0.04	-1.43	0.02	-0.59	0.01	--	--
17	Understands simple directions, requests, and information	2.16	0.05	-1.51	0.02	-0.67	0.01	--	--
18	Shows awareness of how books are organized and used	1.58	0.03	-1.49	0.02	-0.65	0.01	--	--
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)	1.64	0.03	-1.27	0.02	-0.27	0.01	--	--
20	Recognizes his/her most commonly used name in print	1.28	0.03	-1.67	0.02	-1.25	0.02	--	--
21	Engages in imaginative play	1.37	0.03	-1.80	0.02	-1.04	0.02	--	--

Item		<i>a</i>	SE	<i>b1</i>	SE	<i>b2</i>	SE	<i>b3</i>	SE
22	Shows ability to discriminate and identify speech sounds	1.13	0.02	-0.99	0.02	-0.22	0.01	--	--
23	Recognizes 10 or more letters of the alphabet	0.90	0.02	-0.88	0.02	-0.98	0.02	--	--
24	Uses scribbles, symbols or letters to write or represent words or ideas	1.13	0.02	-1.00	0.02	-0.45	0.02	--	--
25	Shows the ability to count 5 or more objects using one-to-one correspondence	1.28	0.03	-1.40	0.02	-1.06	0.02	--	--
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)	1.02	0.02	-1.40	0.02	-0.82	0.02	--	--
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)	0.98	0.03	-2.06	0.03	-1.60	0.03	--	--
28	This student's ability to learn appears to be inhibited by: Illness	0.17	0.01	-1.89	0.20	-0.95	0.18	-10.22	0.49
29	This student's ability to learn appears to be inhibited by: Fatigue	0.23	0.01	-2.73	0.12	0.35	0.11	-6.46	0.23
30	This student's ability to learn appears to be inhibited by: Hunger	0.19	0.01	-1.33	0.18	-0.55	0.17	-9.63	0.44

Note: The *a* represents the discrimination parameter, *b1* represents the likelihood of rating 1 over a 0, *b2* represents the likelihood of rating 2 over a 1, and for items 28-30, *b3* represents the likelihood of rating 3 over a 2. SE = Standard Error

Table C.2 Item properties without items 2 and 28-30 using the Partial Credit IRT model

Item		<i>a</i>	SE	<i>b1</i>	SE	<i>b2</i>	SE
1	Plays cooperatively with different children	1.29	0.02	-1.51	0.02	-0.31	0.01
2	Separates easily from parent/caregiver	--	--	--	--	--	--
3	Uses problem solving skills in social situations	1.69	0.03	-1.12	0.01	0.19	0.01
4	Appropriately expresses feelings and needs	1.53	0.03	-1.21	0.02	-0.10	0.01
5	Adapts to transitions within the school day	1.49	0.03	-1.54	0.02	-0.63	0.01
6	Interacts positively with adults in the classroom	1.42	0.03	-1.86	0.02	-0.79	0.01
7	Can persist in a self-directed activity for at least 15 minutes	1.77	0.03	-1.35	0.02	-0.49	0.01
8	Appears enthusiastic and interested in classroom activities	1.86	0.03	-1.59	0.02	-0.65	0.01
9	Uses a variety of learning strategies in the classroom	2.34	0.04	-1.13	0.01	-0.09	0.01
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes	1.81	0.03	-1.11	0.01	-0.20	0.01
11	Knows when and how to use adults as a resource	2.10	0.04	-1.34	0.02	-0.27	0.01
12	Initiates activities in classroom	1.88	0.03	-1.33	0.02	-0.42	0.01
13	Shows curiosity (asks questions, probes, tries new things, etc.)	1.84	0.03	-1.44	0.02	-0.49	0.01
14	Follows simple classroom rules and instructions with reminders	1.56	0.03	-1.38	0.02	-0.37	0.01
15	Communicates needs, wants, or thoughts in his/her primary language	1.77	0.04	-1.55	0.02	-0.71	0.01
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	2.14	0.04	-1.44	0.02	-0.59	0.01
17	Understands simple directions, requests, and information	2.31	0.04	-1.52	0.02	-0.66	0.01
18	Shows awareness of how books are organized and used	1.61	0.03	-1.49	0.02	-0.65	0.01
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)	1.68	0.03	-1.28	0.02	-0.27	0.01
20	Recognizes his/her most commonly used name in print	1.31	0.03	-1.68	0.02	-1.24	0.02

Item		<i>a</i>	SE	<i>b1</i>	SE	<i>b2</i>	SE
21	Engages in imaginative play	1.50	0.03	-1.85	0.02	-1.01	0.02
22	Shows ability to discriminate and identify speech sounds	1.15	0.02	-1.00	0.02	-0.22	0.01
23	Recognizes 10 or more letters of the alphabet	0.92	0.02	-0.89	0.02	-0.97	0.02
24	Uses scribbles, symbols or letters to write or represent words or ideas	1.15	0.02	-1.01	0.02	-0.44	0.01
25	Shows the ability to count 5 or more objects using one-to-one correspondence	1.33	0.03	-1.41	0.02	-1.04	0.02
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)	1.29	0.03	-1.53	0.02	-0.74	0.01
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)	1.05	0.03	-2.11	0.03	-1.54	0.03
28	This student's ability to learn appears to be inhibited by: Illness	--	--	--	--	--	--
29	This student's ability to learn appears to be inhibited by: Fatigue	--	--	--	--	--	--
30	This student's ability to learn appears to be inhibited by: Hunger	--	--	--	--	--	--

Note: The *a* represents the discrimination parameter, *b1* represents the likelihood of rating 1 over a 0, *b2* represents the likelihood of rating 2 over a 1, and for items 28-30, *b3* represents the likelihood of rating 3 over a 2. SE = Standard Error

Table C.3 Item properties without items 2 and 28-30 using the Partial Credit IRT model

Item		<i>a</i>	SE	<i>b1</i>	SE	<i>b2</i>	SE
1	Plays cooperatively with different children	1.30	0.02	-1.51	0.02	-0.31	0.01
2	Separates easily from parent/caregiver	0.55	0.01	-2.45	0.06	-2.04	0.05
3	Uses problem solving skills in social situations	1.70	0.03	-1.12	0.01	0.19	0.01
4	Appropriately expresses feelings and needs	1.54	0.03	-1.20	0.02	-0.10	0.01
5	Adapts to transitions within the school day	1.51	0.03	-1.53	0.02	-0.62	0.01
6	Interacts positively with adults in the classroom	1.43	0.03	-1.85	0.02	-0.79	0.01
7	Can persist in a self-directed activity for at least 15 minutes	1.77	0.03	-1.35	0.02	-0.49	0.01
8	Appears enthusiastic and interested in classroom activities	1.87	0.03	-1.59	0.02	-0.65	0.01
9	Uses a variety of learning strategies in the classroom	2.34	0.04	-1.13	0.01	-0.09	0.01
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes	1.80	0.03	-1.11	0.01	-0.20	0.01
11	Knows when and how to use adults as a resource	2.10	0.04	-1.34	0.02	-0.27	0.01
12	Initiates activities in classroom	1.89	0.03	-1.33	0.02	-0.42	0.01
13	Shows curiosity (asks questions, probes, tries new things, etc.)	1.84	0.03	-1.43	0.02	-0.49	0.01
14	Follows simple classroom rules and instructions with reminders	1.55	0.03	-1.38	0.02	-0.37	0.01
15	Communicates needs, wants, or thoughts in his/her primary language	1.78	0.04	-1.54	0.02	-0.71	0.01
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	2.14	0.04	-1.43	0.02	-0.59	0.01
17	Understands simple directions, requests, and information	2.31	0.05	-1.52	0.02	-0.66	0.01
18	Shows awareness of how books are organized and used	1.61	0.03	-1.49	0.02	-0.65	0.01
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)	1.67	0.03	-1.28	0.02	-0.27	0.01
20	Recognizes his/her most commonly used name in print	1.31	0.03	-1.68	0.02	-1.24	0.02

Item		<i>a</i>	SE	<i>b1</i>	SE	<i>b2</i>	SE
21	Engages in imaginative play	1.50	0.03	-1.85	0.02	-1.01	0.02
22	Shows ability to discriminate and identify speech sounds	1.15	0.02	-1.00	0.02	-0.22	0.01
23	Recognizes 10 or more letters of the alphabet	0.92	0.02	-0.89	0.02	-0.97	0.02
24	Uses scribbles, symbols or letters to write or represent words or ideas	1.15	0.02	-1.01	0.02	-0.44	0.02
25	Shows the ability to count 5 or more objects using one-to-one correspondence	1.33	0.03	-1.41	0.02	-1.04	0.02
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)	1.29	0.03	-1.53	0.02	-0.74	0.02
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)	1.05	0.03	-2.11	0.03	-1.54	0.03
28	This student's ability to learn appears to be inhibited by: Illness	--	--	--	--	--	--
29	This student's ability to learn appears to be inhibited by: Fatigue	--	--	--	--	--	--
30	This student's ability to learn appears to be inhibited by: Hunger	--	--	--	--	--	--

Note: The *a* represents the discrimination parameter, *b1* represents the likelihood of rating 1 over a 0, *b2* represents the likelihood of rating 2 over a 1, and for items 28-30, *b3* represents the likelihood of rating 3 over a 2. SE = Standard Error

Appendix D. Fairness Review Tables

Table D.1 DIF Statistics for English Language Learner Comparison

Item		MH- LOR	LOR SE	LOR z
1	Plays cooperatively with different children	0.31	0.19	1.67
2	Separates easily from parent/caregiver	0.53	0.25	2.13
3	Uses problem solving skills in social situations	0.38	0.18	2.05
4	Appropriately expresses feelings and needs	0.10	0.18	0.58
5	Adapts to transitions within the school day	0.69	0.21	3.26
6	Interacts positively with adults in the classroom	0.24	0.21	1.12
7	Can persist in a self-directed activity for at least 15 minutes	0.38	0.20	1.91
8	Appears enthusiastic and interested in classroom activities	0.46	0.23	2.00
9	Uses a variety of learning strategies in the classroom	0.27	0.21	1.25
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes	0.07	0.20	0.35
11	Knows when and how to use adults as a resource	-0.12	0.20	-0.63
12	Initiates activities in classroom	-0.42	0.20	-2.16
13	Shows curiosity (asks questions, probes, tries new things, etc.)	-0.19	0.20	-0.98
14	Follows simple classroom rules and instructions with reminders	0.10	0.19	0.49
15	Communicates needs, wants, or thoughts in his/her primary language	-0.97	0.21	-4.68
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	-1.27	0.22	-5.88
17	Understands simple directions, requests, and information	-0.65	0.22	-2.98
18	Shows awareness of how books are organized and used	-0.26	0.21	-1.20
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)	-0.82	0.20	-4.03
20	Recognizes his/her most commonly used name in print	0.44	0.26	1.68
21	Engages in imaginative play	-0.29	0.22	-1.33
22	Shows ability to discriminate and identify speech sounds	-0.03	0.18	-0.15
23	Recognizes 10 or more letters of the alphabet	-0.11	0.20	-0.54

Item		MH- LOR	LOR SE	LOR z
24	Uses scribbles, symbols or letters to write or represent words or ideas	0.74	0.20	3.69
25	Shows the ability to count 5 or more objects using one-to-one correspondence	0.04	0.22	0.19
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)	-0.73	0.20	-3.71
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)	-0.11	0.26	-0.42
28	This student's ability to learn appears to be inhibited by: Illness	0.77	0.29	2.64
29	This student's ability to learn appears to be inhibited by: Fatigue	0.62	0.24	2.63
30	This student's ability to learn appears to be inhibited by: Hunger	-0.16	0.32	-0.51

Note: MH-LOR = Mantel Haenzel log odds ratio, the measure of the DIF effect size; LOR SE = Standard error of the DIF effect size; LOR z = the statistical significance where greater than 1.96 is $p < .05$

Table D.2 DIF Statistics for Special Education Comparison

	tem	MH- LOR	LOR SE	LOR Z
1	Plays cooperatively with different children	0.22	0.08	2.60
2	Separates easily from parent/caregiver	0.70	0.11	6.58
3	Uses problem solving skills in social situations	0.02	0.09	0.21
4	Appropriately expresses feelings and needs	-0.10	0.08	-1.21
5	Adapts to transitions within the school day	-0.03	0.09	-0.28
6	Interacts positively with adults in the classroom	0.37	0.10	3.84
7	Can persist in a self-directed activity for at least 15 minutes	0.01	0.09	0.12
8	Appears enthusiastic and interested in classroom activities	0.34	0.09	3.56
9	Uses a variety of learning strategies in the classroom	-0.02	0.09	-0.17
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes	0.03	0.09	0.35
11	Knows when and how to use adults as a resource	0.14	0.09	1.57
12	Initiates activities in classroom	0.26	0.09	2.93
13	Shows curiosity (asks questions, probes, tries new things, etc.)	0.20	0.09	2.19
14	Follows simple classroom rules and instructions with reminders	0.35	0.09	3.88
15	Communicates needs, wants, or thoughts in his/her primary language	-0.45	0.09	-4.94
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	-0.89	0.10	-9.25
17	Understands simple directions, requests, and information	-0.05	0.10	-0.47
18	Shows awareness of how books are organized and used	0.21	0.09	2.27
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)	-0.45	0.09	-5.17
20	Recognizes his/her most commonly used name in print	0.14	0.11	1.32
21	Engages in imaginative play	0.01	0.10	0.09
22	Shows ability to discriminate and identify speech sounds	-0.45	0.08	-5.63
23	Recognizes 10 or more letters of the alphabet	-0.12	0.09	-1.46
24	Uses scribbles, symbols or letters to write or represent words or ideas	0.05	0.08	0.60
25	Shows the ability to count 5 or more objects using one-to-one correspondence	-0.12	0.10	-1.23
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)	-0.03	0.09	-0.34

tem		MH- LOR	LOR SE	LOR Z
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)	-0.48	0.11	-4.35
28	This student's ability to learn appears to be inhibited by: Illness	-0.07	0.12	-0.60
29	This student's ability to learn appears to be inhibited by: Fatigue	0.21	0.10	2.21
30	This student's ability to learn appears to be inhibited by: Hunger	0.05	0.13	0.38

Note: MH-LOR = Mantel Haenzel log odds ratio, the measure of the DIF effect size; LOR SE = Standard error of the DIF effect size; LOR z = the statistical significance where greater than 1.96 is $p < .05$

Table CD.3 DIF Statistics for Attended Prekindergarten or Did Not Attend Prekindergarten Comparison

Item		MH- LOR	LOR SE	LOR Z
1	Plays cooperatively with different children	-0.34	0.05	-6.32
2	Separates easily from parent/caregiver	0.00	0.06	0.00
3	Uses problem solving skills in social situations	-0.24	0.06	-4.40
4	Appropriately expresses feelings and needs	-0.37	0.06	-6.66
5	Adapts to transitions within the school day	-0.40	0.06	-6.73
6	Interacts positively with adults in the classroom	-0.41	0.06	-6.57
7	Can persist in a self-directed activity for at least 15 minutes	-0.14	0.06	-2.35
8	Appears enthusiastic and interested in classroom activities	-0.29	0.06	-4.66
9	Uses a variety of learning strategies in the classroom	-0.05	0.06	-0.81
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes	-0.31	0.06	-5.35
11	Knows when and how to use adults as a resource	-0.31	0.06	-5.27
12	Initiates activities in classroom	0.08	0.06	1.29
13	Shows curiosity (asks questions, probes, tries new things, etc.)	-0.03	0.06	-0.58
14	Follows simple classroom rules and instructions with reminders	-0.34	0.06	-6.09
15	Communicates needs, wants, or thoughts in his/her primary language	-0.09	0.06	-1.40
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	-0.10	0.06	-1.65
17	Understands simple directions, requests, and information	0.02	0.07	0.33
18	Shows awareness of how books are organized and used	0.41	0.06	6.97
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)	0.15	0.06	2.71
20	Recognizes his/her most commonly used name in print	0.67	0.07	9.97
21	Engages in imaginative play	0.10	0.07	1.49
22	Shows ability to discriminate and identify speech sounds	0.15	0.05	2.85
23	Recognizes 10 or more letters of the alphabet	0.62	0.05	11.52
24	Uses scribbles, symbols or letters to write or represent words or ideas	0.35	0.05	6.43
25	Shows the ability to count 5 or more objects using one-to-one correspondence	0.54	0.06	8.64
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)	0.51	0.06	8.74

Item		MH- LOR	LOR SE	LOR Z
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)	-0.23	0.07	-3.14
28	This student's ability to learn appears to be inhibited by: Illness	-0.03	0.08	-0.33
29	This student's ability to learn appears to be inhibited by: Fatigue	-0.10	0.06	-1.68
30	This student's ability to learn appears to be inhibited by: Hunger	-0.08	0.08	-0.94

Note: MH-LOR = Mantel Haenzel log odds ratio, the measure of the DIF effect size; LOR SE = Standard error of the DIF effect size; LOR z = the statistical significance where greater than 1.96 is $p < .05$

Table D.4 DIF Statistics for Gender Comparison

Item		MH- LOR	LOR SE	LOR Z
1	Plays cooperatively with different children	0.17	0.04	4.46
2	Separates easily from parent/caregiver	-0.38	0.05	-8.13
3	Uses problem solving skills in social situations	0.11	0.04	2.75
4	Appropriately expresses feelings and needs	0.05	0.04	1.33
5	Adapts to transitions within the school day	0.29	0.05	6.47
6	Interacts positively with adults in the classroom	0.12	0.05	2.54
7	Can persist in a self-directed activity for at least 15 minutes	0.32	0.04	7.23
8	Appears enthusiastic and interested in classroom activities	0.07	0.05	1.57
9	Uses a variety of learning strategies in the classroom	-0.03	0.04	-0.72
10	Is able to pay attention during teacher-directed group activities for approximately 15 minutes	0.41	0.04	9.64
11	Knows when and how to use adults as a resource	-0.03	0.04	-0.70
12	Initiates activities in classroom	-0.23	0.04	-5.27
13	Shows curiosity (asks questions, probes, tries new things, etc.)	-0.53	0.05	-11.84
14	Follows simple classroom rules and instructions with reminders	0.62	0.04	14.69
15	Communicates needs, wants, or thoughts in his/her primary language	0.00	0.05	0.02
16	Engages in conversation (e.g. complete sentences, turn-taking etc.)	0.00	0.05	0.04
17	Understands simple directions, requests, and information	0.05	0.05	1.00
18	Shows awareness of how books are organized and used	-0.12	0.05	-2.73
19	Can recall and explain a sequence of events (e.g. can tell about a recent activity, can retell a story)	-0.26	0.04	-6.42
20	Recognizes his/her most commonly used name in print	-0.06	0.06	-1.09
21	Engages in imaginative play	0.17	0.05	3.41
22	Shows ability to discriminate and identify speech sounds	-0.07	0.04	-1.71
23	Recognizes 10 or more letters of the alphabet	0.00	0.04	0.02
24	Uses scribbles, symbols or letters to write or represent words or ideas	0.17	0.04	4.20
25	Shows the ability to count 5 or more objects using one-to-one correspondence	-0.41	0.05	-8.10
26	Can identify several basic geometric shapes (e.g. circle, square, rectangle, triangle)	-0.41	0.04	-9.30

	Item	MH- LOR	LOR SE	LOR Z
27	Demonstrates age appropriate self-help skills (e.g. dressing, toileting, wiping nose, washing hands)	0.19	0.06	3.38
28	This student's ability to learn appears to be inhibited by: Illness	-0.20	0.06	-3.52
29	This student's ability to learn appears to be inhibited by: Fatigue	-0.10	0.05	-2.02
30	This student's ability to learn appears to be inhibited by: Hunger	-0.05	0.06	-0.70

Note: MH-LOR = Mantel Haenzel log odds ratio, the measure of the DIF effect size; LOR SE = Standard error of the DIF effect size; LOR z = the statistical significance where greater than 1.96 is $p < .05$

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