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RESEARCH IN MATHEMATICS EDUCATION

Spatial Reasoning (SR): Teacher Survey Development and Administration

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Spatial Reasoning (SR): Teacher Survey Development and Administration

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Executive Summary

The purpose of this technical report is to describe the survey, data collection efforts, and results of the Spatial Reasoning Teacher Survey. We asked survey respondents a series of questions related to classroom instruction on specific spatial reasoning skills as part of the spatial reasoning learning progression that researchers proposed. Questions asked about clarity of the skills, frequency taught (or not taught), importance as a focus of instruction (or as review), and the developmental appropriateness of the skill for the grade they teach. We deployed the survey twice due to a lack of sufficient sample after the first deployment and due to the Covid-19 pandemic. In the first deployment, we surveyed 95 K-3 teachers in the two targeted learning goals of the Spatial Reasoning learning progression (i.e., Within Objects Spatial Reasoning, and Between Objects Spatial Reasoning). In the second deployment, we surveyed 189 teachers. Results from this survey contributed to the development and refinement of the Spatial Reasoning Learning Progression (see Spatial Reasoning: Learning Progressions Development Technical Report, Perry et al., 2020).

Table of Contents

Introduction 1

Purpose of the Report 1

Method 2

- Description of the Survey 2
- Data Collection Efforts 3
- Inclusion Criteria 4
- Participants 5
- Analyses 8

Results 8

Next Steps 35

References 36

Appendix A – Spatial Reasoning Teacher Survey 37

Appendix B – Additional Figures for Time of Year by Focus 45

Appendix C – Developmental Appropriateness ANOVA Tables 61

Spatial Reasoning (SR): Teacher Survey Development and Administration

Introduction

The Measuring Mathematical Reasoning Skills (MMaRS) project is a National Science Foundation (NSF) funded project to develop learning progressions and assessments for Numerical Relational Reasoning and Spatial Reasoning for students in Grades K-2. For the MMaRS project, researchers constructed two surveys of elementary teachers to learn how educators prioritize various skills related to Numerical Relational Reasoning and Spatial Reasoning. We developed both surveys targeting educators working with students in kindergarten, first, second, and third grades. This report is about the Spatial Reasoning Teacher Survey. For a description of the Numeric Relational Reasoning Survey, see Sparks et al. (2020a).

For the Spatial Reasoning component, researchers created 32 skill statements (subcomponents) in two different targeted learning goals (Reasoning Spatially Within Objects = 16; Reasoning Spatially Between Objects = 16). Researchers embedded these subcomponents within three core concepts for reasoning spatially within objects (Shape = 4; Transformation = 5; Composition/Decomposition = 7) and three core concepts for reasoning spatially between objects (Spatial Language = 3; Understanding Models and Maps = 8; Perspective Thinking = 5). These are skills the mathematics community and experts in early mathematics instruction have deemed necessary to understand spatial reasoning. A description of the development of the spatial reasoning learning progression can be found in the Spatial Reasoning Development technical report (Perry et al., 2020).

Purpose of the Report

The purpose of this report is to describe the survey, data collection efforts, and results. Our overall research questions for the MMaRS project are listed below. The connection between the research questions and the results presented here will be addressed in future manuscripts or technical reports.

RQ 1: Developmental Appropriateness

- 1.1 Do the entry and exit KSAs align with teachers' expectations of pre-requisite and target skills?
- 1.2 Does teachers' frequency of teaching KSA align with progression?
- 1.3 Does student performance and engagement indicate floor or ceiling effects that align with entry and exit KSAs?

RQ 2: Ordering

- 2.1 Are teachers' perceptions of the appropriateness aligned with the hypothesized order?
- 2.2 Do students demonstrate increasingly sophisticated reasoning aligned with the hypothesized ordering?
- 2.3 Do students appear comfortable with tasks and task elements?

RQ 3: Conceptions

3.1 Do students demonstrate reasoning that is consistent with the hypothesized conceptions?

3.2 What misconceptions and/or errors do students make? Is there a pattern leading to greater competence?

RQ 4: Interconnectedness

4.1 In what ways are students' KSAs interconnected?

4.2 In what ways does prior KSAs impact students' responding?

Method

In this section, we describe the survey, data collection efforts, inclusion criteria, and analysis plan of the teacher survey data.

Description of the Survey

We built the survey in Qualtrics (Qualtrics, 2018) and modeled the survey after the Numeric Relational Reasoning (NRR) Survey with some modifications and additions designed to increase clarity of teachers' responses. For example, instead of asking teachers to rank order concepts that they spent the most time teaching, we asked them to simply state "Taught" or "Not Taught" for a given concept. Also, instead of asking one question about "When during the school year do you teach this topic?", we asked them three questions about how frequently they teach the topic in the Fall, Winter, Spring, or not taught and whether or not it was a focus of their instruction. Also, in an effort to confirm skills as bridging, foundational, or target, we included a question asking if, when taught, the topic is primarily a review from the previous grade, a focal skill for the grade that they teach, or a foundational skill for the next grade level.

In the Spatial Reasoning survey, along with some demographic questions, teachers answered questions related to their instruction with Spatial Reasoning, amount of time and focus of their instruction, and the importance of specific skills that are associated with spatial reasoning. We compiled all 32 skills statements together in the survey and asked elementary teachers if they understood the statement, if and when they incorporated those skills in their instruction, if those skills were a focus in their teaching, and if they considered the skills to be developmentally appropriate. This survey was selected response, rating scale, and short answer questions, and was intended to take approximately 20 minutes for teachers to complete. Results from the analysis of the survey data are intended to help researchers decide the importance and the priority of the specific skills related to spatial reasoning.

There was a block of initial questions that every educator saw and included questions about eligibility to take the survey, a consent question, some general demographic questions, and some questions about math concepts and use of manipulatives. The eligibility question asked respondents to verify that they work with students in grades kindergarten, first, second, or third. Next, was a page about consent that informed the respondents about how their answers would be

used and kept confidential, allowing them to opt out of the survey, or agree to participate. Then, there were twelve demographic questions designed to understand the sample of respondents by asking about their level of education, their title or position, which grades they work with, their credentialing, age, and years of experience. The classroom use, time, and manipulatives section asked three questions about how much daily time they devoted to mathematics instruction, which manipulatives they normally use, and to describe the spatial reasoning activities conducted in their classrooms.

From there, respondents were funneled into one of the two domains. To reduce the time taken to complete the survey, respondents only saw one of the domains in an effort to reduce fatigue and maximize responses/completion, which was randomly selected by Qualtrics survey software. Each of the domain segments contained sets of questions about all of the skill statements contained within that domain. The reasoning spatially within objects and reasoning spatially between objects domains each contained 70 questions.

For each core concept, we first asked teachers to identify skills or concepts taught. For example, in spatial language we asked if teachers teach positional language, relative position, etc. At the subcomponent level, we asked teachers if they understood the knowledge or skills students are expected to demonstrate based on the statement. If teachers responded anything other than "No, I don't understand", they were forwarded to follow-up questions. Those questions asked teachers the following four questions for every skill code.

1. How frequently do you teach this topic in the Fall?
2. How frequently do you teach this topic in the Winter?
3. How frequently do you teach this topic in the Spring?
4. How developmentally appropriate is this topic for the grade you teach?

If teachers responded that they do indeed teach the topic in one of the three seasons, they were directed to another follow-up question about how they teach the topic: review from previous grade, focal skill for the grade you teach, and/or foundational skill for the next grade level. If teachers indicated that they did not understand the skill statement, they were forwarded to the next skill statement. A list of survey questions is available in Appendix A.

Data Collection Efforts

To ensure the survey results were representative of the population, researchers needed to collect survey responses from a large number of elementary teachers. Therefore, we distributed the survey to a wide range of elementary teachers across the United States. We planned to collect a minimum of 200 survey responses across two targeted learning goals, with a minimum of 100 responses for each.

Initial deployment (2019). As mentioned earlier, the survey was developed to see how elementary teachers value spatial reasoning in early grade mathematics. At the end of the survey, respondents chose if they wanted to be entered into a drawing to win a $25 Amazon gift card. MMaRS staff developed a multi-media approach to reaching the sample goal through a curated network of (1) Texas district mathematics colleagues, (2) RME's robust database of

approximately 3,000 educators, (3) SMU colleagues, and (4) regular blasts through RME's social media sites.

(1) Over the course of the last eight years, RME has developed strong relationships with district math coordinators and other district and administrative-level mathematics colleagues across the state. Many of these educators are responsible for mathematics curriculum for thousands of students and can reach hundreds of teachers through their district, as well as through various mathematics education organizations (e.g., Texas Association of Supervisors of Mathematics). These educators received an email describing the purpose and importance of the survey as related to the MMaRS project, and were asked to forward the survey with support to relevant K-3 teachers in their districts. In addition to district-level employees, RME has numerous teachers who are actively engaged in ongoing MMaRS research either through cognitive interviews or as part of a Teacher Advisory Panel. These K-3 teachers were asked to participate in the survey directly.
(2) RME has a database of educators that includes teachers, coaches, administrators, and researchers. This now 3,000 strong databases originated as a way to track and maintain participants of RME's annual research-to-practice conference but has since evolved to maintain contact with research participants, consultants, other non-profit colleagues, as well as RME conference attendees. This database of educators received an encouraging communication participation in the survey if they met the K-3 criteria, or to share otherwise the survey with others who would.
(3) SMU colleagues within the Simmons School of Education received an email asking them to share a link to the Spatial Reasoning survey with their network of K-3 teachers, asking for their support in encouraging participation.
(4) RME has over 1,000 followers on Twitter. RME frequently shared the survey with careful hashtag placement to target K-3 teachers as an audience and encourage participation.

The survey participation rate was closely monitored to track progress toward the desired sample. Appropriate follow-up with these four target audiences was utilized, but the survey sample size was not achieved prior to COVID-19.

Redeployment (2020). In an effort to increase the sample size, we redeployed the teacher survey during the summer of 2020. We targeted individuals who took the Numeric Relational Reasoning (NRR) survey previously. In this deployment, every participant who took the survey was given an incentive of $10. We partnered with Rewards Genius ™ to distribute the incentive through Qualtrics when the participant completed the survey. Some technical issues caused a few people to get paid when they didn't complete the survey.

Inclusion Criteria

Not all respondents who started the survey were included for further analyses. Some respondents started the survey but stopped during the demographic information section. Therefore, we only included teachers' responses from the survey if the teachers reached the point in the survey where they were randomly assigned to one of the two targeted learning goals. Initial data

analyses revealed that once respondents made it to the random assignment phase, they completed most of the survey. In some cases, we removed duplicate responses due to outside attempts to unfairly increase a respondent's chances of receiving the incentive. We also experienced duplicate responses from the first deployment. We kept the duplicate responses if they took the survey in a different grade or if they took a different part of the survey (i.e., reasoning spatially within objects or reasoning spatially between objects).

Participants

In this section, we describe the participants included for further analyses by targeted learning goal assigned. Table 1 describes the sample of respondents included. We received 218 responses from 195 participants overall. Most of the respondents were female (77%), white (66%), and were between the ages of 30 and 39 (31%). We did observe fewer participants in the Reasoning Spatially Within Objects targeted learning goal due to participants taking the survey twice and assigned to Reasoning Spatially Between Objects the second time. The table is disaggregated by targeted learning goal and administration to better understand the comparability of the samples across administrations. We do find some differences between the two administrations (e.g., higher percentage of males in the first administration compared to the second). However, these differences should not impact data analysis.

Table 1

Demographic characteristics of survey participants

		2019		2020		Total
		Within	Between	Within	Between	
Gender	Male	12 (6.2%)	11 (5.6%)	1 (0.5%)	9 (4.6%)	33 (17%)
	Female	22 (11%)	36 (18%)	48 (25%)	45 (23%)	151 (77%)
	Prefer not to answer	2 (1.0%)	3 (1.5%)	3 (1.5%)	3 (1.5%)	11 (5.6%)
Race*	Asian American/ Pacific Islander	2 (1.0%)	0 (0.0%)	2 (1.0%)	1 (0.5%)	5 (2.6%)
	Black/African American	2 (1.0%)	4 (2.1%)	4 (2.1%)	3 (1.5%)	13 (6.7%)
	Hispanic/Latino American	4 (2.1%)	7 (3.6%)	12 (6.2%)	12 (6.2%)	35 (18%)
	Native American	0 (0.0%)	3 (1.5%)	0 (0.0%)	2 (1.0%)	5 (2.6%)
	White/European American	26 (13%)	34 (17%)	32 (16%)	36 (18%)	128 (66%)
	Multiracial	1 (0.5%)	1 (0.5%)	0 (0.0%)	1 (0.5%)	3 (1.5%)
	Other	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Prefer not to answer	1 (0.5%)	2 (1.0%)	1 (0.5%)	1 (0.5%)	5 (2.6%)
Age	18-29	9 (4.6%)	13 (6.7%)	10 (5.1%)	8 (4.1%)	40 (21%)
	30-39	8 (4.1%)	17 (8.7%)	18 (9.2%)	17 (8.7%)	60 (31%)
	40-49	11 (5.6%)	9 (4.6%)	15 (7.7%)	21 (11%)	56 (29%)

	2019		2020		Total
	Within	Between	Within	Between	
50-59	4 (2.1%)	9 (4.6%)	5 (2.6%)	7 (3.6%)	25 (13%)
60 years or greater	4 (2.1%)	2 (1.0%)	0 (0.0%)	1 (0.5%)	7 (3.6%)

Note: * Participants could multi-select

We also included questions to gain insight into the professional and educational characteristics of the respondents. Table 2 describes these attributes. Most teachers reported teaching Kindergarten (51%), that their current position was a classroom instructor (73%), most were licensed to teach K-6 (58%), and most reported having attained a master's degree (48%). Similar to the previous table, we do observe some differences in the distribution of participants. However, the overall percentages between administrations may vary due to the targeted sampling of the second administration (see redistribution section above).

Table 2

Professional and educational characteristics of survey participants

		2019		2020		Total
		Within	Between	Within	Between	
Current Grade Level of Teaching	Kindergarten	3 (1.5%)	16 (8.2%)	23 (12%)	9 (4.6%)	51 (26%)
	1st grade	12 (6.2%)	11 (5.6%)	9 (4.6%)	18 (9.2%)	50 (26%)
	2nd grade	12 (6.2%)	6 (3.1%)	10 (5.1%)	21 (11%)	49 (25%)
	3rd grade	9 (4.6%)	17 (8.7%)	10 (5.1%)	9 (4.6%)	45 (23%)
Current Position	Classroom teacher	26 (13%)	27 (14%)	43 (22%)	47 (24%)	143 (73%)
	Special education teacher	3 (1.5%)	9 (4.6%)	2 (1.0%)	7 (3.6%)	21 (11%)
	Math coach	5 (2.6%)	7 (3.6%)	5 (2.6%)	1 (0.5%)	18 (9.2%)
	Interventionist	0 (0.0%)	3 (1.5%)	0 (0.0%)	1 (0.5%)	4 (2.1%)
	Paraprofessional	1 (0.5%)	1 (0.5%)	0 (0.0%)	0 (0.0%)	2 (1.0%)
	Other	1 (0.5%)	3 (1.5%)	2 (1.0%)	1 (0.5%)	7 (3.6%)
Teaching Credentials	K-6	17 (8.7%)	24 (12%)	40 (20%)	33 (16%)	114 (58%)
	K-8	10 (5.1%)	13 (6.7%)	6 (3.1%)	19 (9.7%)	48 (25%)
	Multiple subject (K-12)	6 (3.1%)	12 (6.2%)	5 (2.6%)	5 (2.6%)	28 (14%)
	Secondary, mathematics	4 (2.1%)	3 (1.5%)	0 (0.0%)	0 (0.0%)	7 (3.6%)
	Mathematics specialist	9 (4.6%)	12 (6.2%)	1 (0.5%)	5 (2.6%)	27 (14%)
	Reading specialist	2 (1.0%)	7 (3.6%)	2 (1.0%)	5 (2.6%)	16 (8.2%)
	Special education	7 (3.6%)	6 (3.1%)	3 (1.5%)	6 (3.1%)	22 (11%)

		2019		2020		Total
		Within	Between	Within	Between	
	Gifted and talented ed	4 (2.1%)	7 (3.6%)	10 (5.1%)	8 (4.1%)	29 (15%)
	English Language Learner	3 (1.5%)	7 (3.6%)	8 (4.1%)	12 (6.2%)	30 (15%)
	Administrative	2 (1.0%)	2 (1.0%)	3 (1.5%)	2 (1.0%)	9 (4.6%)
	Other	2 (1.0%)	4 (2.1%)	8 (4.1%)	6 (3.1%)	20 (10%)
Degree	High School Diploma	1 (0.5%)	1 (0.5%)	0 (0.0%)	0 (0.0%)	2 (1.0%)
	Bachelor's	13 (6.7%)	17 (8.7%)	31 (16%)	26 (13%)	87 (45%)
	Master's	17 (8.7%)	30 (15%)	18 (9.2%)	28 (14%)	93 (48%)
	Post Master's	5 (2.6%)	2 (1.0%)	0 (0.0%)	0 (0.0%)	7 (3.6%)

The survey also included questions about years of experience in teaching certain areas. Table 3 describes respondents' years of experience teaching. Respondents reported an average of ten years of teaching experience and an average of nine years teaching in grades K-3.

Table 3

Years of experience of survey participants

	Learning Progression				Total	
	Within		Between			
	M (SD)	*N*	*M (SD)*	*N*	*M (SD)*	*N*
Total teaching experience	10.7 (6.6)	85	9.8 (6.5)	104	10.2 (6.5)	189
Teaching experience in K-3	9.5 (6.5)	85	8.6 (6.0)	104	9.0 (6.2)	189
Years in current position	5.4 (4.7)	85	5.7 (4.9)	104	5.5 (4.8)	189
Years in current school	6.7 (6.0)	85	5.3 (4.7)	104	5.9 (5.3)	189
Years teaching mathematics	9.4 (6.5)	85	8.6 (6.3)	104	8.9 (6.4)	189
Special education mathematics experience	2.8 (5.0)	85	2.3 (4.3)	104	2.5 (4.7)	189

Lastly, we asked participants about their amount of time teaching mathematics daily. Table 4 describes the average responses by grade and learning progression. Average instruction time ranged between 66 minutes to 77 minutes.

Table 4

Mathematics instructional time for survey participants, by grade

	Learning Progression				Total	
	Within		Between			
	M (SD)	*N*	*M (SD)*	*N*	*M (SD)*	*N*
K	71 (17)	25	68 (21)	25	70 (19)	50
1	70 (16)	21	68 (18)	28	69 (17)	49
2	78 (17)	22	71 (22)	26	74 (20)	48
3	76 (19)	17	73 (20)	25	74 (19)	42

Analyses

In this report, we present the descriptive statistics. In most instances, we report the percentage of response option by grade level. We then conduct an independence test (i.e., Fisher's Exact Test) to better understand if response patterns depend on grade level.

For the developmentally appropriateness scales, we coded the responses to an ordinal scale (e.g., "Somewhat disagree" = 1,…, "Strongly agree" = 4). We then calculated the means, standard deviations, and conducted an omnibus ANOVA with grade level as the grouping factor. If a significant mean difference was detected by the ANOVA, we conducted Tukey-adjusted pairwise mean comparisons to determine where the mean difference existed between grade levels.

Results

In this section, we provide descriptive statistics for all survey questions. We follow the structure of the survey and present the results of the results of the spatial task question. Table 5 describes what teachers identified as spatial tasks in their classroom.

Table 5

Manipulatives or Representations Used in the Classrooms of Survey Participants

	Learning Progression				Total	
	Within		Between			
	%	*N*	*%*	*N*	*%*	*N*
Interlocking blocks	21%	46	27%	58	48%	104
Manga-Tiles	17%	36	10%	23	27%	59
Blocks	33%	71	30%	66	63%	137
Tangrams	27%	58	23%	52	50%	110
Pattern blocks	35%	76	35%	76	70%	152
Snap cubes	33%	73	37%	79	70%	152
Maps	8%	18	13%	28	21%	46

	Learning Progression				Total	
	Within		Between			
	%	*N*	*%*	*N*	*%*	*N*
Puzzles	20%	44	25%	55	45%	99
Computer games	25%	54	27%	60	52%	114
Other:	2%	5	5%	11	7%	16
Abacus	0%	0	0.5%	1	0.5%	1
Geoboards	0%	0	0.5%	1	0.5%	1
Dreambox	0%	0	0.5%	1	0.5%	1
Homemade	0%	0	1%	2	1%	2
Sensory bins	0%	0	0.5%	1	0.5%	1
Place-value blocks	1%	2	0.5%	1	1.5%	3
Real-life objects	0%	0	0.5%	1	0.5%	1
Snapping shapes, jenga	0%	0	0.5%	1	0.5%	1
3D shapes, color tiles	0.5%	1	0.5%	1	1%	2
Mini erasers	0.5%	1	0%	0	0.5%	1
No Response	0.5%	1	0.4%	1	1%	2

Next, we asked survey respondents to detail what shapes they taught (within object spatial reasoning) or what spatial language they used in their classrooms (between object spatial reasoning). Table 6 and Table 7 describe the responses. These tables include significance tests for independence by grade level.

Table 6

Within Objects Spatial Reasoning: Taught by Grade

Shape	Grade	Taught	Not Taught	Test
Circles	K	27 (100%)	0 (0%)	.247
	1	23 (96%)	1 (4%)	
	2	22 (88%)	3 (12%)	
	3	26 (96%)	1 (4%)	
Irregular circles	K	2 (7%)	25 (93%)	.074
	1	5 (21%)	19 (79%)	
	2	7 (28%)	18 (72%)	
	3	7 (26%)	20 (74%)	
Squares	K	25 (93%)	2 (7%)	.372
	1	22 (92%)	2 (8%)	
	2	22 (88%)	3 (12%)	
	3	27 (100%)	0 (0%)	
Triangles	K	26 (96%)	1 (4%)	.659
	1	23 (96%)	1 (4%)	
	2	22 (88%)	3 (12%)	
	3	25 (93%)	2 (7%)	

Shape	Grade	Taught	Not Taught	Test
Rectangles	K	24 (89%)	3 (11%)	.350
	1	23 (96%)	1 (4%)	
	2	25 (100%)	0 (0%)	
	3	26 (96%)	1 (4%)	
Pentagons	K	11 (41%)	16 (59%)	.001**
	1	15 (63%)	9 (37%)	
	2	22 (88%)	3 (12%)	
	3	23 (85%)	4 (15%)	
Irregular pentagons	K	3 (11%)	24 (89%)	.026*
	1	6 (35%)	18 (65%)	
	2	11 (44%)	14 (56%)	
	3	11 (41%)	16 (59%)	
Hexagons	K	14 (52%)	13 (48%)	<.001***
	1	22 (92%)	2 (8%)	
	2	21 (84%)	4 (16%)	
	3	26 (94%)	1 (4%)	
Rhombuses	K	17 (63%)	10 (37%)	.271
	1	19 (76%)	5 (24%)	
	2	20 (80%)	5 (20%)	
	3	23 (85%)	4 (15%)	
Cubes	K	25 (93%)	2 (7%)	.494
	1	23 (96%)	1 (4%)	
	2	21 (84%)	4 (16%)	
	3	23 (85%)	4 (15%)	
Cones	K	27 (100%)	0 (0%)	.309
	1	22 (92%)	2 (8%)	
	2	22 (88%)	3 (12%)	
	3	24 (89%)	3 (11%)	
Cylinders	K	26 (96%)	1 (4%)	.481
	1	23 (96%)	1 (4%)	
	2	24 (96%)	1 (4%)	
	3	23 (85%)	4 (15%)	
Spheres	K	26 (96%)	1 (4%)	.497
	1	22 (92%)	2 (8%)	
	2	21 (84%)	4 (16%)	
	3	24 (89%)	3 (11%)	
Pyramids	K	17 (63%)	10 (37%)	.336
	1	18 (75%)	6 (25%)	
	2	21 (84%)	4 (16%)	
	3	18 (67%)	9 (33%)	
Prisms	K	11 (41%)	16 (59%)	.002**
	1	17 (71%)	7 (29%)	

Shape	Grade	Taught	Not Taught	Test
	2	20 (80%)	5 (20%)	
	3	23 (85%)	4 (15%)	
Trapezoids	K	10 (37%)	17 (63%)	<.001***
	1	20 (83%)	4 (17%)	
	2	21 (84%)	4 (16%)	
	3	23 (85%)	4 (15%)	
Quadrilaterals	K	6 (22%)	21 (78%)	<.001***
	1	14 (58%)	10 (42%)	
	2	22 (88%)	3 (12%)	
	3	23 (85%)	4 (15%)	
Irreg. quadrilaterals	K	3 (11%)	24 (89%)	.003**
	1	8 (33%)	16 (67%)	
	2	12 (48%)	13 (52%)	
	3	16 (59%)	11 (41%)	

Table 7

Between Object Spatial Reasoning: Taught by Grade

Topic	Grade	Taught	Not Taught	Test
Up/Down	K	23 (85%)	4 (15%)	.047*
	1	23 (79%)	6 (21%)	
	2	19 (66%)	10 (34%)	
	3	15 (54%)	13 (46%)	
Under/Over	K	24 (89%)	3 (11%)	.027*
	1	23 (79%)	6 (21%)	
	2	18 (62%)	11 (38%)	
	3	16 (57%)	12 (43%)	
Between/Around	K	25 (93%)	2 (7%)	.021*
	1	23 (79%)	6 (21%)	
	2	22 (76%)	7 (24%)	
	3	16 (57%)	12 (43%)	
Toward/Away	K	16 (59%)	11 (41%)	.765
	1	15 (52%)	14 (48%)	
	2	19 (66%)	10 (34%)	
	3	16 (57%)	12 (43%)	
Near/Far	K	18 (67%)	9 (33%)	.896
	1	21 (72%)	8 (28%)	
	2	21 (72%)	8 (28%)	
	3	18 (64%)	10 (36%)	
Behind/in front of	K	25 (93%)	2 (7%)	.006**
	1	24 (83%)	5 (17%)	

Topic	Grade	Taught	Not Taught	Test
	2	20 (69%)	9 (31%)	
	3	15 (54%)	13 (46%)	
Beside	K	24 (89%)	3 (11%)	.033*
	1	23 (79%)	6 (21%)	
	2	20 (69%)	9 (31%)	
	3	15 (54%)	13 (46%)	
Across	K	21 (78%)	6 (22%)	.308
	1	23 (79%)	6 (21%)	
	2	17 (59%)	12 (41%)	
	3	19 (68%)	9 (32%)	
Left/Right	K	22 (81%)	5 (19%)	.180
	1	22 (76%)	7 (24%)	
	2	23 (79%)	6 (21%)	
	3	16 (57%)	12 (43%)	
Relative positions and	K	15 (56%)	12 (44%)	.397
distances from child's	1	17 (59%)	12 (41%)	
perspective	2	22 (76%)	7 (24%)	
	3	19 (68%)	9 (32%)	
Relative positions and	K	8 (30%)	19 (70%)	.206
distances from aerial	1	12 (41%)	17 (59%)	
view	2	18 (62%)	11 (38%)	
	3	18 (64%)	10 (36%)	

Next, we asked teachers the focus on the subcomponent skills that they teach. They could either say as a review from the previous grade, focus on their current grade, or a prerequisite for the next grade. Table 8 and Table 9 summarize these responses for the two targeted learning goals.

Table 8

Reasons Spatially Within Objects: Type of Instruction

Skill Statement	Grade Level	N	Review Previous Grade	Focal Skill	Foundational Skill: Next Grade	Fisher's Test
A.1.a	K	27	1 (4%)	14 (52%)	12 (44%)	P=.163
	1	20	3 (15%)	11 (55%)	6 (30%)	
	2	24	8 (33%)	9 (38%)	7 (29%)	
	3	26	4 (15%)	15 (58%)	7 (27%)	
A.1.b	K	27	2 (7%)	17 (63%)	8 (30%)	P=.019
	1	21	4 (19%)	11 (52%)	6 (29%)	
	2	23	12 (52%)	9 (39%)	2 (9%)	
	3	25	9 (36%)	11 (44%)	5 (20%)	

Skill Statement	Grade Level	N	Review Previous Grade	Focal Skill	Foundational Skill: Next Grade	Fisher's Test
A.1.c	K	26	2 (8%)	17 (65%)	7 (27%)	P=.003
	1	22	9 (41%)	8 (36%)	5 (23%)	
	2	23	13 (57%)	8 (35%)	2 (9%)	
	3	23	13 (57%)	6 (26%)	4 (17%)	
A.1.d	K	25	1 (4%)	15 (60%)	9 (36%)	P=.553
	1	20	4 (20%)	12 (60%)	4 (20%)	
	2	24	4 (17%)	12 (50%)	8 (33%)	
	3	23	5 (22%)	12 (52%)	6 (26%)	
A.2.a	K	8	1 (13%)	2 (25%)	5 (63%)	P=.251
	1	11	4 (36%)	3 (27%)	4 (36%)	
	2	16	0 (0%)	7 (44%)	9 (36%)	
	3	9	1 (11%)	4 (44%)	4 (44%)	
A.2.b	K	19	0 (0%)	6 (32%)	13 (73%)	P=.017
	1	12	5 (42%)	3 (25%)	4 (33%)	
	2	19	5 (26%)	3 (16%)	11 (58%)	
	3	11	2 (18%)	6 (55%)	3 (27%)	
A.2.c	K	11	0 (0%)	3 (27%)	8 (73%)	P=.338
	1	9	2 (22%)	1 (11%)	6 (67%)	
	2	17	2 (12%)	6 (35%)	9 (53%)	
	3	9	1 (11%)	5 (56%)	3 (33%)	
A.2.d	K	16	2 (13%)	2 (13%)	12 (75%)	P=.542
	1	12	2 (17%)	5 (42%)	5 (42%)	
	2	15	1 (7%)	4 (27%)	10 (67%)	
	3	10	2 (20%)	3 (30%)	5 (50%)	
A.2.e	K	12	0 (0%)	3 (25%)	9 (75%)	P=.158
	1	11	3 (27%)	3 (27%)	5 (45%)	
	2	18	2 (11%)	3 (17%)	13 (72%)	
	3	15	4 (27%)	6 (40%)	5 (33%)	
A.3.a	K	8	0 (0%)	4 (50%)	4 (50%)	P=.360
	1	10	4 (40%)	2 (20%)	4 (40%)	
	2	16	3 (19%)	4 (25%)	9 (56%)	
	3	11	3 (27%)	5 (45%)	3 (27%)	
A.3.b	K	9	1 (11%)	2 (22%)	6 (67%)	P=.300
	1	8	4 (50%)	1 (13%)	3 (38%)	
	2	11	1 (9%)	4 (36%)	6 (55%)	
	3	7	0 (0%)	3 (43%)	4 (57%)	
A.3.c	K	15	0 (0%)	6 (40%)	9 (60%)	P=.200
	1	15	2 (13%)	8 (53%)	5 (33%)	
	2	20	5 (25%)	7 (35%)	8 (40%)	
	3	14	4 (29%)	7 (50%)	3 (21%)	
A.3.d	K	15	1 (7%)	6 (40%)	8 (53%)	P=.278

Skill Statement	Grade Level	N	Review Previous Grade	Focal Skill	Foundational Skill: Next Grade	Fisher's Test
	1	11	1 (9%)	6 (55%)	4 (36%)	
	2	21	6 (29%)	6 (29%)	9 (43%)	
	3	12	3 (25%)	7 (58%)	2 (17%)	
A.3.e	K	12	1 (8%)	4 (33%)	7 (58%)	P=.460
	1	3	1 (33%)	1 (33%)	1 (33%)	
	2	11	3 (27%)	3 (27%)	5 (45%)	
	3	11	1 (9%)	7 (%)	3 (%)	
A.3.f	K	9	1 (11%)	3 (33%)	5 (56%)	P=.488
	1	8	2 (25%)	3 (38%)	3 (38%)	
	2	16	5 (31%)	5 (31%)	6 (38%)	
	3	12	2 (17%)	8 (67%)	2 (17%)	
A.3.g	K	10	0 (0%)	5 (50%)	5 (50%)	P=.216
	1	5	2 (40%)	3 (60%)	0 (0%)	
	2	10	3 (30%)	4 (40%)	3 (30%)	
	3	7	1 (14%)	5 (71%)	1 (14%)	

Table 9

Reasons Spatially Between Objects: Type of Instruction

Skill Statement	Grade Level	N	Review Previous Grade	Focal Skill	Foundational skill: Next Grade	Fisher's Test
B.5.a	K	26	1 (4%)	18 (69%)	7 (27%)	P=.004
	1	27	8 (30%)	15 (56%)	4 (15%)	
	2	25	13 (52%)	9 (36%)	3 (12%)	
	3	23	10 (43%)	11 (48%)	2 (9%)	
B.5.b	K	25	3 (12%)	14 (56%)	8 (32%)	P=.084
	1	27	8 (30%)	17 (63%)	2 (7%)	
	2	22	7 (32%)	11 (50%)	4 (18%)	
	3	21	9 (43%)	11 (52%)	1 (5%)	
B.5.c	K	25	1 (4%)	16 (64%)	8 (32%)	P=.048
	1	28	7 (25%)	17 (61%)	4 (14%)	
	2	24	7 (29%)	14 (58%)	3 (13%)	
	3	22	8 (36%)	13 (59%)	1 (5%)	
B.6.a	K	18	0 (0%)	11 (61%)	7 (39%)	P=.210
	1	24	2 (8%)	17 (71%)	5 (21%)	
	2	22	4 (18%)	16 (73%)	2 (9%)	
	3	24	4 (17%)	14 (58%)	6 (25%)	
B.6.b	K	13	1 (8%)	6 (46%)	6 (46%)	P=.086
	1	15	1 (7%)	10 (67%)	4 (27%)	
	2	16	1 (6%)	14 (88%)	1 (6%)	

Skill Statement	Grade Level	N	Review Previous Grade	Focal Skill	Foundational skill: Next Grade	Fisher's Test
	3	19	5 (26%)	9 (47%)	5 (26%)	
B.6.c	K	21	3 (14%)	12 (57%)	6 (29%)	P=.176
	1	23	4 (17%)	14 (61%)	5 (22%)	
	2	26	5 (19%)	20 (77%)	1 (4%)	
	3	25	8 (32%)	15 (60%)	2 (8%)	
B.6.d	K	18	2 (11%)	8 (44%)	8 (44%)	P=.085
	1	23	2 (9%)	18 (78%)	3 (13%)	
	2	25	4 (16%)	18 (72%)	3 (12%)	
	3	24	5 (21%)	11 (46%)	8 (33%)	
B.6.e	K	17	0 (0%)	7 (41%)	10 (59%)	P=.008
	1	23	2 (9%)	16 (70%)	5 (22%)	
	2	24	4 (17%)	16 (67%)	4 (17%)	
	3	20	7 (35%)	10 (50%)	3 (15%)	
B.6.f	K	6	0 (0%)	2 (33%)	4 (67%)	P=.712
	1	14	1 (7%)	8 (57%)	5 (36%)	
	2	21	2 (10%)	14 (67%)	5 (24%)	
	3	20	2 (10%)	12 (60%)	6 (30%)	
B.6.g	K	11	1 (9%)	4 (36%)	6 (55%)	P=.239
	1	20	2 (10%)	14 (70%)	4 (20%)	
	2	24	6 (25%)	14 (58%)	4 (17%)	
	3	18	4 (22%)	8 (44%)	6 (33%)	
B.6.h	K	4	0 (0%)	1 (25%)	3 (75%)	P=.579
	1	10	0 (0%)	7 (70%)	3 (30%)	
	2	17	2 (12%)	11 (65%)	4 (24%)	
	3	21	2 (10%)	11 (52%)	8 (38%)	
B.7.a	K	18	0 (0%)	6 (33%)	12 (67%)	P=.001
	1	20	2 (10%)	13 (65%)	5 (25%)	
	2	22	8 (36%)	11 (50%)	3 (14%)	
	3	17	5 (29%)	10 (59%)	2 (12%)	
B.7.b	K	14	0 (0%)	3 (21%)	11 (79%)	P=.112
	1	16	2 (13%)	7 (44%)	7 (44%)	
	2	18	2 (11%)	10 (56%)	6 (33%)	
	3	18	3 (17%)	10 (56%)	5 (28%)	
B.7.c	K	16	1 (6%)	5 (31%)	10 (63%)	P=.294
	1	17	3 (18%)	6 (35%)	8 (47%)	
	2	16	3 (19%)	7 (44%)	6 (38%)	
	3	16	3 (19%)	10 (63%)	3 (19%)	
B.7.d	K	11	0 (0%)	2 (18%)	9 (82%)	P=.056
	1	14	2 (14%)	6 (43%)	6 (43%)	
	2	14	5 (36%)	4 (29%)	5 (36%)	
	3	14	3 (21%)	8 (57%)	3 (21%)	
B.7.e	K	8	0 (0%)	3 (38%)	5 (63%)	P=.560

Skill Statement	Grade Level	N	Review Previous Grade	Focal Skill	Foundational skill: Next Grade	Fisher's Test
	1	14	1 (7%)	7 (50%)	6 (43%)	
	2	18	3 (17%)	11 (61%)	4 (22%)	
	3	15	2 (13%)	9 (60%)	4 (27%)	

Next, we asked teachers their level of understanding of skills listed within the learning progression. Table 10 and Table 11 describe their responses.

Table 10

Reasoning Spatially Within Objects: Clarity of Subcomponent Language

Skill Statement	Grade Level	N	Does not Understand	Mostly Understands	Understands	Fisher's Test
A.1.a	K	27	0 (0%)	2 (7%)	25 (93%)	.494
	1	24	2 (8%)	3 (13%)	19 (79%)	
	2	25	1 (4%)	4 (16%)	20 (80%)	
	3	26	0 (0%)	5 (19%)	21 (81%)	
A.1.b	K	27	0 (0%)	2 (7%)	25 (93%)	.970
	1	24	1 (4%)	1 (4%)	22 (92%)	
	2	25	1 (4%)	1 (4%)	23 (92%)	
	3	26	1 (4%)	2 (8%)	23 (88%)	
A.1.c	K	27	0 (0%)	1 (4%)	26 (96%)	.633
	1	24	1 (4%)	2 (8%)	21 (88%)	
	2	24	1 (4%)	3 (13%)	20 (83%)	
	3	24	0 (0%)	1 (4%)	23 (96%)	
A.1.d	K	26	1 (4%)	1 (4%)	24 (92%)	.165
	1	24	3 (13%)	2 (8%)	19 (79%)	
	2	24	0 (0%)	5 (21%)	19 (79%)	
	3	23	0 (0%)	2 (9%)	21 (91%)	
A.2.a	K	26	4 (15%)	8 (31%)	14 (54%)	.665
	1	23	5 (22%)	5 (22%)	13 (57%)	
	2	24	1 (4%)	8 (33%)	15 (63%)	
	3	23	2 (9%)	6 (26%)	15 (65%)	
A.2.b	K	26	1 (4%)	4 (15%)	21 (81%)	.806
	1	23	2 (9%)	3 (13%)	18 (78%)	
	2	24	0 (0%)	5 (21%)	19 (79%)	
	3	23	1 (4%)	2 (9%)	20 (87%)	
A.2.c	K	26	3 (12%)	4 (15%)	19 (73%)	.897
	1	23	3 (13%)	4 (17%)	16 (70%)	
	2	24	1 (4%)	6 (25%)	17 (71%)	
	3	23	2 (9%)	3 (13%)	18 (78%)	
A.2.d	K	26	2 (8%)	3 (12%)	21 (81%)	.357

Skill Statement	Grade Level	N	Does not Understand	Mostly Understands	Understands	Fisher's Test
	1	22	3 (14%)	2 (9%)	17 (77%)	
	2	24	1 (4%)	8 (33%)	15 (63%)	
	3	23	1 (4%)	4 (17%)	18 (78%)	
A.2.e	K	26	2 (8%)	6 (23%)	18 (69%)	.853
	1	22	2 (9%)	2 (9%)	18 (82%)	
	2	24	2 (8%)	5 (21%)	17 (71%)	
	3	23	1 (4%)	3 (13%)	19 (83%)	
A.3.a	K	26	8 (31%)	6 (23%)	12 (46%)	.829
	1	21	3 (14%)	5 (24%)	13 (62%)	
	2	24	4 (17%)	7 (29%)	13 (54%)	
	3	22	5 (23%)	4 (18%)	13 (59%)	
A.3.b	K	26	5 (19%)	5 (19%)	16 (62%)	.995
	1	20	5 (25%)	3 (15%)	12 (60%)	
	2	24	6 (25%)	3 (13%)	15 (63%)	
	3	22	5 (23%)	4 (18%)	13 (59%)	
A.3.c	K	26	1 (4%)	5 (19%)	20 (77%)	.697
	1	20	1 (5%)	2 (10%)	17 (85%)	
	2	24	2 (8%)	2 (8%)	20 (83%)	
	3	22	3 (14%)	1 (5%)	18 (82%)	
A.3.d	K	26	1 (4%)	7 (27%)	18 (69%)	.641
	1	20	2 (10%)	4 (20%)	14 (70%)	
	2	24	1 (4%)	6 (25%)	17 (71%)	
	3	22	3 (14%)	2 (9%)	17 (77%)	
A.3.e	K	26	4 (15%)	3 (12%)	19 (73%)	.930
	1	20	2 (10%)	5 (25%)	13 (65%)	
	2	24	4 (17%)	4 (17%)	16 (67%)	
	3	22	4 (18%)	3 (14%)	15 (68%)	
A.3.f	K	26	3 (12%)	6 (23%)	17 (65%)	.944
	1	19	2 (11%)	3 (16%)	14 (74%)	
	2	24	5 (21%)	3 (13%)	16 (67%)	
	3	22	3 (14%)	4 (18%)	15 (68%)	
A.3.g	K	26	6 (23%)	7 (27%)	13 (50%)	.852
	1	19	5 (26%)	2 (11%)	12 (63%)	
	2	24	8 (33%)	4 (17%)	12 (50%)	
	3	22	5 (23%)	5 (23%)	12 (55%)	

Table 11

Reasoning Spatially Between Objects: Clarity of Subcomponent Language

Skill Statement	Grade Level	N	Does not Understand	Mostly Understands	Understands	Fisher's Test
B.5.a	K	27	0 (0%)	8 (30%)	19 (70%)	.902
	1	29	1 (3%)	8 (28%)	20 (69%)	
	2	29	1 (3%)	11 (38%)	17 (59%)	
	3	28	0 (0%)	9 (32%)	19 (68%)	
B.5.b	K	27	1 (4%)	4 (15%)	22 (81%)	.476
	1	29	0 (0%)	7 (24%)	22 (76%)	
	2	28	1 (4%)	9 (32%)	18 (64%)	
	3	28	0 (0%)	9 (32%)	19 (68%)	
B.5.c	K	27	0 (0%)	5 (19%)	22 (81%)	.295
	1	29	0 (0%)	11 (38%)	18 (62%)	
	2	28	1 (4%)	5 (18%)	22 (79%)	
	3	28	1 (4%)	9 (32%)	18 (64%)	
B.6.a	K	26	3 (12%)	6 (23%)	17 (65%)	.572
	1	28	2 (7%)	5 (18%)	21 (75%)	
	2	28	2 (7%)	11 (39%)	15 (54%)	
	3	28	1 (4%)	7 (25%)	20 (71%)	
B.6.b	K	26	1 (4%)	13 (50%)	12 (46%)	.311
	1	28	3 (11%)	12 (43%)	13 (46%)	
	2	28	5 (18%)	13 (46%)	10 (36%)	
	3	28	0 (0%)	13 (46%)	15 (54%)	
B.6.c	K	26	2 (8%)	5 (19%)	19 (73%)	.745
	1	26	1 (4%)	8 (31%)	17 (65%)	
	2	28	2 (7%)	9 (32%)	17 (61%)	
	3	28	0 (0%)	8 (29%)	20 (71%)	
B.6.d	K	25	0 (0%)	6 (24%)	19 (76%)	.822
	1	26	1 (4%)	5 (19%)	20 (77%)	
	2	28	1 (4%)	9 (32%)	18 (64%)	
	3	28	0 (0%)	7 (25%)	21 (75%)	
B.6.e	K	25	2 (8%)	3 (12%)	20 (80%)	.594
	1	26	0 (0%)	8 (31%)	18 (69%)	
	2	28	1 (4%)	8 (29%)	19 (68%)	
	3	28	1 (4%)	7 (25%)	20 (71%)	
B.6.f	K	25	2 (8%)	5 (20%)	18 (72%)	.781
	1	26	1 (4%)	5 (19%)	20 (77%)	
	2	28	0 (0%)	9 (32%)	19 (68%)	
	3	28	1 (4%)	7 (25%)	20 (71%)	
B.6.g	K	25	2 (8%)	3 (12%)	20 (80%)	.563
	1	26	0 (0%)	4 (15%)	22 (85%)	
	2	28	1 (4%)	4 (14%)	23 (82%)	

Skill Statement	Grade Level	N	Does not Understand	Mostly Understands	Understands	Fisher's Test
	3	28	0 (0%)	7 (25%)	21 (75%)	
B.6.h	K	25	2 (8%)	3 (12%)	20 (80%)	.458
	1	26	3 (12%)	4 (15%)	19 (73%)	
	2	28	3 (11%)	5 (18%)	20 (71%)	
	3	28	0 (0%)	8 (29%)	20 (71%)	
B.7.a	K	25	1 (4%)	2 (8%)	22 (88%)	.219
	1	26	1 (4%)	7 (27%)	18 (69%)	
	2	28	0 (0%)	8 (29%)	20 (71%)	
	3	27	1 (4%)	9 (33%)	17 (63%)	
B.7.b	K	24	3 (13%)	4 (17%)	17 (71%)	.821
	1	26	2 (8%)	7 (27%)	17 (65%)	
	2	28	2 (7%)	8 (29%)	18 (64%)	
	3	26	1 (4%)	9 (35%)	16 (62%)	
B.7.c	K	24	1 (4%)	4 (17%)	19 (79%)	.833
	1	25	1 (4%)	5 (20%)	19 (76%)	
	2	28	2 (7%)	7 (25%)	19 (68%)	
	3	26	1 (4%)	9 (35%)	16 (62%)	
B.7.d	K	24	1 (4%)	4 (17%)	19 (79%)	.116
	1	25	1 (4%)	8 (32%)	16 (64%)	
	2	27	3 (11%)	13 (48%)	11 (41%)	
	3	25	1 (4%)	11 (44%)	13 (52%)	
B.7.e	K	24	2 (8%)	6 (25%)	16 (67%)	.676
	1	25	1 (4%)	8 (32%)	16 (64%)	
	2	27	3 (11%)	12 (44%)	12 (44%)	
	3	25	1 (4%)	9 (36%)	15 (60%)	

Next, at each season (i.e., Fall, Winter, Spring) we asked teachers about the focus of the subcomponent in their instruction. Table 12 and Table 13 describe teachers' responses. To aid in interpretations, figures of these data can be found in Appendix B.

Table 12

Reasoning Spatially Within Objects: Time of Year and Emphasis of each Subcomponent by Grade Level

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
A.1.a	K						
		Fall	5 (19%)	10 (37%)	7 (26%)	5 (19%)	27
		Winter	1 (3.7%)	3 (11%)	11 (41%)	12 (44%)	27
		Spring	0 (0.0%)	5 (19%)	10 (37%)	12 44%)	27

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
	1						
		Fall	11 (50%)	3 (14%)	6 (27%)	2 (9.1%)	22
		Winter	8 (36%)	5 (23%)	7 (32%)	2 (9.1%)	22
		Spring	4 (18%)	2 (9.1%)	8 (36%)	8 (36%)	22
	2						
		Fall	5 (21%)	4 (17%)	11 (46%)	4 (17%)	24
		Winter	4 (17%)	6 (25%)	6 (25%)	8 (33%)	24
		Spring	2 (8.3%)	5 (21%)	12 (50%)	5 (21%)	24
	3						
		Fall	11 (42%)	8 (31%)	3 (12%)	4 (15%)	26
		Winter	4 (15%)	8 (31%)	7 (27%)	7 (27%)	26
		Spring	2 (7.7%)	4 (15%)	8 (31%)	12 (46%)	26
	K						
		Fall	3 (11%)	8 (30%)	11 (41%)	5 (19%)	27
		Winter	1 (3.7%)	4 (15%)	7 (26%)	15 (56%)	27
		Spring	0 (0.0%)	4 (15%)	13 (48%)	10 (37%)	27
	1						
		Fall	9 (39%)	4 (17%)	8 (35%)	2 (8.7%)	23
A.1.b		Winter	7 (30%)	6 (26%)	8 (35%)	2 (8.7%)	23
		Spring	4 (17%)	2 (8.7%)	7 (30%)	10 (43%)	23
	2						
		Fall	5 (22%)	4 (17%)	10 (43%)	4 (17%)	23
		Winter	6 (26%)	3 (13%)	3 (13%)	11 (48%)	23
		Spring	2 (8.7%)	5 (22%)	6 (26%)	10 (43%)	23
	3						
		Fall	10 (40%)	9 (36%)	2 (8%)	4 (16%)	25
		Winter	5 (20%)	7 (28%)	7 (28%)	6 (24%)	25
		Spring	2 (8%)	5 (20%)	8 (32%)	10 (40%)	25
	K						
		Fall	4 (15%)	6 (23%)	10 (38%)	6 (23%)	26
		Winter	0 (0.0%)	4 (15%)	6 (23%)	16 (62%)	26
		Spring	1 (3.8%)	5 (19%)	11 (42%)	9 (35%)	26
	1						
		Fall	8 (35%)	5 (22%)	8 (35%)	2 (8.7%)	23
A.1.c		Winter	6 (26%)	8 (35%)	8 (35%)	1 (4.3%)	23
		Spring	3 (13%)	3 (13%)	8 (35%)	9 (39%)	23
	2						
		Fall	5 (22%)	4 (17%)	9 (39%)	5 (22%)	23
		Winter	6 (26%)	3 (13%)	3 (13%)	11 (48%)	23
		Spring	1 (4.3%)	9 (39%)	4 (17%)	9 (39%)	23
	3						
		Fall	10 (42%)	8 (33%)	3 (13%)	3 (13%)	24
		Winter	5 (21%)	7 (29%)	7 (29%)	5 (21%)	24

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Spring	2 (8.3%)	4 (17%)	7 (29%)	11 (46%)	24
	K						
		Fall	6 (24%)	6 (24%)	11 (44%)	2 (8%)	25
		Winter	1 (4%)	5 (20%)	8 (32%)	11 (44%)	25
		Spring	1 (4%)	6 (24%)	9 (36%)	9 (36%)	25
	1						
		Fall	9 (43%)	2 (10%)	6 (29%)	4 (19%)	21
A.1.d		Winter	6 (29%)	7 (33%)	7 (33%)	1 (4.8%)	21
		Spring	3 (14%)	2 (10%)	8 (38%)	8 (38%)	21
	2						
		Fall	6 (25%)	5 (21%)	7 (29%)	6 (25%)	24
		Winter	6 (25%)	4 (17%)	3 (13%)	11 (46%)	24
		Spring	1 (4.2%)	9 (38%)	8 (33%)	6 (25%)	24
	3						
		Fall	10 (43%)	6 (26%)	5 (22%)	2 (8.7%)	23
		Winter	6 (26%)	6 (26%)	6 (26%)	5 (22%)	23
		Spring	2 (8.7%)	4 (17%)	6 (26%)	11 (48%)	23
	K						
		Fall	15 (68%)	2 (9.1%)	2 (9.1%)	3 (14%)	22
		Winter	15 (68%)	2 (9.1%)	3 (14%)	2 (9.1%)	22
		Spring	17 (77%)	1 (4.5%)	4 (18%)	0 (0.0%)	22
A.2.a	1						
		Fall	10 (56%)	6 (33%)	1 (5.6%)	1 (5.6%)	18
		Winter	13 (72%)	2 (11%)	3 (17%)	0 (0.0%)	18
		Spring	9 (50%)	4 (22%)	4 (22%)	1 (5.6%)	18
	2						
		Fall	11 (48%)	5 (22%)	4 (17%)	3 (13%)	23
		Winter	10 (43%)	4 (17%)	4 (17%)	5 (22%)	23
		Spring	9 (39%)	3 (13%)	7 (30%)	4 (17%)	23
	3						
		Fall	15 (71%)	3 (14%)	0 (0.0%)	3 (14%)	21
		Winter	13 (62%)	3 (14%)	3 (14%)	2 (9.5%)	21
		Spring	13 (62%)	2 (9.5%)	3 (14%)	3 (14%)	21
	K						
		Fall	13 (52%)	3 (12%)	6 (24%)	3 (12%)	25
		Winter	10 (40%)	5 (20%)	8 (32%)	2 (8%)	25
		Spring	6 (24%)	6 (24%)	12 (48%)	1 (2%)	25
	1						
A.2.b		Fall	13 (62%)	4 (19%)	1 (4.8%)	3 (14%)	21
		Winter	12 (57%)	6 (29%)	2 (9.5%)	1 (1%)	21
		Spring	10 (48%)	5 (24%)	4 (19%)	2 (10%)	21
	2						
		Fall	10 (42%)	4 (17%)	5 (21%)	5 (21%)	24

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Winter	9 (38%)	2 (8%)	9 (38%)	4 (17%)	24
		Spring	7 (29%)	5 (21%)	6 (25%)	6 (25%)	24
	3						
		Fall	13 (59%)	5 (23%)	4 (18%)	0 (0%)	22
		Winter	11 (50%)	3 (14%)	7 (32%)	1 (5%)	22
		Spring	12 (55%)	1 (5%)	6 (27%)	3 (14%)	22
	K						
		Fall	16 (70%)	2 (9%)	4 (17%)	1 (4%)	23
		Winter	14 (61%)	4 (17%)	5 (22%)	0 (0%)	23
		Spring	13 (57%)	6 (26%)	3 (13%)	1 (4%)	23
	1						
		Fall	14 (74%)	3 (16%)	2 (11%)	0 (0%)	19
A.2.c		Winter	12 (63%)	4 (21%)	2 (11%)	1 (5%)	19
		Spring	11 (58%)	3 (16%)	4 (21%)	1 (5%)	19
	2						
		Fall	12 (52%)	4 (17%)	3 (13%)	4 (%)	23
		Winter	11 (48%)	3 (13%)	6 (26%)	3 (%)	23
		Spring	9 (39%)	6 (26%)	5 (22%)	3 (%)	23
	3						
		Fall	14 (67%)	4 (19%)	3 (14%)	0 (0%)	21
		Winter	13 (62%)	2 (10%)	5 (24%)	1 (5%)	21
		Spring	13 (62%)	2 (10%)	5 (24%)	1 (5%)	21
	K						
A.2.d		Fall	15 (63%)	2 (8%)	6 (25%)	1 (4%)	24
		Winter	12 (50%)	3 (13%)	7 (29%)	2 (8%)	24
		Spring	8 (33%)	6 (25%)	8 (33%)	2 (8%)	24
	1						
		Fall	13 (68%)	3 (16%)	2 (11%)	1 (5%)	19
		Winter	13 (68%)	4 (21%)	2 (11%)	0 (0%)	19
		Spring	8 (42%)	5 (26%)	4 (21%)	2 (11%)	19
	2						
		Fall	11 (48%)	7 (30%)	2 (9%)	3 (13%)	23
		Winter	12 (52%)	4 (17%)	3 (13%)	4 (17%)	23
		Spring	10 (43%)	4 (17%)	6 (26%)	3 (13%)	23
	3						
		Fall	14 (64%)	4 (18%)	3 (14%)	1 (5%)	22
		Winter	13 (59%)	3 (14%)	5 (23%)	1 (5%)	22
		Spring	12 (55%)	2 (9%)	7 (32%)	1 (5%)	22
	K						
		Fall	17 (71%)	2 (8%)	4 (17%)	1 (4%)	24
A.2.e		Winter	15 (70%)	2 (8%)	5 (21%)	2 (8%)	24
		Spring	12 (45%)	8 (33%)	3 (13%)	1 (4%)	24
	1						

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Fall	15 (75%)	2 (10%)	2 (10%)	1 (5%)	20
		Winter	14 (70%)	3 (15%)	1 (5%)	2 (10%)	20
		Spring	9 (45%)	3 (15%)	4 (20%)	4 (20%)	20
	2						
		Fall	10 (45%)	5 (23%)	3 (14%)	4 (18%)	22
		Winter	11 (50%)	4 (18%)	4 (18%)	3 (14%)	22
		Spring	7 (32%)	7 (32%)	4 (18%)	4 (18%)	22
	3						
		Fall	12 (55%)	5 (23%)	4 (18%)	1 (5%)	22
		Winter	9 (41%)	3 (14%)	5 (23%)	5 (23%)	22
		Spring	9 (41%)	4 (18%)	7 (32%)	2 (9%)	22
	K						
		Fall	13 (72%)	0 (0%)	3 (17%)	2 (11%)	18
		Winter	13 (72%)	0 (0%)	4 (22%)	1 (6%)	18
		Spring	10 (56%)	5 (28%)	2 (11%)	1 (6%)	18
	1						
		Fall	9 (53%)	3 (18%)	2 (12%)	3 (18%)	17
A.3.a		Winter	11 (65%)	2 (12%)	2 (12%)	2 (12%)	17
		Spring	9 (53%)	4 (24%)	1 (6%)	3 (18%)	17
	2						
		Fall	11 (55%)	4 (20%)	2 (10%)	3 (15%)	20
		Winter	11 (55%)	4 (20%)	2 (10%)	3 (15%)	20
		Spring	5 (25%)	8 (40%)	2 (10%)	5 (25%)	20
	3						
		Fall	9 (53%)	4 (24%)	3 (18%)	1 (6%)	17
		Winter	7 (41%)	4 (24%)	3 (18%)	3 (18%)	17
		Spring	7 (41%)	5 (29%)	2 (12%)	3 (18%)	17
	K						
		Fall	14 (67%)	2 (10%)	2 (10%)	3 (14%)	21
		Winter	12 (57%)	4 (19%)	3 (14%)	2 (10%)	21
		Spring	13 (62%)	3 (14%)	4 (19%)	1 (5%)	21
	1						
		Fall	11 (73%)	3 (20%)	1 (7%)	0 (0%)	15
A.3.b		Winter	10 (67%)	4 (27%)	1 (7%)	0 (0%)	15
		Spring	8 (53%)	4 (27%)	2 (13%)	1 (7%)	15
	2						
		Fall	9 (50%)	5 (28%)	1 (6%)	3 (17%)	18
		Winter	10 (56%)	3 (17%)	2 (11%)	3 (17%)	18
		Spring	8 (44%)	2 (11%)	4 (22%)	4 (22%)	18
	3						
		Fall	12 (71%)	3 (18%)	2 (12%)	0 (0%)	17
		Winter	11 (65%)	3 (18%)	2 (12%)	1 (6%)	17
		Spring	10 (59%)	3 (18%)	4 (24%)	0 (0%)	17

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
	K						
		Fall	15 (60%)	3 (12%)	5 (20%)	2 (8%)	25
		Winter	12 (48%)	6 (24%)	5 (20%)	2 (8%)	25
		Spring	10 (40%)	6 (24%)	8 (32%)	1 (4%)	25
	1						
		Fall	13 (68%)	1 (5%)	2 (11%)	3 (16%)	19
A.3.c		Winter	13 (68%)	2 (11%)	1 (5%)	3 (16%)	19
		Spring	5 (26%)	6 (32%)	4 (21%)	4 (21%)	19
	2						
		Fall	11 (50%)	5 (23%)	3 (14%)	3 (14%)	22
		Winter	9 (41%)	5 (23%)	4 (18%)	4 (18%)	22
		Spring	7 (32%)	4 (18%)	6 (27%)	5 (23%)	22
	3						
		Fall	13 (68%)	2 (11%)	2 (11%)	2 (11%)	19
		Winter	8 (42%)	4 (21%)	2 (11%)	5 (26%)	19
		Spring	8 (42%)	4 (21%)	4 (21%)	3 (16%)	19
	K						
		Fall	15 (60%)	4 (16%)	5 (20%)	1 (4%)	25
		Winter	12 (48%)	6 (24%)	5 (20%)	2 (8%)	25
		Spring	11 (44%)	6 (24%)	6 (24%)	2 (8%)	25
	1						
		Fall	13 (72%)	1 (6%)	3 (17%)	1 (6%)	18
A.3.d		Winter	12 (67%)	3 (17%)	2 (11%)	1 (6%)	18
		Spring	7 (39%)	4 (22%)	5 (28%)	2 (11%)	18
	2						
		Fall	12 (52%)	5 (22%)	4 (17%)	2 (9%)	23
		Winter	10 (43%)	2 (9%)	7 (30%)	4 (17%)	23
		Spring	6 (26%)	5 (22%)	8 (35%)	4 (17%)	23
	3						
		Fall	12 (63%)	4 (21%)	3 (16%)	0 (0%)	19
		Winter	10 (53%)	6 (32%)	1 (5%)	2 (11%)	19
		Spring	8 (42%)	3 (16%)	6 (32%)	2 (11%)	19
	K						
		Fall	16 (73%)	3 (14%)	3 (14%)	0 (0%)	22
		Winter	15 (%68)	2 (9%)	3 (14%)	2 (9%)	22
		Spring	11 (50%)	4 (18%)	5 (23%)	2 (9%)	22
	1						
A.3.e		Fall	17 (94%)	0 (0%)	1 (6%)	0 (0%)	18
		Winter	16 (89%)	0 (0%)	1 (6%)	1 (6%)	18
		Spring	15 (83%)	1 (6%)	1 (6%)	1 (6%)	18
	2						
		Fall	13 (65%)	2 (20%)	2 (10%)	3 (15%)	20
		Winter	11 (55%)	1 (5%)	5 (25%)	3 (15%)	20

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Spring	10 (50%)	4 (20%)	1 (5%)	5 (25%)	20
	3						
		Fall	12 (67%)	3 (17%)	3 (17%)	0 (0%)	18
		Winter	9 (50%)	5 (28%)	2 (11%)	2 (11%)	18
		Spring	8 (44%)	5 (28%)	4 (22%)	1 (6%)	18
	K						
		Fall	18 (78%)	1 (4%)	3 (12%)	1 (4%)	23
		Winter	16 (70%)	1 (4%)	5 (22%)	1 (4%)	23
		Spring	15 (65%)	2 (9%)	4 (17%)	2 (9%)	23
	1						
		Fall	12 (71%)	2 (12%)	2 (12%)	1 (6%)	17
A.3.f		Winter	12 (71%)	3 (18%)	0 (0%)	2 (12%)	17
		Spring	10 (59%)	1 (6%)	4 (24%)	2 (12%)	17
	2						
		Fall	11 (58%)	3 (16%)	3 (16%)	2 (11%)	19
		Winter	8 (42%)	5 (26%)	3 (16%)	3 (16%)	19
		Spring	5 (26%)	5 (26%)	5 (26%)	4 (21%)	19
	3						
		Fall	14 (74%)	2 (11%)	3 (16%)	0 (0%)	19
		Winter	11 (58%)	2 (11%)	6 (32%)	0 (0%)	19
		Spring	9 (47%)	3 (16%)	5 (26%)	2 (11%)	19
	K						
		Fall	13 (65%)	4 (20%)	2 (10%)	1 (5%)	20
		Winter	13 (65%)	2 (10%)	4 (20%)	1 (5%)	20
		Spring	11 (55%)	2 (10%)	5 (25%)	2 (10%)	20
A.3.g	1						
		Fall	10 (71%)	2 (14%)	1 (7%)	1 (7%)	14
		Winter	10 (71%)	3 (21%)	0 (0%)	1 (7%)	14
		Spring	9 (64%)	1 (7%)	3 (21%)	1 (7%)	14
	2						
		Fall	11 (69%)	2 (13%)	2 (13%)	1 (6%)	16
		Winter	7 (44%)	3 (29%)	2 (13%)	4 (25%)	16
		Spring	7 (44%)	3 (19%)	4 (25%)	2 (13%)	16
	3						
		Fall	12 (71%)	1 (6%)	3 (18%)	1 (6%)	17
		Winter	11 (65%)	1 (6%)	1 (6%)	4 (24%)	17
		Spring	11 (65%)	1 (6%)	3 (18%)	2 (12%)	17

Table 13

Reasoning Spatially Between Objects: Time of Year and Emphasis of Skill Statements by Grade Level

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
B.5.a	K	Fall	3 (11%)	10 (37%)	8 (30%)	6 (22%)	27
		Winter	1 (4%)	10 (37%)	13 (48%)	3 (11%)	27
		Spring	2 (7%)	5 (19%)	13 (48%)	7 (26%)	27
	1	Fall	3 (11%)	7 (25%)	12 (43%)	6 (21%)	28
		Winter	3 (11%)	7 (25%)	8 (29%)	10 (36%)	28
		Spring	4 (14%)	7 (25%)	8 (29%)	9 (32%)	28
	2	Fall	7 (26%)	10 (37%)	4 (15%)	6 (22%)	27
		Winter	6 (22%)	4 (15%)	13 (48%)	4 (15%)	27
		Spring	5 (19%)	8 (30%)	9 (33%)	5 (19%)	27
	3	Fall	7 (25%)	12 (43%)	5 (18%)	4 (14%)	28
		Winter	7 (25%)	6 (21%)	12 (43%)	3 (11%)	28
		Spring	6 (21%)	9 (32%)	3 (11%)	10 (36%)	28
B.5.b	K	Fall	4 (15%)	8 (31%)	7 (27%)	7 (27%)	26
		Winter	3 (12%)	6 (23%)	16 (62%)	1 (4%)	26
		Spring	2 (8%)	6 (23%)	14 (54%)	4 (15%)	26
	1	Fall	2 (7%)	6 (21%)	15 (52%)	6 (21%)	29
		Winter	3 (10%)	6 (21%)	10 (34%)	10 (34%)	29
		Spring	4 (14%)	4 (14%)	13 (45%)	8 (28%)	29
	2	Fall	8 (30%)	10 (37%)	6 (22%)	3 (11%)	27
		Winter	7 (26%)	6 (22%)	9 (33%)	5 (19%)	27
		Spring	6 (22%)	7 (26%)	8 (30%)	6 (22%)	27
	3	Fall	9 (32%)	9 (32%)	6 (21%)	4 (14%)	28
		Winter	10 (36%)	4 (14%)	12 (43%)	2 (7%)	28
		Spring	8 (29%)	7 (25%)	5 (18%)	8 (29%)	28
B.5.c	K	Fall	4 (15%)	9 (35%)	6 (23%)	7 (27%)	26
		Winter	1 (4%)	9 (35%)	13 (50%)	3 (12%)	26
		Spring	2 (8%)	4 (15%)	15 (58%)	5 (19%)	26
	1	Fall	3 (10%)	5 (17%)	15 (52%)	6 (21%)	29

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Winter	3 (10%)	8 (28%)	8 (28%)	10 (34%)	29
		Spring	4 (14%)	6 (21%)	10 (34%)	9 (31%)	29
	2						
		Fall	7 (26%)	11 (41%)	7 (26%)	2 (7%)	27
		Winter	4 (15%)	7 (26%)	11 (41%)	5 (19%)	27
		Spring	5 (19%)	10 (37%)	6 (22%)	6 (22%)	27
	3						
		Fall	9 (33%)	7 (26%)	8 (30%)	3 (11%)	27
		Winter	8 (30%)	6 (22%)	9 (33%)	4 (15%)	27
		Spring	6 (22%)	9 (33%)	8 (30%)	4 (15%)	27
	K						
		Fall	13 (57%)	5 (22%)	5 (22%)	0 (0%)	23
		Winter	10 (43%)	5 (22%)	2 (9%)	6 (26%)	23
		Spring	5 (22%)	2 (9%)	10 (43%)	6 (26%)	23
	1						
		Fall	8 (31%)	4 (15%)	9 (35%)	5 (19%)	26
B.6.a		Winter	6 (23%)	2 (8%)	8 (31%)	10 (38%)	26
		Spring	2 (8%)	3 (12%)	7 (27%)	14 (54%)	26
	2						
		Fall	7 (27%)	9 (35%)	4 (15%)	6 (23%)	26
		Winter	5 (19%)	7 (27%)	9 (35%)	5 (19%)	26
		Spring	5 (19%)	8 (31%)	9 (35%)	4 (15%)	26
	3						
		Fall	10 (37%)	8 (30%)	7 (26%)	2 (7%)	27
		Winter	10 (37%)	6 (22%)	5 (19%)	6 (22%)	27
		Spring	3 (11%)	8 (30%)	8 (30%)	8 (30%)	27
	K						
		Fall	19 (76%)	3 (12%)	2 (8%)	1 (4%)	25
		Winter	14 (56%)	7 (28%)	3 (12%)	1 (4%)	25
		Spring	12 (48%)	5 (20%)	6 (24%)	2 (8%)	25
	1						
		Fall	12 (50%)	6 (25%)	2 (8%)	4 (17%)	24
B.6.b		Winter	11 (46%)	5 (21%)	4 (17%)	4 (17%)	24
		Spring	11 (46%)	6 (25%)	3 (13%)	4 (17%)	24
	2						
		Fall	10 (43%)	7 (30%)	5 (22%)	1 (4%)	23
		Winter	9 (39%)	4 (17%)	7 (30%)	3 (13%)	23
		Spring	7 (30%)	6 (26%)	4 (17%)	6 (26%)	23
	3						
		Fall	13 (46%)	9 (32%)	2 (7%)	4 (14%)	28
		Winter	14 (50%)	6 (21%)	5 (18%)	3 (11%)	28
		Spring	9 (32%)	7 (25%)	9 (32%)	3 (11%)	28
B.6.c	K						

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Fall	7 (29%)	11 (46%)	4 (17%)	2 (8%)	24
		Winter	4 (17%)	8 (33%)	7 (29%)	5 (21%)	24
		Spring	2 (8%)	10 (42%)	7 (29%)	5 (21%)	24
	1						
		Fall	4 (16%)	7 (28%)	7 (28%)	7 (28%)	25
		Winter	5 (20%)	3 (12%)	7 (28%)	10 (40%)	25
		Spring	3 (12%)	3 (12%)	10 (40%)	9 (36%)	25
	2						
		Fall	2 (8%)	11 (42%)	9 (35%)	4 (15%)	26
		Winter	2 (8%)	8 (31%)	12 (46%)	4 (15%)	26
		Spring	2 (8%)	7 (27%)	11 (42%)	6 (23%)	26
	3						
		Fall	9 (32%)	13 (46%)	4 (14%)	2 (7%)	28
		Winter	6 (21%)	7 (25%)	9 (32%)	6 (21%)	28
		Spring	4 (14%)	7 (25%)	9 (32%)	8 (29%)	28
	K						
		Fall	10 (40%)	9 (36%)	5 (20%)	1 (4%)	25
		Winter	7 (28%)	8 (32%)	7 (28%)	3 (12%)	25
		Spring	7 (28%)	6 (24%)	9 (36%)	3 (12%)	25
	1						
		Fall	5 (20%)	8 (32%)	6 (24%)	6 (24%)	25
B.6.d		Winter	6 (24%)	3 (12%)	9 (36%)	7 (28%)	25
		Spring	4 (16%)	1 (4%)	13 (52%)	7 (28%)	25
	2						
		Fall	6 (22%)	6 (22%)	9 (33%)	6 (22%)	27
		Winter	6 (22%)	5 (19%)	12 (44%)	4 (15%)	27
		Spring	5 (19%)	7 (26%)	6 (22%)	9 (33%)	27
	3						
		Fall	11 (39%)	6 (21%)	7 (25%)	4 (14%)	28
		Winter	8 (29%)	7 (25%)	8 (29%)	5 (18%)	28
		Spring	7 (25%)	8 (29%)	7 (25%)	6 (21%)	28
	K						
		Fall	12 (52%)	6 (26%)	3 (13%)	2 (9%)	23
		Winter	9 (39%)	6 (26%)	6 (26%)	2 (9%)	23
		Spring	8 (35%)	7 (30%)	3 (13%)	5 (22%)	23
	1						
		Fall	6 (23%)	7 (27%)	8 (31%)	5 (19%)	26
B.6.e		Winter	6 (23%)	5 (19%)	9 (35%)	6 (23%)	26
		Spring	5 (19%)	2 (8%)	9 (35%)	10 (38%)	26
	2						
		Fall	5 (19%)	7 (26%)	12 (44%)	3 (11%)	27
		Winter	8 (30%)	4 (15%)	11 (41%)	4 (15%)	27
		Spring	6 (22%)	4 (15%)	11 (41%)	6 (22%)	27

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
	3						
		Fall	8 (30%)	9 (33%)	8 (30%)	2 (7%)	27
		Winter	9 (33%)	5 (19%)	9 (33%)	4 (15%)	27
		Spring	10 (37%)	4 (15%)	9 (33%)	4 (15%)	27
	K						
		Fall	20 (87%)	2 (9%)	1 (4%)	0 (0%)	23
		Winter	20 (87%)	1 (4%)	1 (4%)	1 (4%)	23
		Spring	17 (74%)	3 (13%)	3 (13%)	0 (0%)	23
	1						
		Fall	12 (48%)	7 (28%)	2 (8%)	4 (16%)	25
B.6.f		Winter	12 (48%)	3 (12%)	6 (24%)	4 (16%)	25
		Spring	12 (48%)	5 (20%)	4 (16%)	4 (16%)	25
	2						
		Fall	12 (43%)	6 (21%)	10 (36%)	0 (0%)	28
		Winter	10 (36%)	4 (14%)	11 (39%)	3 (11%)	28
		Spring	8 (29%)	7 (25%)	10 (36%)	3 (11%)	28
	3						
		Fall	9 (33%)	10 (37%)	5 (19%)	3 (11%)	27
		Winter	11 (41%)	5 (19%)	9 (33%)	2 (7%)	27
		Spring	9 (33%)	6 (22%)	8 (30%)	4 (15%)	27
	K						
		Fall	14 (61%)	6 (26%)	3 (13%)	0 (0%)	23
		Winter	14 (61%)	6 (26%)	3 (13%)	0 (0%)	23
		Spring	12 (52%)	7 (30%)	2 (9%)	2 (9%)	23
	1						
		Fall	11 (42%)	7 (27%)	6 (23%)	2 (8%)	26
B.6.g		Winter	11 (42%)	3 (12%)	7 (27%)	5 (19%)	26
		Spring	7 (27%)	5 (19%)	11 (42%)	3 (12%)	26
	2						
		Fall	6 (22%)	11 (41%)	7 (26%)	3 (11%)	27
		Winter	6 (22%)	9 (33%)	10 (37%)	2 (7%)	27
		Spring	5 (19%)	6 (22%)	12 (44%)	4 (15%)	27
	3						
		Fall	14 (50%)	4 (14%)	7 (25%)	3 (11%)	28
		Winter	12 (43%)	3 (11%)	10 (36%)	3 (11%)	28
		Spring	11 (39%)	7 (25%)	8 (29%)	2 (7%)	28
	K						
		Fall	21 (91%)	1 (4%)	1 (4%)	0 (0%)	23
		Winter	20 (87%)	2 (9%)	1 (4%)	0 (0%)	23
B.6.h		Spring	19 (83%)	3 (13%)	1 (4%)	0 (0%)	23
	1						
		Fall	16 (70%)	4 (17%)	1 (4%)	2 (9%)	23
		Winter	15 (65%)	5 (22%)	1 (4%)	2 (9%)	23

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Spring	13 (57%)	1 (4%)	6 (26%)	3 (13%)	23
	2						
		Fall	13 (52%)	6 (24%)	5 (20%)	1 (4%)	25
		Winter	13 (52%)	5 (20%)	5 (20%)	2 (8%)	25
		Spring	10 (40%)	5 (20%)	8 (32%)	2 (8%)	25
	3						
		Fall	10 (36%)	8 (29%)	6 (21%)	4 (14%)	28
		Winter	9 (32%)	6 (21%)	10 (36%)	3 (11%)	28
		Spring	9 (32%)	7 (25%)	10 (36%)	2 (7%)	28
	K						
		Fall	11 (38%)	9 (31%)	7 (24%)	2 (7%)	29
		Winter	8 (35%)	6 (26%)	8 (35%)	1 (4%)	23
		Spring	5 (22%)	10 (43%)	3 (13%)	5 (22%)	23
	1						
		Fall	7 (28%)	7 (28%)	8 (32%)	3 (12%)	25
B.7.a		Winter	10 (40%)	3 (12%)	8 (32%)	4 (16%)	25
		Spring	7 (28%)	4 (16%)	10 (40%)	4 (16%)	25
	2						
		Fall	6 (21%)	6 (21%)	11 (39%)	5 (18%)	28
		Winter	8 (29%)	3 (11%)	11 (39%)	6 (21%)	28
		Spring	7 (25%)	6 (21%)	8 (29%)	7 (25%)	28
	3						
		Fall	12 (46%)	6 (23%)	7 (27%)	1 (4%)	26
		Winter	10 (38%)	3 (12%)	11 (42%)	2 (8%)	26
		Spring	10 (38%)	7 (27%)	6 (23%)	3 (12%)	26
	K						
		Fall	12 (57%)	7 (33%)	2 (10%)	0 (0%)	21
		Winter	9 (43%)	10 (48%)	2 (10%)	0 (0%)	21
		Spring	8 (38%)	9 (43%)	3 (14%)	1 (5%)	21
	1						
		Fall	10 (43%)	8 (35%)	3 (13%)	2 (9%)	23
B.7.b		Winter	11 (48%)	5 (22%)	5 (22%)	2 (9%)	23
		Spring	8 (35%)	7 (30%)	4 (17%)	4 (17%)	23
	2						
		Fall	8 (31%)	8 (31%)	8 (31%)	2 (8%)	26
		Winter	8 (31%)	4 (15%)	11 (42%)	3 (12%)	26
		Spring	8 (31%)	8 (31%)	9 (35%)	1 (4%)	26
	3						
		Fall	12 (48%)	6 (24%)	4 (16%)	3 (12%)	25
		Winter	8 (32%)	9 (36%)	4 (16%)	4 (16%)	25
		Spring	9 (36%)	5 (20%)	5 (20%)	6 (24%)	25
B.7.c	K						
		Fall	12 (52%)	7 (30%)	2 (9%)	2 (9%)	23

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Winter	10 (43%)	8 (35%)	3 (13%)	2 (9%)	23
		Spring	8 (35%)	8 (35%)	7 (30%)	0 (0%)	23
	1						
		Fall	9 (38%)	9 (38%)	3 (13%)	3 (13%)	24
		Winter	9 (38%)	7 (29%)	4 (17%)	4 (17%)	24
		Spring	8 (33%)	7 (29%)	6 (25%)	3 (13%)	24
	2						
		Fall	13 (52%)	6 (24%)	4 (16%)	2 (8%)	25
		Winter	11 (44%)	5 (20%)	6 (24%)	3 (12%)	25
		Spring	9 (36%)	6 (24%)	8 (32%)	2 (8%)	25
	3						
		Fall	13 (52%)	7 (28%)	3 (12%)	2 (8%)	25
		Winter	11 (44%)	5 (20%)	6 (24%)	3 (12%)	25
		Spring	10 (36%)	8 (29%)	6 (21%)	4 (14%)	28
	K						
		Fall	16 (70%)	6 (26%)	1 (4%)	0 (0%)	23
		Winter	16 (70%)	4 (17%)	3 (13%)	0 (0%)	23
		Spring	13 (57%)	6 (26%)	4 (17%)	0 (0%)	23
	1						
		Fall	12 (50%)	5 (21%)	3 (13%)	4 (17%)	24
B.7.d		Winter	13 (54%)	2 (8%)	5 (21%)	4 (17%)	24
		Spring	10 (42%)	3 (13%)	5 (21%)	6 (25%)	24
	2						
		Fall	11 (46%)	7 (29%)	5 (21%)	1 (4%)	24
		Winter	11 (46%)	3 (13%)	6 (25%)	4 (17%)	24
		Spring	11 (46%)	5 (21%)	5 (21%)	3 (13%)	24
	3						
		Fall	12 (50%)	7 (29%)	3 (13%)	2 (8%)	24
		Winter	12 (50%)	5 (21%)	5 (21%)	2 (8%)	24
		Spring	10 (42%)	5 (21%)	6 (25%)	3 (13%)	24
	K						
		Fall	18 (86%)	3 (14%)	0 (0%)	0 (0%)	21
		Winter	16 (76%)	4 (19%)	1 (5%)	0 (0%)	21
		Spring	13 (62%)	4 (19%)	4 (19%)	0 (0%)	21
	1						
		Fall	13 (54%)	2 (8%)	7 (29%)	2 (8%)	24
B.7.e		Winter	11 (46%)	4 (17%)	5 (21%)	4 (17%)	24
		Spring	11 (46%)	1 (4%)	9 (38%)	3 (13%)	24
	2						
		Fall	11 (46%)	5 (21%)	5 (21%)	3 (13%)	24
		Winter	8 (33%)	4 (17%)	7 (29%)	5 (21%)	24
		Spring	8 (33%)	5 (21%)	8 (33%)	3 (13%)	24
	3						

Skill Statement	Grade Level	Time	Not Taught	Touched on Briefly	Minor Focus	Major Focus	N
		Fall	13 (54%)	6 (25%)	3 (13%)	2 (8%)	24
		Winter	12 (50%)	2 (8%)	7 (29%)	3 (13%)	24
		Spring	9 (38%)	5 (21%)	6 (25%)	4 (17%)	24

Lastly, we asked teachers to rate the development appropriateness of subcomponents found in the learning progression. Table 14 and Table 15 describe their responses by grade level. We also coded the response options to an ordinal scale and calculated means, standard deviations, and conducted ANOVA tests to assess any differences in means by grade level. If significant mean difference were detected by the ANOVA, we then conducted a Tukey-adjusted pairwise mean comparisons. These results can be found in Appendix C.

Table 14

Reasons Spatially Within Objects: Developmental Appropriateness of Subcomponents by Grade Level

Skill Statement	Grade Level	N	Not Appropriate	Somewhat Appropriate	Appropriate	Very Appropriate	Fisher's Test
A.1.a	K	27	0 (0%)	3 (11%)	18 (67%)	6 (22%)	p = .29
	1	22	2 (9%)	3 (14%)	11 (50%)	6 (27%)	
	2	24	1 (4%)	4 (17%)	11 (46%)	8 (33%)	
	3	26	0 (0%)	5 (19%)	12 (46%)	9 (35%)	
A.1.b	K	27	0 (0%)	2 (7%)	10 (37%)	15 (56%)	p = .28
	1	23	1 (4%)	5 (22%)	9 (39%)	8 (35%)	
	2	23	0 (0%)	2 (9%)	9 (39%)	12 (52%)	
	3	25	0 (0%)	4 (16%)	12 (48%)	9 (36%)	
A.1.c	K	26	0 (0%)	2 (8%)	10 (38%)	14 (54%)	p = .45
	1	23	1 (4%)	2 (9%)	12 (52%)	8 (35%)	
	2	23	0 (0%)	1 (4%)	9 (39%)	13 (57%)	
	3	24	1 (4%)	4 (17%)	10 (42%)	9 (38%)	
A.1.d	K	25	0 (0%)	7 (28%)	10 (40%)	8 (32%)	p = .24
	1	21	1 (5%)	6 (29%)	9 (43%)	5 (24%)	
	2	24	1 (4%)	2 (8%)	8 (33%)	13 (54%)	
	3	23	0 (0%)	2 (9%)	10 (43%)	11 (48%)	
A.2.a	K	22	13 (59%)	6 (27%)	2 (9%)	1 (5%)	P = .03
	1	18	3 (17%)	9 (50%)	4 (22%)	2 (11%)	
	2	23	3 (13%)	8 (35%)	9 (39%)	3 (13%)	
	3	21	4 (19%)	9 (43%)	4 (19%)	4 (19%)	
A.2.b	K	25	3 (12%)	9 (36%)	8 (32%)	5 (20%)	P = .71
	1	21	3 (14%)	11 (52%)	5 (24%)	2 (10%)	
	2	24	2 (8%)	8 (32%)	10 (42%)	4 (17%)	
	3	22	5 (23%)	7 (32%)	6 27(%)	4 (18%)	

Skill Statement	Grade Level	N	Not Appropriate	Somewhat Appropriate	Appropriate	Very Appropriate	Fisher's Test
A.2.c	K	23	10 (43%)	7 (30%)	5 (22%)	1 (4%)	P = .56
	1	19	3 (16%)	10 (53%)	4 (21%)	2 (11%)	
	2	23	5 (22%)	8 (35%)	7 (30%)	3 (13%)	
	3	22	7 (33%)	6 (29%)	7 (33%)	1 (5%)	
A.2.d	K	24	6 (25%)	7 (29%)	8 (33%)	3 (13%)	P = .51
	1	19	3 (16%)	11 (58%)	4 (21%)	1 (5%)	
	2	23	6 (26%)	5 (22%)	9 (39%)	3 (13%)	
	3	22	7 (32%)	5 (23%)	7 (32%)	3 (14%)	
A.2.e	K	24	9 (38%)	7 (29%)	6 (25%)	2 (8%)	P = .44
	1	20	6 (30%)	9 (45%)	3 (15%)	2 (10%)	
	2	22	4 (18%)	7 (32%)	6 (27%)	5 (23%)	
	3	22	3 (14%)	7 (32%)	8 (36%)	4 (18%)	
A.3.a	K	18	7 (39%)	6 (33%)	4 (22%)	1 (6%)	P = .99
	1	17	7 (41%)	4 (24%)	3 (18%)	3 (18%)	
	2	20	5 (25%)	7 (35%)	5 (25%)	3 (15%)	
	3	17	5 (29%)	5 (29%)	4 (24%)	3 (18%)	
A.3.b	K	21	11 (52%)	4 (19%)	5 (24%)	1 (5%)	P = .73
	1	15	8 (53%)	3 (20%)	3 (20%)	1 (7%)	
	2	18	6 (33%)	5 (28%)	4 (22%)	3 (17%)	
	3	17	9 (53%)	3 (18%)	5 (29%)	0 (0%)	
A.3.c	K	25	9 (36%)	5 (20%)	8 (32%)	3 (12%)	P = .50
	1	19	3 (16%)	5 (26%)	2 (6%)	9 (47%)	
	2	22	3 (14%)	5 (23%)	11 (35%)	3 (14%)	
	3	19	2 (11%)	6 (32%)	3 (28%)	8 (42%)	
A.3.d	K	25	7 (28%)	8 (32%)	7 (28%)	3 (12%)	P = .30
	1	18	3 (17%)	6 (33%)	7 (39%)	2 (11%)	
	2	23	0 (0%)	8 (35%)	11 (48%)	4 (17%)	
	3	19	3 (16%)	5 (26%)	6 (32%)	5 (26%)	
A.3.e	K	22	9 (41%)	6 (27%)	7 (32%)	0 (0%)	P = .16
	1	18	12 (67%)	4 (22%)	1 (6%)	1 (6%)	
	2	20	8 (40%)	2 (10%)	7 (35%)	3 (15%)	
	3	18	4 (22%)	7 (39%)	5 (28%)	2 (11%)	
A.3.f	K	23	10 (43%)	8 (35%)	4 (17%)	1 (4%)	P = .18
	1	17	6 (35%)	4 (24%)	5 (29%)	2 (12%)	
	2	19	2 (11%)	6 (32%)	8 (42%)	3 (16%)	
	3	19	3 (16%)	10 (53%)	5 (26%)	1 (5%)	
A.3.g	K	20	7 (35%)	9 (45%)	4 (20%)	0 (0%)	P = .56
	1	14	5 (36%)	4 (29%)	4 (29%)	1 (7%)	
	2	16	3 (19%)	6 (38%)	4 (25%)	3 (19%)	
	3	17	6 (35%)	5 (29%)	3 (18%)	3 (18%)	

Table 15

Reasons Spatially Between Objects: Developmental Appropriateness of Subcomponents by Grade Level

Skill Statement	Grade Level	N	Not Appropriate	Somewhat Appropriate	Appropriate	Very Appropriate	Fisher's Test
B.5.a	K	27	0 (0%)	0 (0%)	16 (59%)	11 (41%)	P<.001
	1	28	0 (0%)	6 (21%)	9 (32%)	13 (46%)	
	2	27	1 (4%)	11 (41%)	10 (37%)	5 (19%)	
	3	28	3 (11%)	9 (32%)	12 (43%)	4 (14%)	
B.5.b	K	26	0 (0%)	1 (4%)	15 (58%)	10 (38%)	P<.001
	1	29	1 (3%)	3 (10%)	11 (38%)	14 (48%)	
	2	27	2 (7%)	11 (41%)	8 (30%)	6 (22%)	
	3	28	7 (25%)	7 (25%)	9 (32%)	5 (18%)	
B.5.c	K	26	0 (0%)	1 (4%)	16 (62%)	9 (35%)	P=.001
	1	29	1 (3%)	3 (10%)	12 (41%)	13 (45%)	
	2	27	1 (4%)	10 (37%)	12 (44%)	4 (15%)	
	3	27	5 (19%)	10 (37%)	5 (19%)	7 (26%)	
B.6.a	K	23	2 (9%)	4 (17%)	12 (52%)	5 (22%)	P=.24
	1	26	1 (4%)	2 (8%)	14 (54%)	9 (35%)	
	2	26	3 (12%)	10 (38%)	6 (23%)	7 (27%)	
	3	27	2 (7%)	7 (26%)	10 (37%)	8 (30%)	
B.6.b	K	25	6 (24%)	12 (48%)	3 (12%)	4 (16%)	P = .66
	1	24	5 (21%)	8 (33%)	6 (25%)	5 (21%)	
	2	23	5 (22%)	10 (43%)	7 (30%)	1 (4%)	
	3	28	5 (18%)	10 (36%)	11 (39%)	2 (7%)	
B.6.c	K	24	2 (8%)	3 (13%)	13 (54%)	6 (25%)	P=.23
	1	25	0 (0%)	5 (20%)	10 (40%)	10 (40%)	
	2	26	0 (0%)	6 (23%)	18 (69%)	2 (8%)	
	3	28	1 (4%)	6 (21%)	14 (50%)	7 (25%)	
B.6.d	K	25	4 (16%)	6 (24%)	11 (44%)	4 (16%)	P=.04
	1	25	0 (0%)	5 (20%)	11 (44%)	9 (36%)	
	2	27	3 (11%)	1 (4%)	14 (52%)	9 (33%)	
	3	28	0 (0%)	11 (39%)	12 (43%)	5 (18%)	
B.6.e	K	23	3 (13%)	7 (30%)	9 (39%)	4 (17%)	P=.91
	1	26	3 (12%)	6 (23%)	8 (31%)	9 (35%)	
	2	27	2 (7%)	6 (22%)	11 (41%)	8 (30%)	
	3	27	2 (7%)	6 (22%)	11 (41%)	8 (30%)	
B.6.f	K	23	15 (65%)	6 (26%)	2 (9%)	0 (0%)	P=.006
	1	25	6 (24%)	7 (28%)	6 (24%)	6 (24%)	
	2	28	5 (18%)	9 (32%)	11 (39%)	3 (11%)	
	3	27	4 (15%)	6 (22%)	12 (44%)	5 (19%)	
B.6.g	K	23	4 (17%)	14 (61%)	4 (17%)	1 (4%)	P=.41
	1	26	5 (19%)	9 (35%)	7 (27%)	5 (19%)	

Skill Statement	Grade Level	N	Not Appropriate	Somewhat Appropriate	Appropriate	Very Appropriate	Fisher's Test
	2	27	2 (7%)	10 (37%)	10 (37%)	5 (19%)	
	3	28	5 (18%)	10 (36%)	6 (21%)	7 (25%)	
B.6.h	K	23	17 (74%)	4 (17%)	2 (9%)	0 (0%)	P=.003
	1	23	11 (48%)	4 (17%)	5 (22%)	3 (13%)	
	2	25	6 (24%)	8 (32%)	7 (28%)	4 (16%)	
	3	28	2 (7%)	8 (29%)	11 (39%)	7 (25%)	
B.7.a	K	23	2 (9%)	9 (39%)	9 (39%)	3 (13%)	P=.83
	1	25	4 (16%)	8 (32%)	7 (28%)	6 (24%)	
	2	28	3 (11%)	8 (29%)	12 (43%)	5 (18%)	
	3	26	3 (12%)	6 (23%)	12 (46%)	5 (19%)	
B.7.b	K	21	5 (24%)	12 (57%)	4 (19%)	0 (0%)	P=.08
	1	23	2 (9%)	13 (57%)	2 (9%)	6 (26%)	
	2	26	5 (19%)	10 (38%)	8 (31%)	3 (12%)	
	3	25	2 (8%)	8 (32%)	10 (40%)	5 (20%)	
B.7.c	K	23	1 (4%)	13 (57%)	8 (35%)	1 (4%)	P=.57
	1	24	4 (17%)	11 (46%)	5 (21%)	4 (17%)	
	2	25	5 (20%)	11 (44%)	6 (24%)	3 (12%)	
	3	25	4 (16%)	8 (32%)	11 (44%)	2 (8%)	
B.7.d	K	23	6 (26%)	14 (61%)	3 (13%)	0 (0%)	P=.38
	1	24	5 (21%)	9 (38%)	6 (25%)	4 (17%)	
	2	24	8 (33%)	8 (33%)	4 (17%)	4 (17%)	
	3	24	2 (8%)	11 (46%)	7 (29%)	4 (17%)	
B.7.e	K	21	5 (24%)	12 (57%)	4 (19%)	0 (0%)	P=.29
	1	24	5 (21%)	9 (38%)	4 (17%)	6 (25%)	
	2	24	4 (17%)	8 (33%)	8 (33%)	4 (17%)	
	3	24	2 (8%)	7 (29%)	9 (38%)	6 (25%)	

Next Steps

We will utilize the results from the Spatial Reasoning teacher survey in conjunction with the Spatial Reasoning cognitive interviews (See Spatial Reasoning Cognitive Interview Quantitative Analyses TR; Sparks et al., 2020b) to empirically recover the Spatial Reasoning learning progression.

References

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Appendix A – Spatial Reasoning Teacher Survey

Q1. First Name

Q2. Last Name

Q4. What is the highest level of education you completed?

- High School Diploma
- Bachelor's Degree
- Master's Degree
- Doctorate/Ph.D.

Q5. What is your current title/position?

- Classroom teacher
- Special education teacher
- Math coach
- Interventionist
- Paraprofessional
- Other: _____

Q9. What grade(s) do you currently teach (select all that apply):

- K
- 1
- 2
- 3

Q178. For this survey, please choose the grade level that most closely relates to your experiences with mathematics education (you will answer the questions based on this grade):

- K
- 1

- 2
- 3

Q7. Select how many years of experience you have in each of the following areas:

- Current position
- Teaching experience
- Teaching elementary (K-3) students
- Teaching in current school
- Mathematics classroom teaching experience
- Special education mathematics teaching experience

Q8. Please select the option(s) that best reflect your credentials (select all that apply):

- K-6 teaching credential
- K-8 teaching credential
- Multiple subject (K-12)
- Secondary, single subject mathematics
- Mathematics specialist
- Reading specialist
- Special education
- Gifted and talented education
- English language learner specialist
- Administrative
- Other (please specify):

Q298. In what state do you currently teach?

Q9. Gender with which you identify:

- Male

- Female
- Prefer not to answer

Q10. Race/ethnicity

- Asian American/Pacific Islander
- Black/African American
- Hispanic/Latino American
- Native American
- White/European American
- Multiracial
- Other (please specify):
- Prefer not to answer

Q11. Age:

- 18-29 years
- 30-39 years
- 40-49 years
- 50-59 years
- 60 years or greater

Q12. How many minutes of instruction are devoted to mathematics each day?

Q14. Select the materials that children regularly play with or use in your classroom involving spatial tasks (select all that apply):

- Interlocking construction blocks (i.e., Lego™, Duplo™)
- Manga-Tiles
- Blocks
- Tangrams
- Pattern blocks

- Snap cubes (Unifix™)
- Maps
- Puzzles
- Computer games or apps involving spatial tasks (manipulating shapes, building things, Tetris)
- Other (please specify):

Q15. Describe a spatial reasoning activity you have done with your class:

Q182. Are the following shapes taught in your grade? Please select “Taught” or “Not Taught” for each example below.

- Circles
- Irregular circles
- Squares
- Triangles
- Rectangles
- Pentagons
- Irregular pentagons
- Hexagons
- Rhombuses
- Cubes
- Cones
- Cylinders
- Spheres
- Pyramids
- Prisms
- Trapezoids

- Quadrilaterals
- Irregular Quadrilaterals

Q234. Are the following examples of Positional Language and routes taught in your grade? Please select "Taught" or "Not Taught" for each example below.

- Up/down
- Under/over
- Between/around
- Towards/away
- Near/far
- Behind/in front of
- Beside
- Across
- Left/right
- Relative positions and distances from child's perspective (e.g., turn left, go straight three steps)
- Relative positions and distances from aerial views (e.g., go north three units)

Q300. The following skills were developed as part of a learning progression. You will be asked a series of questions related to classroom instruction on spatial reasoning including frequency taught, and appropriateness of specific skills. The same questions are asked about each skill.

Q238. When you teach this topic, it is primarily taught as a:

- Review from the previous grade
- Focal skill of the grade you teach
- Foundational skill for the next grade level

Q112. Do you understand the knowledge of skills students are expected to demonstrate based on the statement below?

- Yes, I completely understand
- I mostly understand

- No, I don't understand

How frequently do you teach this topic in the fall?

- Not taught
- Not a focus, but touched on briefly
- A minor focus
- A major focus

How frequently do you teach this topic in the winter?

- Not taught
- Not a focus, but touched on briefly
- A minor focus
- A major focus

How frequently do you teach this topic in the spring?

- Not taught
- Not a focus, but touched on briefly
- A minor focus
- A major focus

How developmentally appropriate is this topic for the grade you teach?

- Not appropriate
- Somewhat appropriate
- Appropriate
- Very appropriate

Q100. Thank you for your participation! Would you like your name to be entered into a drawing to win an $25 Amazon gift card?

- Yes
- No, submit without entering drawing

Q110. Please fill out the following information so that we may contact you if you win a gift card.

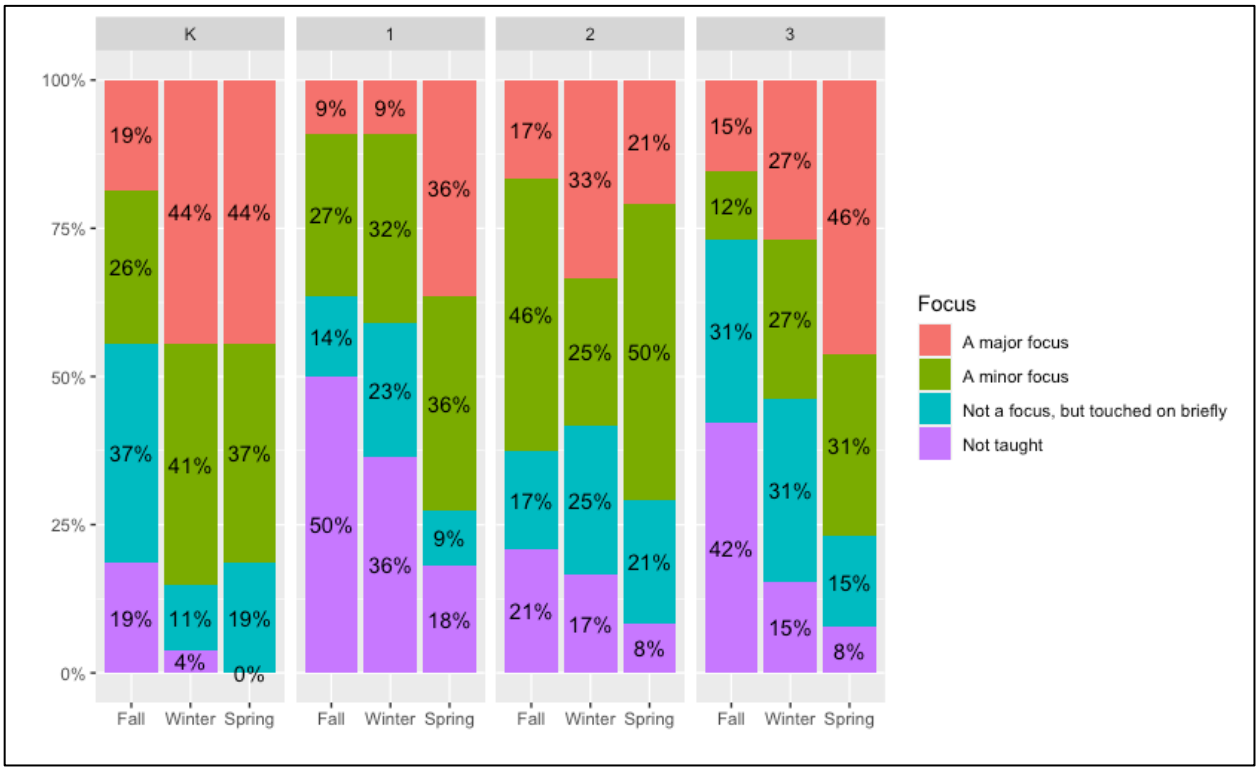
- First Name
- Last Name
- Email

Skills
SR.A.1.a – Sort similar two- and three-dimensional shapes regardless of size, orientation, or dimensionality
SR.A.1.b – Given the name of a two- or three-dimensional shape, recognize the shape
SR.A.1.c – Name two- and three-dimensional shapes
SR.A.1.d – Using defining attributes, classify two- and three-dimensional shapes
SR.A.2.a – Recognize a two-dimensional figure that has been translated
SR.A.2.b – Recognize a two-dimensional figure that has been rotated
SR.A.2.c – Recognize a two-dimensional figure that has been reflected
SR.A.2.d – Recognize three-dimensional shapes or figures that have been rotated
SR.A.2.e – Recognize the three-dimensional result of folding a two-dimensional figure
SR.A.3.a – Recognize the results of mentally translating two- or three-dimensional figures together
SR.A.3.b – Compose a two-dimensional composite figure or a three-dimensional composite figure using transformations (i.e., translations, reflections, rotations, and combinations of these)
SR.A.3.c – Compose a two-dimensional composite figure or a three-dimensional composite figure in more than one way (e.g., a hexagon can be composed of two trapezoids or six triangles)
SR.A.3.d – Find embedded figures within larger figures
SR.A.3.e – Recognize the two-dimensional cross section created by cutting a three-dimensional shape into two parts
SR.A.3.f – Decompose a two-dimensional composite figure in such a way that the parts can be used to create another given figure
SR.A.3.g – Compose a two-dimensional composite figure and iterate it to compose another figure
SR.B.5.a – Identify an object's spatial position in relation to other objects.
SR.B.5.b – Place an object when given positional language
SR.B.5.c – Describe an object's location in relation to other objects using positional language
SR.B.6.a – Recognize a three-dimensional representation (e.g., model) of a three-dimensional space
SR.B.6.b – Scale distances and figures based on the size of the representation (e.g., place an object on a line based on the relative placement of the object on a smaller line)
SR.B.6.c – Recognize a two-dimensional representation (e.g., model or map) of a three-dimensional space
SR.B.6.d – Create a map to represent a three-dimensional space, such as a classroom
SR.B.6.e – Use a map to find locations of objects, including one's own location
SR.B.6.f – Identify the grid reference systems coordinates of an object on a grid
SR.B.6.g – Describe and follow routes on maps
SR.B.6.h – Identify the location of an object on a grid when given map coordinates
SR.B.7.a – Recognize the view from one's own perspective
SR.B.7.b – Understand that changes in perspective changes the view

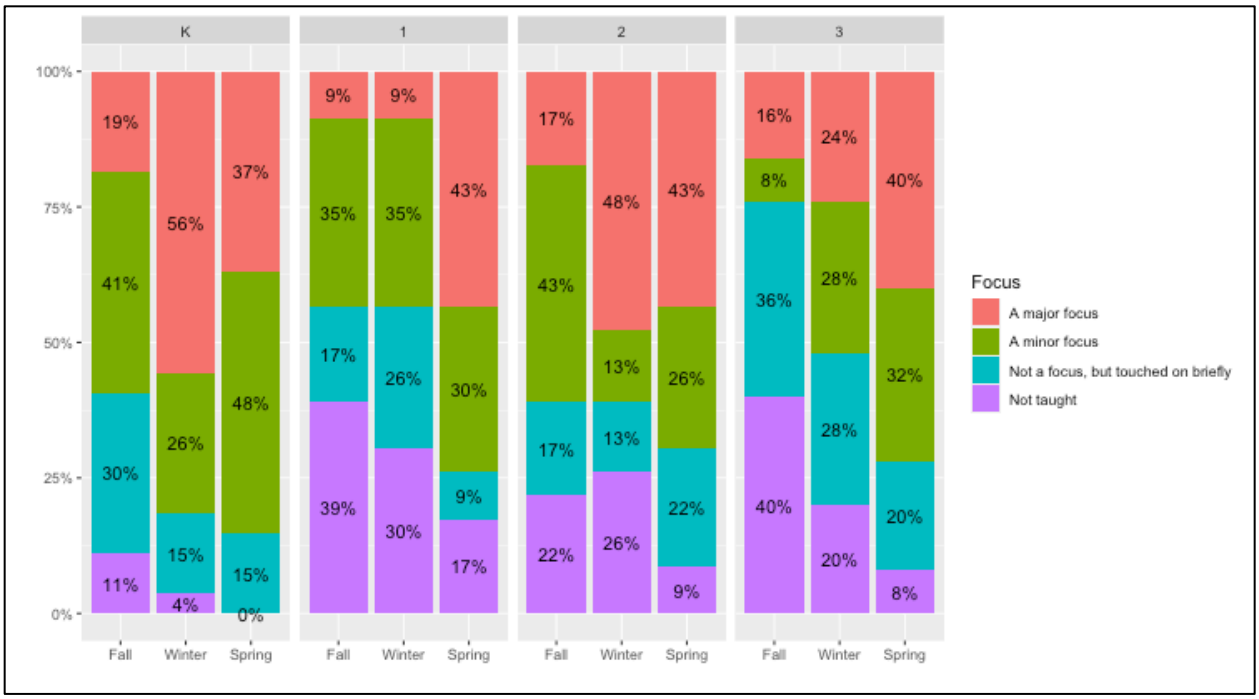
SR.B.7.c – Describe the relative spatial positions of objects from different perspectives (e.g., “the chair would be closest to me if I stood over there”)
SR.B.7.d – Recognize views from different perspectives (e.g., identifies what photo could be taken from a specific viewpoint of a concrete or pictorial representation of a three-dimensional space or object)
SR.B.7.e – Construct a three-dimensional object or space given at least two images of top, front, or side views

Appendix B – Additional Figures for Time of Year by Focus

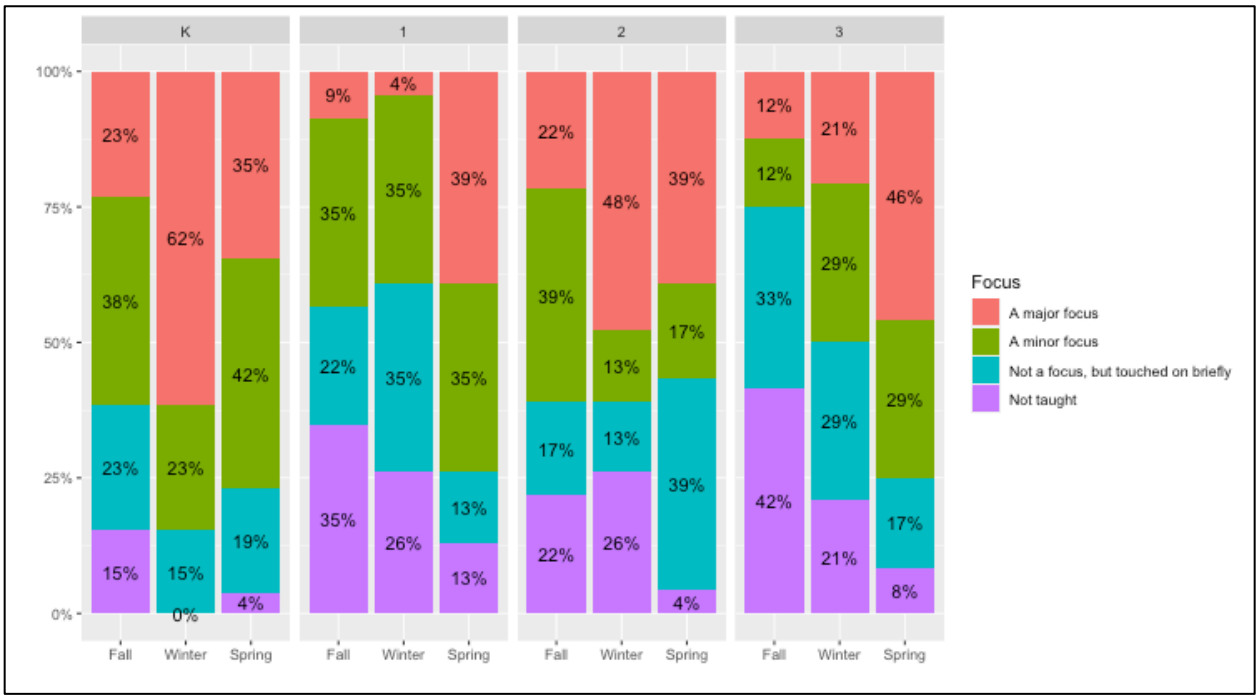
SR.A.1.a



SR.A.1.b



SR.A.1.c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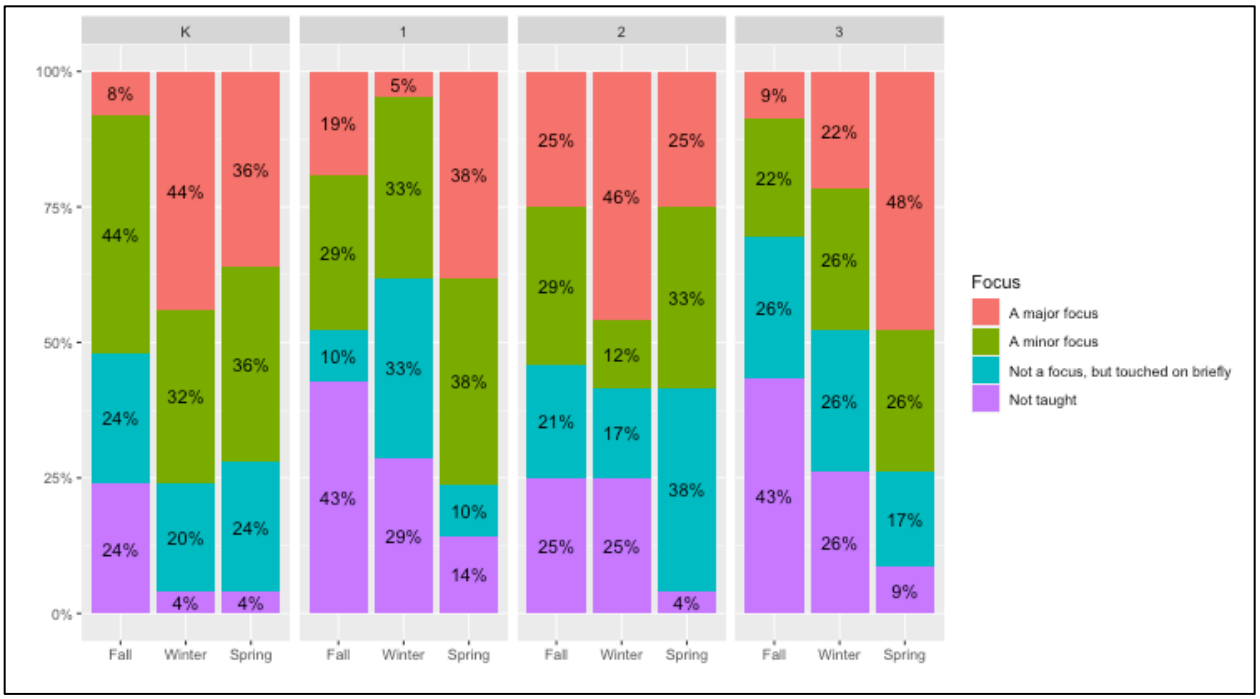
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.1.d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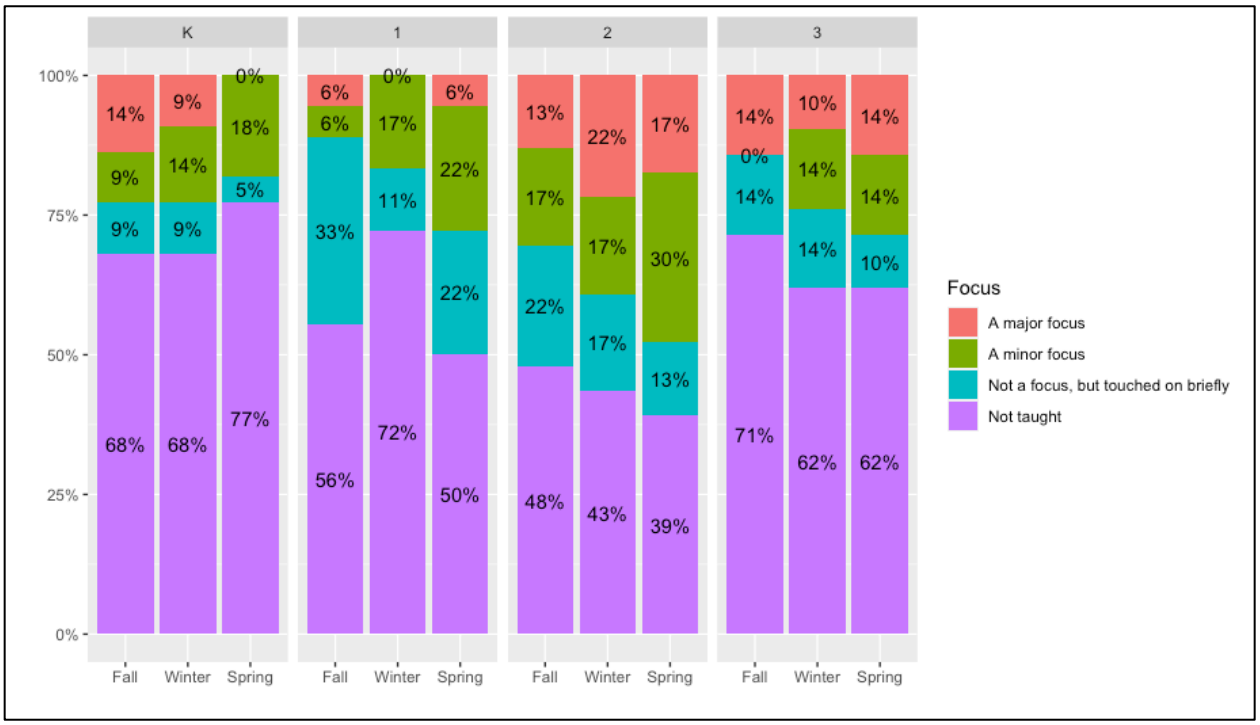
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.2.a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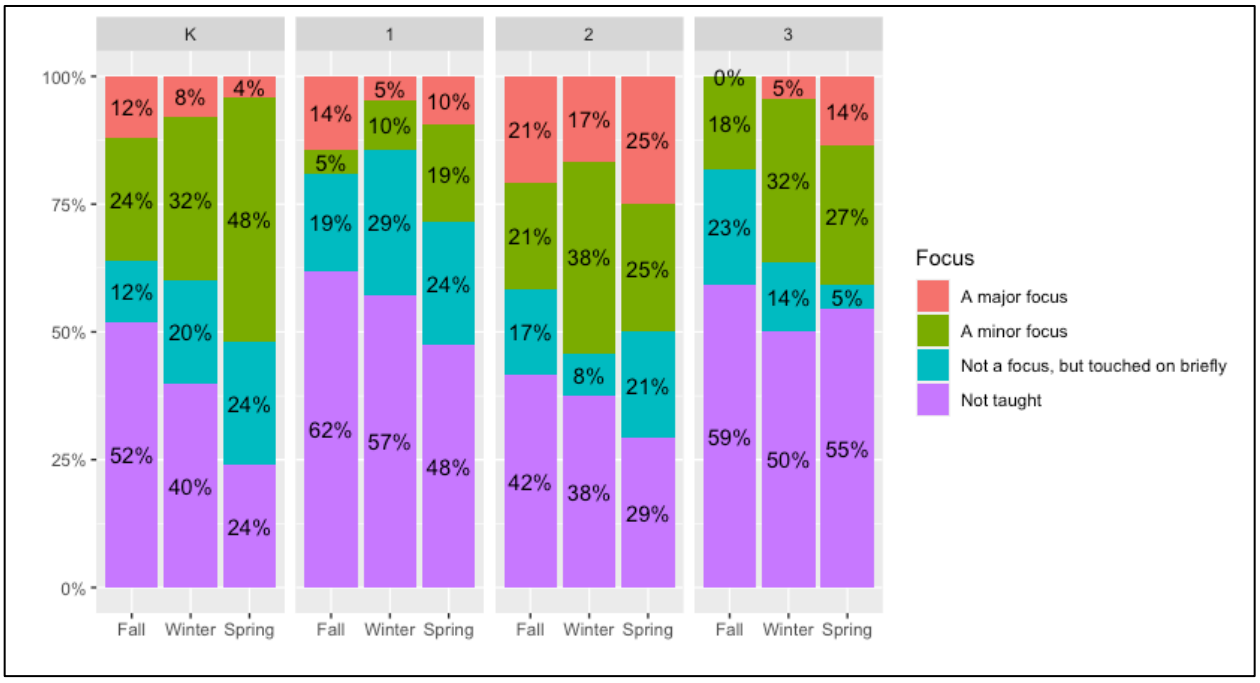
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.2.b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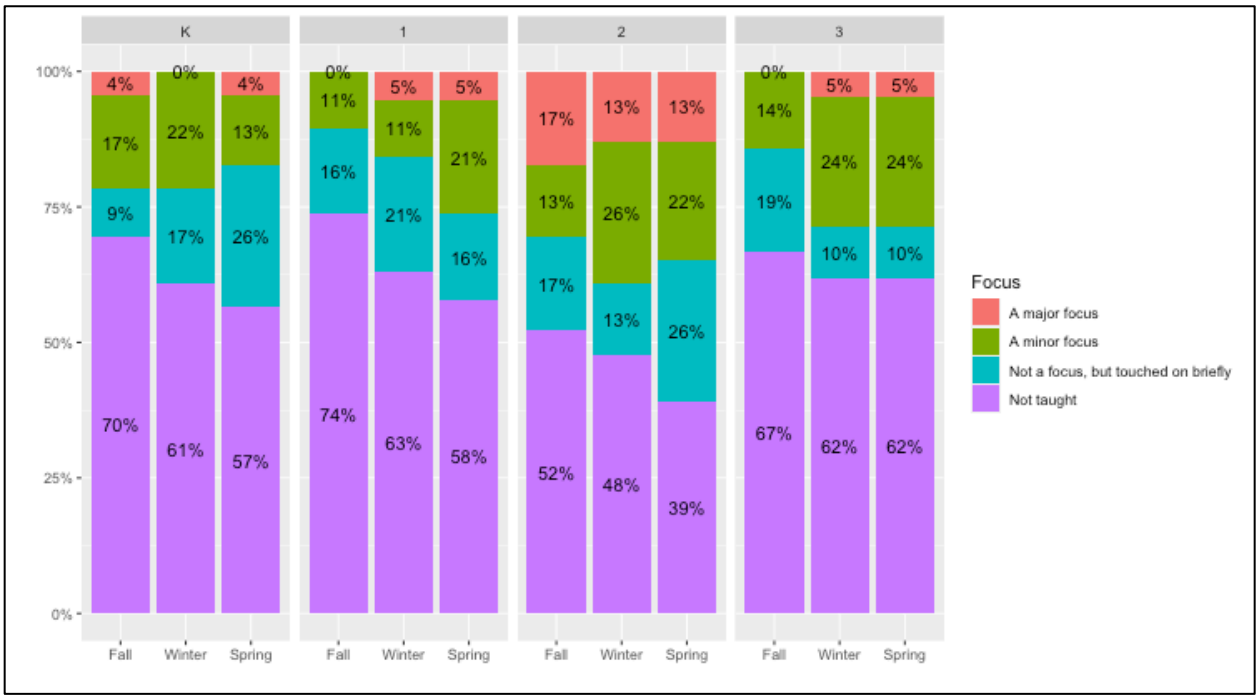
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.2.c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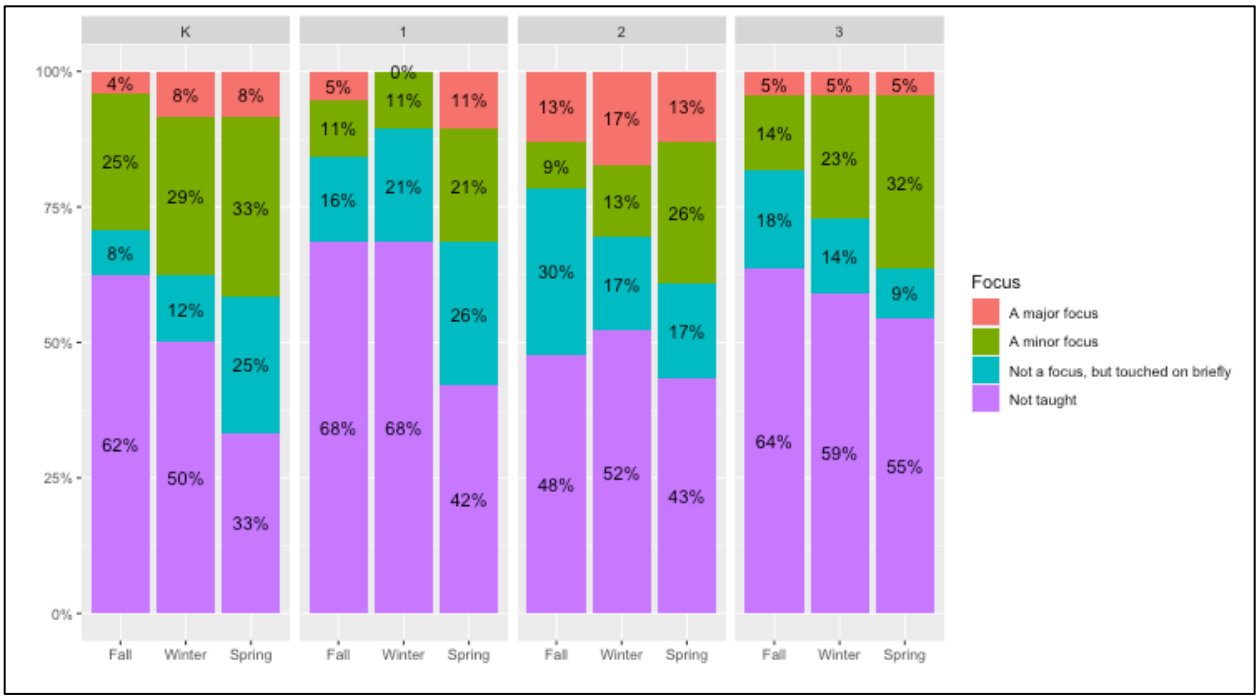
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.2.d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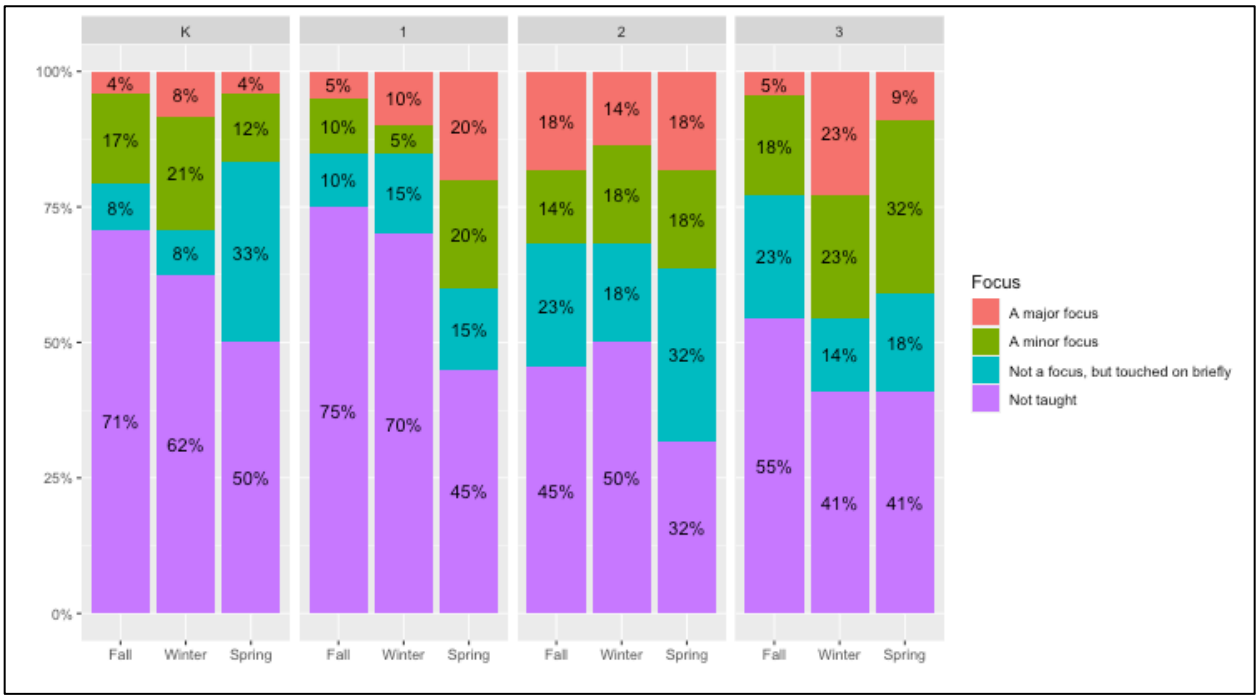
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.2.e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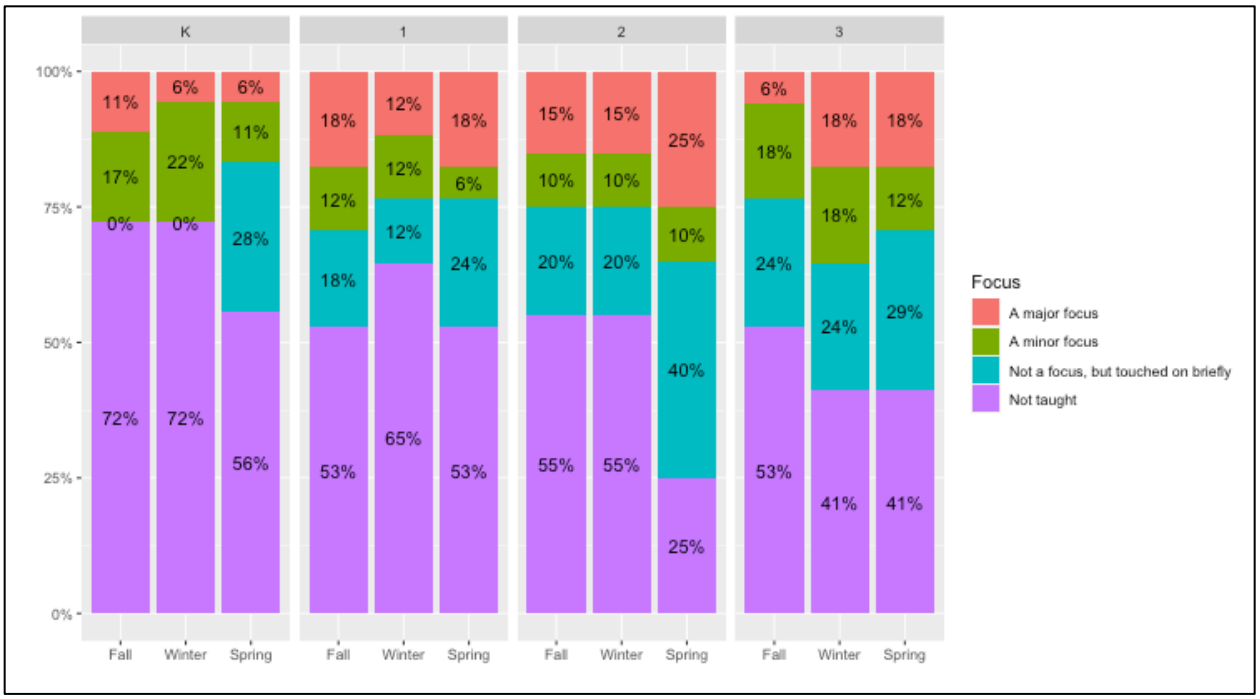
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.3.a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Focus
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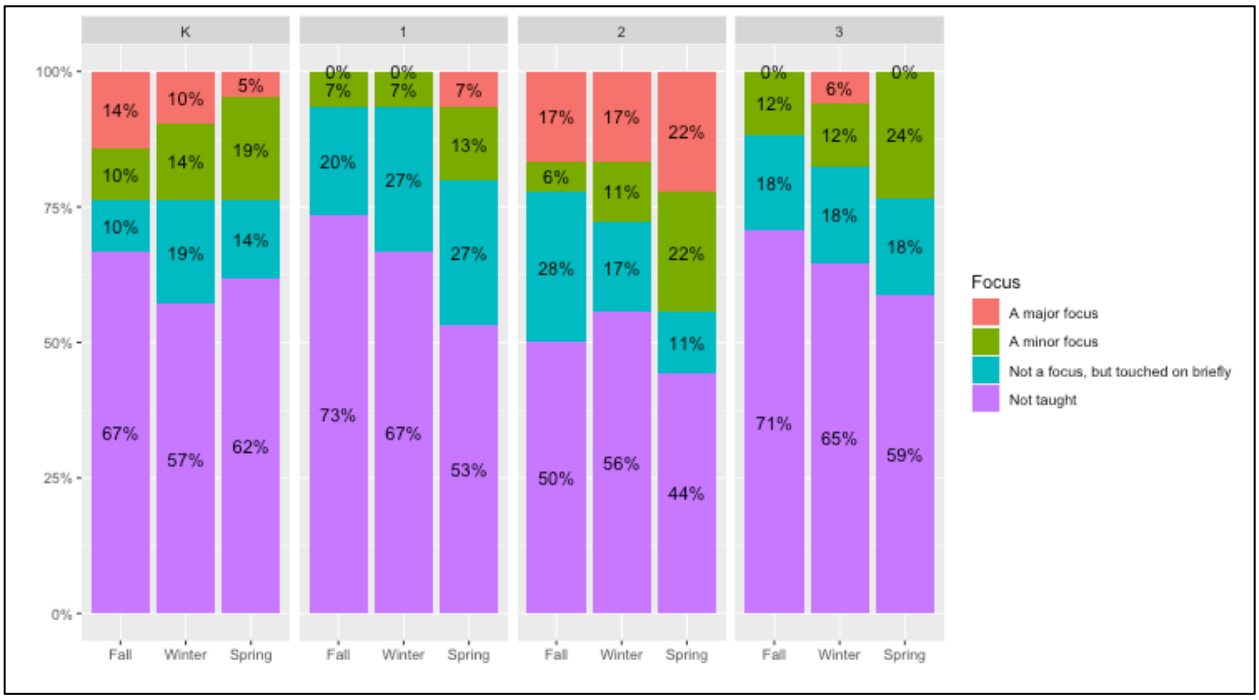
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.3.b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Focus
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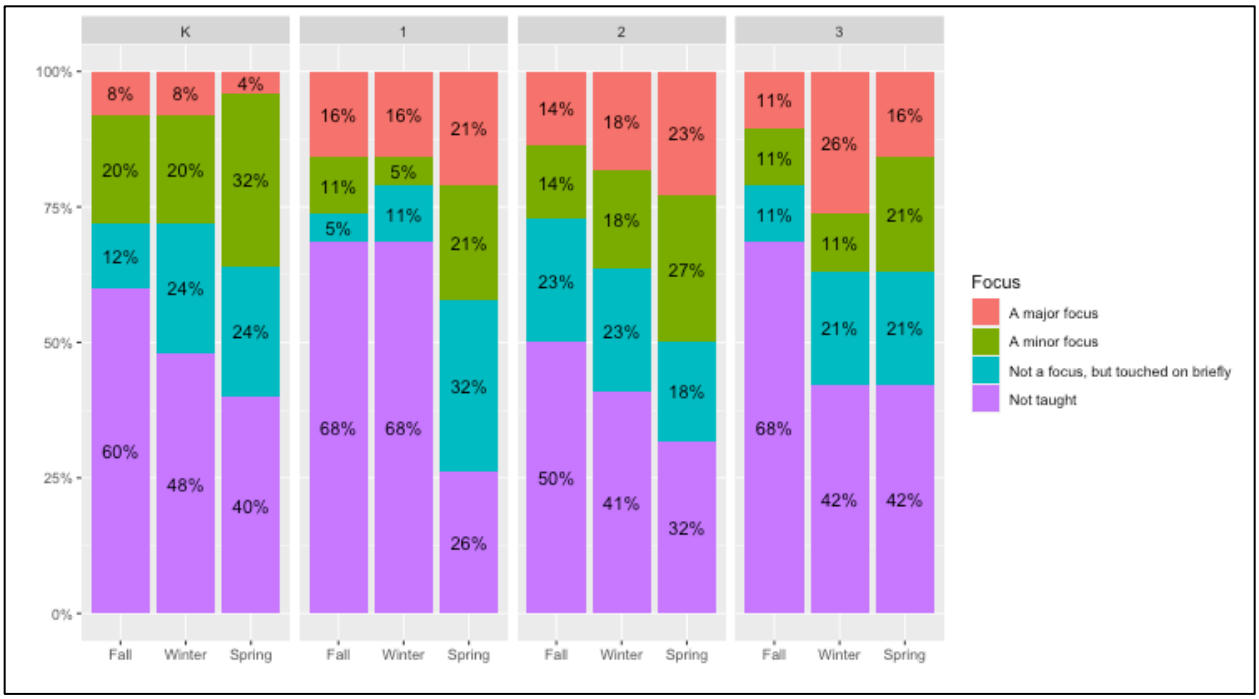
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.3.c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Fall
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Focus
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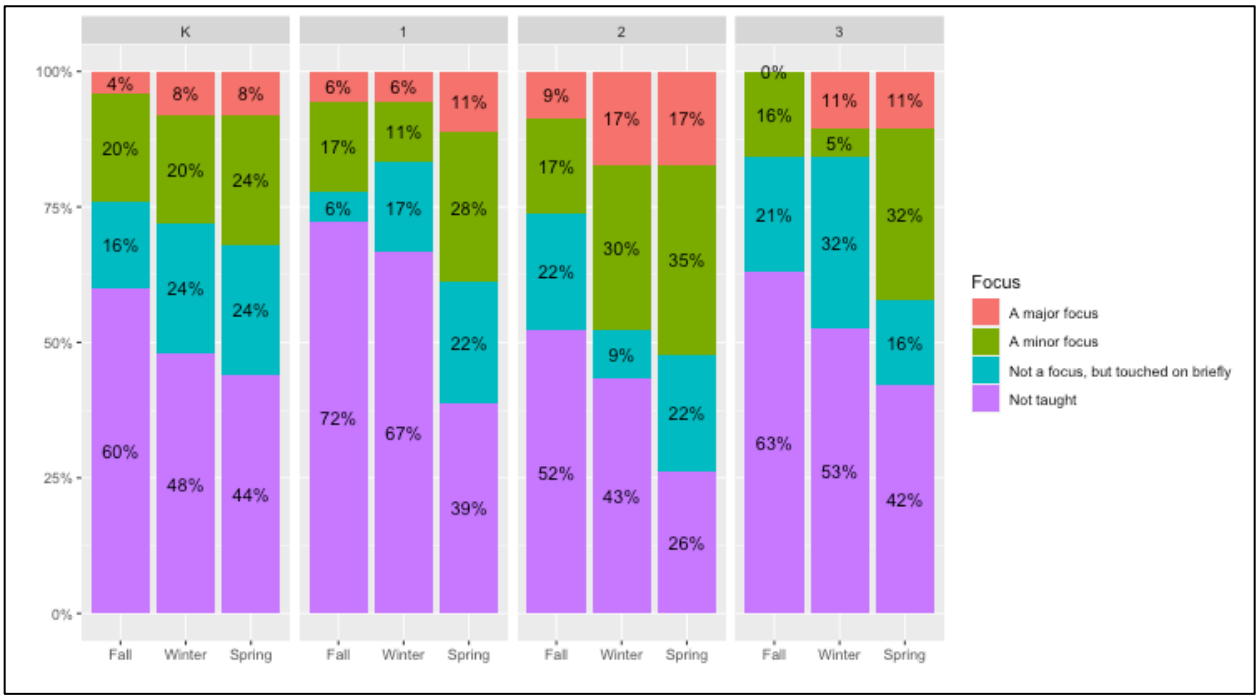
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.3.d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Focus
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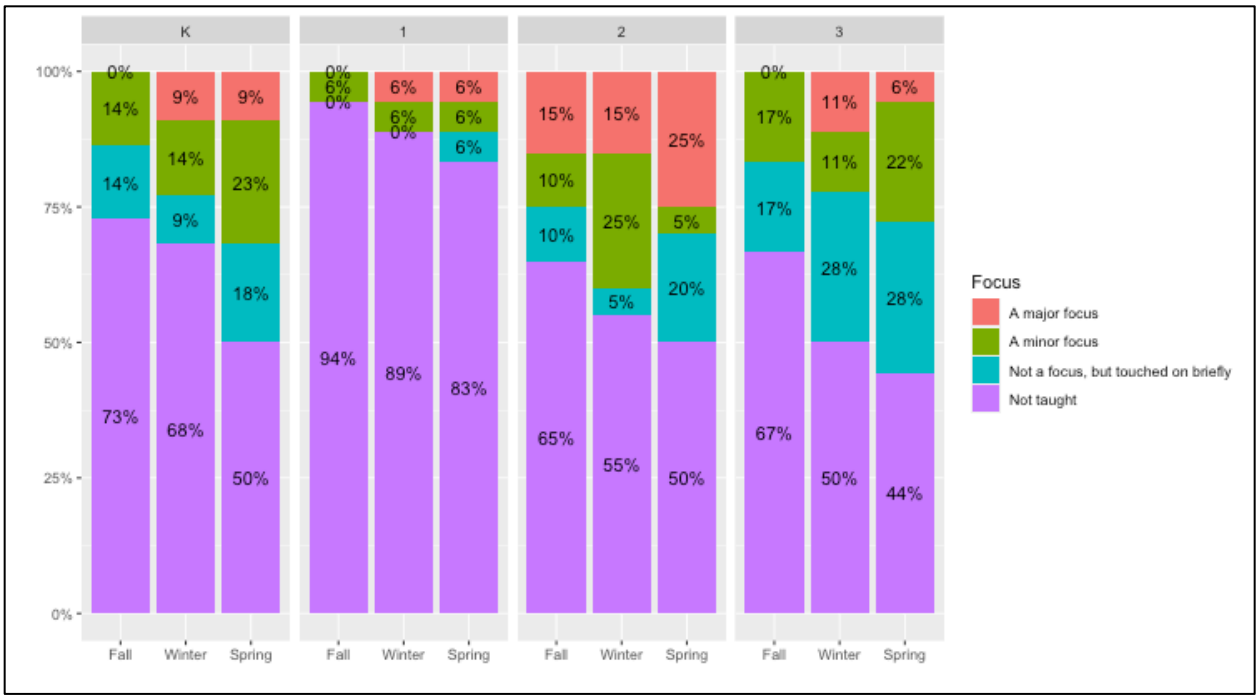
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.3.e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Fall
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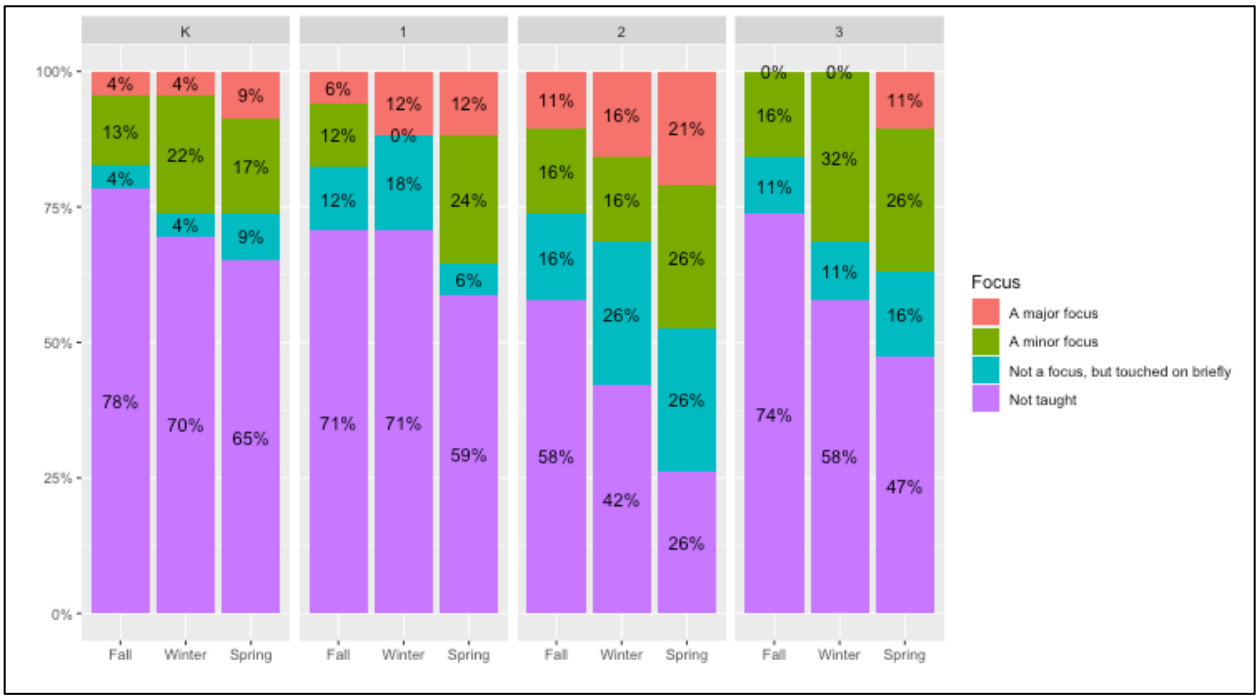
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.3.f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Fall
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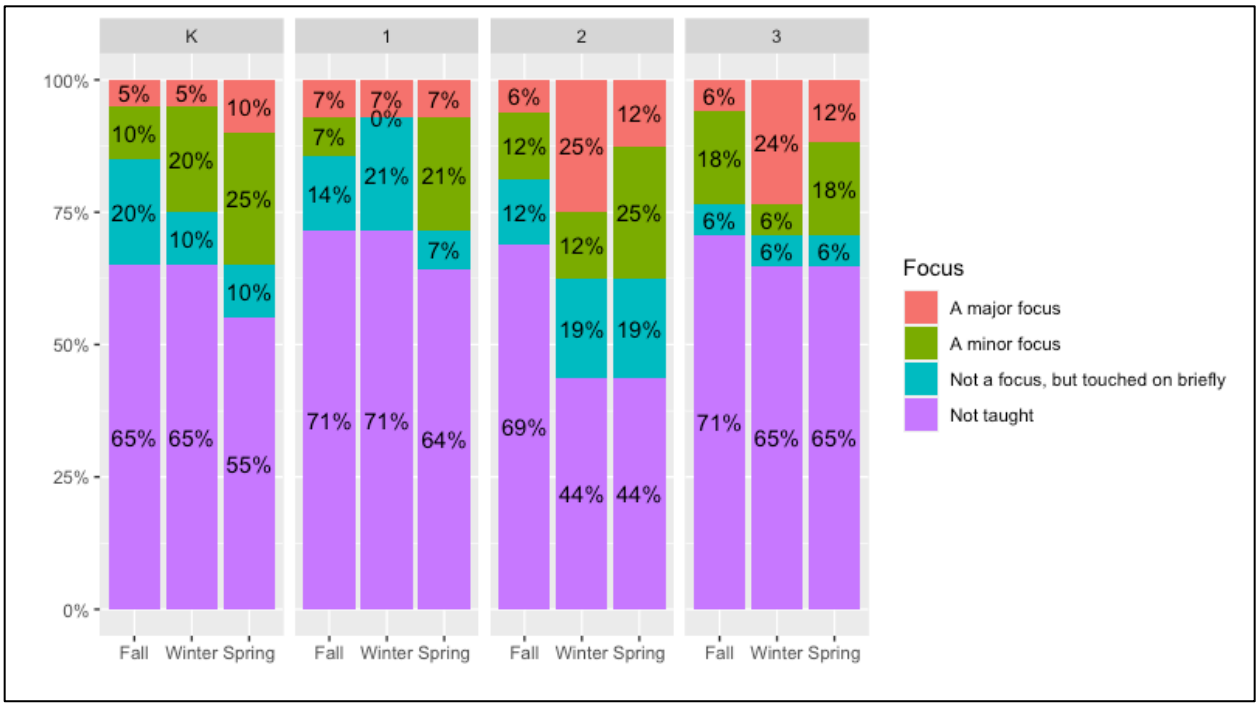
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.A.3.g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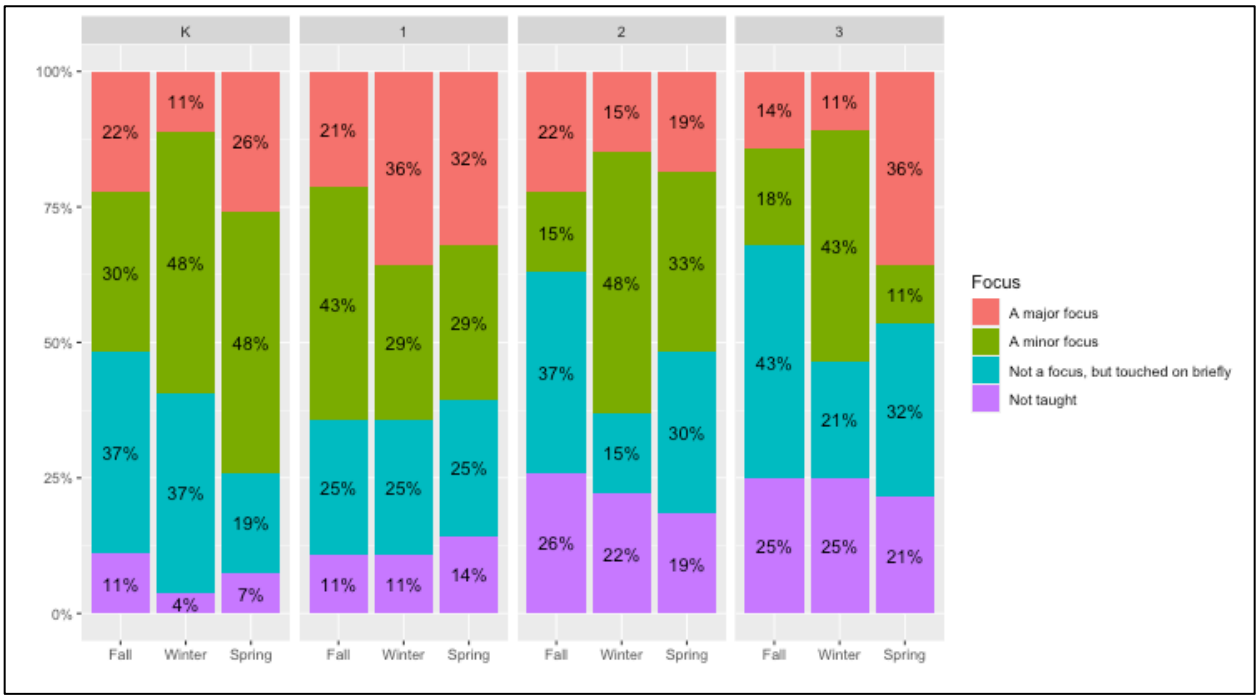
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.5.a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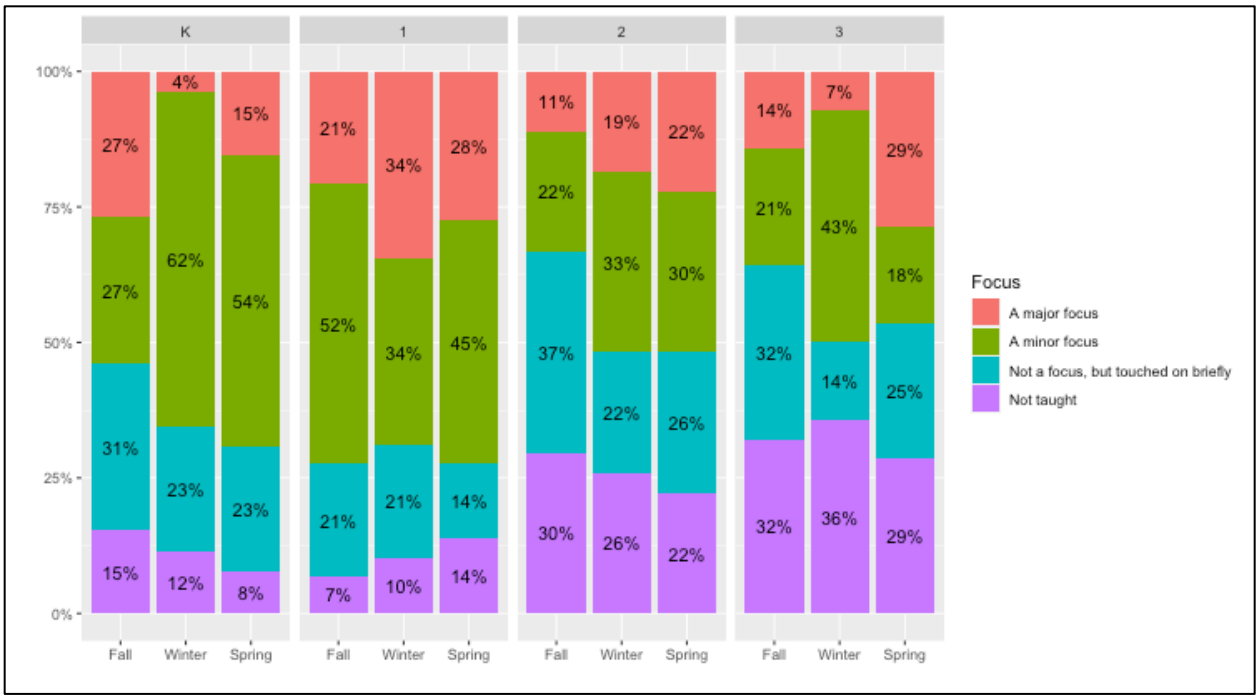
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.5.b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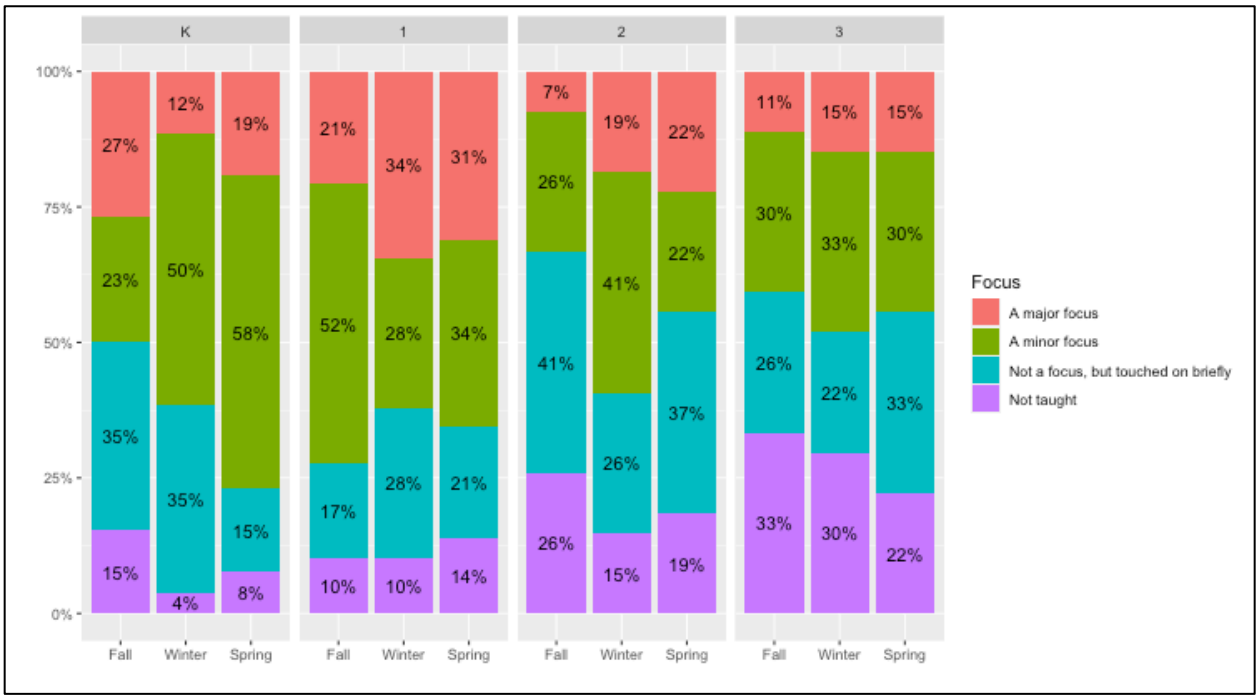
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.5.c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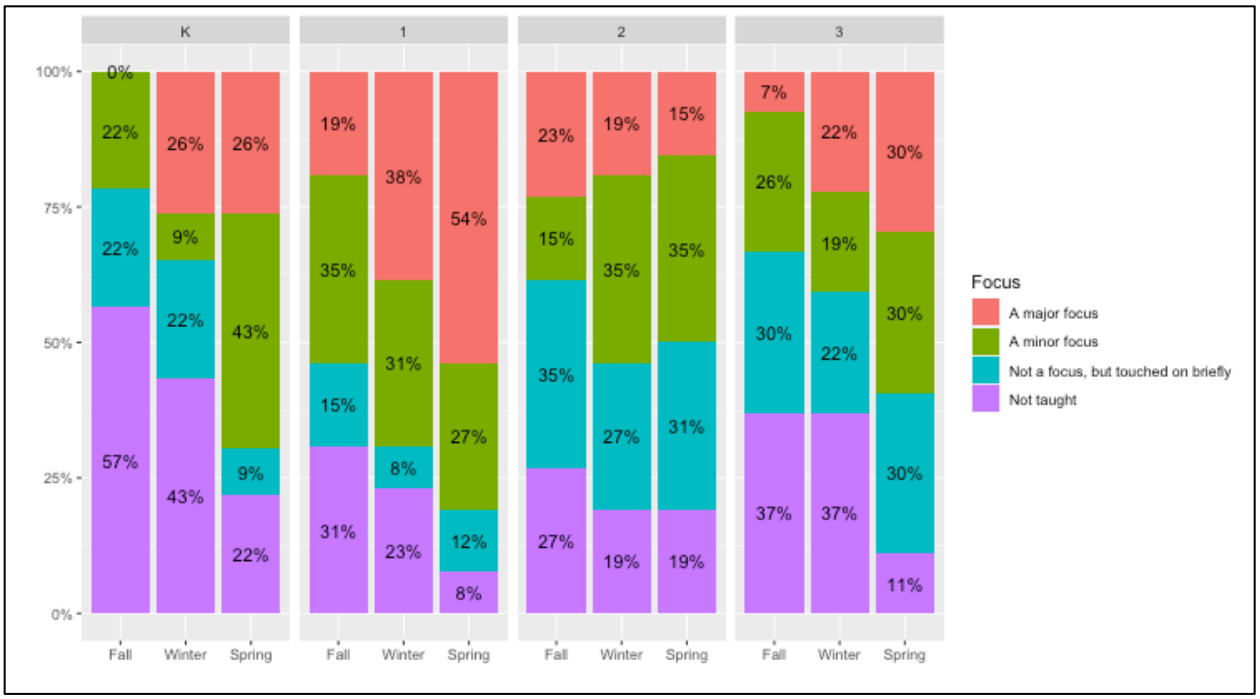
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.6.a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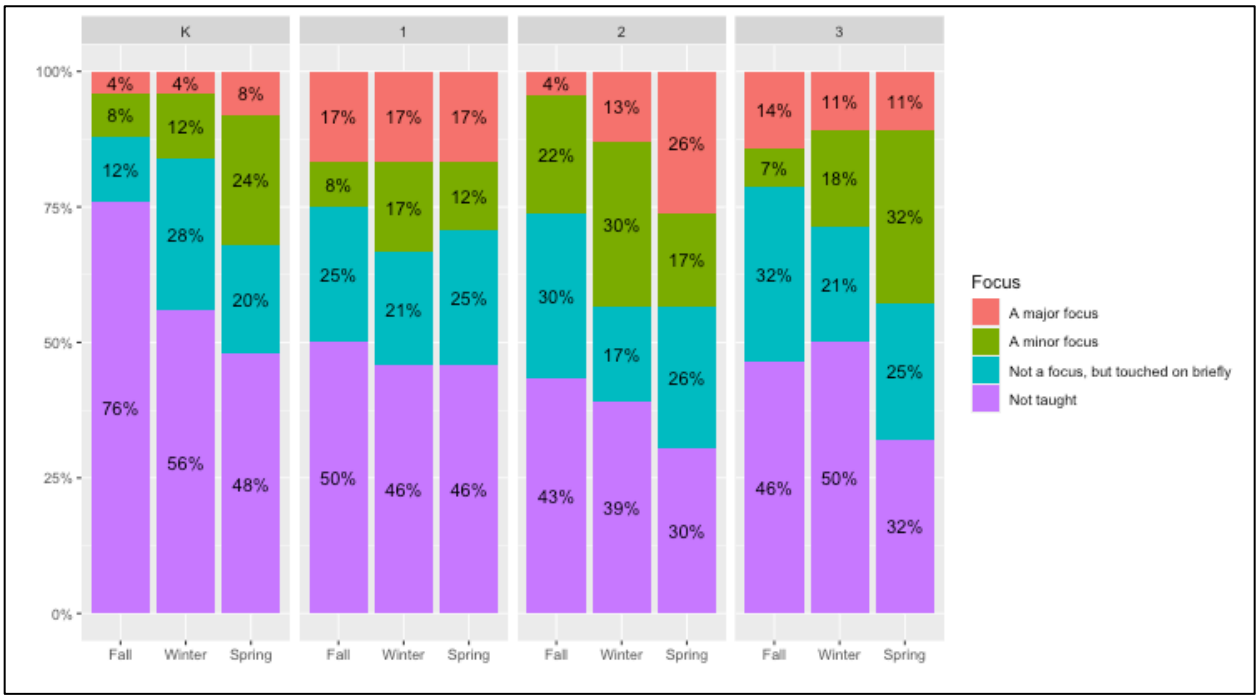
11%
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.6.b


K
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32%
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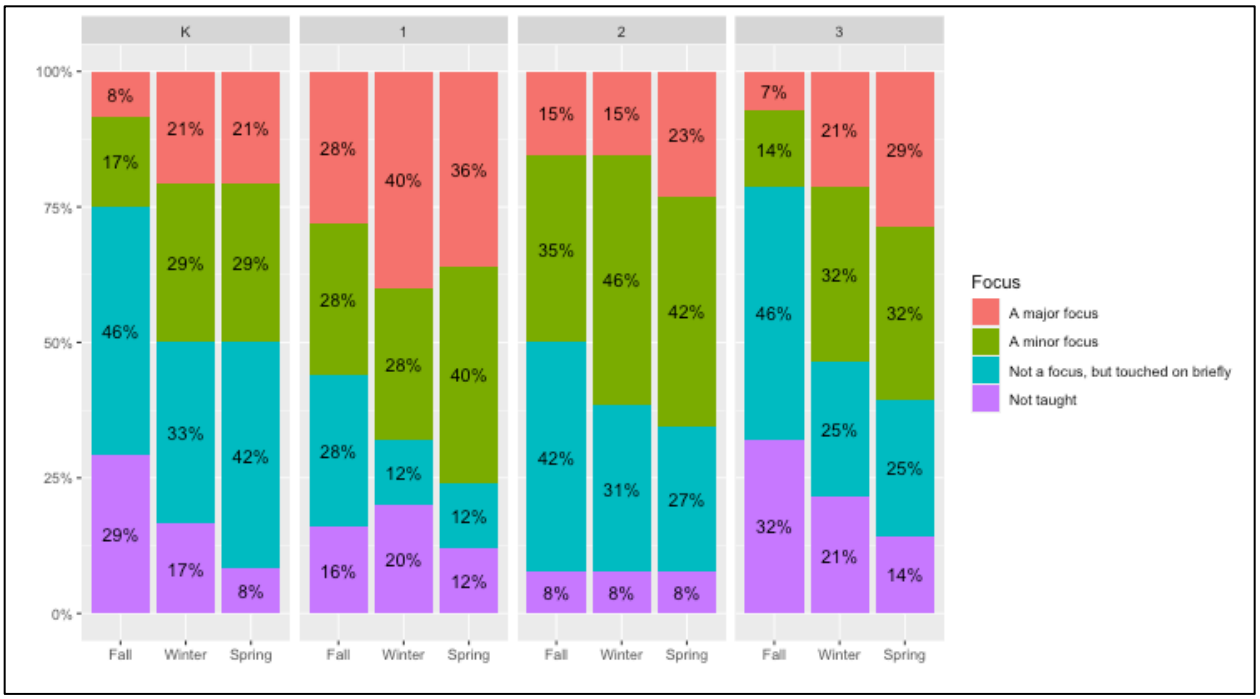
32%
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.6.c


K
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32%
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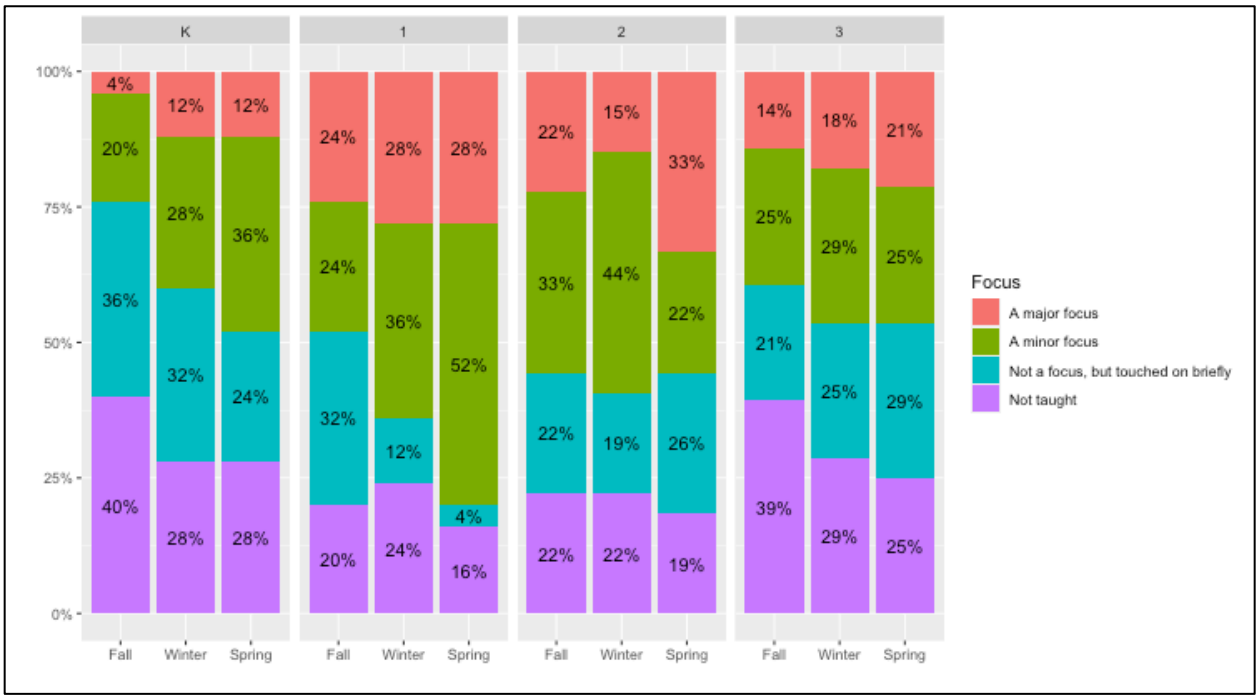
14%
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.6.d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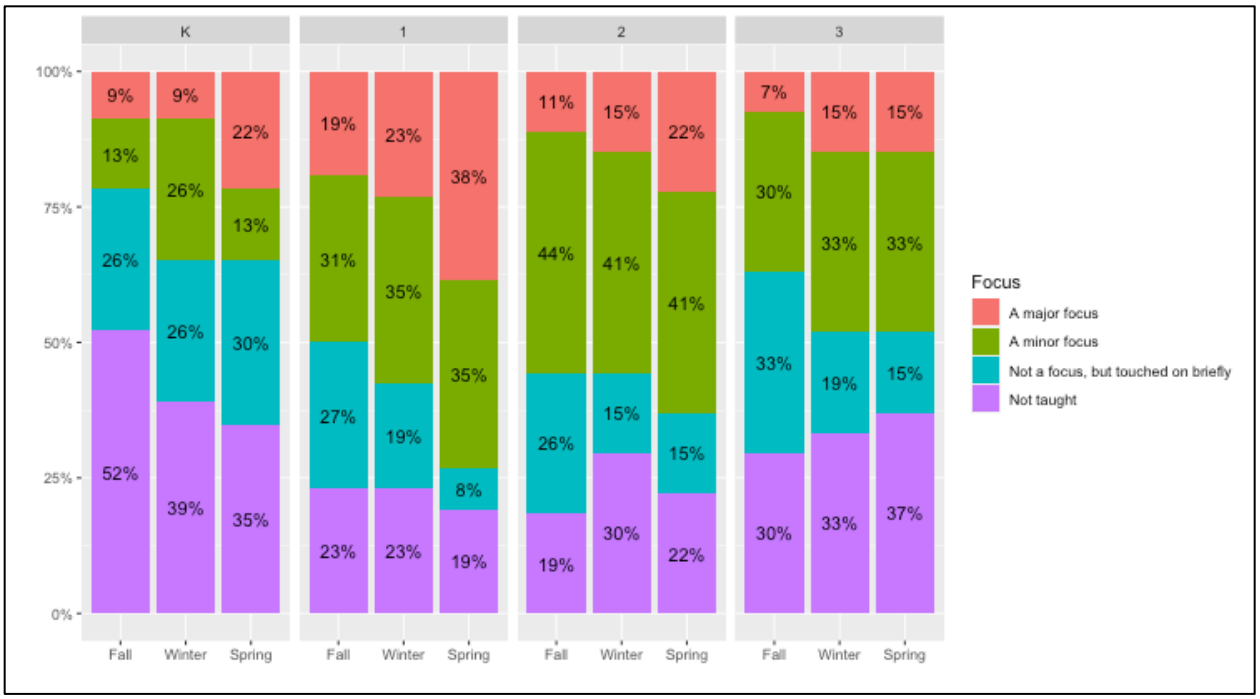
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.6.e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33%
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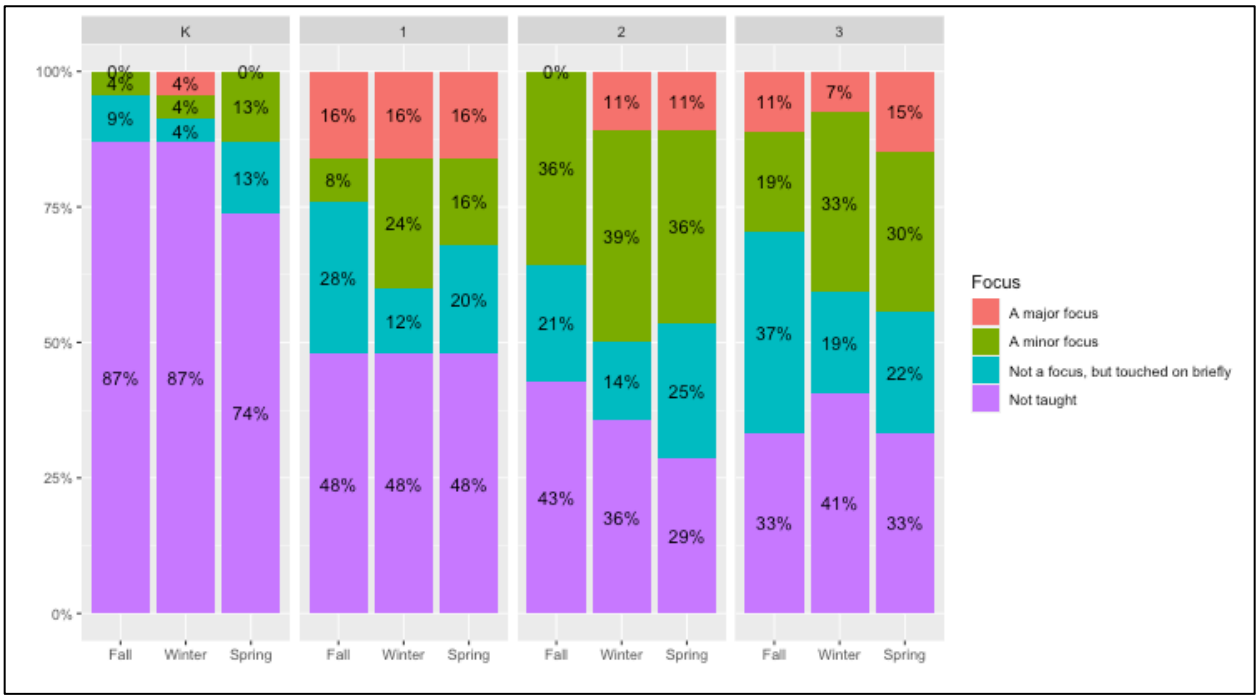
37%
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.6.f


K
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Fall
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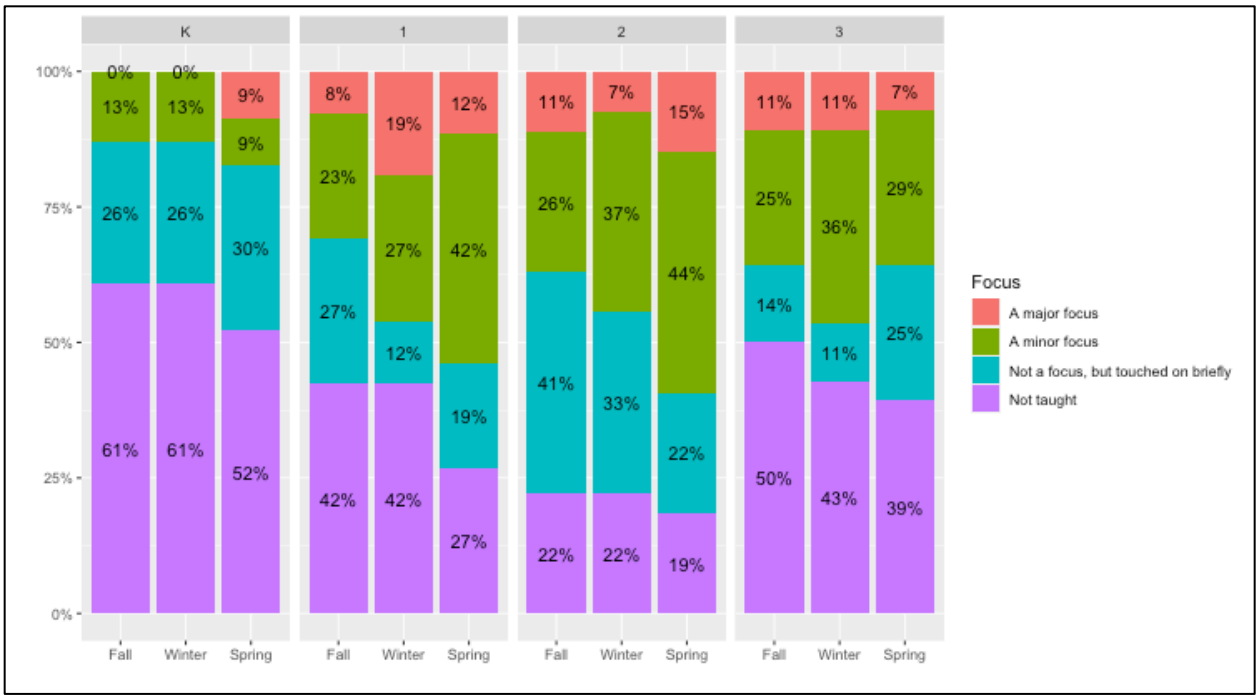
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.6.g


K
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Fall
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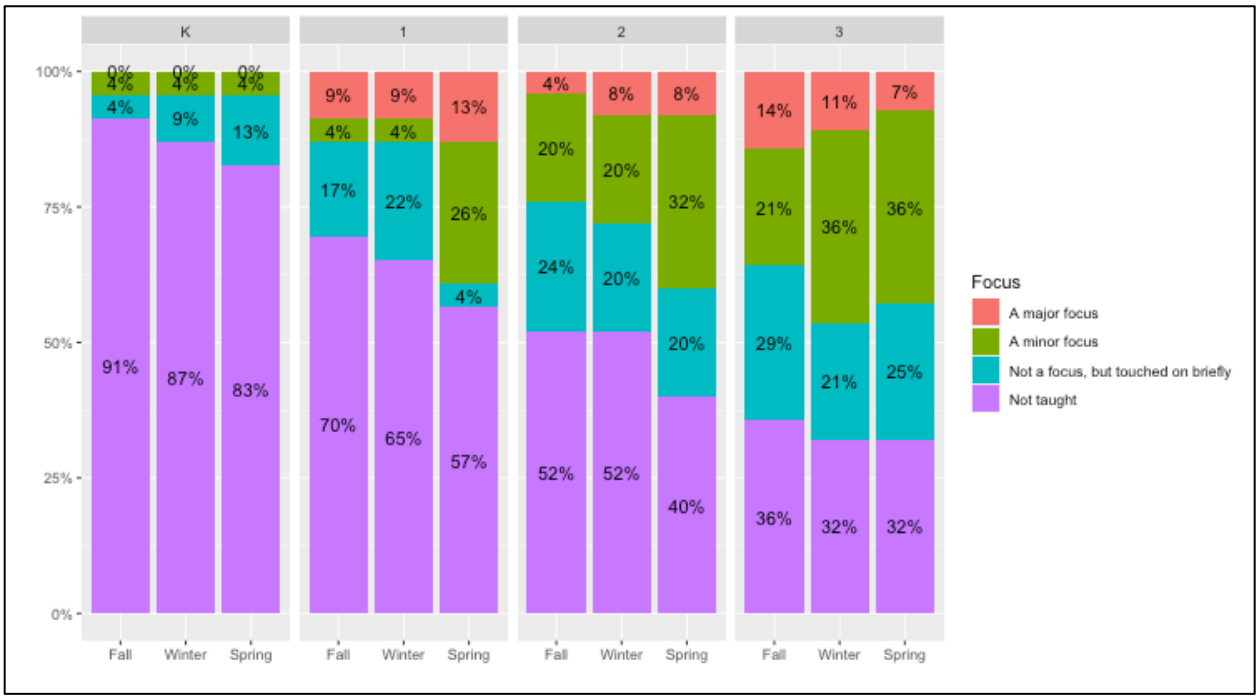
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.6.h


K
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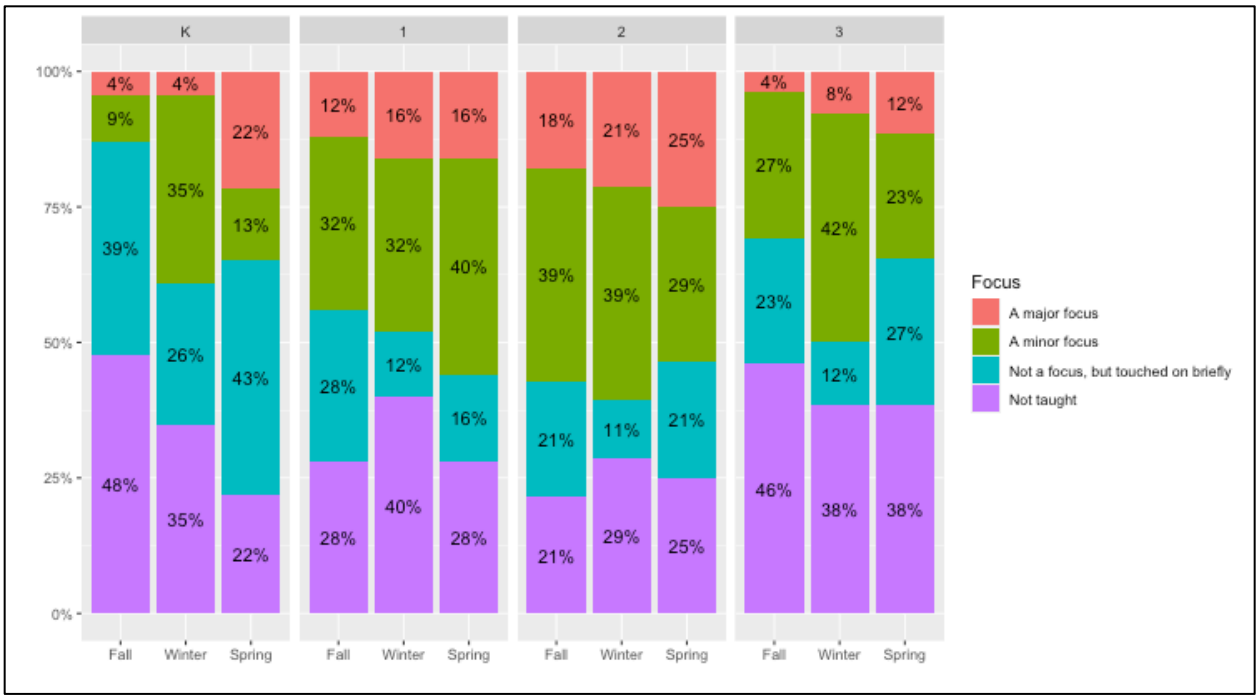
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.7.a


K
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Fall
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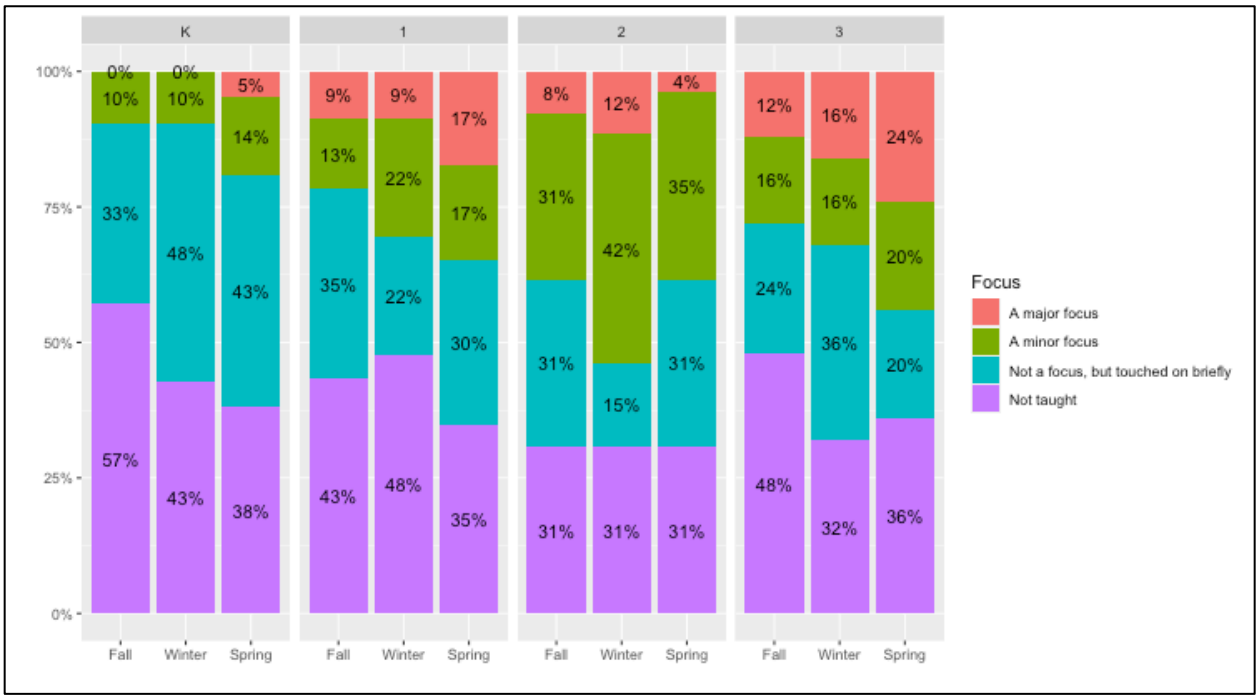
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.7.b


K
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Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.7.c

K
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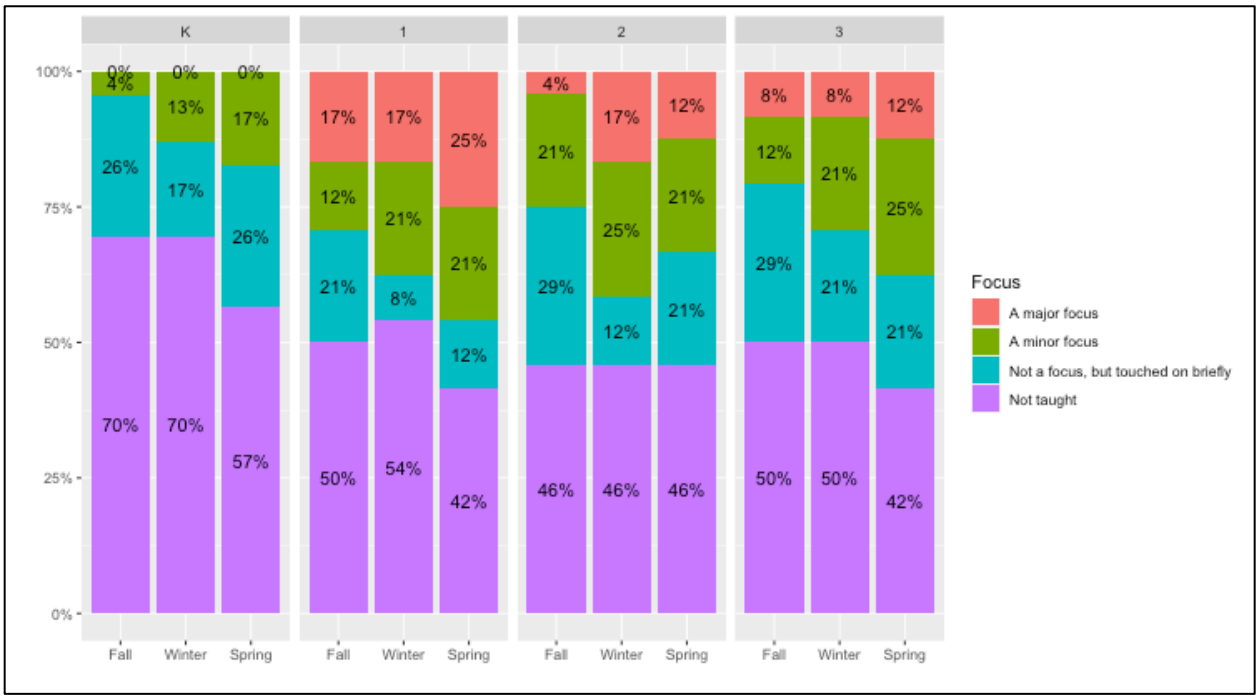
Fall
Winter
Spring
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.7.d


K
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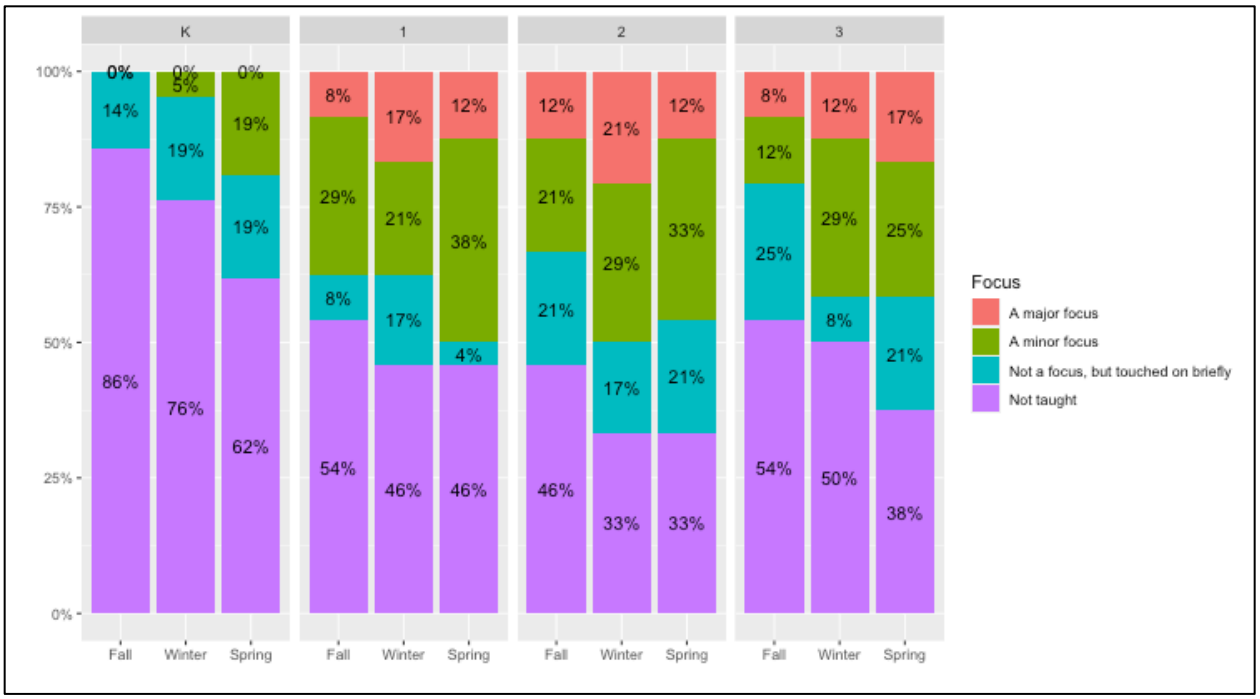
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

SR.B.7.e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38%
Focus
A major focus
A minor focus
Not a focus, but touched on briefly
Not taught

Appendix C – Developmental Appropriateness ANOVA Tables

Reasons spatially within objects: Mean developmental appropriateness of skills statement by grade level

Skill Statement	Grade				ANOVA Results		
	K	1	2	3	F-Statistic	p-value	Significant Pairwise Comparison
A.1.a	3.1 (.58)	2.9 (.90)	3.1 (.83)	3.2 (.73)	F(3,95) = .30	P = .83	--
A.1.b	3.5 (.64)	3.0 (.88)	3.4 (.36)	3.2 (.71)	F(3,94) = 1.9	P = .13	--
A.1.c	2.8 (.39)	2.7 (.59)	2.9 (.32)	2.6 (.63)	F(3,48) = .79	P = .50	--
A.1.d	2.6 (.51)	2.5 (.63)	2.6 (.67)	2.8 (.39)	F(3,52) = .48	P = .48	--
A.2.a	1.5 (.68)	2.1 (.68)	2.3 (.73)	2.0 (.71)	F(3,70) = 5.0	P = .003	K,2 (p = .002)
A.2.b	2.3 (.72)	2.1 (.66)	2.4 (.68)	2.1 (.80)	F(3,74) = .91	P = .44	--
A.2.c	1.8 (.81)	2.1 (.66)	2.1 (.79)	2.0 (.86)	F(3,75) = .72	P = .54	--
A.2.d	2.1 (.83)	2.1 (.64)	2.2 (.88)	2.0 (.88)	F(3,74) = .12	P = .95	--
A.2.e	2.0 (1.0)	2.1 (.94)	2.5 (1.1)	2.6 (.96)	F(3,84) = 2.0	P = .11	--
A.3.a	1.9 (.94)	2.1 (1.2)	2.3 (1.0)	2.3 (1.1)	F(3,68) = .46	P = .71	--
A.3.b	1.8 (.98)	1.8 (1.0)	2.2 (1.1)	1.8 (.90)	F(3,67) = .82	P = .49	--
A.3.c	2.2 (1.1)	2.5 (.90)	2.6 (.90)	2.6 (.90)	F(3,81) = 1.1	P = .36	--
A.3.d	2.2 (1.0)	2.4 (.92)	2.8 (.72)	2.7 (1.1)	F(3,81) = 1.8	P = .15	--
A.3.e	1.9 (.86)	1.5 (.86)	2.3 (1.2)	2.3 (.96)	F(3,74) = 2.6	P = .06	--
A.3.f	1.8 (.89)	2.2 (1.1)	2.6 (.90)	2.2 (.79)	F(3,74) = 2.3	P = .05	--
A.3.g	1.9 (.75)	2.1 (1.0)	2.4 (1.0)	2.2 (1.1)	F(3,63) = 1.1	P = .35	--

Note: Developmental appropriateness was reported on a 4-point scale (1 = Not appropriate, 2 = Somewhat appropriate, 3 = Appropriate, 4 = Very appropriate).

Reasons Spatially Between Objects: Mean Developmental Appropriateness of Skill Statement by Grade Level

Skill Statement	Grade				ANOVA Results		
	K	1	2	3	F-Statistic	p-value	Significant Pairwise Combinations
B.5.a	3.0 (0.0)	2.6 (.51)	2.4 (.59)	2.4 (.71)	F(3,73) = 4.8	P = .004	K,2 (P = .01); K,3 (P = .005)
B.5.b	2.9 (.25)	2.7 (.62)	2.3 (.64)	2.1 (.85)	F(3,71) = 6.3	P <.001	K,2 (P = .02); K,3 (P <.001); 1,3 (P = .045)
B.5.c	2.9 (.24)	2.7 (.60)	2.5 (.59)	2.0 (.73)	F(3,72) = 8.8	P <.001	K,3 (P < .001); 1,3 (P = .004); 2,3 (P = .04)
B.6.a	2.6 (.70)	2.8 (.56)	2.2 (.69)	2.4 (.69)	F(3,69) = 2.6	P = .06	--
B.6.b	1.9 (.65)	2.1 (.78)	2.1 (.75)	2.2 (.76)	F(3,84) = 1.0	P = .40	--
B.6.c	2.6 (.70)	2.7 (.49)	2.8 (.44)	2.6 (.59)	F(3,74) = .29	P = .83	--
B.6.d	2.3 (.80)	2.7 (.48)	2.6 (.78)	2.5 (.51)	F(3,74) = 1.0	P = .39	--
B.6.e	2.6 (.94)	2.9 (1.0)	2.9 (.92)	2.9 (.92)	F(3,99) = .62	P = .61	--
B.6.f	1.4 (.66)	2.5 (1.1)	2.4 (.92)	2.7 (.96)	F(3,99) = 8.4	P<.001	K,2 (P = .002); K-3 (P <.001); K,1 (P = .001)
B.6.g	2.1 (.73)	2.5 (1.0)	2.7 (.88)	2.5 (1.1)	F(3,100) = 1.7	P = .18	--
B.6.h	1.3 (.65)	2.0 (1.1)	2.4 (1.0)	2.8 (.90)	F(3,95) = 10.8	P < .001	K,2 (P = .002); K-3 (P <.001); 1,3 (P = .01)
B.7.a	2.6 (.84)	2.6 (1.0)	2.7 (.90)	2.7 (.92)	F(3,98) = .16	P = .92	--
B.7.b	2.0 (.67)	2.5 (.99)	2.3 (.94)	2.7 (.89)	F(3,91) = 3.0	P = .03	K,3 (P = .02)
B.7.c	2.4 (.66)	2.4 (.97)	2.3 (.94)	2.4 (.87)	F(3,93) = .15	P = .93	--
B.7.d	1.9 (.63)	2.4 (1.0)	2.2 (1.1)	2.5 (.88)	F(3,91) = 2.3	P = .08	--
B.7.e	2.0 (.67)	2.5 (1.1)	2.5 (.98)	2.8 (.93)	F(3,89) = 3.0	P = .03	K,3 (P = .02)

Note: Developmental appropriateness was reported on a 4-point scale (1 = Not appropriate, 2 = Somewhat appropriate, 3 = Appropriate, 4 = Very appropriate).