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RESEARCH IN MATHEMATICS EDUCATION

Numeric Relational Reasoning (NRR): Teacher Survey Administration

Technical Report 20-01

Numeric Relational Reasoning (NRR): Teacher Survey Administration

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Executive Summary

The purpose of this technical report is to describe the teacher survey of the Numeric Relational Reasoning (NRR) learning progression. The NRR learning progression is part of a National Science Foundation funded project known as Measuring Mathematical Reasoning Skills (MMaRS). In addition to describing the teacher survey, we also describe the distribution efforts for the survey data collection and provide results of the survey. Questions from the survey asked respondents to rate the developmental appropriateness, importance as a focal skill, importance as a prerequisite skill, understandability, time of year taught, and frequency of teaching skills within the NRR learning progression. Overall, we surveyed 274 K-3 teachers in the three core concepts of the NRR learning progression (i.e., relations, composition and decomposition, and properties of operations). Results from this survey assisted with the development and refinement of the NRR learning progression (Kuehnert et al., NRR Development Technical Report 20-02).

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Numeric Relational Reasoning (NRR): Teacher Survey Administration

Overview of MMaRS

The Measuring Mathematical Reasoning Skills (MMaRS) project is a National Science Foundation (NSF) funded project to develop learning progressions and assessments for Numeric Relational Reasoning (NRR) and Spatial Reasoning (SR) for students in Grades K-2. For the MMaRS project, we conducted a survey of elementary teachers to learn how educators prioritize various skills related to Numeric Relational Reasoning (NRR). We developed the NRR survey for educators working with students in kindergarten, first, second, and third grades. We created 58 skill statements, which are skills the mathematics community and experts in early mathematics instructions have deemed necessary to understand numeric relational reasoning, in three different core concepts, called learning progressions (Properties of Operations = 22 skill statements; Relations = 20 skill statements; Composition/Decomposition = 16 skill statements). A description of the development of the NRR learning progression can be found in the NRR development technical report (Kuehnert et al., NRR Development Technical Report 20-02)

Purpose of the Report

The purpose of this report is to describe the survey, data collection efforts, and results of the NRR Teacher Survey. In particular, we answer the following research questions:

1. How developmentally appropriate are the MMaRS NRR learning progressions for K-2?
    a. To what degree do K-3 teachers rate the skill statements as developmentally appropriate for the grade they teach? Does this differ by grade level?
    b. To what degree do K-3 teachers rate the skill statements as focal skills for the grade they teach? Does this differ by grade level?
    c. To what degree do K-3 teachers rate the skill statements as prerequisite skills for the grade they teach? Does this differ by grade level?
2. To what degree do the upper and lower bounds of the skill statements on the MMaRS NRR learning progression align with teachers' conceptions about developmental appropriateness and when NRR skills are introduced?
    a. When in the school year do teachers introduce numeric relational reasoning skills?
    b. How often do K-3 teachers teach or review concepts that align with the skill statements on the MMaRS NRR learning progression? Does the frequency at which teachers spend teaching or reviewing numeric relational reasoning skills differ by grade level?
3. Are the skill statements on the MMaRS NRR learning progression understandable by teachers in K-3? Does this differ by grade level or teachers' years of classroom experience?

Method

In this section, we describe the survey, data collection efforts, and analyses of the teacher survey data.

Description of the Survey

We built the survey in Qualtrics (Qualtrics, 2018). In the survey, along with demographic questions, we asked questions related to teachers' instruction on NRR, amount of time and focus of their instruction, and importance of specific skills associated with numeric relational reasoning. We compiled the 58 skill statements together in the survey and asked elementary teachers if they: (a) believe the skill statements are developmentally appropriate, (b) incorporate each skill in their instruction, (c) prioritize teaching each skill, and (d) perceive each skill as importance. The survey consisted of select response, rating scale, and short answer questions, and was intended to require approximately 20 minutes of the teacher's time. Results from the analysis of the survey data helped with decisions regarding the importance and the priority of each specific skill related to numeric relational reasoning.

The survey begins with a block of questions that every respondent saw and included questions about the eligibility to take the survey, a consent question, some general demographic questions, and questions about math concepts and use of manipulatives. A copy of the survey can be found in Appendix A. The eligibility questions asked respondents to verify that they work with students in either kindergarten, first, second, or third grade. Next, respondents consented to participate in the study, with the option to opt out. Then, teachers responded to 12 demographic questions asking about their level of education, their title or position, which grades they work with, their credentialing, age, and years of experience. Teachers subsequently responded to a classroom use, time, and manipulatives section, which included four questions about the mathematical concepts the respondents spend the most time teaching, how much daily time they devote to mathematics instruction, and which manipulatives they normally use.

The survey then randomly assigned respondents into one of the three core concepts. We only presented respondents with one core concept to minimize time to complete the survey. Each of the three core concept segments contained sets of questions about all skill statements contained within that core concept. The Properties of Operations core concept contained 52 questions, the Relations core concept contained 49 questions, and the Composition/Decomposition core concept contained 39 questions. At the end of the survey, respondents were allowed to choose if they want to be entered into a drawing for a $25 Amazon© gift card.

For each skill statement, we first asked teachers if they understood the skill statement and the knowledge students were expected to demonstrate. If the response was "No, I don't understand," then respondents moved to the next skill statement and prompted again for their understanding. If the response was not "No, I don't understand," then respondents were presented follow-up questions. The follow-up are listed below.

1. How much time do you spend teaching and reviewing this topic?
2. When during the school year do you teach this topic?

3. How important is this topic as a prerequisite skill in the grade you teach?
4. How important is this topic as a focal skill in the grade you teach?
5. How developmentally appropriate is this topic for the grade you teach?

Data Collection Efforts

We developed the NRR survey to assess how often and when elementary teachers teach numeric relational reasoning in early grades mathematics. The survey also assessed the appropriateness of skill for the grade level teachers reported teaching. MMaRS staff developed a multi-media approach to reaching the sample goal through a curated network of (a) Texas district mathematics colleagues, (b) SMU's Research in Mathematics Education (RME)'s robust database of approximately 3,000 educators, (c) SMU colleagues, and (d) regular updates through RME's social media sites. We provide a description of each below.

1. Over the course of the last eight years, RME has developed strong relationships with colleagues across the state. Many of these educators are responsible for mathematics curriculum for thousands of students and can reach hundreds of teachers in their districts, 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 it related to the MMaRS project, and were asked to forward the survey to relevant K-3 teachers in their districts. In addition to district-level employees, RME had numerous teachers who were actively engaged in ongoing MMaRS research, either through cognitive interviews or as part of the 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 database of over 3,000 originated as a way to track and maintain participants of RME's annual research-to-practice conference but has since evolved into a means 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 asking them to participate in the survey if they met the K-3 criteria, or to otherwise share the survey with others who would.

3. SMU colleagues within the Simmons School of Education and Human Development received an email asking them to share the link to the NRR survey with their network of K-3 teachers.

4. RME has over 1,000 followers on Twitter and 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 towards the desired sample. Appropriate follow-up with these four target audiences was employed until the sample survey size was achieved, with a goal of around 300 respondents.

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 three learning progressions. Initial data analyses revealed that once respondents made it to the random assignment phase, they completed most of the survey.

Analyses

In this section, we describe the analyses conducted for each research question.

RQ1a-c. These research questions asked respondents to rate their perceived developmentally appropriateness, focal importance, and importance as a prerequisite skill for the grade they teach. Respondents selected an answer on a four-point scale for each skill statement. We analyzed the frequency and percent of each response by grade level. Then, we created contingency tables and calculated Chi-squared statistics to test for an association between grade and the response categories. In some instances, we conducted Fisher's Exact Test when sample sizes were small and a reliable Chi-squared statistic could not be estimated. Next, we calculated the means as standard deviations by grade and skill statement. We conducted ANOVAs for each skills statement to test for mean differences between grade levels.

RQ1d. To assess the relation between teachers' perceptions of developmental appropriateness and importance as a focal skill, we calculated the correlation between these two domains by grade. We also expressed these relations in the form of modified bubble charts, which illustrate the size of the matching rating on the two domains. For example, a larger bubble indicates more agreement in both developmental appropriateness and importance as a focal skill.

RQ2a-b. We asked respondents what time during the school year that they teach each skill statement and the frequency of teaching each skill statement using a four-point scale. We reported the frequency and percent of each response by grade level in contingency tables. Then, we calculated the Chi-squared statistic to test for an association between grade and time of year or frequency of instruction. In some instances, we conducted Fisher's Exact Test when sample sizes were small.

RQ3. We asked respondents about their level of understanding of the skill statement using a three-point scale. We created contingency tables by level of understanding and grade, and tested for the association between grade level and understanding using a chi-square or Fisher's Exact Test. Then, we averaged over teachers' responses and analyzed mean differences by grade using an ANOVA.

Results

In this section, we provide the results of the survey. First, we describe the sample of respondents, then we provide the results by research question.

Participating Respondents

We included 274 survey respondents who reached the assignment phase of the survey. Table 1 describes the gender, race, and age of respondents by assigned learning progression. Ninety-two (34%) respondents were assigned to relations, 90 (33%) to composition/decomposition, and 92 (34%) to properties of operations. Across core concepts, most respondents were female (87%), white/European (57%), and aged between 30-49 (64%).

Table 1. *Demographic Characteristics of Survey Respondents*

		By Core Concept			Total
		Relations	Composition/ Decomposition	Properties of Operations	
Gender	Male	10 (3.6%)	12 (4.4%)	9 (3.3%)	31 (11%)
	Female	80 (29%)	77 (28%)	81 (30%)	238 (87%)
	Prefer not to answer	2 (.73%)	1 (.36%)	2 (.73%)	5 (1.8%)
Race	Asian American/ Pacific Islander	4 (1.5%)	2 (.73%)	2 (.73%)	8 (2.9%)
	Black/African American	7 (2.6%)	11 (4.0%)	8 (2.9%)	26 (9.5%)
	Hispanic/Latino American	21 (7.6%)	23 (8.4%)	22 (8.0%)	66 (24%)
	Native American	1 (.36%)	2 (.73%)	0 (0%)	3 (1.1%)
	White/European American	52 (19%)	47 (17%)	56 (20%)	155 (56%)
	Multiracial	3 (1.1%)	2 (.73%)	0 (0%)	5 (1.8%)
	Other	2 (.73%)	1 (.36%)	1 (.36%)	4 (1.5%)
	Prefer not to answer	2 (.73%)	4 (1.5%)	1 (.36%)	7 (2.6%)
Age	20-29	17 (6.2%)	14 (5.1%)	20 (7.3%)	51 (19%)
	30-39	36 (13%)	28 (10%)	24 (8.8%)	88 (32%)
	40-49	29 (11%)	30 (11%)	28 (10%)	87 (32%)
	50-59	16 (5.8%)	16 (5.8%)	12 (4.4%)	44 (16%)
	60 years or greater	4 (1.5%)	3 (1.1%)	6 (2.2%)	13 (4.7%)
	No Answer	0 (0%)	0 (0%)	1 (.36%)	1 (.36%)

Table 2 describes respondents current grade level of teaching, current position, teaching credentials, and degree achieved by core concept. Across core concepts, most respondents taught first or second grade (44%), were classroom teachers (84%), were credentialed to teach K-6 (65%), and had a bachelor's degree (65%).

Table 2. *Professional and Educational Characteristics of Survey Participants*

		By Core Concept			Total
		Relations	Composition/ Decomposition	Properties of Operations	
Current Grade Level of Teaching	Kindergarten	12 (4.4%)	23 (8.4%)	15 (5.5%)	50 (18%)
	1st grade	21 (7.7%)	18 (6.6%)	22 (8.0%)	61 (22%)
	2nd grade	22 (8.0%)	15 (5.5%)	22 (8.0%)	59 (22%)
	3rd grade	12 (4.4%)	17 (6.2%)	14 (5.1%)	43 (16%)
	Combination of grades	5 (1.8%)	5 (1.8%)	2 (.73%)	12 (4.4%)
	Not Specified	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Current position	Classroom teacher	78 (28%)	78 (28%)	75 (27%)	231 (84%)
	Special education teacher	2 (.73%)	3 (1.1%)	4 (1.5%)	9 (3.3%)
	Math coach	6 (2.2%)	6 (2.2%)	5 (1.8%)	17 (6.2%)
	Interventionist	2 (.73%)	1 (.36%)	4 (1.5%)	7 (2.6%)
	Other	4 (1.5%)	3 (1.1%)	3 (1.1%)	10 (3.6%)
Teaching Credential	K-6	64 (23%)	59 (22%)	55 (20%)	178 (65%)
	K-8	21 (7.7%)	21 (7.7%)	23 (8.4%)	65 (24%)
	Multiple subject (K-12)	13 (4.7%)	13 (4.7%)	9 (3.3%)	35 (13%)
	Secondary, mathematics	1 (.36%)	1 (.36%)	2 (.73%)	4 (1.5%)
	Mathematics specialist	3 (1.1%)	1 (.36%)	6 (2.2%)	10 (3.6%)
	Reading specialist	3 (1.1%)	5 (1.8%)	8 (2.9%)	16 (5.8%)
	Special education	13 (4.7%)	14 (5.1%)	10 (3.6%)	37 (14%)
	Gifted and talented ed	13 (4.7%)	14 (5.1%)	20 (7.3%)	47 (17%)
	English Language Learner	23 (8.4%)	23 (8.4%)	24 (8.8%)	70 (26%)
	Administrative	8 (2.9%)	6 (2.2%)	5 (1.8%)	19 (6.9%)
	Single Subject Mathematics	1 (.36%)	5 (1.8%)	2 (.73%)	8 (2.9%)
	Other	13 (4.7%)	20 (7.3%)	18 (6.6%)	51 (19%)
Degree	Bachelor's	61 (22%)	60 (22%)	58 (21%)	179 (65%)
	Master's	29 (11%)	30 (11%)	37 (14%)	96 (35%)
	Post Master's	6 (2.2%)	2 (.73%)	6 (2.2%)	14 (5.1%)

Table 3 describes the years and types of experience teaching. Most respondents had between six and fifteen years of teaching experience (51%) and teaching K-3 (50%). Most respondents reported between zero and five years at their current position (69%) and between zero and five years at current school (59%). Furthermore, most respondents had between zero and ten years of experience teaching mathematics (54%).

Table 3. *Years of Experience of Survey Respondents*

	Core Concept			Total
	Relations	Composition/ Decomposition	Properties of Operations	
Total teaching experience				
0-5	19 (6.9%)	14 (5.1%)	18 (6.6%)	51 (19%)
6-10	26 (9.5%)	22 (8.0%)	25 (9.1%)	73 (27%)
11-15	20 (7.3%)	24 (8.8%)	22 (8.0%)	66 (24%)
16-20	11 (4.0%)	15 (5.5%)	8 (2.9%)	34 (12%)
20+	16 (5.8%)	16 (5.8%)	18 (6.6%)	50 (18%)
Teaching experience in K-3				
0-5	28 (10%)	21 (7.7%)	25 (9.1%)	74 (27%)
6-10	29 (11%)	28 (10%)	27 (9.9%)	84 (31%)
11-15	19 (6.9%)	18 (6.6%)	17 (6.2%)	54 (20%)
16-20	10 (3.6%)	10 (3.6%)	13 (4.7%)	33 (12%)
20+	6 (2.2%)	14 (5.1%)	9 (3.3%)	29 (11%)
Years in current position				
0-5	69 (25%)	62 (23%)	58 (21%)	189 (69%)
6-10	14 (5.1%)	18 (6.6%)	16 (5.8%)	48 (18%)
11-15	4 (1.5%)	5 (1.8%)	13 (4.7%)	22 (8.0%)
16-20	4 (1.5%)	3 (1.2%)	4 (1.5%)	11 (4.0%)
20+	1 (.36%)	3 (1.1%)	0 (0%)	4 (1.5%)
Years in current school				
0-5	61 (22%)	51 (19%)	49 (18%)	161 (59%)
6-10	15 (5.5%)	18 (6.6%)	21 (7.7%)	54 (20%)
11-15	9 (3.3%)	14 (5.1%)	13 (4.7%)	36 (13%)
16-20	5 (1.8%)	6 (2.2%)	6 (2.2%)	17 (6.2%)
20+	2 (.73%)	2 (.73%)	2 (.73%)	6 (2.2%)
Years teaching mathematics				
0-5	31 (11%)	19 (6.9%)	23 (8.4%)	73 (27%)
6-10	23 (8.4%)	26 (9.5%)	27 (9.9%)	76 (28%)
11-15	18 (6.6%)	22 (8.0%)	18 (6.6%)	58 (21%)
16-20	8 (2.9%)	10 (3.6%)	11 (4.0%)	29 (11%)
20+	12 (4.4%)	14 (5.1%)	12 (4.4%)	38 (14%)
Years special education mathematics				
0-5	77 (28%)	71 (26%)	75 (27%)	223 (81%)
6-10	6 (2.2%)	7 (2.6%)	6 (2.2%)	19 (6.9%)
11-15	6 (2.2%)	7 (2.6%)	6 (2.2%)	19 (6.9%)
16-20	0 (0%)	3 (1.1%)	2 (.73%)	5 (1.8%)
20+	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 4 provides the means and standard deviations for reported instructional time by grade and core concept. In relations and composition/decomposition, grade two teachers report spending more time teaching mathematics compared to other grades. In properties of operations, grade three teachers report spending more time teaching mathematics compared to other grades. Overall, grade two teachers report spending more instructional time on mathematics compared to other grades. We also asked respondents about their use of manipulatives, which we summarize in Appendix B.

Table 4. *Mathematics Instructional Time (in minutes) for Survey Respondents by Grade*

Grade level	Learning Progression							
	Relations		Composition/ Decomposition		Properties of Operations		Total	
	M (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*
Kindergarten	72.9 (21.0)	16	71.8 (25.4)	27	73.1 (14.3)	19	72.5 (21.1)	62
1	76.2 (15.3)	25	77.0 (15.5)	23	76.3 (17.3)	26	76.5 (15.9)	74
2	80.1 (13.2)	24	86.2 (13.6)	19	81.7 (16.2)	24	82.4 (14.5)	67
3	78.4 (18.6)	27	80.4 (14.2)	22	87.0 (10.9)	22	81.7 (15.4)	71

Results for RQ 1

Developmentally Appropriate

To assess the developmental appropriateness of MMaRS NNR learning progression, we asked teachers to rate the appropriateness of each skill statement for the grade they taught. Appendix C describes the number of responses by grade level for the relations, composition/decomposition, and properties of operations core concepts. We found five (25%) skill statements where the level of reported developmental appropriateness depended on grade level. This means that the number of respondents in each of the categories (i.e., Not Appropriate, Somewhat Appropriate, Appropriate, and Very Appropriate) significantly depended on the grade level taught of the respondent. For the composition/decomposition core concept, we found 13 (81%) skill statements where the level of reported developmental appropriateness depended on grade level taught. Lastly, four (18%) of the properties of operations skills statements significantly depended on grade level taught.

When we treated the responses as numeric and compared means across grade levels, we found significant mean differences in reported appropriateness for seven (35%) skill statements in the relations core concept, 15 (94%) skill statements in the composition/decomposition core concept, and six (27%) skill statements in the properties of operations core concept.

Focal Skill Importance

We also asked respondents to rate the importance of each skill statement as a focal skill. Appendix D describes the number of responses by grade level for each skill statement in each core concept. When analyzed for independence, we found seven (35%) skill statements within the relations core concept that depended on grade level. We also found twelve (75%) skill statements within the composition/decomposition core concept that depended on grade level and

nine (41%) skill statements within the properties of operations core concept that depended on grade level.

When treated numerically, we found seven (35%) skill statements with significant mean differences by grade level in the relations core concept, 14 (88%) skills statement with significant mean differences by grade level in the composition/decomposition core concept, and nine (41%) skill statements with significant mean differences by grade level in the properties of operations core concept.

Prerequisite Skill

We also asked respondents to rate each skill statement on their perceived importance as a prerequisite skill for the grade level they teach. Appendix E describes the responses by core concept and grade level. For the relations core concept, we found 11 (55%) skill statements significantly depended on the reported grade level taught. We found significant dependence by grade level for 14 (88%) skill statements in the composition/decomposition core concept, and five (23%) skill statements in the properties of operations core concepts.

When we treated the responses numerically, we found significant mean differences by grade level for ten (50%) skill statements within the relations core concept, 14 (88%) skill statements within the composition/decomposition core concept, and three (14%) skill statements within the properties of operations core concept.

Relation between Developmental Appropriateness and Importance as a Focal Skill

We analyzed the relation between developmental appropriateness and importance as a focal skill through correlations and visually with modified bubble charts (Appendix F). For most skill statements across grades, we found significant positive correlations between respondents' perception of developmental appropriateness and their perception of importance as a focal skill. This means that respondents tended to similarly rate developmental appropriateness and importance as a focal skill. We found similar relations with the modified bubble charts.

Results for RQ2

Time of Year

To understand the appropriateness of the skill statements, we also asked respondents to report when they teach each skill statement (i.e., Not Taught, Fall, Winter, Spring). Appendix G describes the response pattern by skill statement and grade level. For the relations core concept, 16 (80%) skill statements significantly depended on the grade level of the respondent. For the composition/decomposition core concept, ten (63%) skill statements significantly depended on grade level, and nine (41%) skill statements significantly depended on grade level for the properties of operations core concept.

Teaching Frequency

We also asked respondents to indicate how frequently they teach skill statements. Appendix H describes the responses by skill statement and grade level. Within the relations core concept, seven (35%) skill statements significantly depended on grade level, 12 (75%) skill statements within the composition/decomposition core concept significantly depended on grade level, and seven (32%) skill statements within the properties of operations significantly depended on grade level.

Relation between Developmental Appropriateness and Time of Year

To examine the relation between developmental appropriateness and time of year taught, we created modified bubble charts. These modified bubble charts allowed us to examine the utility of skills statements within each grade level. These modified bubble charts can be found in Appendix G.

Results for RQ3

Understandability

We asked respondents to rate the understandability of each skill statement. Appendix I describes the response patterns by skill statement and grade level. We examined the independence of understandability rating by grade level. Understandability of two (10%) skill statements within the relations core concept significantly depended on grade level, zero (0%) skill statements within the composition/decomposition significantly depended on grade level, and two (9%) skill statements within the properties of operations core concept significantly depended on grade level. We further analyzed whether years of experience was a significant predictor of understandability. We found the same two skill statements in relations where years of experience significantly predicted understandability.

Summary

The purpose of the NRR teacher survey was to provide evidence for the evaluation of the proposed learning progression. The results from this survey, when used with other sources of evidence, assisted with the evaluation of the conceptualization of skill statements (i.e., developmental appropriateness, importance as a focal skill, and importance as a prerequisite skill). The results also assisted with the evaluation of the ordering of skill statements (i.e., time of year taught, frequency of teaching) and overall understandability. The evaluation of these sources of evidence can be found in the NRR Development Technical Report (Kuehnert et al., Forthcoming).

References

Kuehnert, E. A., Perry, L., Haider, M. Q., Geller, J., Hatfield, C., & Ketterlin-Geller, L. R. (Forthcoming). Numeric relational reasoning: Learning progression development.

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Appendix A – NRR Teacher Survey

Opening

Thank you for your willingness to complete this survey. Your participation will help us understand how students learn to reason numerically. You will be asked a series of questions related to classroom instruction on numeric relational reasoning including time spent, perceived importance, and appropriateness of specific skills.

Although it is possible to complete this survey on a mobile device, formatting and functions are optimized for completing with a computer or tablet.

Consent

We are conducting a research study to learn more about the developmental appropriateness of numeric relational reasoning skills in K-2 mathematics. Your participation in this study is voluntary. If you agree to take part and then change your mind, you can withdraw for any reason. There are no penalties if you withdraw, decline to participate, or skip any parts of the survey. If you agree to participate, you will answer questions related to your instruction on numeric relational reasoning including the time and focus of your instruction and the importance of specific skills that are associated with numeric relational reasoning. We will also ask you a few demographic questions. Survey questions will be a mix of short answers, selected response, and rating scale. The survey should take approximately 20 minutes to complete.

There is no cost to you for taking part in this research study. You will not be paid for taking part in the research study. However, if you agree to participate in this study, your name will be entered into a drawing to win a $25 Amazon gift card. Your chance of winning a $25 Amazon gift card is approximately 1 in 10. You will be asked to provide your name and email address, but this information will only be used for communication about the giftcards.
Risks associated with this survey are minimal. Aggregated responses from all respondents will help researchers determine the importance and priority of specific skills related to numerical relational reasoning.

You have a full right to privacy. This means that only the researchers who are part of this study will see the information about you from this survey. If the results of this study are shared with other people, your name will not be used. All data from this survey will be kept safe from access by people who should not see it, through password-protection. If you have questions about this study or the procedures, please email leperry@smu.edu.
If you have concerns or questions about the study or have a research-related injury, contact any of the following:

Leanne Ketterlin Geller, Ph.D.
Texas Instruments Chair in Education
Professor, Education Policy & Leadership
Director, Research in Mathematics Education
Simmons School of Education and Human Development
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Email: lkgeller@smu.edu

If you have questions about your rights as a participant or feel you have been placed at risk, you may contact:
Austin Baldwin, Ph.D., IRB Chair
researchcomplaince@smu.edu
214-768-2033

Would you like to participate in this research study?

By clicking "Agree" below, you agree to participate in this research study.

Agree ○ Disagree ○

Demographics

First name:

Last name:

Email address:

Please select the option(s) that best reflect your education (select all that apply):

- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Post Master's Degree

What is your current title/position?

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

Which grade(s) do you currently teach (select all that apply):

- [ ] K
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] none of the above

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	

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):

Gender with which you identify:

- [ ] Male
- [ ] Female
- [ ] Prefer not to answer

Race/Ethnicity:

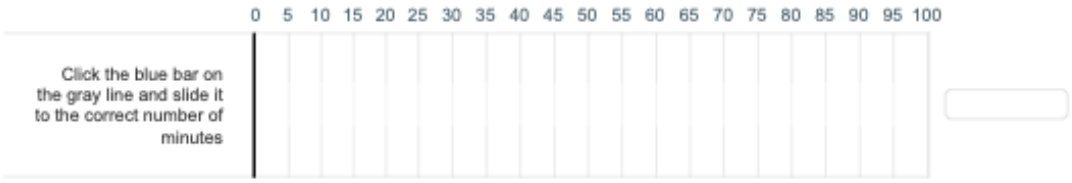
- Asian American/Pacific Islander
- Black/African American
- Hispanic/Latino American
- Native American
- White/European American
- Multiracial
- Other (please specify):
- I prefer not to respond

Age:

- 20-29 years
- 30-39 years
- 40-49 years
- 50-59 years
- 60 years or greater

Classroom Use, Time, and Manipulatives

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



Which mathematical concepts do you spend the most time teaching?

Items	Please rank the concepts you spend the most time teaching here
Counting and Cardinality	
Operations and Algebraic Thinking	

Number and Operations in Base 10

Measurement and Data

Geometry

Other

Please drag and drop concepts you do NOT spend time teaching here

Select the manipulatives or representations you normally use in your classroom (select all that apply):

- Interlocking Cubes
- Base Ten Blocks/Rods
- Counters/Counting Chips
- Number lines
- Balances
- Fraction strips
- Other (please specify):

How would you describe numeric relational reasoning to parents?

Properties of Operations

The following skills were developed as part of a learning progression. You will be asked a series of questions related to classroom instruction on numeric relational reasoning including time spent, perceived importance, and appropriateness of specific skills. The same five questions are asked about each skill.

Equivalence of Quantity and Number

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

Given equivalent sets of quantities, recognize that the quantity of each set remains the same regardless of size, color, or arrangement (conservation of number).

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given equivalent sets of quantities, recognize that the quantity of each set remains the same regardless of size, color, or arrangement (conservation of number).

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given a quantity broken into two parts, recognize that order does not change the quantity (commutative property).

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a quantity broken into two parts, recognize that order does not change the quantity (commutative property).

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring

How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given a quantity, recognize that the quantity remains the same after joining/removing a part then removing/joining the same part (undoing or additive inverse).

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a quantity, recognize that the quantity remains the same after joining/removing a part then removing/joining the same part (undoing or additive inverse).

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given two associated parts and another part, recognize that the quantity of the three parts remains the same if the parts are reassociated (associative property).

- Yes, I completely understand

I mostly understand

No, I don't understand

Given two associated parts and another part, recognize that the quantity of the three parts remains the same if the parts are reassociated (associative property).

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given a quantity, recognize an equivalent expression that demonstrates one or more properties of operations.

Yes, I completely understand

I mostly understand

No, I don't understand

Given a quantity, recognize an equivalent expression that demonstrates one or more properties of operations.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important

How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Recognize two equivalent expressions that demonstrate one or more properties of operations.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Recognize two equivalent expressions that demonstrate one or more properties of operations.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Recognize two equivalent expressions that demonstrate decomposition and at least one property of operations.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Recognize two equivalent expressions that demonstrate decomposition and at least one property of operations.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week

When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Equivalence of Quantity and Number:

Equal Sign as a Relational Symbol

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

Recognize the equality between two quantities using a balance.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Recognize the equality between two quantities using a balance.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important

	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate
How developmentally appropriate is this topic for the grade you teach?	○	○	○	○

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

Write a true equation using an equal sign to represent the relationship between given quantities on a balance or in a pictorial representation.

- ○ Yes, I completely understand
- ○ I mostly understand
- ○ No, I don't understand

Write a true equation using an equal sign to represent the relationship between given quantities on a balance or in a pictorial representation.

How much time do you spend teaching and/or reviewing this topic?	Not taught ○	2-3 times per year ○	2-3 times per month ○	2-3 times per week ○
When during the school year do you teach this topic?	Not taught ○	Fall ○	Winter ○	Spring ○
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important ○	Somewhat important ○	Important ○	Very important ○
How important is this topic as a *focal* skill in the grade you teach?	Not important ○	Somewhat important ○	Important ○	Very important ○
How developmentally appropriate is this topic for the grade you teach?	Not appropriate ○	Somewhat appropriate ○	Appropriate ○	Very appropriate ○

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

Recognize true and not true equations with different equation structures: operations on the left side (a + b = c); no operations (a = a); operations on the right side (c = a + b).

- ○ Yes, I completely understand
- ○ I mostly understand
- ○ No, I don't understand

Recognize true and not true equations with different equation structures: operations on the left side (a + b = c); no operations (a = a); operations on the right side (c = a + b).

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Recognize true and not true equations with different equation structures: operations on both sides (a + b = c + d); multiple instances of a number.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Recognize true and not true equations with different equation structures: operations on both sides (a + b = c + d); multiple instances of a number.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Equal Sign as a Relational Symbol:

Maintaining Equality

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

Given a contextual situation with *known* quantities, use one or more properties of operations to recognize when equality is maintained.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a contextual situation with *known* quantities, use one or more properties of operations to recognize when equality is maintained.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given a contextual situation with *unknown* quantities, use one or more properties of operations to recognize when equality is maintained.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a contextual situation with *unknown* quantities, use one or more properties of operations to recognize when equality is maintained.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given a contextual situation with *known* quantities that models one or more properties of operations, write a true equation to represent the situation.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a contextual situation with *known* quantities that models one or more properties of operations, write a true equation to represent the situation.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important

How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Recognize true and not true equations with *known* numbers using one or more properties of operations.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Recognize true and not true equations with *known* numbers using one or more properties of operations.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Maintaining Equality:

Solving for Unknown Values

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

Solve for an unknown value in a true equation using a relational definition of the equal sign.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Solve for an unknown value in a true equation using a relational definition of the equal sign.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given a contextual situation modeling a true equation, apply one or two properties of operations or property of equality to solve for an unknown value **using concrete objects**

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a contextual situation modeling a true equation, apply one or two properties of operations or property of equality to solve for an unknown value **using concrete objects**

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring

How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very Appropriate

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

Given a contextual situation modeling a true equation, apply one or two properties of operations or a property of equality to solve for an unknown value **in a true equation**.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a contextual situation modeling a true equation, apply one or two properties of operations or a property of equality to solve for an unknown value **in a true equation**.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very Appropriate

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

Apply one or two properties of operations or a property of equality to solve for an unknown value in a true equation.

- Yes, I completely understand
- I mostly understand

- No, I don't understand

Apply one or two properties of operations or a property of equality to solve for an unknown value in a true equation.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very Appropriate

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

Given a contextual situation modeling a true equation, apply decomposition with one or two properties of operations or a property of equality to solve for an unknown value **using concrete objects**.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a contextual situation modeling a true equation, apply decomposition with one or two properties of operations or a property of equality to solve for an unknown value **using concrete objects**.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important

	Not appropriate	Somewhat appropriate	Appropriate	Very Appropriate
How developmentally appropriate is this topic for the grade you teach?	○	○	○	○

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

Given a contextual situation modeling a true equation, apply decomposition with one or two properties of operations or a property of equality to solve for an unknown value **in a true equation**.

- ○ Yes, I completely understand
- ○ I mostly understand
- ○ No, I don't understand

Given a contextual situation modeling a true equation, apply decomposition with one or two properties of operations or a property of equality to solve for an unknown value **in a true equation**.

How much time do you spend teaching and/or reviewing this topic?	Not taught ○	2-3 times per year ○	2-3 times per month ○	2-3 times per week ○
When during the school year do you teach this topic?	Not taught ○	Fall ○	Winter ○	Spring ○
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important ○	Somewhat important ○	Important ○	Very important ○
How important is this topic as a *focal* skill in the grade you teach?	Not important ○	Somewhat important ○	Important ○	Very important ○
How developmentally appropriate is this topic for the grade you teach?	Not appropriate ○	Somewhat appropriate ○	Appropriate ○	Very appropriate ○

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

Apply decomposition with one or two properties of operations or a property of equality to solve for an unknown value in a true equation.

- ○ Yes, I completely understand
- ○ I mostly understand
- ○ No, I don't understand

Apply decomposition with one or two properties of operations or a property of equality to solve for an unknown value in a true equation.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Relations

The following skills were developed as part of a learning progression. You will be asked a series of questions related to classroom instruction on numeric relational reasoning including time spent, perceived importance, and appropriateness of specific skills. The same five questions are asked about each skill.

Comparison

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

Compare two quantities to find which is more/less using matching and counting strategies.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compare two quantities to find which is more/less using matching and counting strategies.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring

How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compare two unspecified weights using balances to find which weighs more/less.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compare two unspecified weights using balances to find which weighs more/less.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compare two quantities to find which is more/less using mental images.

- Yes, I completely understand
- I mostly understand

No, I don't understand

Compare two quantities to find which is more/less using mental images.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compare two numbers using mental number lines to determine which is more/less.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compare two numbers using mental number lines to determine which is more/less.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compare two numbers using written number lines to determine which is more/less.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compare two numbers using written number lines to determine which is more/less.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compare two numbers using *open* number lines to determine which is more/less.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compare two numbers using *open* number lines to determine which is more/less.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week

When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compare two numbers using symbols: >, <.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compare two numbers using symbols: >, <.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Comparison:

Ordinality

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

Without counting, use tools to find a unit more/less than a given number.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Without counting, use tools to find a unit more/less than a given number.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Without calculating, mentally find a unit more/less than a given number.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Without calculating, mentally find a unit more/less than a given number.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week

When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Ordinality:

Transitivity

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

Compare two unspecified lengths (a) and (b) to a given reference length (c) to determine which is longer/shorter (a) or (b).

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compare two unspecified lengths (a) and (b) to a given reference length (c) to determine which is longer/shorter (a) or (b).

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important

How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat apropriate	Appropriate	Very appropriate

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

Order unspecified quantities in a word problem.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Order unspecified quantities in a word problem.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Order three unspecified weights using balances.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Order three unspecified weights using balances.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Order three numbers using number relationships with tools.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Order three numbers using number relationships with tools.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Order three numbers using number relationships without tools (i.e., mental strategies).

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Order three numbers using number relationships without tools (i.e., mental strategies).

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Order three numbers in a word problem.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Order three numbers in a word problem.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important

How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Transitivity:

Representations of Order in Comparison Situations

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

Find how much more/less between two quantities using matching and counting strategies.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Find how much more/less between two quantities using matching and counting strategies.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Find how much more/less between two quantities using tools.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Find how much more/less between two quantities using tools.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Find how much more/less between two numbers in a word problem using tools.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Find how much more/less between two numbers in a word problem using tools.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important

How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Find how much more/less between two numbers in a word problem.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Find how much more/less between two numbers in a word problem.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compare two numbers to find which is [closest to/furthest from] a benchmark.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compare two numbers to find which is [closest to/furthest from] a benchmark.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about these Representations of Order in Comparison Situations:

Composition/Decomposition

The following skills were developed as part of a learning progression. You will be asked a series of questions related to classroom instruction on numeric relational reasoning including time spent, perceived importance, and appropriateness of specific skills. The same five questions are asked about each skill.

Composition

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

Compose a number with single objects.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compose a number with single objects.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compose a number with two parts.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compose a number with two parts.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compose a number with three or more parts.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compose a number with three or more parts.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compose a number with two or more parts using different number combinations.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compose a number with two or more parts using different number combinations.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you	Not	Somewhat	Important	Very important

teach?	important	important		
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Compose a number with two or more parts using concepts of place value.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Compose a number with two or more parts using concepts of place value.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Composition:

Decomposition

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

Decompose a number into two parts.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Decompose a number into two parts.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Decompose a number into two parts using equipartitioning.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Decompose a number into two parts using equipartitioning.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade	Not	Somewhat	Important	Very important

you teach?	important	important		
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Decompose a number into three or more parts.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Decompose a number into three or more parts.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Decompose a number up to 25 into three or more parts using equipartitioning.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Decompose a number up to 25 into three or more parts using equipartitioning.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Decompose a number into two or more parts using different number combinations.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Decompose a number into two or more parts using different number combinations.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Decompose a number with two or more parts using concepts of place value.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Decompose a number with two or more parts using concepts of place value.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Decomposition

Applying and Representing Composition and Decomposition

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

Given one part of a number, identify the missing part.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given one part of a number, identify the missing part.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given a unit, identify the missing part.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given a unit, identify the missing part.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given one part of a number, identify two or more missing parts.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given one part of a number, identify two or more missing parts.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Given one part of a number, identify two or more missing parts using different number combinations.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Given one part of a number, identify two or more missing parts using different number combinations.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade	Not	Somewhat	Important	Very important

you teach?	important	important		
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

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

Write an expression to represent the decomposition of a number.

- Yes, I completely understand
- I mostly understand
- No, I don't understand

Write an expression to represent the decomposition of a number.

How much time do you spend teaching and/or reviewing this topic?	Not taught	2-3 times per year	2-3 times per month	2-3 times per week
When during the school year do you teach this topic?	Not taught	Fall	Winter	Spring
How important is this topic as a *prerequisite* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How important is this topic as a *focal* skill in the grade you teach?	Not important	Somewhat important	Important	Very important
How developmentally appropriate is this topic for the grade you teach?	Not appropriate	Somewhat appropriate	Appropriate	Very appropriate

Additional comments about Applying and Representing Composition and Decomposition:

Ending Thank You

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

- ○ Yes
- ○ No, submit without entering drawing.

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

Name (First Last)	
Email	
Phone Number?	

Appendix B – Respondents use of Manipulatives

	Learning Progression						Total	
	Relations		Composition/ Decomposition		Properties of Operations			
	%	N	%	N	%	N	%	N
Interlocking cubes	82.6	76	80.0	72	76.1	70	79.6	218
Base ten blocks/rods	89.1	82	80.0	72	81.5	75	83.6	229
Number lines	93.5	86	86.7	78	97.8	90	92.7	254
Balances	29.3	27	31.1	28	30.4	28	30.3	83
Fraction strips	53.3	49	38.9	35	43.5	40	45.3	124
Other:								
10's Frames	5.43	5	5.56	5	2.17	2	4.38	12
100's Charts	3.26	3	4.44	4	1.09	1	2.92	8
2D/3D Shapes	4.35	4	3.33	3	3.26	3	3.65	10
Anchor Charts	1.09	1	.000	0	.000	0	.365	1
Counting Manipulatives	6.52	6	4.44	4	10.9	10	7.30	20
Calendars	.000	0	.000	0	2.17	2	.730	2
Clocks	3.26	3	.000	1	2.17	2	2.19	6
Coins	3.26	3	2.22	2	2.17	2	2.55	7
Dice	4.35	4	2.22	2	3.26	3	3.28	9
Dominos	1.09	1	.000	0	2.17	2	1.09	3
Fraction Circles/Tiles	1.09	1	1.11	1	.000	0	.730	2
Geo Blocks	.000	0	1.11	1	.000	0	.365	1
Inch/cm Cubes	2.17	2	.000	0	1.09	1	1.09	3
Links	1.09	1	.000	0	.000	0	.365	1
Math Racks	1.09	1	.000	0	.000	0	.365	1
Math Strategies	.000	0	1.11	1	.000	0	.365	1
Mont. Golden Beads	.000	0	1.11	1	.000	0	.365	1
Multiplication Tables	1.09	1	.000	0	.000	0	.365	1
Number Chart	1.09	1	.000	0	2.17	2	1.09	3
Part Part Total	.000	0	1.11	1	1.09	1	.730	2
Pattern Blocks	2.17	2	1.11	1	.000	0	1.09	3
Place Value Blocks/Disks	3.26	3	1.11	1	1.09	1	1.46	4
Play Money	2.17	2	1.11	1	3.26	3	2.19	6
Playing Cards	.000	0	.000	0	1.09	1	.365	1
Real-Objects	.000	0	.000	0	1.09	1	.365	1
Rekenreks	2.17	2	3.33	3	4.35	4	3.28	9
Rulers	3.26	3	1.11	1	1.09	1	1.46	4
Sequin Board	.000	0	1.11	1	.000	0	.365	1
Space Figures	2.17	2	2.22	2	.000	0	1.46	4
Spinners	.000	0	.000	0	1.09	1	.365	1
STEM items	1.09	1	.000	0	.000	0	.365	1
Strip Diagrams	1.09	1	1.11	1	.000	0	.730	2
Tape Measures	.000	0	.000	0	1.09	1	.365	1
Toys	.000	0	1.11	1	.000	0	.365	1
White Boards	.000	0	1.11	1	1.09	1	.730	2
Word Wall	1.09	1	.000	0	.000	0	.365	1

Appendix C – Developmentally Appropriateness Tables

Relations: Developmental appropriateness of skill statement by grade level

Skill Statement	Grade Level	N	Not Appropriate	Somewhat Appropriate	Appropriate	Very Appropriate	Fisher's Test Results
A.1.a	K	15	0	1	5	9	p = .99
	1	25	0	2	7	16	
	2	23	1	1	7	14	
	3	25	0	3	8	14	
A.1.b	K	15	1	1	6	7	p = .13
	1	25	3	3	14	5	
	2	24	3	6	10	5	
	3	25	0	10	10	5	
A.1.c	K	15	4	2	6	3	p = .16
	1	25	5	6	9	5	
	2	23	1	2	15	5	
	3	24	0	4	14	6	
A.1.d	K	14	3	4	5	2	p = .12
	1	23	7	4	6	6	
	2	23	1	5	13	4	
	3	23	1	3	10	9	
A.1.e	K	15	2	0	8	5	p = .52
	1	24	0	1	10	13	
	2	23	0	1	13	9	
	3	22	0	1	11	10	
A.1.f	K	13	6	5	0	2	p < .001
	1	24	2	6	9	7	
	2	23	1	2	13	7	
	3	23	1	4	10	8	
A.1.g	K	15	5	6	3	1	p < .001
	1	23	0	2	8	13	
	2	23	0	0	10	13	
	3	23	0	0	6	17	
A.2.a	K	15	1	2	7	5	p = .98
	1	23	4	2	10	7	
	2	22	3	2	9	8	
	3	21	4	1	7	9	
A.2.b	K	13	1	4	3	5	p = .40
	1	22	4	2	9	7	
	2	21	0	3	12	6	
	3	23	3	3	8	9	
A.3.a	K	15	1	3	6	5	p = .76
	1	21	1	2	12	6	

	2	22	2	2	14	4	
	3	22	4	4	9	5	
A.3.b	K	11	2	5	3	1	p = .33
	1	20	3	3	9	5	
	2	22	2	4	9	5	
	3	21	3	4	4	10	
A.3.c	K	14	2	3	8	1	p = .87
	1	22	6	5	7	4	
	2	20	4	5	9	2	
	3	20	2	7	8	3	
A.3.d	K	12	1	6	3	2	p = .21
	1	21	1	4	10	6	
	2	21	0	2	14	5	
	3	21	1	3	10	7	
A.3.e	K	13	3	6	2	2	p = .01
	1	21	2	4	9	6	
	2	21	0	4	13	4	
	3	21	0	4	6	11	
A.3.f	K	14	7	2	2	3	p = .046
	1	20	6	3	7	4	
	2	19	1	2	5	11	
	3	22	1	4	10	7	
A.4.a	K	15	0	4	8	3	p = .94
	1	20	0	3	9	8	
	2	20	1	4	9	7	
	3	21	1	3	9	8	
A.4.b	K	13	1	4	4	4	p = .20
	1	20	0	2	11	7	
	2	22	0	2	14	6	
	3	21	2	3	6	10	
A.4.c	K	15	2	4	5	4	p = .41
	1	20	0	2	12	6	
	2	21	0	3	11	7	
	3	21	2	1	10	8	
A.4.d	K	15	3	4	5	3	p = .06
	1	20	0	5	7	8	
	2	21	0	2	9	10	
	3	22	0	1	12	9	
A.4.e	K	14	6	6	0	2	p < .001
	1	21	4	3	10	4	
	2	20	1	4	11	4	
	3	22	0	1	14	7	

Composition/Decomposition: Developmental appropriateness of skill statement by grade level

Skill Statement	Grade Level	N	Not Appropriate	Somewhat Appropriate	Appropriate	Very Appropriate	Fisher's Test Results
B.5.a	K	26	0	0	6	20	p = .047
	1	23	2	3	9	9	
	2	19	1	5	6	7	
	3	21	1	4	7	9	
B.5.b	K						
	1						
	2						
	3						
B.5.c	K	25	13	6	4	2	p < .001
	1	21	1	6	7	7	
	2	18	0	3	3	12	
	3	21	0	4	7	10	
B.5.d	K	26	6	6	10	4	p = .049
	1	21	0	3	8	10	
	2	18	0	3	5	10	
	3	21	1	3	6	11	
B.5.e	K	22	8	7	3	4	p < .001
	1	22	1	2	9	10	
	2	19	1	0	3	15	
	3	20	0	0	7	13	
B.6.a	K	25	2	6	8	9	p = .07
	1	21	0	1	10	10	
	2	17	0	3	4	10	
	3	19	0	1	3	15	
B.6.b	K	14	4	3	4	3	p = .22
	1	18	2	5	5	6	
	2	11	0	2	1	8	
	3	14	1	1	4	8	
B.6.c	K	25	15	5	2	3	p < .001
	1	18	3	5	12	1	
	2	17	1	2	4	10	
	3	18	1	1	6	10	
B.6.d	K	17	14	2	1	0	p < .001
	1	16	3	5	7	1	
	2	17	1	1	5	6	
	3	15	1	3	4	7	
B.6.e	K	23	4	6	9	4	p = .01
	1	21	2	4	11	4	
	2	17	0	1	5	11	
	3	17	1	0	6	10	
B.6.f	K	19	11	2	5	1	p < .001

	1	20	0	4	7	9	
	2	16	0	0	4	12	
	3	18	0	2	6	10	
B.7.a	K	23	4	6	8	5	p = .002
	1	19	1	1	10	7	
	2	16	1	3	1	11	
	3	18	0	1	3	14	
B.7.b	K	19	7	5	3	4	p < .001
	1	20	1	7	7	5	
	2	15	0	1	2	12	
	3	18	0	1	4	13	
B.7.c	K	19	12	3	4	0	p < .001
	1	18	3	4	9	2	
	2	16	2	1	5	8	
	3	18	1	2	5	10	
B.7.d	K	19	13	2	4	0	p < .001
	1	19	5	6	6	2	
	2	18	2	4	1	9	
	3	18	2	2	5	9	
B.7.e	K	20	6	5	5	4	p = .02
	1	20	3	4	7	6	
	2	17	1	1	5	10	
	3	18	1	0	4	13	

Properties of Operations: Developmental appropriateness of skill statement by grade level

Skill Statement	Grade Level	N	Not Appropriate	Somewhat Appropriate	Appropriate	Very Appropriate	Fisher's Test Results
C.8.a	K	19	2	0	7	10	p = .16
	1	26	0	5	9	12	
	2	23	1	6	10	6	
	3	20	0	5	8	7	
C.8.b	K	19	3	3	6	7	p = .16
	1	26	1	2	11	12	
	2	22	0	2	12	8	
	3	20	0	5	4	11	
C.8.c	K	19	7	3	3	6	p = .09
	1	25	1	4	12	8	
	2	21	1	5	11	4	
	3	20	3	3	7	7	
C.8.d	K	18	7	4	3	4	p = .15
	1	23	2	6	10	5	
	2	19	3	2	11	3	
	3	20	3	3	6	8	
C.8.e	K	19	6	6	5	2	p = .10

	1	22	3	5	10	4	
	2	19	2	5	9	3	
	3	19	1	3	5	10	
C.8.f	K	18	11	2	5	0	p = .03
	1	21	4	4	7	6	
	2	19	3	6	5	5	
	3	19	5	1	7	6	
C.8.g	K	17	7	4	3	3	p = .79
	1	21	4	4	7	4	
	2	19	4	3	8	4	
	3	18	3	3	6	6	
C.9.a	K	19	1	4	8	6	p = .99
	1	22	1	7	9	5	
	2	19	2	6	7	4	
	3	18	1	4	7	6	
C.9.b	K	19	4	7	4	4	p = .12
	1	22	0	7	9	6	
	2	19	4	3	8	4	
	3	19	0	4	7	8	
C.9.c	K	19	12	1	4	2	p = .11
	1	21	4	4	7	6	
	2	19	5	3	6	5	
	3	19	2	4	7	6	
C.9.d	K	19	13	2	3	1	p = .10
	1	21	5	7	5	4	
	2	19	6	2	7	4	
	3	18	4	4	5	5	
C.10.a	K	15	8	4	2	1	p = .37
	1	19	5	4	8	2	
	2	15	7	3	3	2	
	3	17	3	5	4	5	
C.10.b	K	14	8	3	3	0	p = .33
	1	20	6	6	7	1	
	2	16	7	2	5	2	
	3	17	4	3	5	5	
C.10.c	K	17	10	2	3	2	p = .004
	1	19	4	4	9	2	
	2	18	7	0	6	5	
	3	17	0	4	9	4	
C.10.d	K	17	11	1	4	1	p < .001
	1	19	2	4	12	1	
	2	17	2	4	7	4	
	3	17	0	3	10	4	
C.11.a	K	16	6	4	3	3	p = .37
	1	20	4	3	10	3	

	2	15	3	5	6	1	
	3	17	1	5	7	4	
C.11.b	K	17	6	1	7	3	p = .14
	1	19	4	2	12	1	
	2	18	4	3	7	4	
	3	17	1	5	5	6	
C.11.c	K	17	8	4	3	2	p = .38
	1	18	6	2	9	1	
	2	16	5	4	5	2	
	3	16	3	2	6	5	
C.11.d	K	15	8	2	3	2	p = .21
	1	19	5	3	10	1	
	2	17	5	5	4	3	
	3	16	2	3	6	5	
C.11.e	K	17	4	4	3	6	p = .48
	1	17	3	3	9	2	
	2	17	3	5	4	5	
	3	16	2	2	5	7	
C.11.f	K	16	9	1	4	2	p = .09
	1	17	5	4	8	0	
	2	17	5	5	3	4	
	3	16	4	1	7	4	
C.11.g	K	15	9	0	4	2	p = .04
	1	16	4	4	8	0	
	2	16	5	5	3	3	
	3	17	3	4	5	5	

Relations: Mean developmental appropriateness of skill statement by grade level

	Grade				ANOVA Results	
	K	1	2	3	F-Statistic	p-value
A.1.a	2.5 (.64)	2.6 (.65)	2.5 (.79)	2.4 (.71)	F(3,84) = .139	.94
A.1.b	2.3 (.88)	1.8 (.90)	1.7 (.95)	1.8 (.76)	F(3,85) = 1.36	.26
A.1.c	1.5 (1.1)	1.6 (1.0)	2.0 (.71)	2.1 (.65)	F(3,83) = 2.45	.07
A.1.d	1.4 (1.0)	1.5 (1.2)	1.9 (.76)	2.2 (.83)	F(3,79) = 2.73	.05*
A.1.e	2.1 (.96)	2.5 (.59)	2.3 (.57)	2.4 (.59)	F(3,80) = 1.37	.26
A.1.f	.85 (1.1)	1.9 (.95)	2.1 (.76)	2.1 (.85)	F(3,79) = 6.80	.000***
A.1.g	1.0 (.93)	2.5 (.67)	2.6 (.51)	2.7 (.45)	F(3,80) = 26.9	.000***
A.2.a	2.1 (.88)	1.9 (1.1)	2.0 (1.0)	2.0 (1.1)	F(3,77) = .126	.94
A.2.b	1.9 (1.0)	1.9 (1.1)	2.1 (.65)	2.0 (1.0)	F(3,75) = .322	.81
A.3.a	2.3 (.87)	2.2 (.71)	2.0 (.79)	1.8 (1.1)	F(3,65) = .808	.49
A.3.b	1.3 (.90)	1.8 (1.0)	1.9 (.93)	2.0 (1.1)	F(3,68) = .289	.29
A.3.c	1.6 (.85)	1.4 (1.1)	1.5 (.94)	1.6 (.88)	F(3,72) = .182	.91
A.3.d	1.5 (.90)	2.0 (.84)	2.1 (.57)	2.1 (.83)	F(3,71) = 1.97	.13
A.3.e	1.2 (1.0)	1.9 (.94)	2.0 (.63)	2.3 (.80)	F(3,72) = 4.67	.005**
A.3.f	1.1 (1.3)	1.5 (1.1)	2.1 (.78)	2.0 (.84)	F(3,71) = 3.88	.013*

A.4.a	1.9 (.70)	2.3 (.72)	2.0 (.86)	2.1 (.85)	F(3,73) = .506	.68
A.4.b	1.8 (.99)	2.3 (.64)	2.2 (.59)	2.1 (1.0)	F(3,72) = .709	.55
A.4.c	1.7 (1.0)	2.2 (.62)	2.2 (.68)	2.1 (.91)	F(3,73) = 1.23	.31
A.4.d	1.5 (1.1)	2.2 (.81)	2.4 (.67)	2.4 (.58)	F(3,74) = 4.36	.007**
A.4.e	.86 (1.0)	1.7 (1.0)	1.9 (.79)	2.3 (.55)	F(3,73) = 8.23	.000***

Note: Developmental appropriateness was reported on a 4-point scale (0 = Not appropriate, 1 = Somewhat appropriate, 2 = Appropriate, 3 = Very appropriate).

Composition/Decomposition: Mean developmental appropriateness of skill statement by grade

Skill	Grade				ANOVA Results	
Statement	K	1	2	3	F-Statistic	p-value
B.5.a	2.8 (.43)	2.1 (.95)	2.0 (.94)	2.1 (.91)	F(3,85) = 4.46	.006**
B.5.b						
B.5.c	.80 (1.0)	2.0 (.92)	2.5 (.79)	2.3 (.78)	F(3,81) = 16.6	.001***
B.5.d	1.5 (1.0)	2.3 (.73)	2.4 (.78)	2.3 (.90)	F(3,82) = 5.96	.001***
B.5.e	1.1 (1.1)	2.3 (.83)	2.7 (.75)	2.7 (.49)	F(3,79) = 15.9	.001***
B.6.a	2.0 (.98)	2.4 (.60)	2.4 (.80)	2.7 (.56)	F(3,78) = 3.87	.01*
B.6.b	1.4 (1.2)	1.8 (1.0)	2.5 (.82)	2.4 (.93)	F(3,53) = 3.32	.03*
B.6.c	.72 (1.1)	1.5 (.81)	2.4 (.93)	2.4 (.85)	F(3,77) = 15.5	.000***
B.6.d	.24 (.56)	1.4 (.89)	2.2 (.93)	2.1 (.99)	F(3,57) = 18.6	.000***
B.6.e	1.6 (.99)	1.8 (.88)	2.6 (.62)	2.5 (.80)	F(3,74) = 6.74	.000***
B.6.f	.79 (1.0)	2.3 (.79)	2.8 (.45)	2.4 (.70)	F(3,69) = 22.6	.000***
B.7.a	1.6 (1.0)	2.2 (.79)	2.4 (1.0)	2.7 (.57)	F(3,72) = 5.75	.000**
B.7.b	1.2 (1.2)	1.8 (.89)	2.7 (.59)	2.7 (.59)	F(3,68) = 12.6	.000***
B.7.c	.58 (.84)	1.6 (.92)	2.2 (1.0)	2.3 (.91)	F(3,67) = 13.6	.000***
B.7.d	.53 (.84)	1.3 (.99)	2.1 (1.2)	2.2 (1.0)	F(3,68) = 10.4	.000***
B.7.e	1.4 (1.1)	1.8 (1.1)	2.4 (.87)	2.6 (.78)	F(3,71) = 6.54	.000***

Note: Developmental appropriateness was reported on a 4-point scale (0 = Not appropriate, 1 = Somewhat appropriate, 2 = Appropriate, 3 = Very appropriate).

Properties of Operations: Mean developmental appropriateness of skill statement by grade level

Skill	Grade				ANOVA Results	
Statement	K	1	2	3	F-Statistic	p-value
C.8.a	2.3 (.95)	2.3 (.78)	1.9 (.85)	2.1 (.79)	F(3,84) = 1.06	.37
C.8.b	1.9 (1.1)	2.3 (.79)	2.3 (.63)	2.3 (.86)	F(3,83) = 1.10	.35
C.8.c	1.4 (1.3)	2.1 (.81)	1.9 (.79)	1.9 (1.1)	F(3,81) = 1.62	.19
C.8.d	1.2 (1.2)	1.8 (.90)	1.7 (.93)	2.0 (1.1)	F(3,76) = 1.72	.17
C.8.e	1.2 (1.0)	1.7 (.95)	1.7 (.89)	2.3 (.93)	F(3,75) = 4.33	.007**
C.8.f	.67 (.91)	1.7 (1.1)	1.6 (1.1)	1.7 (1.2)	F(3,73) = 4.24	.008**
C.8.g	1.1 (1.2)	1.6 (1.1)	1.6 (1.1)	1.8 (1.1)	F(3,69) = 1.32	.28
C.9.a	2.0 (.88)	1.8 (.85)	1.7 (.95)	2.0 (.91)	F(3,74) = .557	.65
C.9.b	1.4 (1.1)	2.0 (.79)	1.6 (1.1)	2.2 (.79)	F(3,75) = 2.68	.053
C.9.c	.79 (1.1)	1.7 (1.1)	1.6 (1.2)	1.9 (.99)	F(3,74) = 3.74	.01*
C.9.d	.58 (.96)	1.4 (1.1)	1.5 (1.2)	1.6 (1.1)	F(3,73) = 3.43	.02*
C.10.a	.73 (.96)	1.4 (1.0)	1.0 (1.1)	1.6 (1.1)	F(3,62) = 2.33	.08
C.10.b	.64 (.84)	1.2 (.93)	1.1 (1.1)	1.6 (1.2)	F(3,63) = 2.43	.07

C.10.c	.82 (1.1)	1.5 (.96)	1.5 (1.3)	2.0 (.71)	F(3,67) = 3.60	.02*
C.10.d	.71 (1.0)	1.6 (.76)	1.8 (.97)	2.1 (.66)	F(3,66) = 7.67	.000***
C.11.a	1.2 (1.2)	1.6 (.99)	1.3 (.90)	1.8 (.88)	F(3,64) = 1.34	.27
C.11.b	1.1 (1.0)	1.4 (.86)	1.2 (.89)	1.4 (.67)	F(3,53) = .541	.66
C.11.c	.67 (.82)	1.2 (.95)	1.0 (.88)	1.3 (.90)	F(3,53) = 1.26	.30
C.11.d	.62 (.87)	1.3 (.89)	.93 (.83)	1.4 (.81)	F(3,52) = 2.12	.11
C.11.e	.91 (.83)	1.4 (.83)	1.1 (.79)	1.3 (.87)	F(3,43) = .902	.45

Note: Developmental appropriateness was reported on a 4-point scale (0 = Not appropriate, 1 = Somewhat appropriate, 2 = Appropriate, 3 = Very appropriate).

Appendix D – Focal Skills Tables

Relations: Importance of skill statement as a focal skill by grade level

Skill Statement	Grade Level	N	Not Important	Somewhat Important	Important	Very Important	Fisher's Test Results
A.1.a	K	15	0	1	5	9	p = .03
	1	25	0	0	11	14	
	2	25	1	4	9	9	
	3	25	0	6	14	5	
A.1.b	K	15	2	5	7	1	p = .63
	1	25	5	8	8	4	
	2	24	8	7	7	2	
	3	25	4	13	5	3	
A.1.c	K	15	4	1	6	4	p = .45
	1	25	5	4	11	5	
	2	23	2	3	15	3	
	3	24	1	5	11	7	
A.1.d	K	14	3	4	5	2	p = .31
	1	23	5	6	6	6	
	2	23	1	8	8	6	
	3	23	1	3	9	10	
A.1.e	K	15	2	1	6	6	p = .42
	1	24	0	1	9	14	
	2	23	0	2	11	10	
	3	22	0	2	6	14	
A.1.f	K	13	8	3	0	2	p <.001
	1	24	2	6	6	10	
	2	23	1	3	12	7	
	3	23	2	1	11	9	
A.1.g	K	15	7	5	1	2	p < .001
	1	23	1	2	8	12	
	2	23	0	0	10	13	
	3	23	0	0	6	17	
A.2.a	K	15	1	2	7	5	p = .99
	1	23	4	3	8	8	
	2	22	3	2	11	6	
	3	21	4	3	8	6	
A.2.b	K	13	1	4	3	5	p = .33
	1	22	4	1	10	7	
	2	21	0	3	10	8	
	3	23	4	4	8	7	
A.3.a	K	15	1	4	6	4	p = .83
	1	21	1	7	8	5	

	2	22	2	6	11	3	
	3	21	5	5	9	3	
A.3.b	K	11	2	5	2	2	p = .14
	1	20	2	3	9	6	
	2	20	2	4	11	3	
	3	11	2	5	2	2	
A.3.c	K	14	2	6	6	0	p = .66
	1	22	6	5	7	4	
	2	20	6	7	6	1	
	3	20	3	9	6	2	
A.3.d	K	12	3	3	4	2	p = .33
	1	21	1	2	10	8	
	2	21	1	2	13	5	
	3	21	1	6	9	5	
A.3.e	K	13	4	5	2	2	p = .03
	1	21	3	3	8	7	
	2	21	0	4	10	7	
	3	21	0	2	9	10	
A.3.f	K	14	7	2	2	3	p < .001
	1	20	7	2	6	5	
	2	19	1	0	13	5	
	3	22	0	2	11	9	
A.4.a	K	15	1	3	8	3	p = .90
	1	20	0	3	8	9	
	2	21	1	4	10	6	
	3	21	2	4	8	7	
A.4.b	K	13	2	3	4	4	p = .47
	1	20	0	3	8	9	
	2	21	0	3	13	6	
	3	21	2	2	9	8	
A.4.c	K	15	3	2	6	4	p = .24
	1	20	0	2	10	8	
	2	21	0	2	11	8	
	3	21	2	0	8	11	
A.4.d	K	15	4	3	5	3	p = .005
	1	20	0	5	6	9	
	2	21	0	1	8	12	
	3	22	0	0	10	12	
A.4.e	K	14	8	4	0	2	p < .001
	1	21	5	3	9	4	
	2	20	2	3	10	5	
	3	22	0	2	13	7	

Composition/Decomposition: Importance of skill statement as a focal skill by grade level

Skill Statement	Grade Level	N	Not Important	Somewhat Important	Important	Very Important	Fisher's Test Results
B.5.a	K	26	0	1	6	19	p = .06
	1	23	2	3	11	7	
	2	19	3	4	4	8	
	3	21	1	3	8	9	
B.5.b	K						
	1						
	2						
	3						
B.5.c	K	25	15	5	1	4	p < .001
	1	21	3	4	8	6	
	2	18	0	1	3	14	
	3	21	1	1	10	9	
B.5.d	K	26	6	5	8	7	p = .01
	1	21	0	4	8	9	
	2	18	0	1	4	13	
	3	21	0	1	11	9	
B.5.e	K	22	8	7	3	4	p < .001
	1	22	1	3	9	9	
	2	19	0	0	3	16	
	3	20	0	0	5	15	
B.6.a	K	25	1	4	8	12	p = .20
	1	21	0	1	11	9	
	2	20	0	3	3	11	
	3	19	0	1	4	14	
B.6.b	K	14	4	3	5	2	p = .19
	1	18	2	5	7	4	
	2	11	0	2	3	6	
	3	14	0	2	4	8	
B.6.c	K	25	15	5	2	3	p < .001
	1	21	3	5	12	1	
	2	17	1	3	3	10	
	3	18	1	2	5	10	
B.6.d	K	17	14	2	1	0	p < .001
	1	16	3	5	6	2	
	2	13	1	1	4	7	
	3	15	1	2	4	8	
B.6.e	K	23	4	6	6	7	p = .007
	1	21	1	3	13	4	
	2	17	0	2	4	11	
	3	17	0	0	9	8	
B.6.f	K	19	11	3	3	2	p < .001

	1	20	1	2	9	8	
	2	16	0	0	3	13	
	3	18	0	2	7	9	
B.7.a	K	23	5	5	7	6	p = .01
	1	19	0	3	7	9	
	2	16	1	1	2	12	
	3	18	0	1	3	14	
B.7.b	K	19	7	4	4	4	p < .001
	1	20	1	6	10	3	
	2	15	0	1	1	13	
	3	18	0	1	4	13	
B.7.c	K	19	11	4	4	0	p < .001
	1	18	2	4	10	2	
	2	16	1	1	3	11	
	3	18	1	2	3	12	
B.7.d	K	19	13	2	4	0	p < .001
	1	19	5	3	9	2	
	2	16	1	2	5	8	
	3	18	1	3	6	8	
B.7.e	K	20	8	3	5	4	p = .002
	1	20	1	5	8	6	
	2	17	0	2	4	11	
	3	18	0	1	5	12	

Properties of Operations: Importance of skill statement as a focal skill by grade level

Skill Statement	Grade Level	N	Not Important	Somewhat Important	Important	Very Important	Fisher's Test Results
C.8.a	K	19	1	0	8	10	p = .02
	1	26	0	7	11	8	
	2	23	1	10	7	5	
	3	20	2	8	6	4	
C.8.b	K	19	4	1	6	8	p = .57
	1	25	1	4	10	11	
	2	22	0	4	9	9	
	3	20	1	3	6	10	
C.8.c	K	19	6	3	4	6	p = .03
	1	25	2	4	11	8	
	2	21	1	3	12	5	
	3	20	1	8	3	8	
C.8.d	K	18	5	6	3	4	p = .38
	1	23	2	6	10	5	
	2	19	2	2	11	4	
	3	20	2	4	9	5	
C.8.e	K	19	5	4	7	3	p = .21

	1	22	4	4	9	5	
	2	19	3	2	10	4	
	3	19	0	3	6	10	
C.8.f	K	20	10	2	4	2	p = .26
	1	21	5	3	8	5	
	2	19	3	5	6	5	
	3	19	3	2	7	7	
C.8.g	K	17	5	4	4	4	p = .75
	1	19	4	4	8	3	
	2	19	4	3	7	5	
	3	18	2	2	6	8	
C.9.a	K	19	1	7	5	6	p = .91
	1	22	1	6	9	6	
	2	19	2	5	7	5	
	3	18	2	4	4	8	
C.9.b	K	19	2	8	5	4	p = .74
	1	22	1	7	6	8	
	2	19	3	5	6	5	
	3	19	1	3	8	7	
C.9.c	K	19	12	1	3	3	p = .02
	1	21	3	5	7	6	
	2	19	5	4	5	5	
	3	19	2	1	8	8	
C.9.d	K	19	14	2	2	1	p = .02
	1	21	6	6	5	4	
	2	19	6	2	5	6	
	3	18	3	2	8	5	
C.10.a	K	15	7	6	0	2	p = .07
	1	19	5	6	6	2	
	2	15	6	3	2	4	
	3	17	3	2	6	6	
C.10.b	K	14	7	5	2	0	p = .047
	1	20	5	6	8	1	
	2	16	6	3	3	4	
	3	17	4	1	6	6	
C.10.c	K	17	8	4	3	2	p = .007
	1	19	3	7	7	2	
	2	18	6	1	4	7	
	3	17	1	1	9	6	
C.10.d	K	17	11	1	4	1	p < .001
	1	19	1	7	10	1	
	2	17	3	3	7	4	
	3	17	0	1	11	5	
C.11.a	K	16	5	5	3	3	p = .07
	1	20	4	4	9	3	

	2	15	1	5	6	3	
	3	17	1	1	9	6	
C.11.b	K	17	6	3	3	5	p = .12
	1	19	4	2	11	2	
	2	18	3	3	8	4	
	3	17	0	3	8	6	
C.11.c	K	17	9	2	3	3	p = .06
	1	18	6	1	10	1	
	2	16	4	3	6	3	
	3	14	2	0	9	3	
C.11.d	K	15	8	2	2	3	p = .04
	1	19	4	2	12	1	
	2	17	5	3	5	4	
	3	16	1	2	9	4	
C.11.e	K	17	5	1	4	7	p = .59
	1	17	3	4	7	3	
	2	17	4	3	4	6	
	3	16	1	3	6	6	
C.11.f	K	16	9	1	3	3	p = .046
	1	17	5	4	7	1	
	2	17	5	4	3	5	
	3	16	1	2	9	4	
C.11.g	K	15	9	0	3	3	p = .07
	1	16	4	6	5	1	
	2	16	4	4	4	4	
	3	17	2	4	6	5	

Relations: Mean "importance as a focal skill" rating of skill statement by grade level

Skill	Grade				ANOVA Results	
Statement	K	1	2	3	F-Statistic	p-value
A.1.a	2.5 (.64)	2.6 (.51)	2.1 (.87)	2.0 (.68)	F(3,84)=4.3	.008**
A.1.b	1.5 (.83)	1.4 (1.0)	1.1 (.99)	1.3 (.89)	F(3,85)=.61	.609
A.1.c	1.7 (1.2)	1.6 (1.0)	1.8 (.78)	2.0 (.83)	F(3,83)=.70	.556
A.1.d	1.4 (1.0)	1.6 (1.1)	1.8 (.89)	2.2 (.85)	F(3,79)=2.6	.061
A.1.e	2.1 (1.0)	2.5 (.59)	2.3 (.65)	2.5 (.67)	F(3,80)=1.7	.170
A.1.f	.69 (1.1)	2.0 (1.0)	2.1 (.79)	2.2 (.89)	F(3,79)=8.2	.000***
A.1.g	.87 (1.1)	2.3 (.83)	2.6 (.51)	2.7 (045)	F(3,80)=24	.000***
A.2.a	2.1 (.88)	1.9 (1.1)	1.9 (.97)	1.8 (1.1)	F(3,77)=.26	.852
A.2.b	1.9 (1.0)	1.9 (1.1)	2.2 (.70)	1.8 (1.1)	F(3,75)=.84	.478
A.3.a	1.9 (.92)	1.8 (.87)	1.7 (.84)	1.5 (1.0)	F(3,76)=.80	.499
A.3.b	1.4 (1.0)	2.0 (.94)	1.8 (.85)	2.2 (1.0)	F(3,68)=2.0	.129
A.3.c	1.3 (.73)	1.4 (1.1)	1.1 (.91)	1.4 (.88)	F(3,72)=.42	.736
A.3.d	1.4 (1.1)	2.2 (.81)	2.0 (.74)	1.9 (.85)	F(3,71)=2.3	.086
A.3.e	1.2 (1.1)	1.9 (1.0)	2.1 (.73)	2.4 (.67)	F(3,72)=5.6	.002**
A.3.f	1.1 (1.3)	1.5 (1.2)	2.2 (.69)	2.3 (.65)	F(3,71)=6.4	.001**

A.4.a	1.9 (.83)	2.3 (.73)	2.0 (.84)	2.0 (.97)	F(3,73)=.92	.436
A.4.b	1.8 (1.1)	2.3 (.73)	2.1 (.64)	2.1 (.94)	F(3,72)=1.1	.371
A.4.c	1.7 (1.1)	2.3 (.66)	2.3 (.64)	2.3 (.91)	F(3,73)=1.9	.131
A.4.d	1.5 (1.1)	2.2 (.83)	2.5 (.60)	2.5 (.51)	F(3,74)=7.2	.000***
A.4.e	.71 (1.1)	1.6 (1.1)	1.9 (.91)	2.2 (.61)	F(3,73)=8.2	.000***

Note: "Importance as a focal skill" was reported on a 4-point scale (0 = Not important, 1 = Somewhat important, 2 = Important, 3 = Very important).

Composition/Decomposition: Mean "importance as a focal skill" rating of skill statement by grade level

Skill	Grade				ANOVA Results	
Statement	K	1	2	3	F-Statistic	p-value
B.5.a	2.7 (.55)	2.0 (.90)	1.9 (1.1)	2.2 (.87)	F(3,85)=3.9	.011
B.5.b						
B.5.c	.76 (1.1)	1.8 (1.0)	2.7 (.57)	2.3 (.78)	F(3,81)=18	.000***
B.5.d	1.6 (1.1)	2.2 (.77)	2.7 (.59)	2.4 (.59)	F(3,82)=6.5	.000***
B.5.e	1.1 (1.1)	2.2 (.85)	2.8 (.37)	2.8 (.44)	F(3,79)=21	.000***
B.6.a	2.2 (.88)	2.4 (.59)	2.5 (.80)	2.7 (.58)	F(3,78)=1.4	.258
B.6.b	1.4 (1.1)	1.7 (.96)	2.4 (.81)	2.4 (.76)	F(3,53)=4.3	.009**
B.6.c	.72 (1.1)	1.5 (.81)	2.3 (.99)	2.3 (.91)	F(3,77)=14	.000***
B.6.d	.24 (.56)	1.4 (.96)	2.3 (.95)	2.3 (.96)	F(3,57)=20	.000***
B.6.e	1.7 (1.1)	2.0 (.74)	2.5 (.72)	2.5 (.51)	F(3,74)=4.7	.004**
B.6.f	.79 (1.1)	2.2 (.83)	2.8 (.40)	2.4 (.70)	F(3,69)=21	.000***
B.7.a	1.6 (1.1)	2.3 (.75)	2.6 (.89)	2.7 (.57)	F(3,72)=6.6	.000***
B.7.b	1.3 (1.2)	1.8 (.79)	2.8 (.56)	2.7 (.59)	F(3,68)=14	.000***
B.7.c	.63 (.83)	1.7 (.84)	2.5 (.89)	2.4 (.92)	F(3,67)=18	.000***
B.7.d	.53 (.84)	1.4 (1.0)	2.3 (.93)	2.2 (.92)	F(3,68)=13	.000***
B.7.e	1.3 (1.2)	2.0 (.89)	2.5 (.72)	2.6 (.61)	F(3,71)=9.3	.000***

Note: "Importance as a focal skill" was reported on a 4-point scale (0 = Not important, 1 = Somewhat important, 2 = Important, 3 = Very important).

Properties of Operations: Mean "importance as a focal skill" rating of skill statement by grade level

Skill	Grade				ANOVA Results	
Statement	K	1	2	3	F-Statistic	p-value
C.8.a	2.4 (.77)	2.0 (.77)	1.7 (.88)	1.6 (.94)	F(3,84)=3.9	.011*
C.8.b	1.9 (1.2)	2.2 (.85)	2.2 (.75)	2.3 (.91)	F(3,83)=.45	.718
C.8.c	1.5 (1.3)	2.0 (.91)	2.0 (.77)	1.9 (1.0)	F(3,81)=1.0	.389
C.8.d	1.3 (1.1)	1.8 (.90)	1.9 (.88)	1.9 (.93)	F(3,76)=1.3	.270
C.8.e	1.4 (1.1)	1.7 (1.0)	1.8 (.98)	2.4 (.76)	F(3,75)=3.2	.027*
C.8.f	.89 (1.1)	1.6 (1.1)	1.7 (1.1)	1.9 (1.1)	F(3,73)=3.1	.031*
C.8.g	1.4 (1.2)	1.5 (1.0)	1.7 (1.1)	2.1 (1.0)	F(3,69)=1.4	.242
C.9.a	1.8 (.96)	1.9 (.87)	1.8 (.98)	2.0 (1.1)	F(3,74)=.16	.921
C.9.b	1.6 (.96)	2.0 (.95)	1.7 (1.1)	2.1 (.88)	F(3,75)=1.2	.310
C.9.c	.84 (1.2)	1.8 (1.0)	1.5 (1.2)	2.2 (.96)	F(3,74)=4.8	.004**
C.9.d	.47 (.90)	1.3 (1.1)	1.6 (1.3)	1.8 (1.0)	F(3,73)=5.5	.002**

C.10.a	.80 (1.0)	1.3 (.99)	1.3 (1.3)	1.9 (1.1)	F(3,62)=2.6	.058
C.10.b	.64 (.74)	1.3 (.91)	1.3 (1.3)	1.8 (1.2)	F(3,63)=3.3	.027*
C.10.c	.94 (1.1)	1.4 (.90)	1.7 (1.3)	2.2 (.81)	F(3,67)=4.1	.010*
C.10.d	.71 (1.0)	1.6 (.69)	1.7 (1.0)	2.2 (.56)	F(3,66)=9.3	.000***
C.11.a	1.3 (1.1)	1.6 (1.0)	1.7 (.88)	2.2 (.81)	F(3,64)=2.7	.053
C.11.b	1.4 (1.3)	1.6 (.96)	1.7 (1.0)	2.2 (.73)	F(3,67)=1.8	.156
C.11.c	1.0 (1.2)	1.3 (1.0)	1.5 (1.1)	2.1 (.93)	F(3,63)=2.8	.047*
C.11.d	1.0 (1.3)	1.5 (0.9)	1.5 (1.2)	2.0 (.82)	F(3,63)=2.4	.079
C.11.e	1.8 (1.3)	1.6 (1.0)	1.7 (1.2)	2.1 (.93)	F(3,63)=.53	.665
C.11.f	1.0 (1.3)	1.2 (.97)	1.5 (1.2)	2.0 (.82)	F(3,62)=2.5	.069
C.11.g	1.0 (1.3)	1.2 (.91)	1.5 (1.2)	1.8 (1.0)	F(3,60)=1.7	.169

Note: “Importance as a focal skill” was reported on a 4-point scale (0 = Not important, 1 = Somewhat important, 2 = Important, 4 = Very important).

Appendix E - Prerequisite Skills Tables

Relations: Importance of skill statement as a prerequisite skill by grade level

Skill Statement	Grade Level	N	Not Important	Somewhat Important	Important	Very Important	Fisher's Test Results
A.1.a	K	15	1	4	4	6	p = .69
	1	25	0	4	7	14	
	2	23	0	2	9	12	
	3	25	0	3	8	14	
A.1.b	K	15	5	5	4	1	p = .14
	1	25	7	6	7	5	
	2	24	8	8	7	1	
	3	25	1	13	9	2	
A.1.c	K	15	4	5	3	3	p = .19
	1	25	6	5	10	4	
	2	23	2	6	9	6	
	3	24	0	5	11	8	
A.1.d	K	14	6	1	5	2	p = .01
	1	23	6	6	5	6	
	2	23	1	7	9	6	
	3	23	0	3	10	10	
A.1.e	K	15	5	2	5	3	p = .03
	1	24	1	3	8	12	
	2	23	0	3	12	8	
	3	22	0	3	6	13	
A.1.f	K	13	10	1	1	1	p < .001
	1	24	3	7	6	8	
	2	23	1	6	11	5	
	3	23	2	2	10	9	
A.1.g	K	15	8	3	3	1	p < .001
	1	23	5	2	6	10	
	2	25	2	3	11	9	
	3	23	0	1	4	18	
A.2.a	K	15	4	4	4	3	p = .15
	1	23	5	2	9	7	
	2	22	2	6	9	5	
	3	21	4	0	7	10	
A.2.b	K	13	6	2	2	3	p = .13
	1	22	4	4	7	7	
	2	21	0	7	8	6	
	3	23	4	3	9	7	
A.3.a	K	15	4	4	5	2	p = .76
	1	21	3	8	5	5	

	2	22	1	7	10	4	
	3	22	3	9	7	3	
A.3.b	K	11	5	2	3	1	p = .28
	1	20	4	2	8	6	
	2	20	3	4	10	3	
	3	21	3	3	6	9	
A.3.c	K	15	6	5	3	0	p = .34
	1	22	7	5	6	4	
	2	20	7	8	4	1	
	3	20	2	10	6	2	
A.3.d	K	12	6	3	3	0	p = .004
	1	21	3	5	5	8	
	2	21	0	5	10	6	
	3	21	0	4	10	7	
A.3.e	K	13	7	3	1	2	p < .001
	1	21	5	2	6	8	
	2	21	0	7	10	4	
	3	21	0	3	8	10	
A.3.f	K	14	8	2	3	1	p < .001
	1	20	7	2	5	6	
	2	19	1	4	11	3	
	3	22	0	1	13	8	
A.4.a	K	15	3	4	5	3	p = .24
	1	20	2	4	6	8	
	2	21	0	5	11	5	
	3	21	2	2	6	11	
A.4.b	K	13	5	1	4	3	p = .008
	1	20	2	3	7	8	
	2	22	0	9	10	3	
	3	21	2	1	9	9	
A.4.c	K	15	6	0	6	3	p = .02
	1	20	3	2	8	7	
	2	21	0	5	9	7	
	3	21	2	0	9	10	
A.4.d	K	15	6	0	7	2	p < .001
	1	20	3	5	4	8	
	2	21	0	4	9	8	
	3	22	0	0	10	12	
A.4.e	K	14	10	2	0	2	p < .001
	1	21	7	3	7	4	
	2	20	2	5	10	3	
	3	22	0	1	11	10	

Composition/Decomposition: Importance of skill statement as a prerequisite skill by grade level

Skill Statement	Grade Level	N	Not Important	Somewhat Important	Important	Very Important	Fisher's Test Results
B.5.a	K	26	1	5	8	12	p = .34
	1	23	1	0	8	14	
	2	19	0	1	4	14	
	3	21	0	1	6	14	
B.5.b	K						
	1						
	2						
	3						
B.5.c	K	25	17	7	1	0	p < .001
	1	21	3	7	8	3	
	2	18	1	1	4	12	
	3	21	0	1	9	11	
B.5.d	K	26	13	4	5	4	p < .001
	1	21	1	5	9	6	
	2	18	0	1	7	10	
	3	21	0	3	6	12	
B.5.e	K	22	12	8	1	1	p < .001
	1	22	3	6	7	6	
	2	19	0	0	5	14	
	3	20	0	1	4	15	
B.6.a	K	25	7	9	3	6	p < .001
	1	21	1	3	11	6	
	2	17	0	4	4	9	
	3	19	0	0	3	16	
B.6.b	K	14	10	2	1	1	p < .001
	1	18	4	6	6	2	
	2	11	1	3	3	4	
	3	14	0	1	5	8	
B.6.c	K	25	20	4	0	1	p < .001
	1	21	3	7	11	0	
	2	17	1	3	6	7	
	3	18	1	3	4	10	
B.6.d	K	17	15	1	1	0	p < .001
	1	16	4	5	5	2	
	2	13	2	2	6	3	
	3	15	1	2	4	8	
B.6.e	K	23	9	5	3	6	p < .001
	1	21	1	8	9	3	
	2	17	0	2	7	8	
	3	17	0	1	9	7	
B.6.f	K	19	13	3	1	2	p < .001

	1	20	2	5	7	6	
	2	16	0	2	5	9	
	3	18	0	1	8	9	
B.7.a	K	23	9	5	5	4	$p < .001$
	1	19	1	5	8	5	
	2	16	1	1	1	13	
	3	18	0	1	2	15	
B.7.b	K	19	8	7	1	3	$p < .001$
	1	20	1	8	8	3	
	2	15	1	1	3	10	
	3	18	0	1	4	13	
B.7.c	K	19	14	4	1	0	$p < .001$
	1	18	3	6	8	1	
	2	16	1	5	3	7	
	3	18	1	2	3	12	
B.7.d	K	19	14	2	3	0	$p < .001$
	1	19	6	5	6	2	
	2	16	1	5	2	8	
	3	18	1	3	5	9	
B.7.e	K	20	12	4	2	2	$p < .001$
	1	20	3	7	6	4	
	2	17	0	2	5	10	
	3	18	1	0	7	10	

Properties of Operations: Importance of skill statement as a prerequisite skill by grade level

Skill Statement	Grade Level	N	Not Important	Somewhat Important	Important	Very Important	Fisher's Test Results
C.8.a	K	19	2	1	2	14	$p = .09$
	1	26	0	6	11	9	
	2	23	1	2	9	11	
	3	20	1	4	5	10	
C.8.b	K	19	4	2	4	9	$p = .43$
	1	26	4	4	8	10	
	2	22	0	4	7	11	
	3	20	0	4	6	10	
C.8.c	K	19	6	4	6	3	$p = .41$
	1	25	2	4	10	9	
	2	21	2	5	7	7	
	3	20	1	5	5	9	
C.8.d	K	18	6	6	4	2	$p = .53$
	1	23	5	4	9	5	
	2	19	4	3	7	5	
	3	20	2	4	6	8	

C.8.e	K	19	7	4	5	3	p = .18
	1	22	8	3	8	3	
	2	19	4	3	9	3	
	3	19	1	5	5	8	
C.8.f	K	18	10	1	6	1	p = .54
	1	21	8	4	4	5	
	2	19	6	3	5	5	
	3	19	5	3	5	6	
C.8.g	K	17	9	1	4	3	p = .13
	1	19	8	2	6	3	
	2	19	5	3	5	6	
	3	18	1	5	5	7	
C.9.a	K	19	4	4	7	4	p = .81
	1	22	4	5	8	5	
	2	19	2	6	6	5	
	3	18	1	2	8	7	
C.9.b	K	19	5	5	3	6	p = .80
	1	19	2	3	7	7	
	2	19	4	3	8	4	
	3	19	2	3	7	7	
C.9.c	K	19	11	3	3	2	p = .17
	1	21	8	3	5	5	
	2	19	6	4	4	5	
	3	19	2	2	8	7	
C.9.d	K	19	15	1	3	0	p = .03
	1	21	9	6	3	3	
	2	19	6	3	5	5	
	3	18	4	4	5	5	
C.10.a	K	15	8	5	1	1	p = .15
	1	19	8	4	6	1	
	2	15	7	3	2	3	
	3	17	5	1	5	6	
C.10.b	K	14	9	3	2	0	p = .11
	1	20	9	5	6	0	
	2	16	7	2	4	3	
	3	17	4	2	6	5	
C.10.c	K	17	10	1	2	4	p = .04
	1	19	7	5	6	1	
	2	18	6	4	4	4	
	3	17	1	2	8	6	
C.10.d	K	17	12	0	4	1	p = .002
	1	19	4	6	8	1	
	2	17	4	4	4	5	
	3	17	1	5	6	5	
C.11.a	K	16	7	2	4	3	p = .15

	1	20	6	5	7	2	
	2	15	2	5	5	3	
	3	17	1	3	8	5	
C.11.b	K	17	10	1	2	4	$p < .001$
	1	19	5	3	10	1	
	2	18	4	4	3	7	
	3	17	0	6	4	7	
C.11.c	K	17	10	2	2	3	$p = .18$
	1	18	7	3	7	1	
	2	16	6	4	3	3	
	3	16	2	3	6	5	
C.11.d	K	15	9	1	2	3	$p = .09$
	1	19	6	3	9	1	
	2	17	5	5	3	4	
	3	16	2	4	6	4	
C.11.e	K	17	7	1	4	5	$p = .45$
	1	17	5	3	6	3	
	2	17	3	5	3	6	
	3	16	2	2	5	7	
C.11.f	K	16	10	1	2	3	$p = .03$
	1	17	7	4	5	1	
	2	17	5	5	2	5	
	3	16	1	4	7	4	
C.11.g	K	15	10	0	3	2	$p = .07$
	1	16	8	3	4	1	
	2	16	5	4	3	4	
	3	17	2	5	5	5	

Relations: Mean "importance as a prerequisite skill" rating of skill statement by grade level

Skill	Grade				ANOVA Results	
Statement	K	1	2	3	F-Statistic	p-value
A.1.a	2.0 (1.0)	2.4 (.76)	2.4 (.66)	2.4 (.71)	F(3,84)=1.3	.288
A.1.b	1.1 (.96)	1.4 (1.1)	1.0 (.91)	1.5 (.71)	F(3,85)=1.3	.280
A.1.c	1.3 (1.1)	1.5 (1.0)	1.8 (.94)	2.1 (.74)	F(3,83)=2.9	.040*
A.1.d	1.2 (1.2)	1.5 (1.2)	1.9 (.87)	2.3 (.70)	F(3,79)=4.6	.005**
A.1.e	1.4 (1.2)	2.3 (.86)	2.2 (.67)	2.5 (.74)	F(3,80)=5.1	.003**
A.1.f	.46 (.97)	1.8 (1.1)	1.9 (.81)	2.1 (.92)	F(3,79)=9.4	.000***
A.1.g	.80 (1.0)	1.9 (1.2)	2.2 (.80)	2.7 (.54)	F(3,80)=14	.000***
A.2.a	1.4 (1.1)	1.8 (1.1)	1.8 (.92)	2.1 (1.1)	F(3,77)=1.2	.307
A.2.b	1.2 (1.3)	1.8 (1.1)	2.0 (.80)	1.8 (1.1)	F(3,75)=1.7	.180
A.3.a	1.3 (1.0)	1.6 (1.0)	1.8 (.81)	1.5 (.91)	F(3,76)=.75	.526
A.3.b	1.2 (1.3)	1.8 (1.1)	1.7 (.93)	2.0 (1.1)	F(3,68)=1.4	.248
A.3.c	.79 (.80)	1.3 (1.1)	.95 (.89)	1.4 (.82)	F(3,72)=1.7	.169
A.3.d	.75 (.87)	1.9 (1.1)	2.0 (.74)	2.1 (.73)	F(3,71)=7.4	.000***
A.3.e	.85 (1.1)	1.8 (1.2)	1.9 (.73)	2.3 (.73)	F(3,72)=6.5	.001**

A.3.f	.79 (1.1)	1.5 (1.3)	1.8 (.76)	2.3 (.57)	F(3,71)=8.0	.000***
A.4.a	1.5 (1.1)	2.0 (1.0)	2.0 (.71)	2.2 (1.0)	F(3,73)=1.6	.189
A.4.b	1.4 (1.3)	2.1 (1.0)	1.7 (.70)	2.2 (.93)	F(3,72)=2.3	.084
A.4.c	1.4 (1.2)	2.0 (1.1)	2.1 (.77)	2.3 (.90)	F(3,73)=2.5	.065
A.4.d	1.3 (1.2)	1.9 (1.1)	2.2 (.75)	2.5 (.51)	F(3,74)=5.8	.001**
A.4.e	.57 (1.1)	1.4 (1.2)	1.7 (.86)	2.4 (.59)	F(3,73)=12	.000***

Note: "Importance as a prerequisite skill" was reported on a 4-point scale (0 = Not important, 1 = Somewhat important, 2 = Important, 3 = Very important).

Composition/Decomposition: Mean "importance as a prerequisite skill" rating of skill statement by grade level

Skill	Grade				ANOVA Results	
Statement	K	1	2	3	F-Statistic	p-value
B.5.a	2.2 (.90)	2.5 (.73)	2.7 (.58)	2.6 (.59)	F(3,85)=2.1	.101
B.5.b						
B.5.c	.36 (.57)	1.5 (.93)	2.5 (.86)	2.5 (.60)	F(3,81)=42	.000***
B.5.d	1.0 (1.2)	2.0 (.86)	2.5 (.62)	2.4 (.75)	F(3,82)=14	.000***
B.5.e	.59 (.80)	1.7 (1.0)	2.7 (.45)	2.7 (.57)	F(3,79)=37	.000***
B.6.a	1.3 (1.1)	2.0 (.80)	2.3 (.85)	2.8 (.37)	F(3,78)=12	.000***
B.6.b	.50 (.94)	1.3 (.97)	1.9 (1.0)	2.5 (.65)	F(3,53)=12	.000***
B.6.c	.28 (.68)	1.4 (.74)	2.1 (.93)	2.3 (.96)	F(3,77)=27	.000***
B.6.d	.18 (.53)	1.3 (1.0)	1.8 (1.0)	2.3 (.96)	F(3,57)=16	.000***
B.6.e	1.3 (1.3)	1.7 (.80)	2.4 (.70)	2.4 (.61)	F(3,74)=7.0	.000***
B.6.f	.58 (1.0)	1.9 (.99)	2.4 (.73)	2.4 (.62)	F(3,69)=19	.000***
B.7.a	1.2 (1.2)	1.9 (.88)	2.6 (.89)	2.8 (.55)	F(3,72)=13	.000***
B.7.b	.95 (1.1)	1.7 (.81)	2.5 (.92)	2.7 (.59)	F(3,68)=15	.000***
B.7.c	.32 (.58)	1.4 (.85)	2.0 (1.0)	2.4 (.92)	F(3,67)=21	.000***
B.7.d	.42 (.77)	1.2 (1.0)	2.1 (1.1)	2.2 (.94)	F(3,68)=14	.000***
B.7.e	0.7 (1.0)	1.6 (1.0)	2.5 (.72)	2.4 (.78)	F(3,71)=17	.000***

Note: "Importance as a prerequisite skill" was reported on a 4-point scale (0 = Not important, 1 = Somewhat important, 2 = Important, 3 = Very important).

Properties of Operations: Mean "importance as a prerequisite skill" rating of skill statement by grade level

Skill	Grade				ANOVA Results	
Statements	K	1	2	3	F-Statistic	p-value
C.8.a	2.5 (1.0)	2.1 (.77)	2.3 (.82)	2.2 (.95)	F(3,84)=.65	0.583
C.8.b	1.9 (1.2)	1.9 (1.1)	2.3 (.78)	2.3 (.80)	F(3,83)=1.0	0.378
C.8.c	1.3 (1.1)	2.0 (.93)	1.9 (1.0)	2.1 (.97)	F(3,81)=2.6	0.061
C.8.d	1.1 (1.0)	1.6 (1.1)	1.7 (1.1)	2.0 (1.0)	F(3,76)=2.3	0.088
C.8.e	1.2 (1.1)	1.3 (1.1)	1.6 (1.0)	2.1 (.97)	F(3,75)=2.5	0.063
C.8.f	.89 (1.1)	1.3 (1.2)	1.5 (1.2)	1.6 (1.2)	F(3,73)=1.3	0.270
C.8.g	1.1 (1.2)	1.2 (1.2)	1.6 (1.2)	2.0 (.97)	F(3,69)=2.4	0.074
C.9.a	1.6 (1.1)	1.6 (1.0)	1.7 (.99)	2.2 (.86)	F(3,74)=1.3	0.276
C.9.b	1.5 (1.2)	1.7 (1.1)	1.6 (1.1)	2.0 (1.0)	F(3,75)=.64	0.590
C.9.c	.79 (1.1)	1.3 (1.2)	1.4 (1.2)	2.1 (.97)	F(3,74)=3.9	0.011*

C.9.d	.37 (.76)	1.0 (1.1)	1.5 (1.2)	1.6 (1.1)	F(3,73)=5.2	0.003
C.10.a	.67 (.90)	1.0 (1.0)	1.1 (1.2)	1.7 (1.3)	F(3,62)=2.5	0.066
C.10.b	.50 (.76)	.85 (.88)	1.2 (1.2)	1.7 (1.2)	F(3,63)=4.0	0.011*
C.10.c	.88 (1.2)	1.1 (.97)	1.3 (1.2)	2.1 (.86)	F(3,67)=4.6	0.005**
C.10.d	.65 (1.1)	1.3 (.89)	1.6 (1.2)	1.9 (.93)	F(3,66)=4.6	0.006
C.11.a	1.2 (1.2)	1.3 (1.0)	1.6 (.99)	2.0 (.87)	F(3,64)=2.3	0.089
C.11.b	1.0 (1.3)	1.4 (.96)	1.7 (1.2)	2.1 (.90)	F(3,67)=2.9	0.042
C.11.c	.88 (1.2)	1.1 (1.0)	1.2 (1.2)	1.9 (1.0)	F(3,63)=2.4	0.074
C.11.d	.93 (1.3)	1.3 (.99)	1.4 (1.2)	1.8 (1.0)	F(3,63)=1.4	0.242
C.11.e	1.4 (1.3)	1.4 (1.1)	1.7 (1.2)	2.1 (1.1)	F(3,63)=1.1	0.340
C.11.f	.88 (1.3)	1.0 (1.0)	1.4 (1.2)	1.9 (.89)	F(3,62)=2.7	0.053
C.11.g	0.80 (1.2)	.88 (1.0)	1.4 (1.2)	1.8 (1.0)	F(3,60)=2.7	0.056

Note: “Importance as a prerequisite skill” was reported on a 4-point scale (0 = Not important, 1 = Somewhat important, 2 = Important, 4 = Very important).

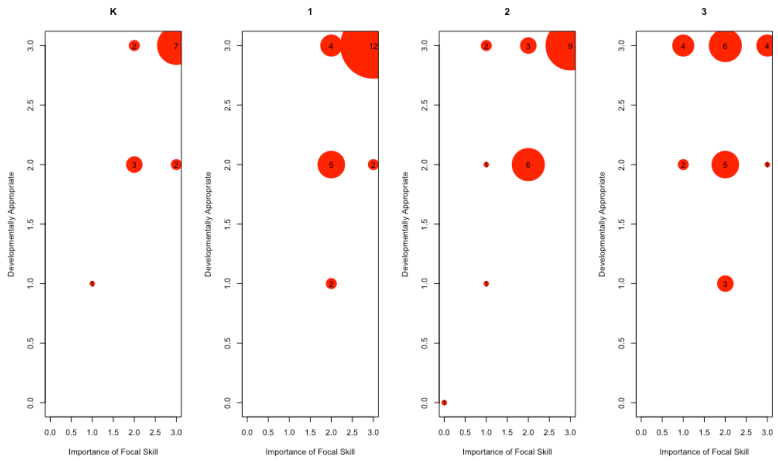
Appendix F – RQ1 Developmental Appropriateness and Importance as a Focal Skill Relations

Correlation coefficient for developmental appropriateness rating and "importance as a focal skill" rating by grade level by skill statement

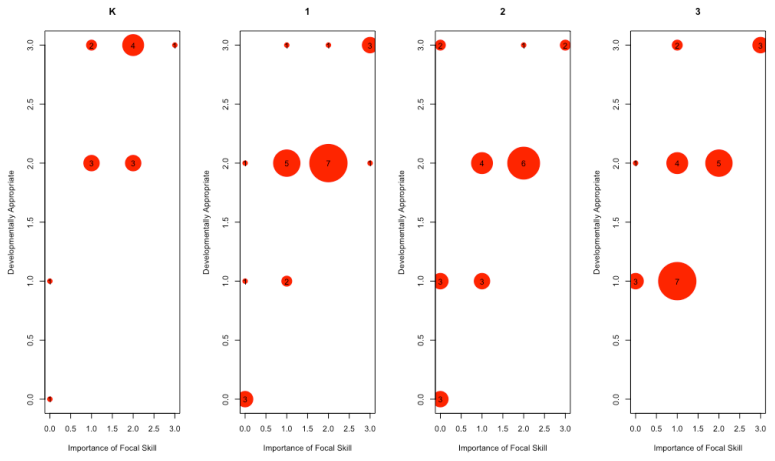
	K	1	2	3
A.1.a	.65**	.53**	.70***	.04
A.1.b	.69**	.73***	.59**	.64***
A.1.c	.85***	.89***	.84***	.72***
A.1.d	1.0***	.90***	.78***	.52*
A.1.e	.93***	.81***	.76***	.37
A.1.f	.94***	.85***	.81***	.76***
A.1.g	.87***	.75***	.82***	.77***
A.2.a	1.0***	.84***	.91***	.76***
A.2.b	1.0***	.90***	.90***	.72***
A.3.a	.77**	.84***	.86***	.85***
A.3.b	.96***	.71***	.94***	.85***
A.3.c	.84***	.84***	.74***	.67**
A.3.d	.88***	.73***	.81***	.58**
A.3.e	.89***	.90***	.87***	.88***
A.3.f	1.0***	.89***	.92***	.67***
A.4.a	.96***	.85***	.97***	.55**
A.4.b	.97***	.73***	.94***	.82***
A.4.c	.94***	.62***	.78***	.90***
A.4.d	.97***	.81***	.72***	.75***
A.4.e	.94***	.96***	.86***	.37
B.5.a	.53**	.85***	.72***	.53*
B.5.c	.92***	.83***	.59*	.67***
B.5.d	.88***	.74***	.55*	.63**
B.5.e	.89***	.80***	.60**	.79***
B.6.a	.59**	.79***	.86***	.75***
B.6.b	.91***	.89***	.88***	.86***
B.6.c	.96***	1.0***	.63**	.81***
B.6.d	1.0***	.97***	.96***	.94***
B.6.e	.83***	.84***	.66**	.64**
B.6.f	.95***	.88***	.83***	.82***
B.7.a	.92***	.82***	.92***	.82***
B.7.b	.98***	.45*	.90***	1.0***
B.7.c	.88***	.86***	.89***	.94***
B.7.d	1.0***	.93***	.71**	.95***
B.7.e	.93***	.94***	.93***	.91***
C.8.a	.49*	.65***	.51*	.41
C.8.b	.68**	.80***	.77***	.64**
C.8.c	.77***	.84***	.90***	.86***
C.8.d	.67**	.94***	.85***	.92***

C.8.e	.70***	.76***	.88***	.79***
C.8.f	.71**	.88***	.93***	.94***
C.8.g	.78***	.98***	.93***	.86***
C.9.a	.59**	.62**	.89***	.54*
C.9.b	.83***	.89***	.93***	.85***
C.9.c	.98***	.94***	.94***	.84***
C.9.d	.94***	.98***	.93***	.83***
C.10.a	.89***	.78***	.89***	.87***
C.10.b	.88***	.88***	.95***	.85***
C.10.c	.96***	.91***	.96***	.66**
C.10.d	1.0***	.85***	.91***	.80***
C.11.a	.98***	.97***	.84***	.83***
C.11.b	.74**	.97***	.80***	.03
C.11.c	.90***	.97***	.79***	.71*
C.11.d	.97***	.90***	.92***	.82**
C.11.e	.86***	.91***	.87***	.66
C.11.f	.98***	.97***	.92***	.86***
C.11.g	.98***	.88***	.92***	.90***

Note: Developmental appropriateness was reported on a 4-point scale (0 = Not important, 1 = Somewhat important, 2 = Important, 3 = Very important). “Importance as a focal skill” was reported on a 4-point scale (0 = Not important, 1 = Somewhat important, 2 = Important, 3 = Very important).



A.1.a



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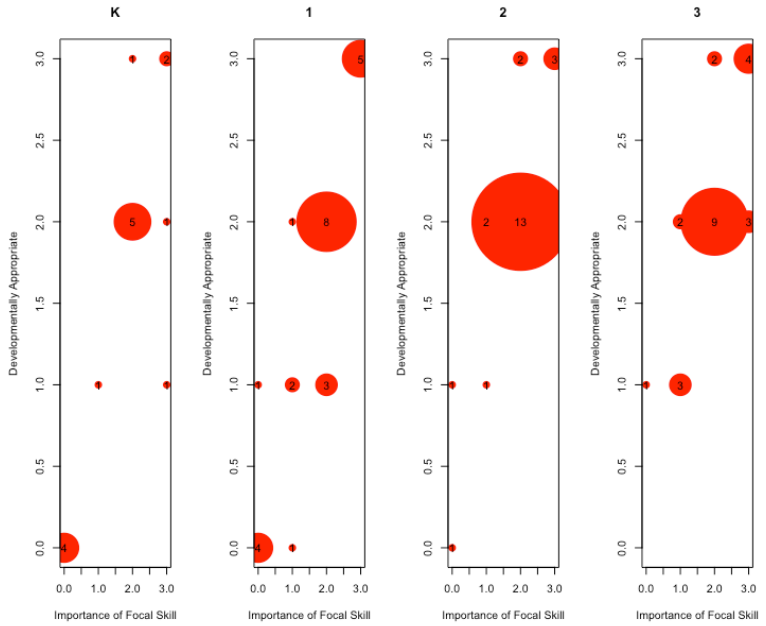
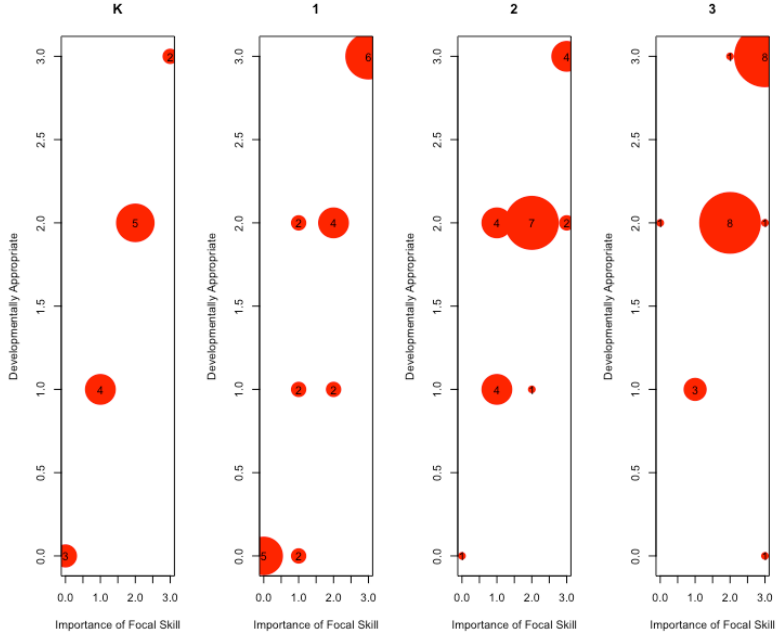


A.1.c



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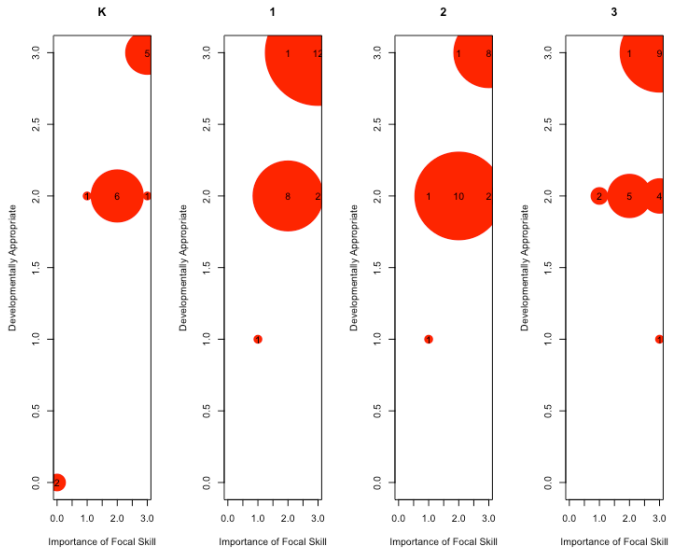

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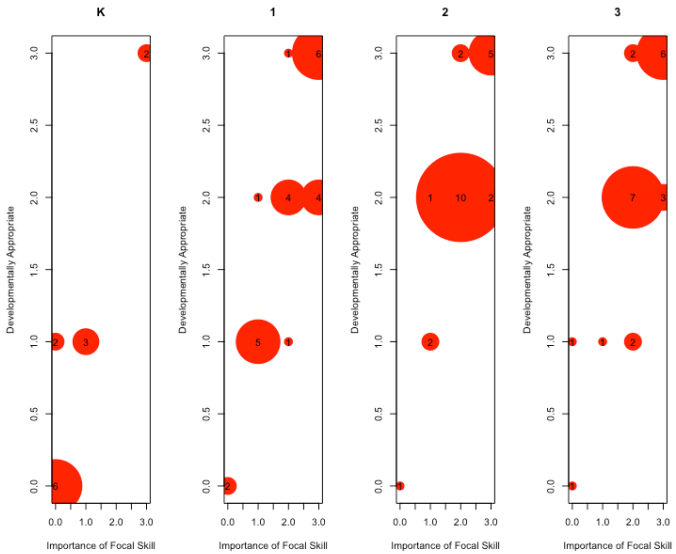
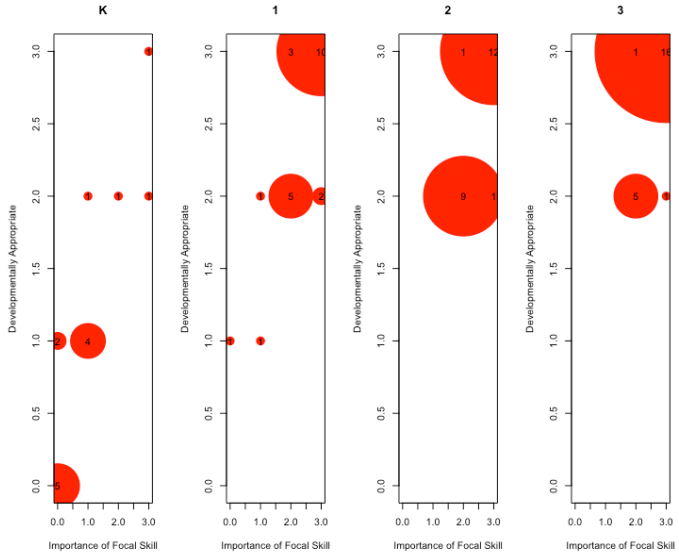
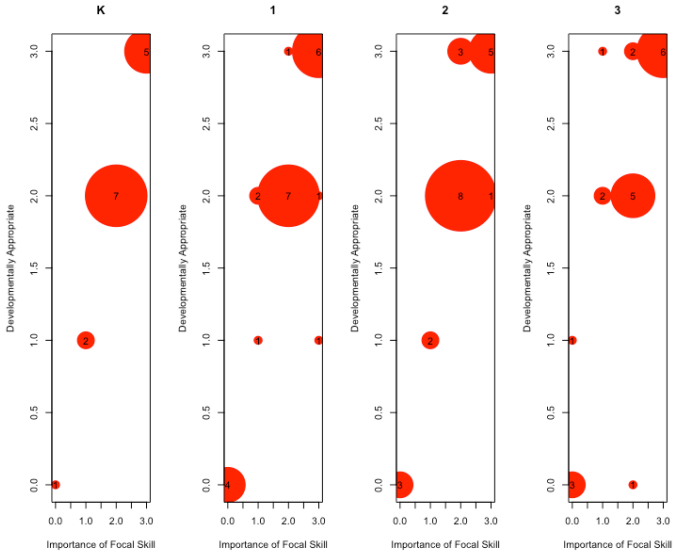


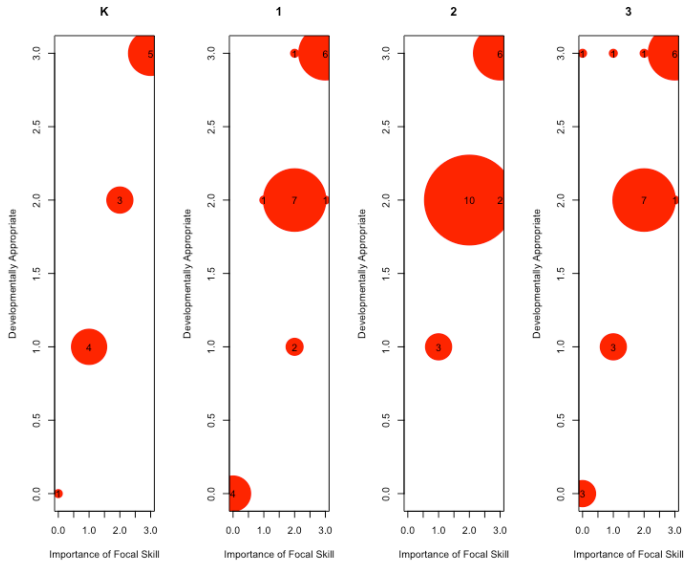
A.1.f



A.1.g



A.2.a



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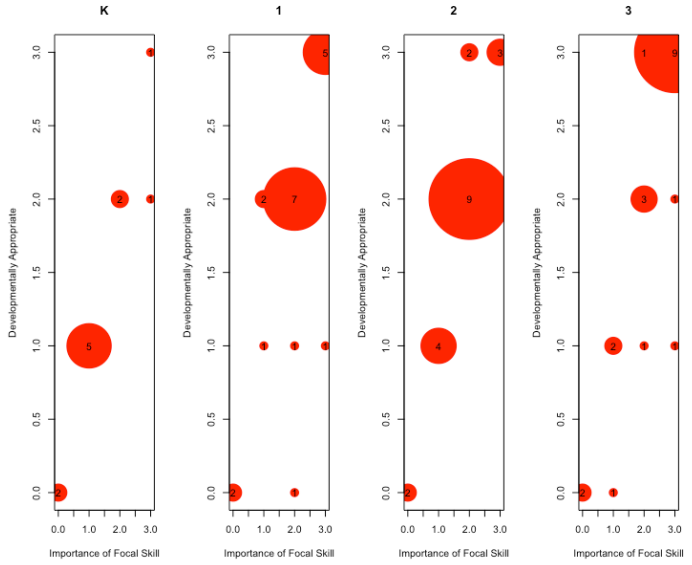

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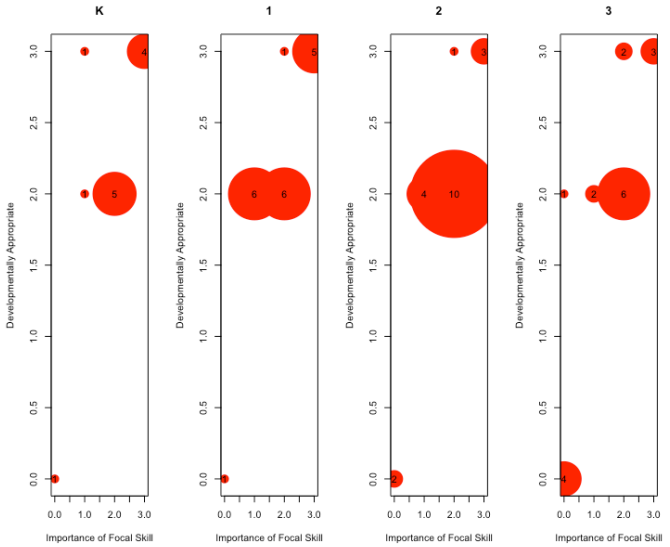

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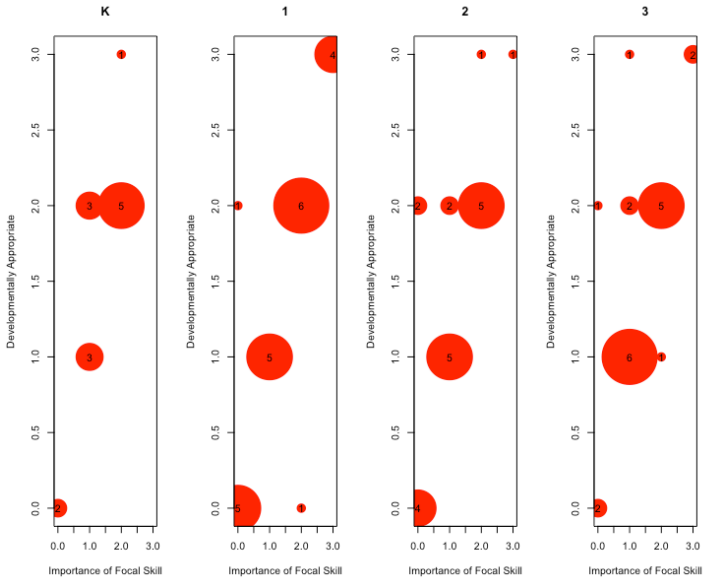

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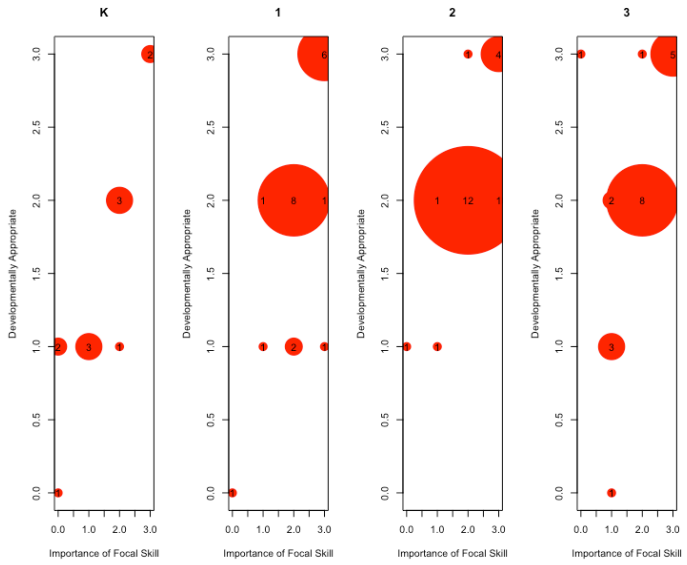

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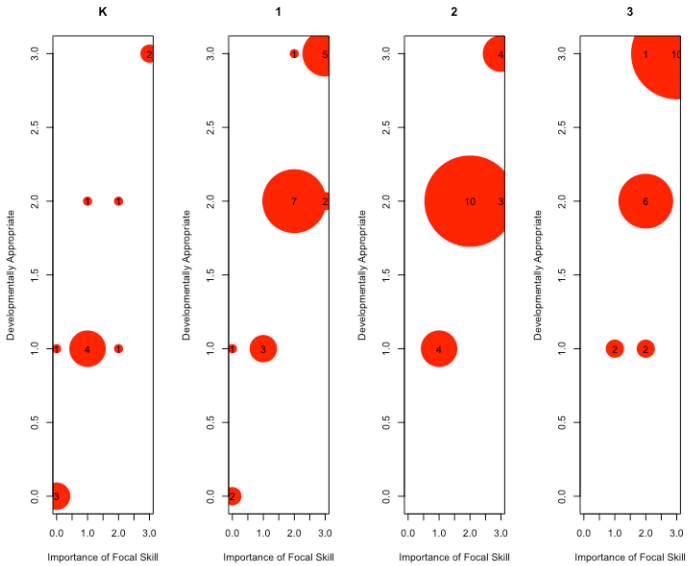

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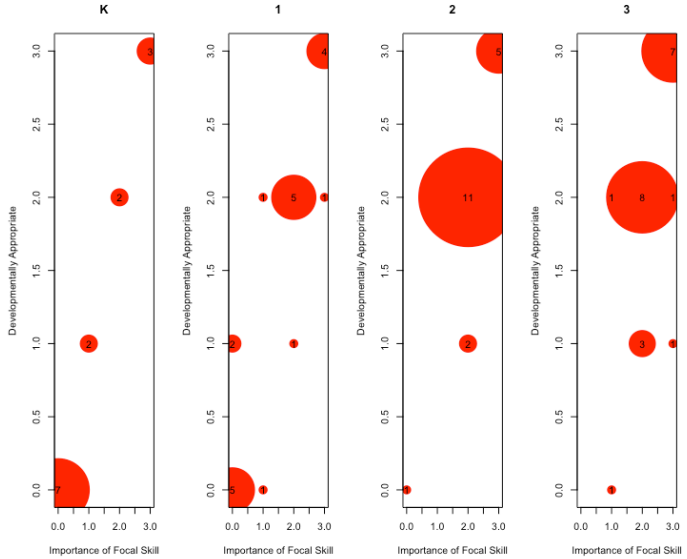

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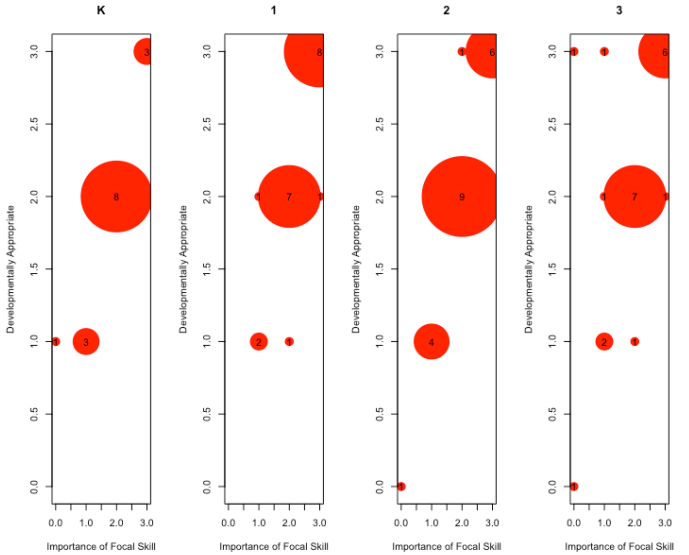

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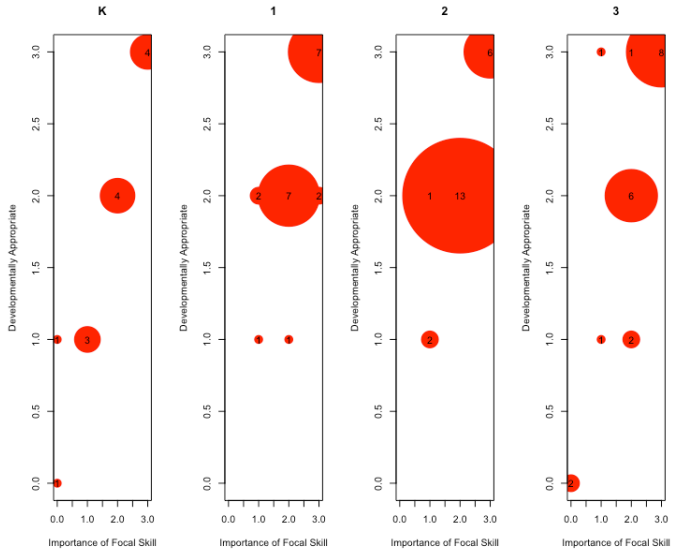

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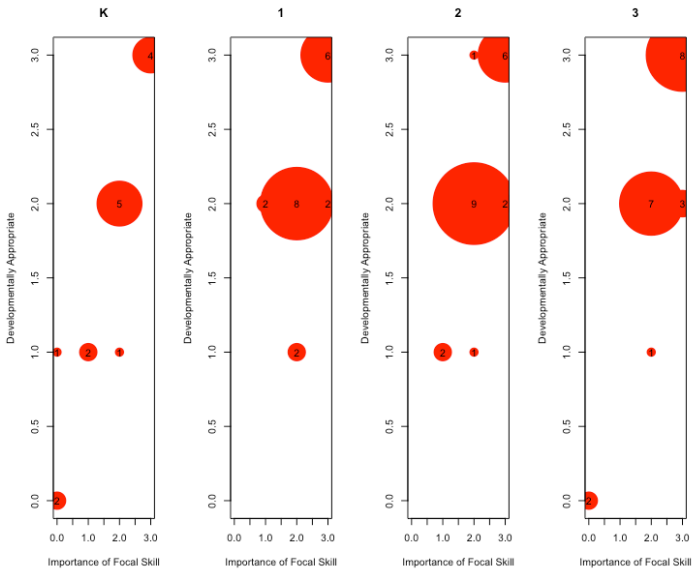

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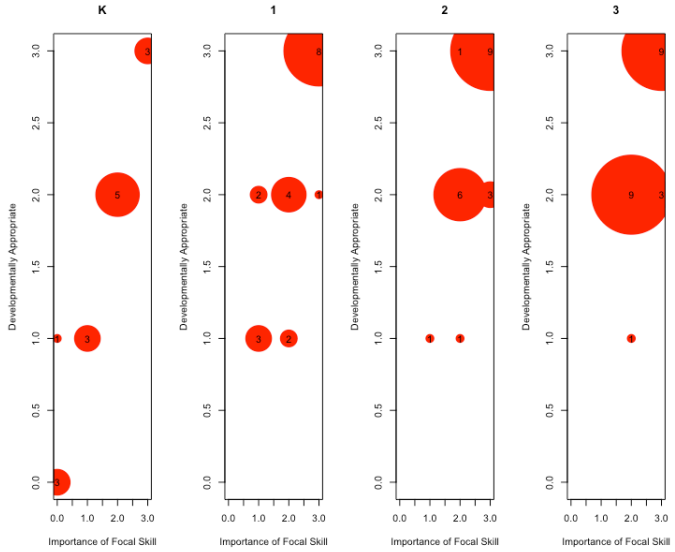

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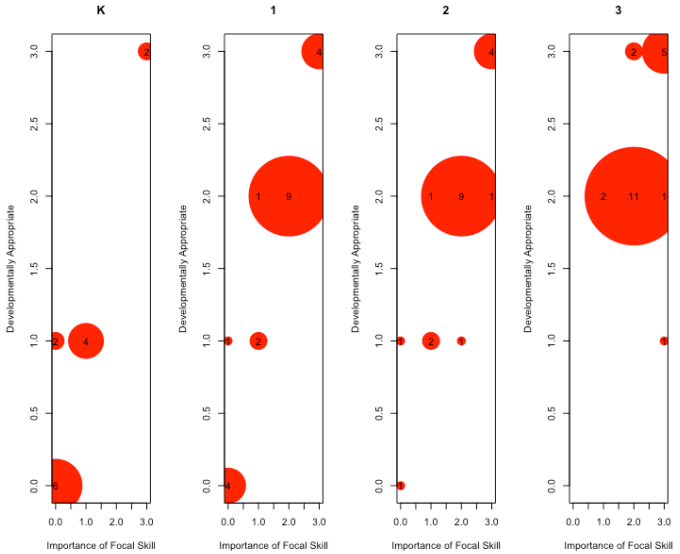

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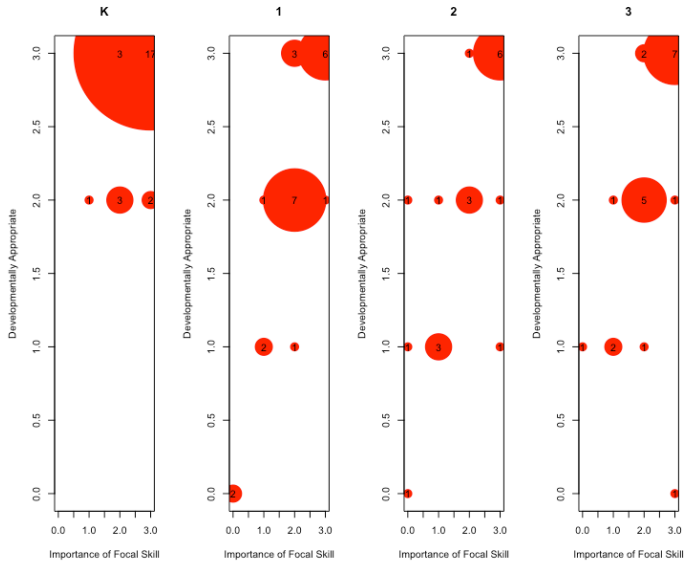
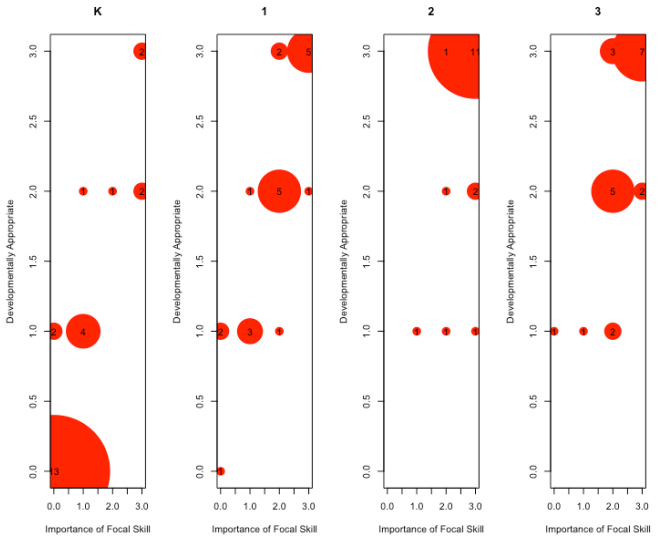


B.5.a



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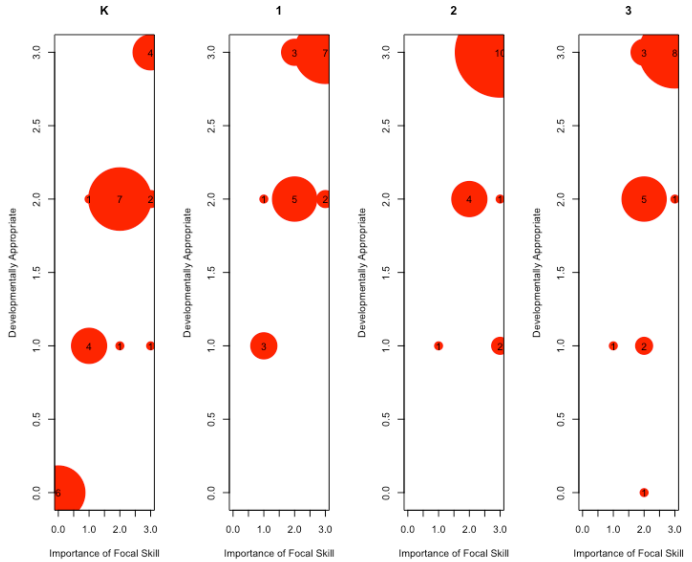

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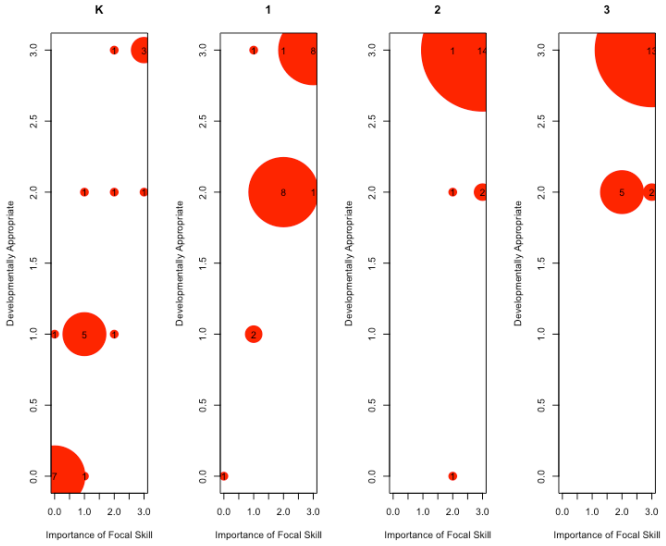
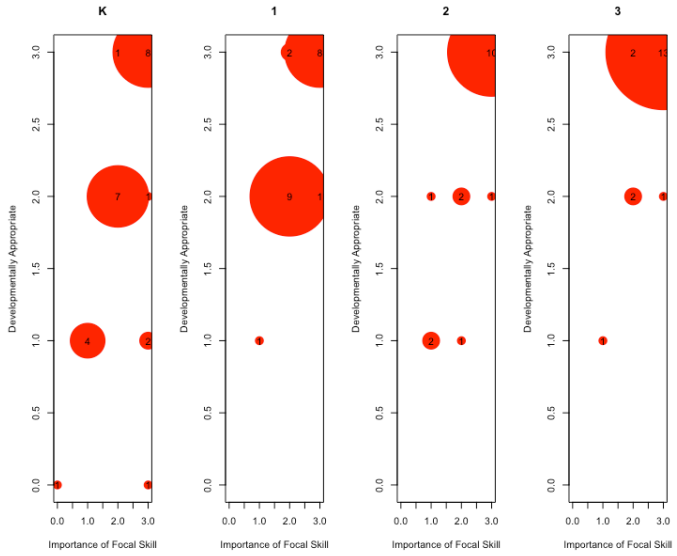
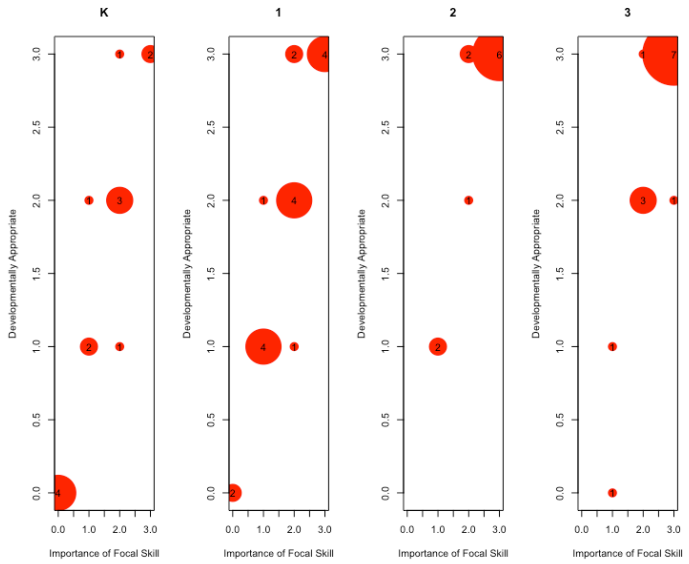


B.5.e



B.6.a



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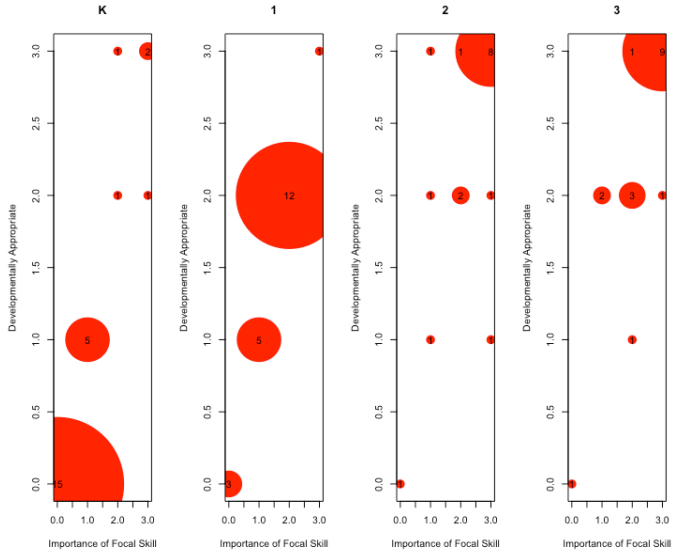

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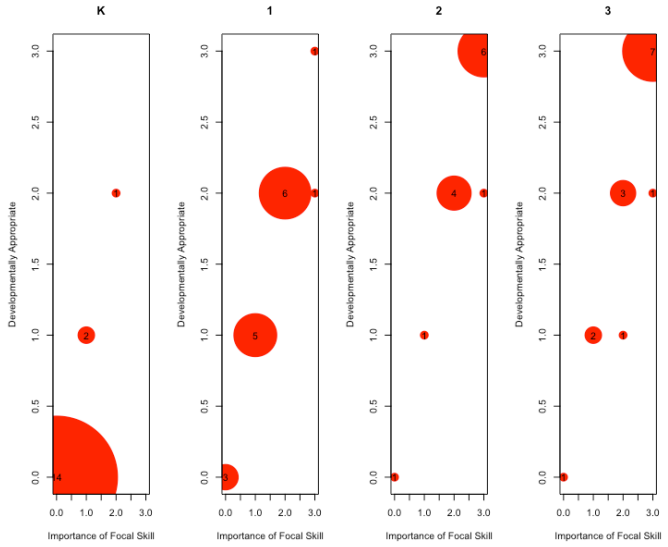

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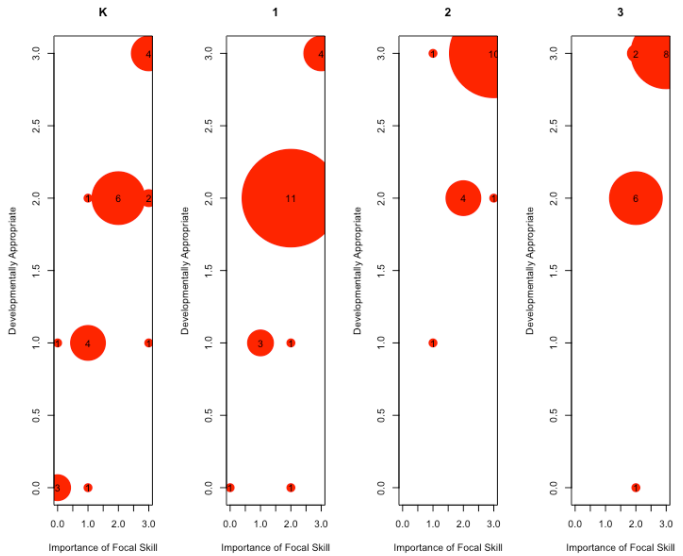

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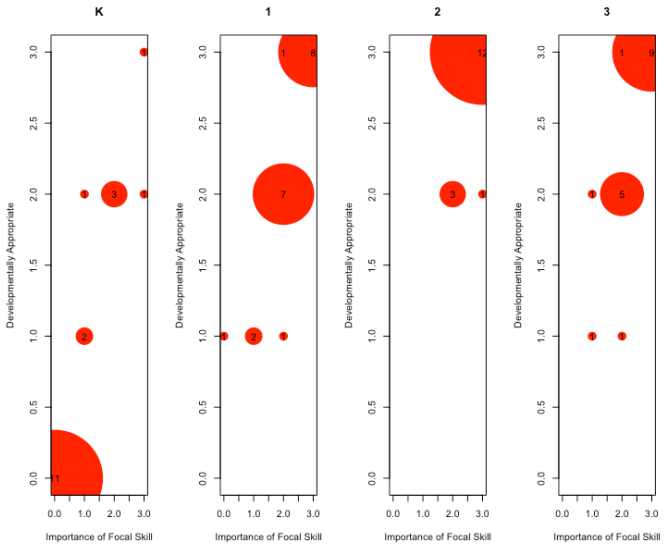

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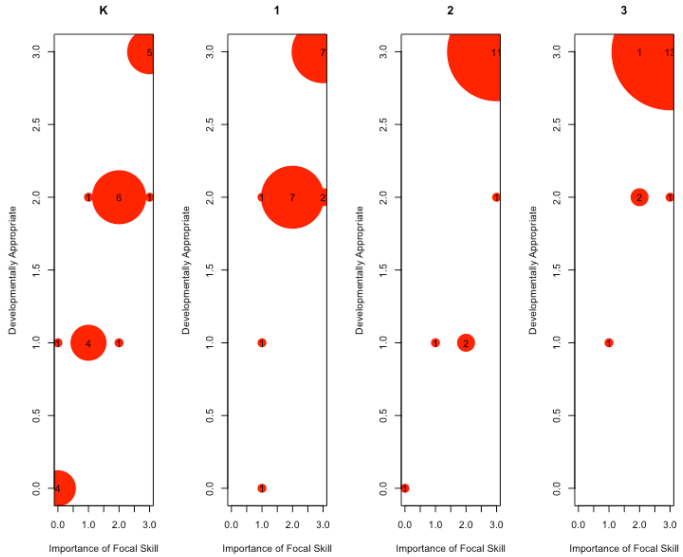

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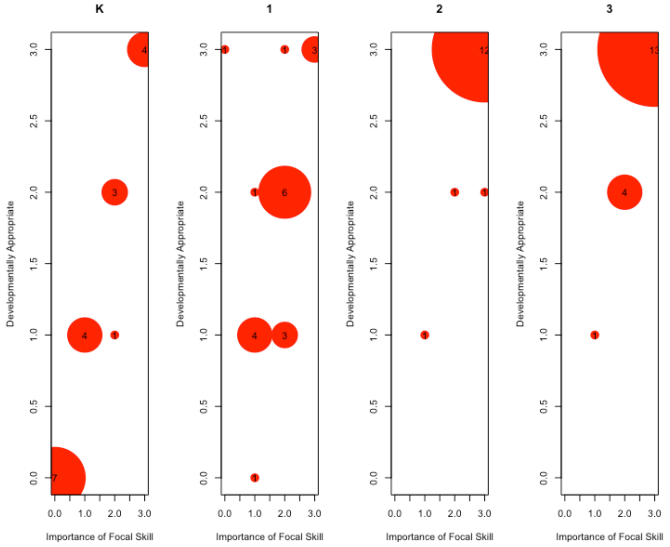

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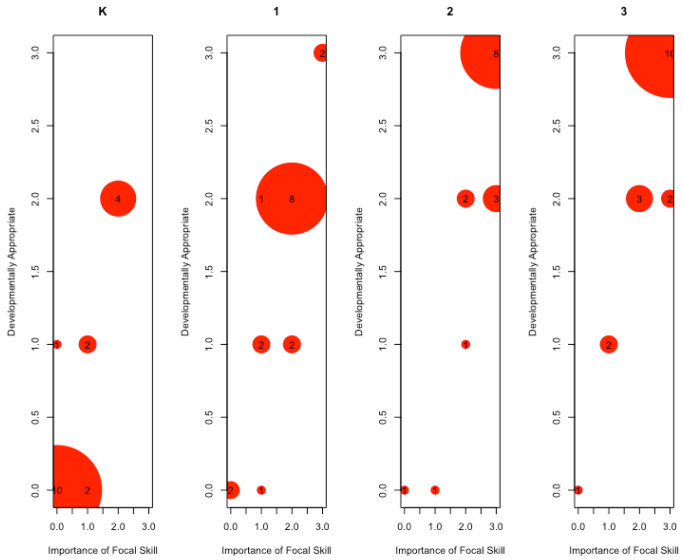

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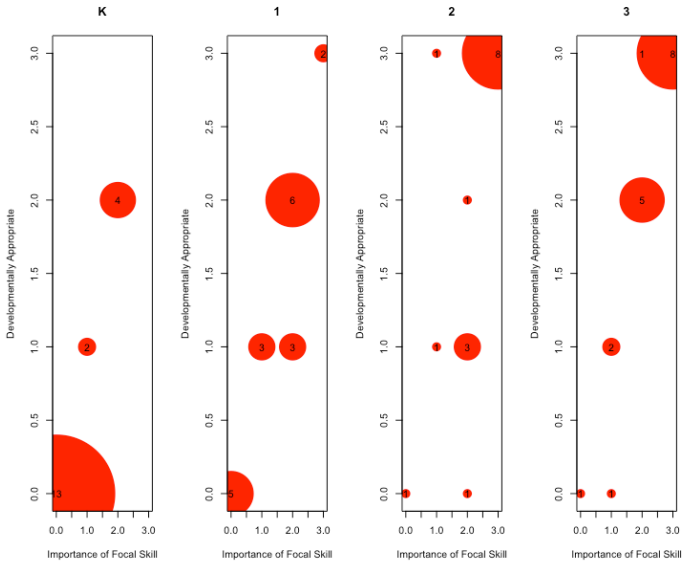

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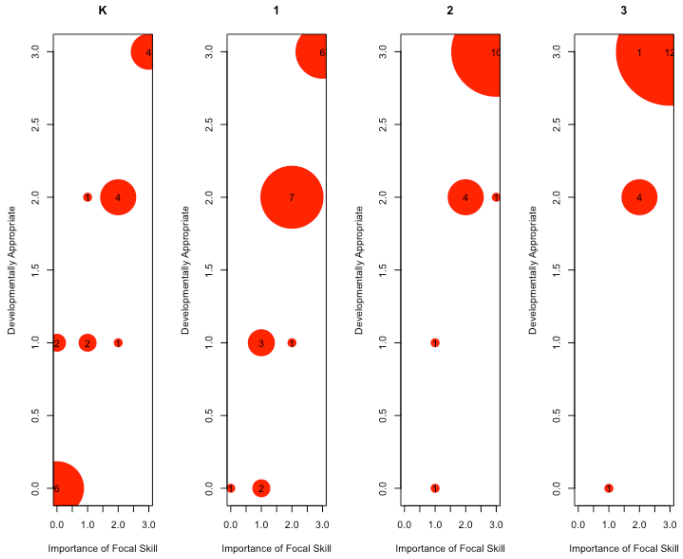

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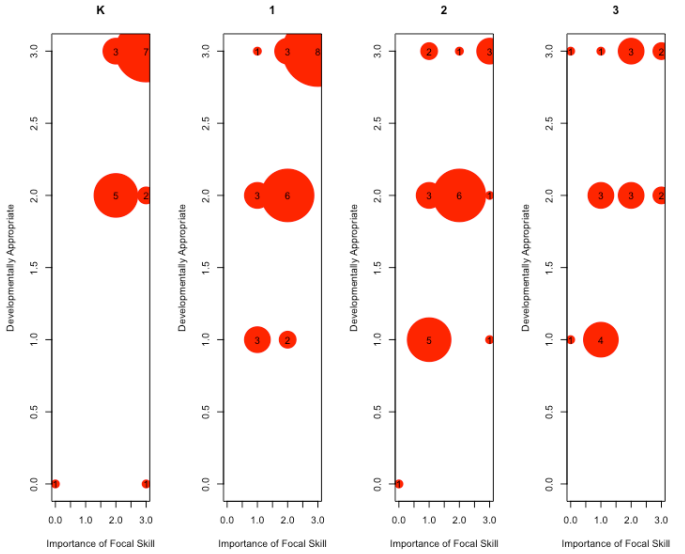

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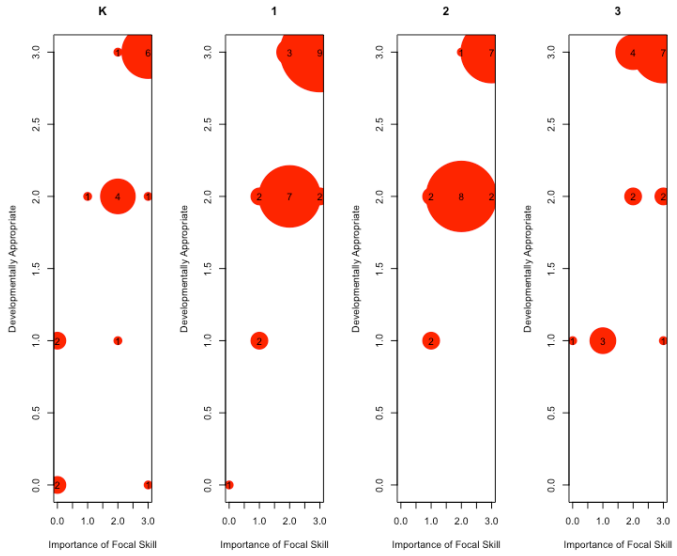

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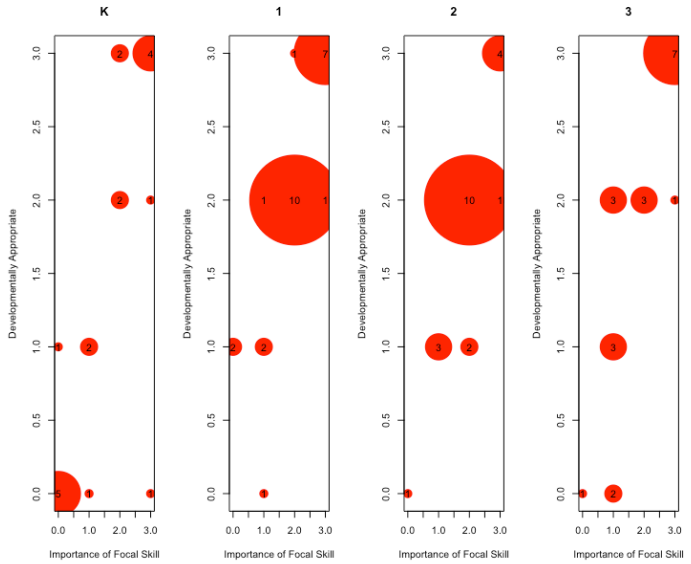

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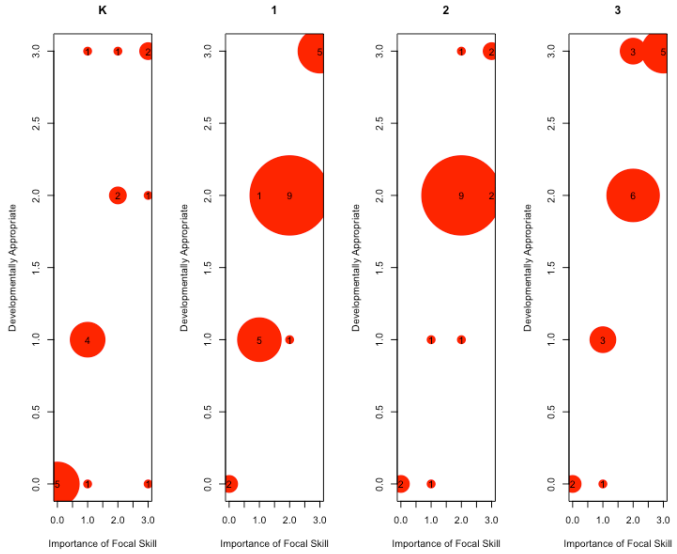

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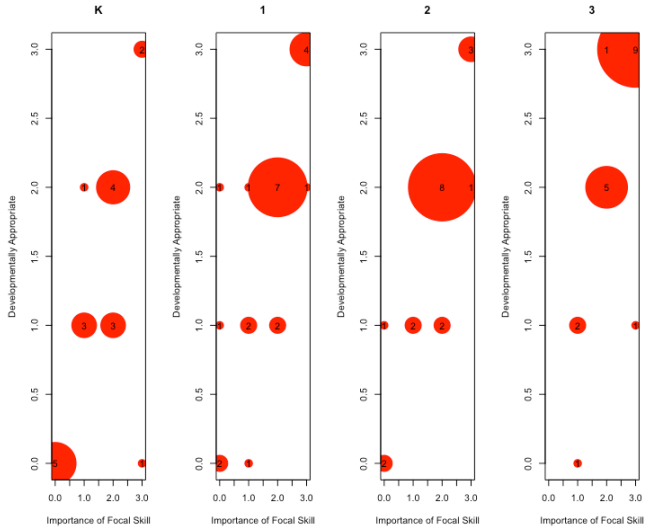

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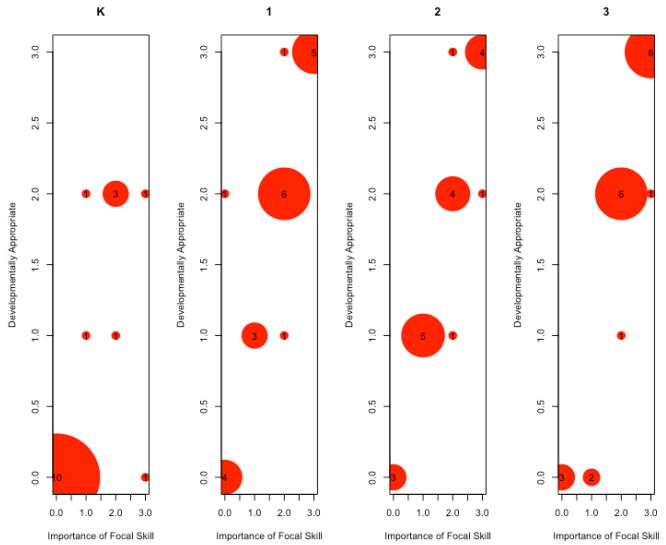

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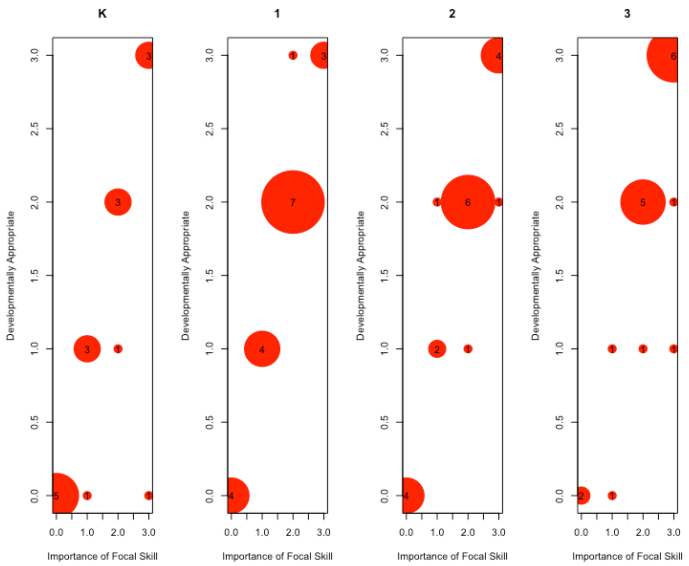

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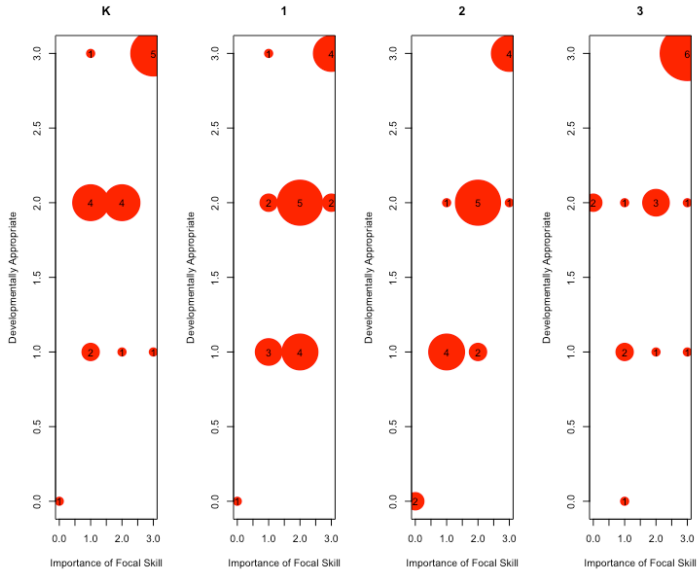

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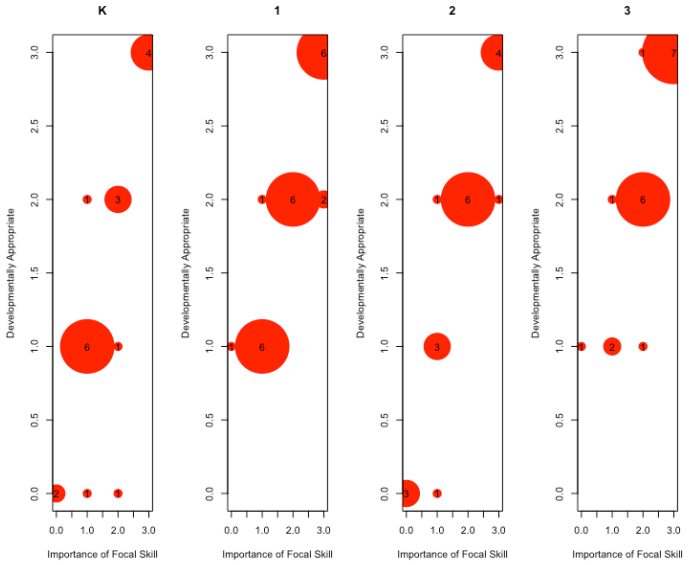

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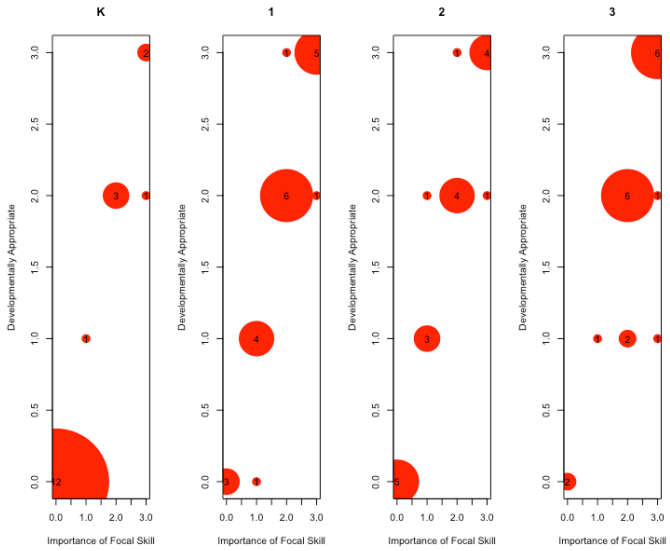

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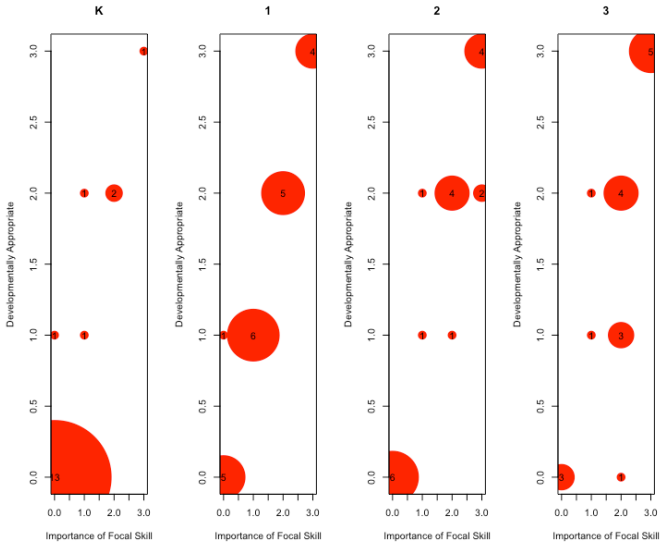
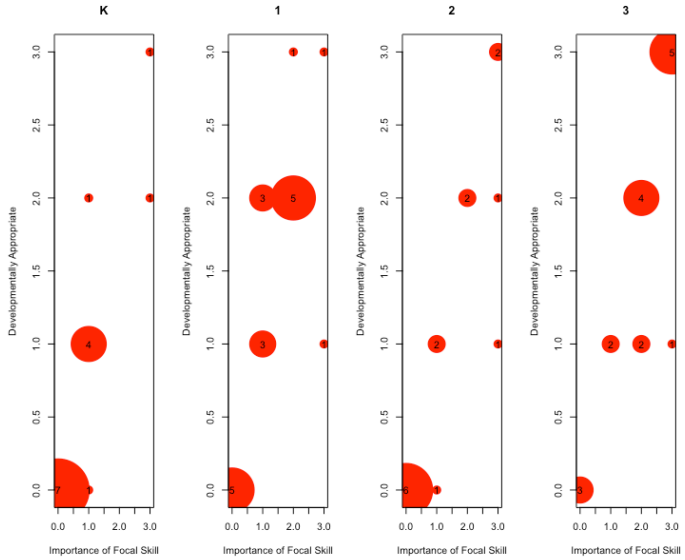


C.9.d



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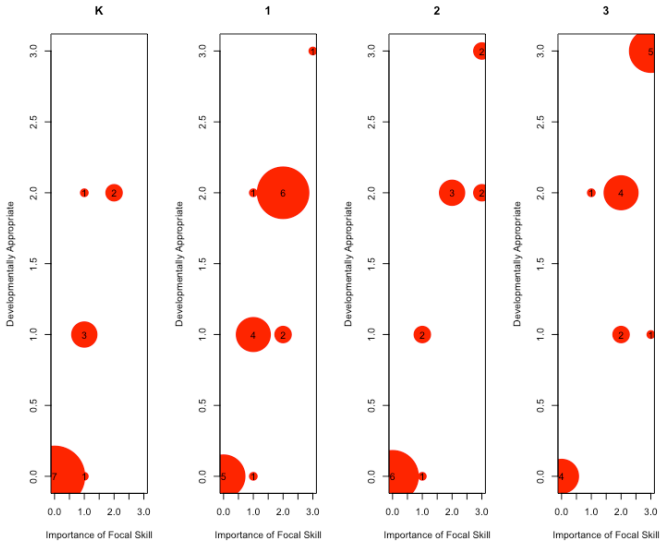

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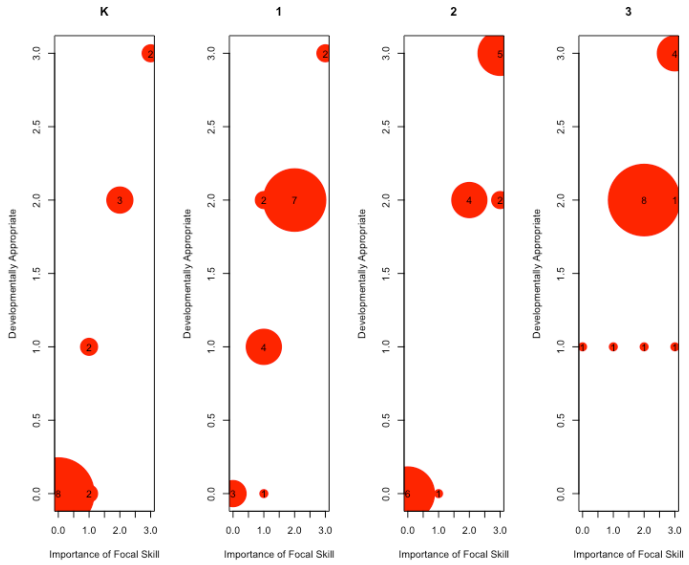

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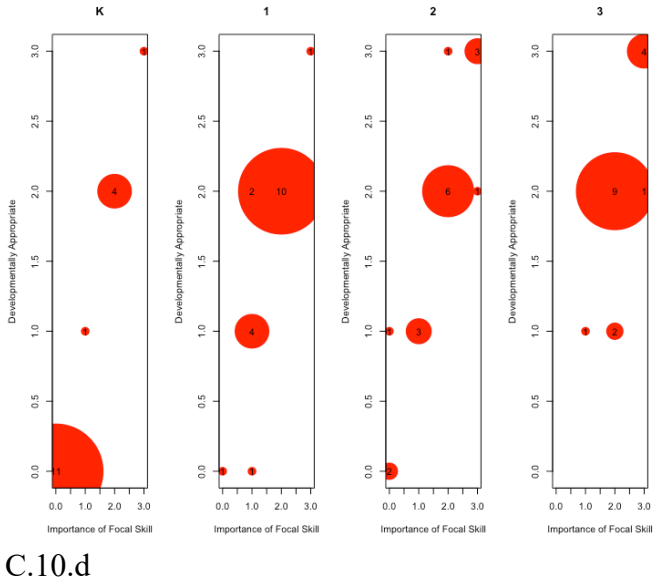

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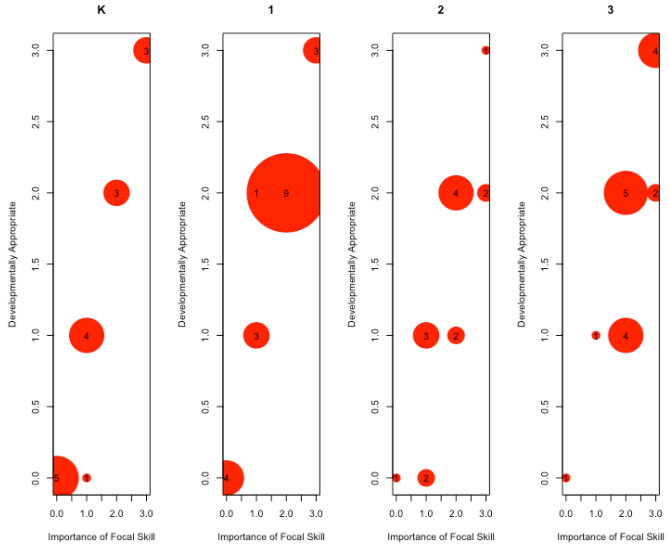
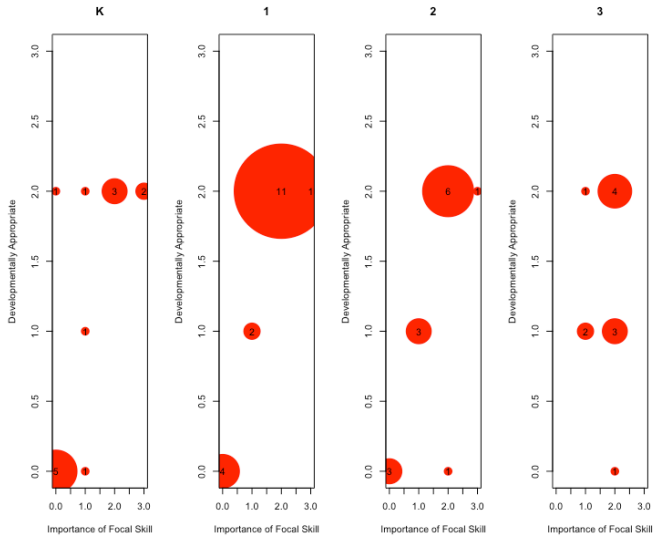


C.11.a



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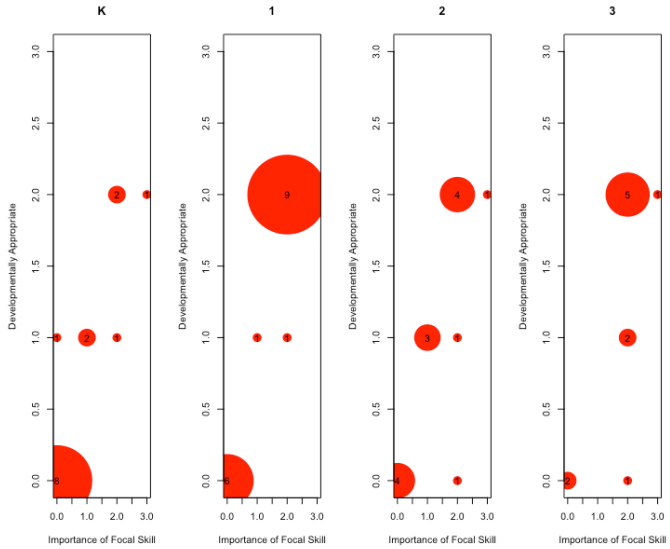

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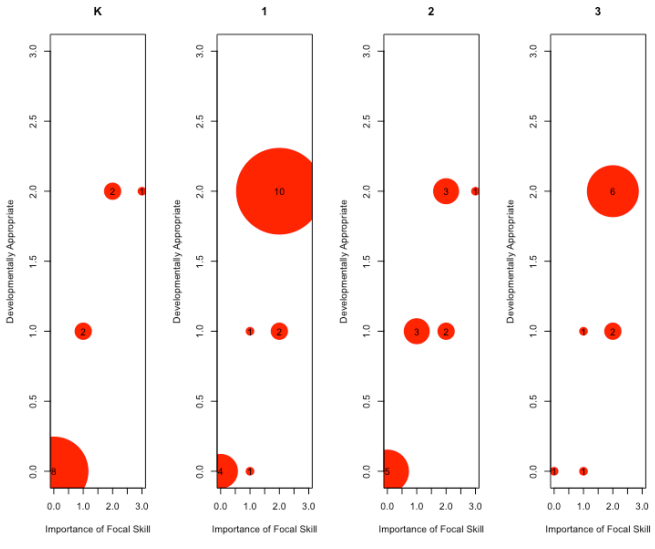

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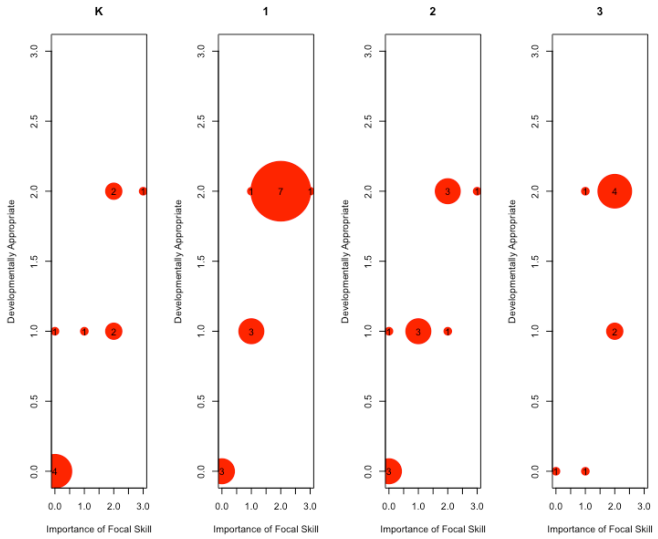

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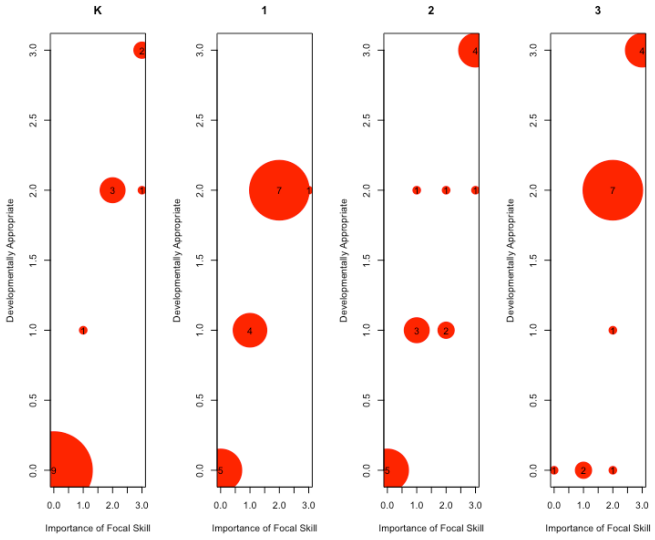

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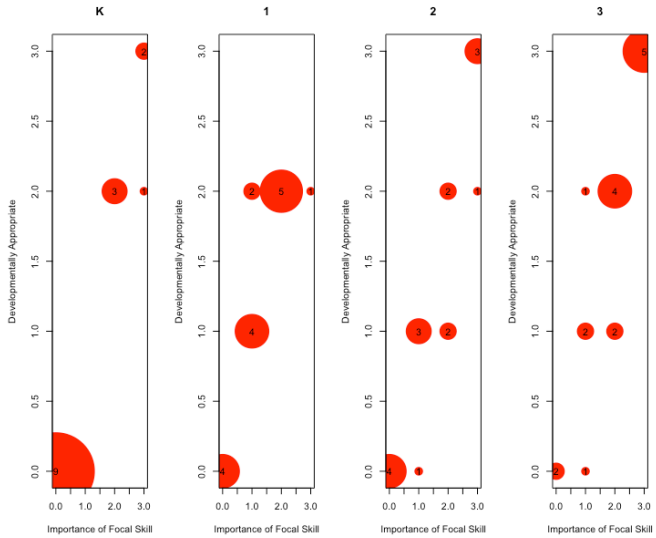

K
1
2
3
Developmentally Appropriate
Importance of Focal Skill
0.0
0.5
1.0
1.5
2.0
2.5
3.0

C.11.g

Appendix G – Time of Year

Relations: Time of year each skill statement is taught by grade level

Skill Statement	Grade Level	N	Not Taught	Fall	Winter	Spring	Fisher test results
A.1.a	K	15	0	10	2	3	p = .008
	1	25	0	12	8	5	
	2	23	1	20	1	1	
	3	25	1	22	1	1	
A.1.b	K	15	2	4	4	5	p < .001
	1	25	4	8	6	7	
	2	24	11	2	7	4	
	3	25	3	2	1	19	
A.1.c	K	15	4	5	3	3	p < .001
	1	25	10	5	3	7	
	2	23	3	13	4	3	
	3	24	1	20	1	2	
A.1.d	K	14	5	5	2	2	p = .003
	1	23	10	5	5	3	
	2	23	1	12	5	5	
	3	23	1	17	4	1	
A.1.e	K	15	1	5	3	6	p = .016
	1	24	0	10	7	7	
	2	23	0	15	5	3	
	3	22	0	13	9	0	
A.1.f	K	13	8	2	1	2	p < .001
	1	24	2	4	9	9	
	2	23	1	15	4	3	
	3	23	2	13	6	2	
A.1.g	K	15	7	0	3	5	p < .001
	1	23	0	12	4	7	
	2	23	0	18	4	1	
	3	23	0	20	3	0	
A.2.a	K	15	1	5	5	4	p = .119
	1	23	3	6	7	7	
	2	22	4	11	6	1	
	3	21	5	12	3	1	
A.2.b	K	13	2	3	4	4	p = .109
	1	22	6	5	5	6	
	2	21	2	11	7	1	
	3	23	6	11	5	1	

A.3.a	K	15	1	2	3	9	p = .075
	1	21	3	1	6	11	
	2	22	2	5	5	10	
	3	22	10	1	2	9	
A.3.b	K	11	3	0	1	7	p = .040
	1	20	4	4	7	5	
	2	20	5	8	4	3	
	3	21	6	9	4	2	
A.3.c	K	14	4	1	3	6	p = .180
	1	22	9	4	7	2	
	2	20	9	3	2	6	
	3	20	7	3	1	9	
A.3.d	K	12	3	1	2	6	p = .016
	1	21	2	7	7	5	
	2	21	1	12	7	1	
	3	21	3	12	4	2	
A.3.e	K	13	5	1	1	6	p < .001
	1	21	3	4	6	8	
	2	21	0	11	8	2	
	3	21	0	19	0	2	
A.3.f	K	14	8	0	3	3	p < .001
	1	20	5	1	4	10	
	2	19	2	7	9	1	
	3	22	1	19	2	0	
A.4.a	K	25	1	1	5	8	p < .001
	1	20	0	7	6	7	
	2	21	1	15	3	2	
	3	21	3	14	3	1	
A.4.b	K	13	2	2	4	5	p < .001
	1	20	0	5	8	7	
	2	22	1	8	12	1	
	3	21	2	15	3	1	
A.4.c	K	15	3	2	3	7	p < .001
	1	20	0	2	12	6	
	2	21	0	9	9	3	
	3	21	2	16	3	0	
A.4.d	K	15	3	1	4	7	p < .001
	1	20	0	1	13	6	
	2	21	0	11	6	4	
	3	22	0	16	6	0	
A.4.e	K	14	9	0	1	4	p < .001
	1	21	8	5	4	4	
	2	20	3	9	5	3	
	3	22	0	14	6	2	

Composition/Decomposition: Time of year each skill statement is taught by grade level

Skill Statement	Grade Level	N	Not Taught	Fall	Winter	Spring	Fisher test results
B.5.a	K	26	0	19	3	4	p = .051
	1	23	2	19	1	1	
	2	19	0	19	0	0	
	3	21	1	20	0	0	
B.5.b	K						
	1						
	2						
	3						
B.5.c	K	25	17	2	3	3	p < .001
	1	21	2	2	8	9	
	2	18	1	7	7	3	
	3	21	1	15	3	2	
B.5.d	K	26	7	2	7	10	p < .001
	1	21	0	6	9	6	
	2	18	0	6	8	4	
	3	21	1	12	6	2	
B.5.e	K	22	7	4	2	9	p < .001
	1	22	1	8	6	7	
	2	19	0	14	5	0	
	3	20	0	17	3	0	
B.6.a	K	25	2	9	6	8	p = .009
	1	21	0	9	6	6	
	2	17	0	6	10	1	
	3	19	0	15	3	1	
B.6.b	K	14	3	2	4	5	p = .258
	1	18	2	6	5	5	
	2	11	0	2	6	3	
	3	14	0	8	3	3	
B.6.c	K	25	16	1	1	7	p < .001
	1	21	3	2	2	14	
	2	17	1	6	2	8	
	3	18	2	11	2	3	
B.6.d	K	17	14	1	0	2	p < .001
	1	16	5	1	3	7	
	2	13	1	3	2	7	
	3	15	2	7	3	3	
B.6.e	K	23	3	6	6	8	p = .797
	1	21	1	9	4	7	
	2	17	0	6	5	6	
	3	17	1	8	5	3	

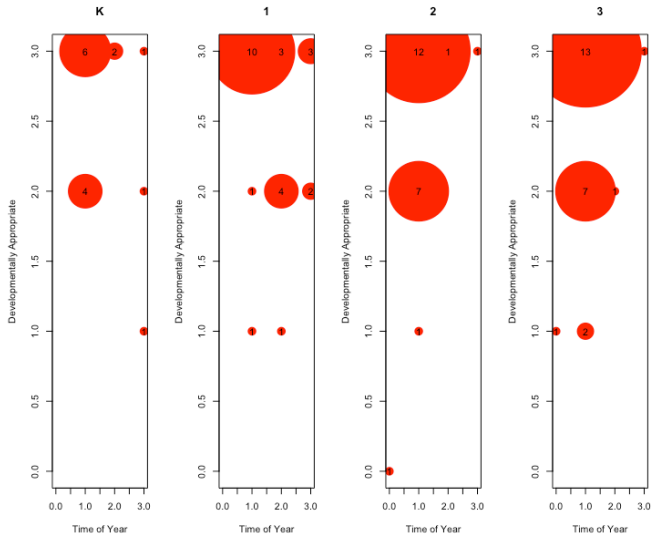
B.6.f	K	19	10	3	0	6	p < .001
	1	20	0	5	7	8	
	2	16	0	7	6	3	
	3	18	1	12	4	1	
B.7.a	K	23	5	2	7	9	p = .223
	1	19	0	7	7	5	
	2	16	1	4	7	4	
	3	18	1	7	5	5	
B.7.b	K	19	10	1	5	3	p = .016
	1	20	1	7	6	6	
	2	15	2	3	7	4	
	3	18	2	5	7	5	
B.7.c	K	19	13	0	3	3	p = .015
	1	18	2	3	8	5	
	2	16	3	1	7	5	
	3	18	3	3	6	6	
B.7.d	K	19	13	1	1	4	p = .015
	1	19	5	1	8	5	
	2	16	3	2	4	7	
	3	18	3	5	4	6	
B.7.e	K	20	7	3	3	7	p = .113
	1	20	3	6	6	5	
	2	17	0	9	3	5	
	3	18	1	7	5	5	

Properties of Operations: Time of year each skill statement is taught by grade level

Skill Statement	Grade Level	N	Not Taught	Fall	Winter	Spring	Fisher test results
C.8.a	K	19	1	12	3	3	p = .436
	1	26	1	18	2	5	
	2	23	2	15	4	2	
	3	20	0	18	2	0	
C.8.b	K	19	3	3	8	5	p = .016
	1	26	1	15	6	4	
	2	22	1	13	5	3	
	3	20	0	14	6	0	
C.8.c	K	19	7	1	5	6	p < .001
	1	25	2	8	8	7	
	2	21	1	10	6	4	
	3	20	1	13	3	3	
C.8.d	K	18	8	1	3	6	p < .001
	1	23	3	6	6	8	
	2	19	2	4	10	3	
	3	20	1	8	9	2	

C.8.e	K	19	7	0	6	6	p < .001
	1	22	2	2	6	12	
	2	19	2	7	6	4	
	3	19	0	8	8	3	
C.8.f	K	18	10	2	1	5	p = .116
	1	21	6	3	4	8	
	2	19	3	6	6	4	
	3	19	3	3	7	6	
C.8.g	K	17	7	1	6	3	p = .354
	1	19	5	4	7	3	
	2	19	4	6	3	6	
	3	18	2	5	7	4	
C.9.a	K	19	1	6	9	3	p = .275
	1	22	1	10	5	6	
	2	19	4	8	6	1	
	3	18	3	10	3	2	
C.9.b	K	19	4	3	6	6	p = .316
	1	22	1	7	4	8	
	2	19	3	5	6	5	
	3	19	1	10	6	2	
C.9.c	K	19	13	2	3	1	p < .001
	1	21	3	5	3	10	
	2	19	6	8	2	3	
	3	19	2	7	6	4	
C.9.d	K	19	14	0	1	4	p < .001
	1	21	5	3	2	11	
	2	19	7	8	2	2	
	3	18	3	3	9	3	
C.10.a	K	15	9	0	2	4	p = .081
	1	19	5	3	4	7	
	2	15	6	5	2	2	
	3	17	3	7	4	3	
C.10.b	K	14	8	1	1	4	p = .271
	1	20	7	1	7	5	
	2	16	6	3	6	1	
	3	17	4	3	7	3	
C.10.c	K	17	8	1	4	4	p = .009
	1	19	3	2	7	7	
	2	18	7	4	6	1	
	3	17	1	9	4	3	
C.10.d	K	17	12	0	3	2	p < .001
	1	19	1	2	9	7	
	2	17	2	6	3	6	
	3	17	1	9	4	3	
C.11.a	K	16	6	1	5	4	p = .112

	1	20	3	3	9	5	
	2	15	1	4	3	7	
	3	17	2	7	6	2	
C.11.b	K	17	6	3	4	4	p = .072
	1	19	4	2	7	6	
	2	18	3	9	3	3	
	3	17	0	6	7	4	
C.11.c	K	17	9	1	5	2	p = .526
	1	18	6	2	6	4	
	2	16	4	4	4	4	
	3	16	3	5	4	4	
C.11.d	K	15	7	1	4	3	p = .061
	1	19	4	4	8	3	
	2	17	5	6	5	1	
	3	16	0	3	10	3	
C.11.e	K	17	4	5	3	5	p = .382
	1	17	3	4	4	6	
	2	17	3	8	4	2	
	3	16	1	9	5	1	
C.11.f	K	16	8	1	6	1	p = .032
	1	17	5	2	3	7	
	2	17	5	6	3	3	
	3	16	1	5	7	3	
C.11.g	K	15	8	1	4	2	p = .268
	1	16	4	1	6	5	
	2	16	4	5	4	3	
	3	17	2	4	5	6	



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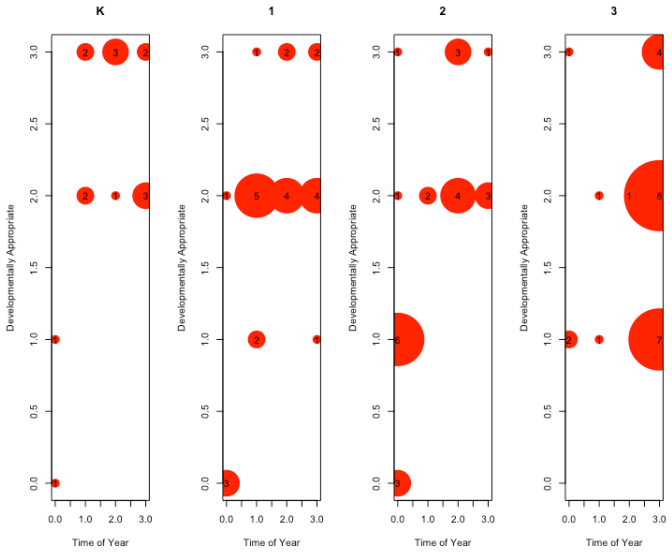

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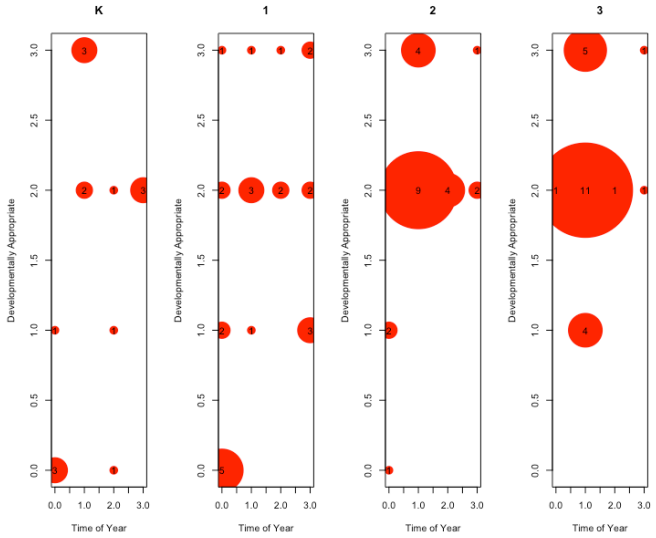

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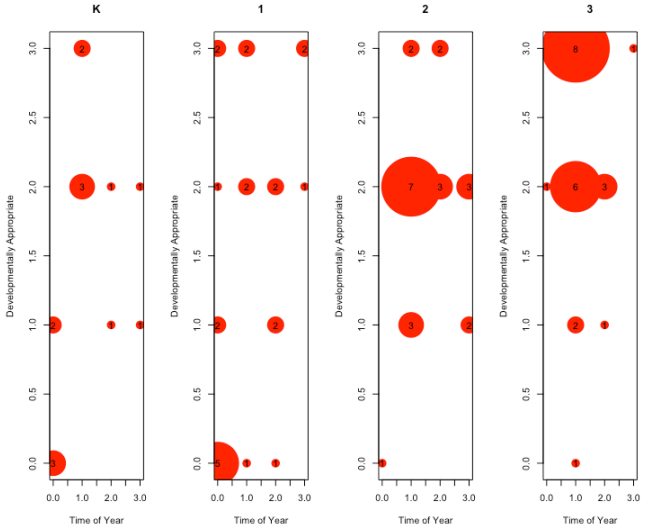

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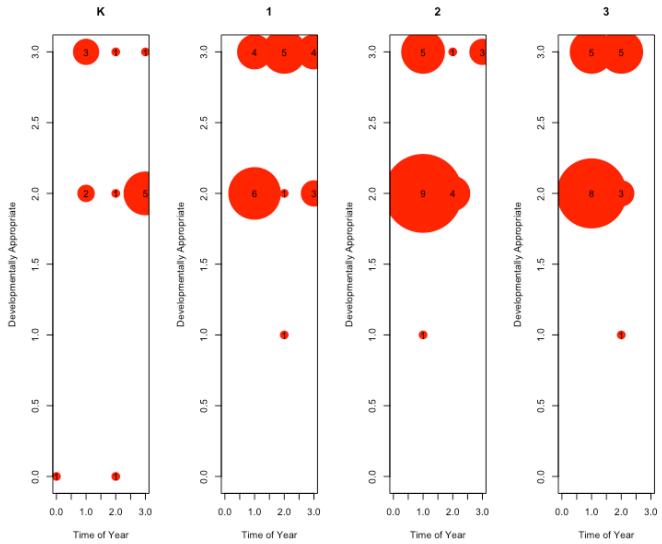

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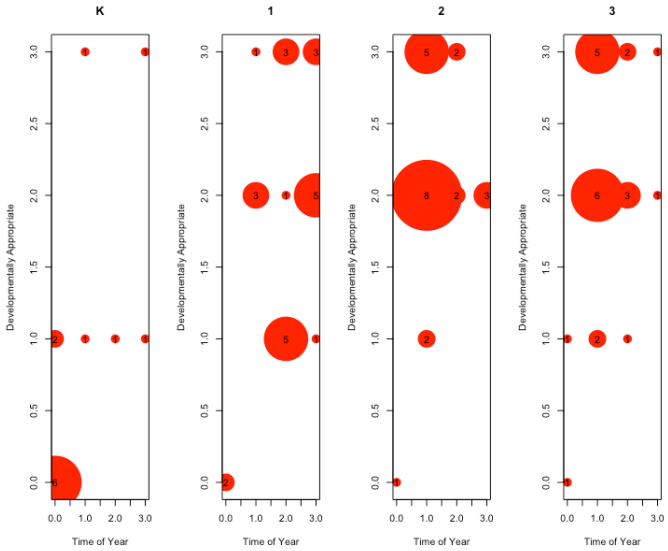

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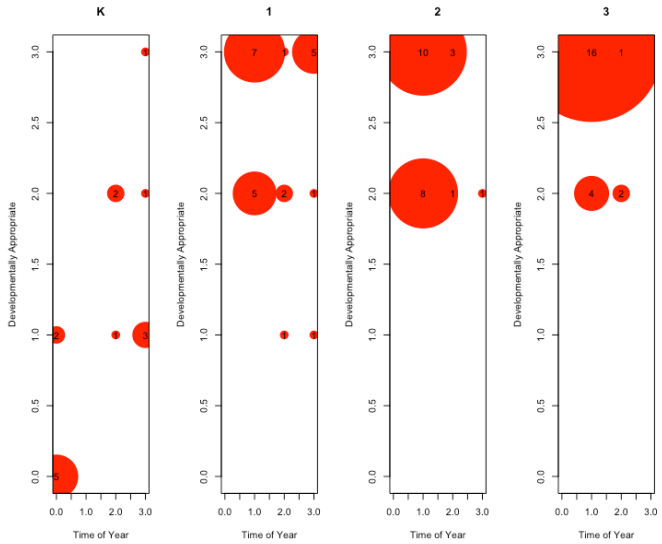

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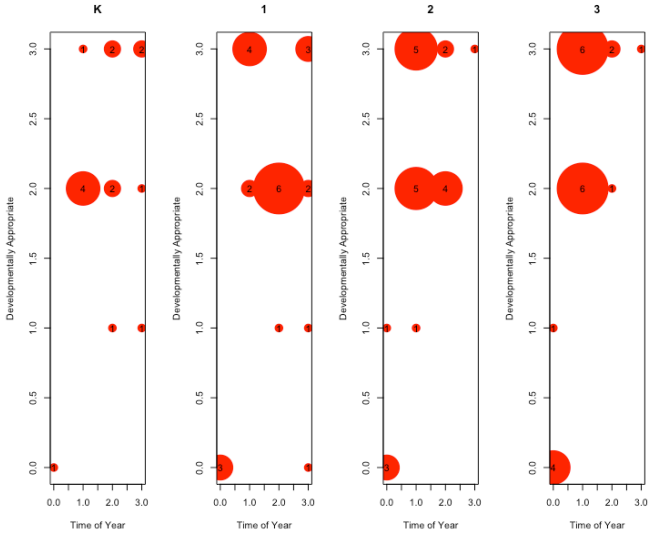

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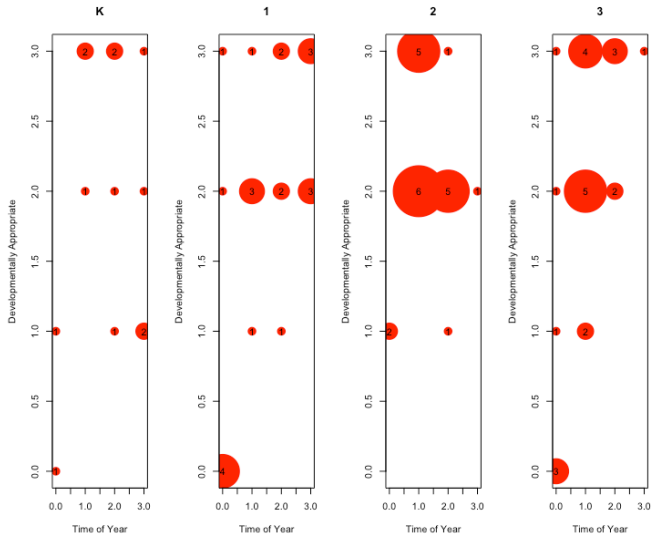

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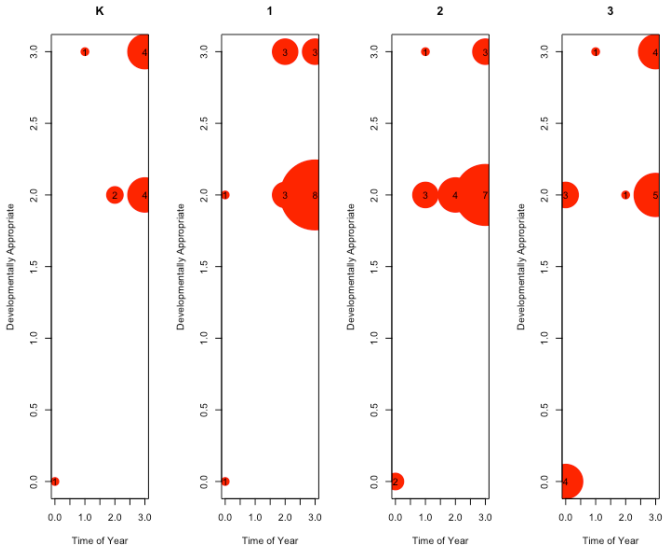

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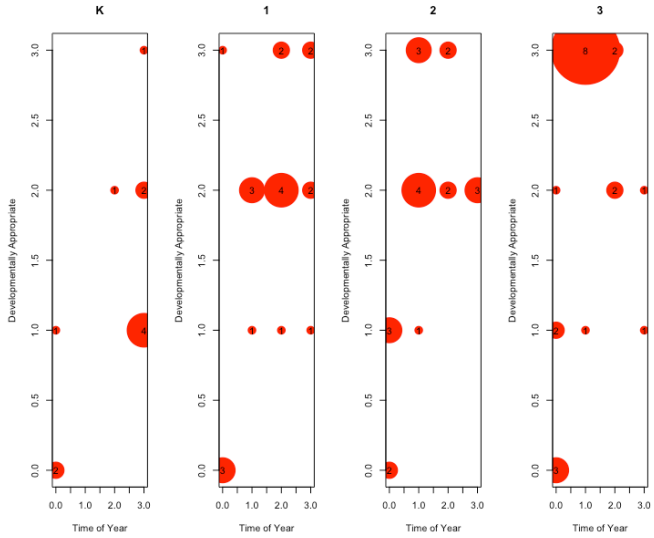

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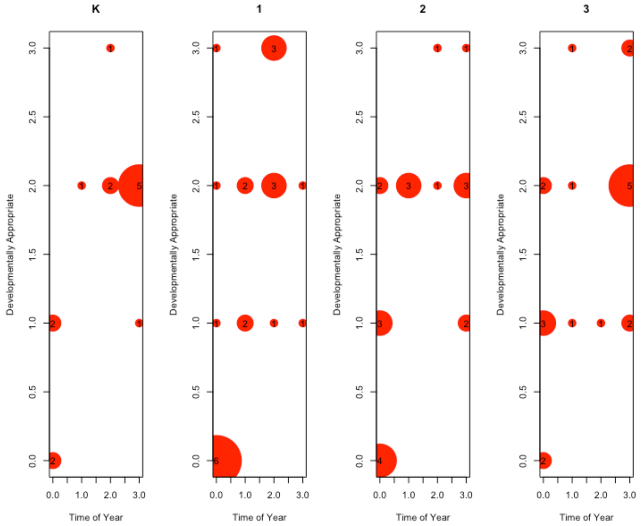

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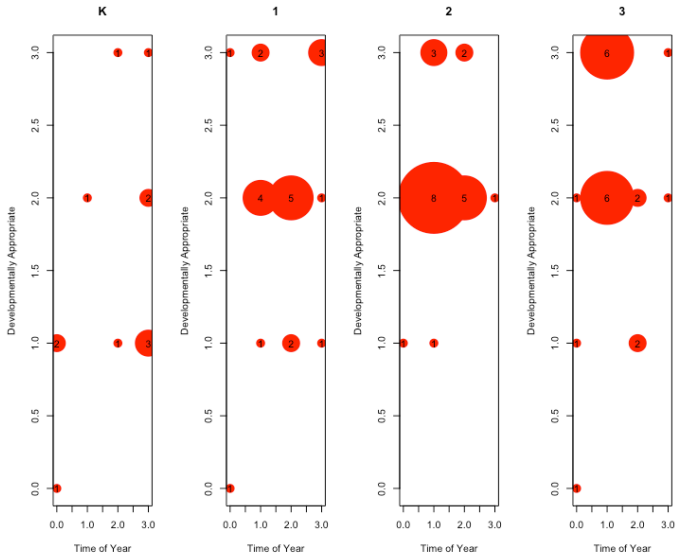

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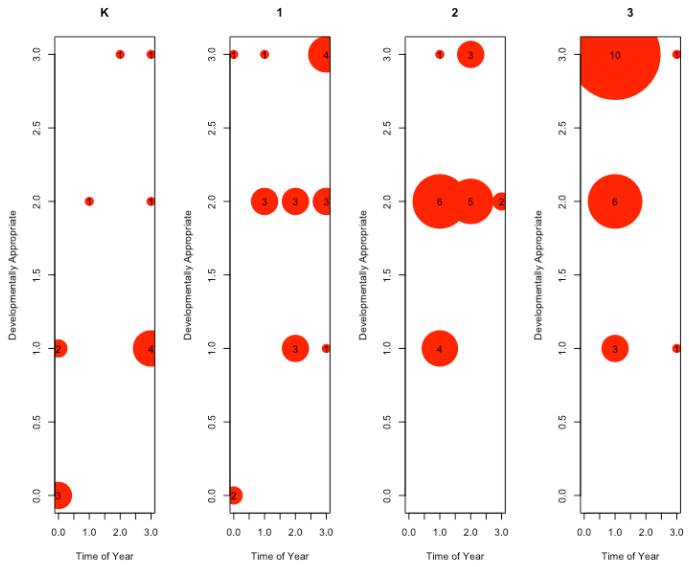

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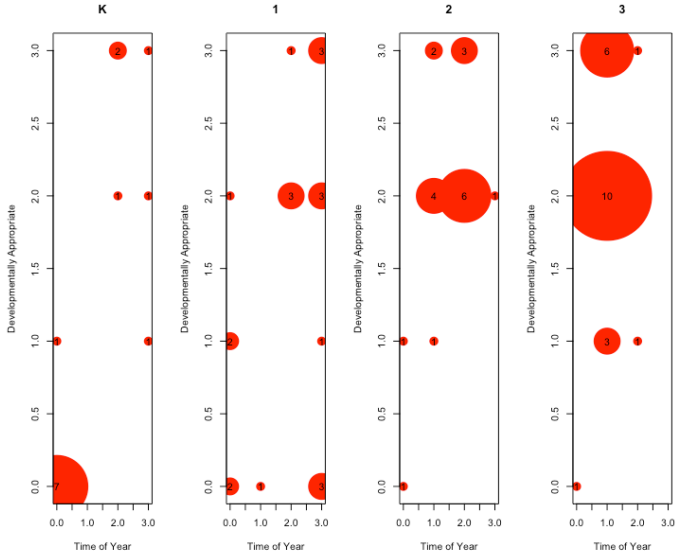

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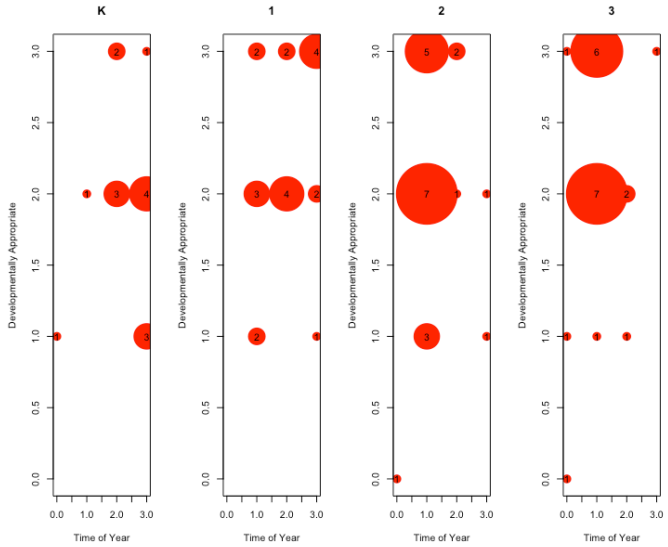

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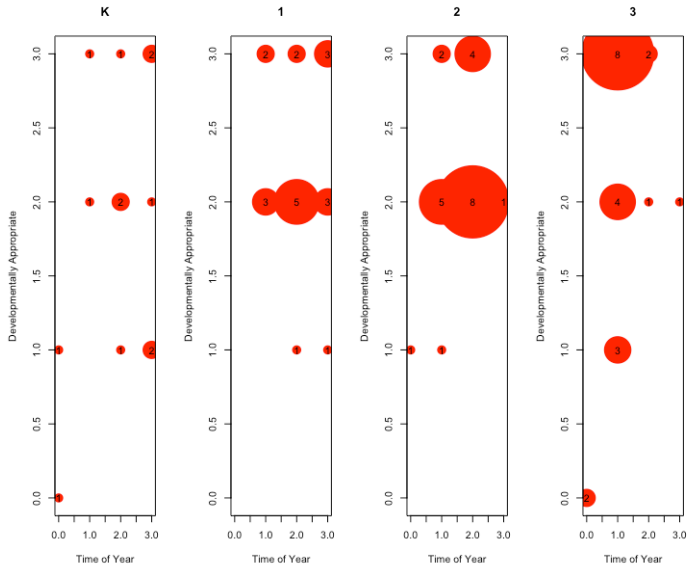

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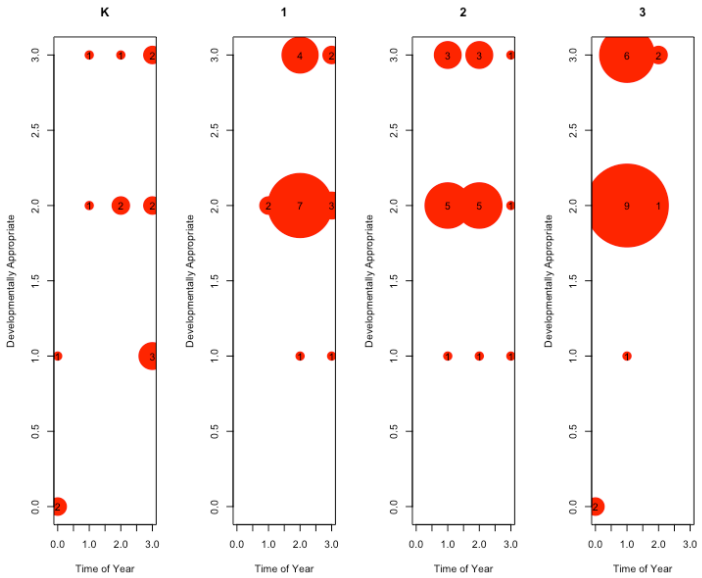

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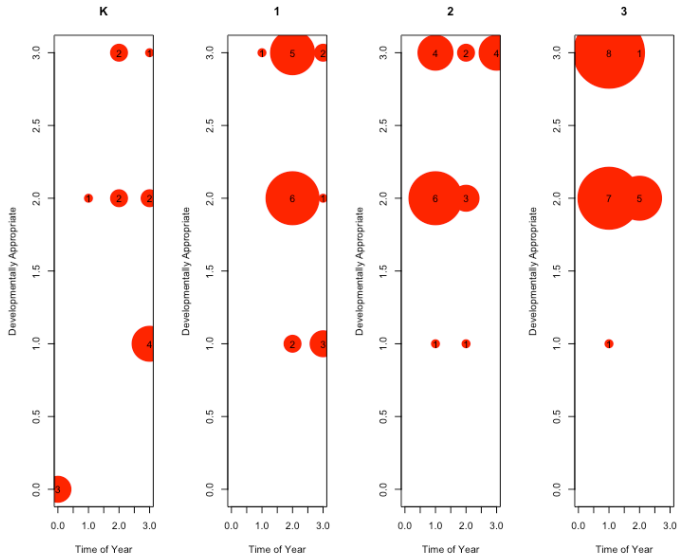

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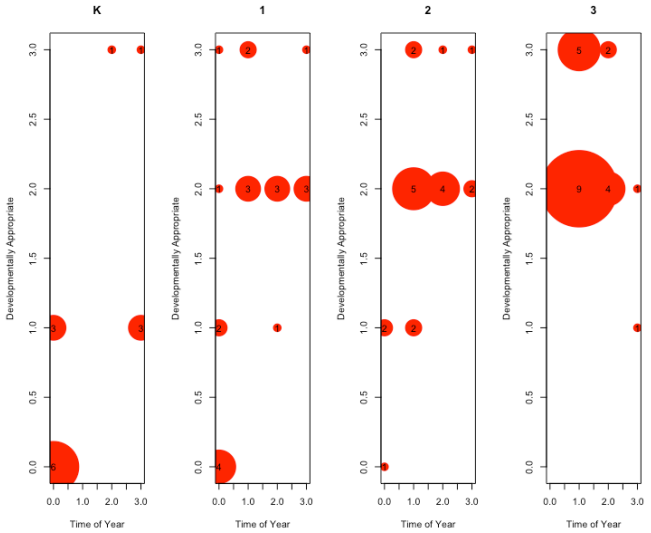

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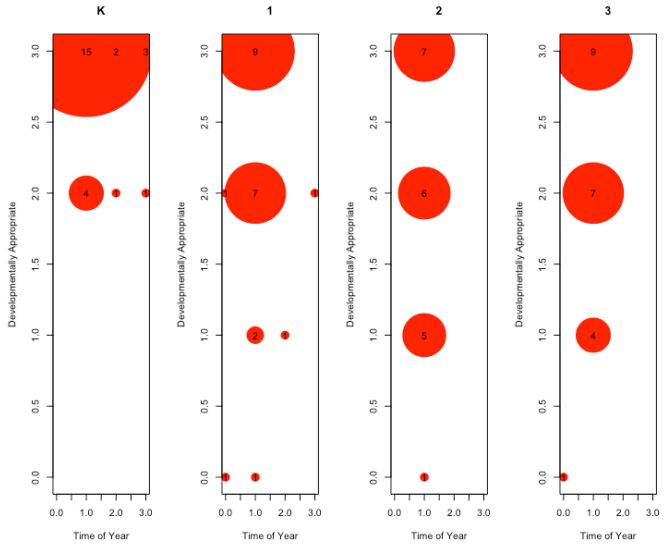

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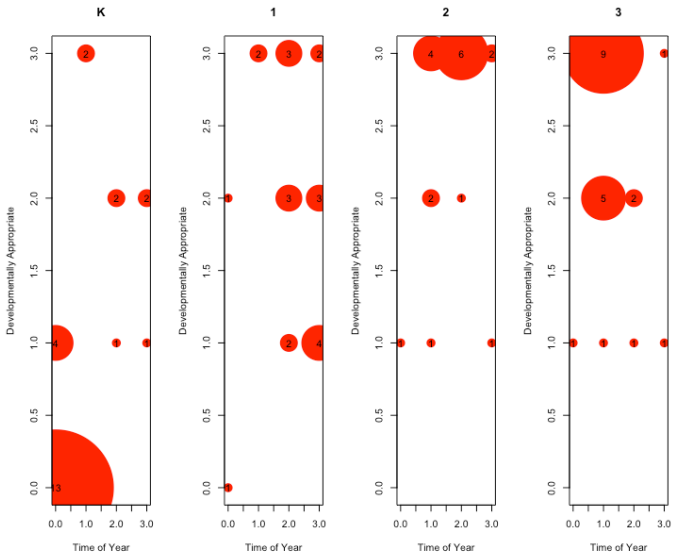

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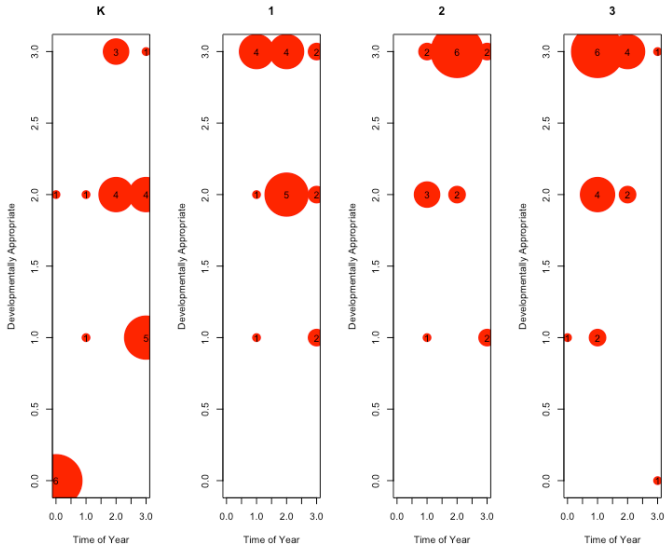

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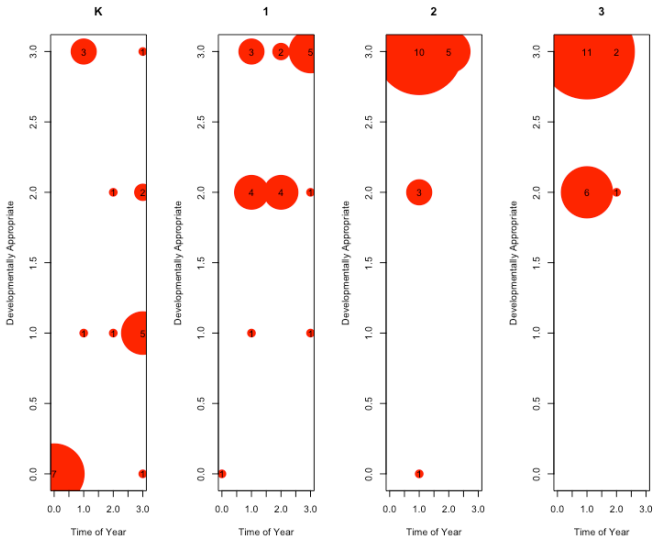

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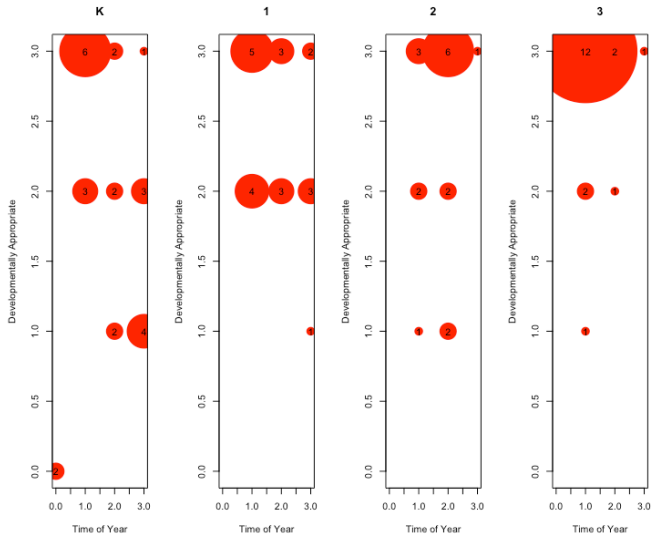
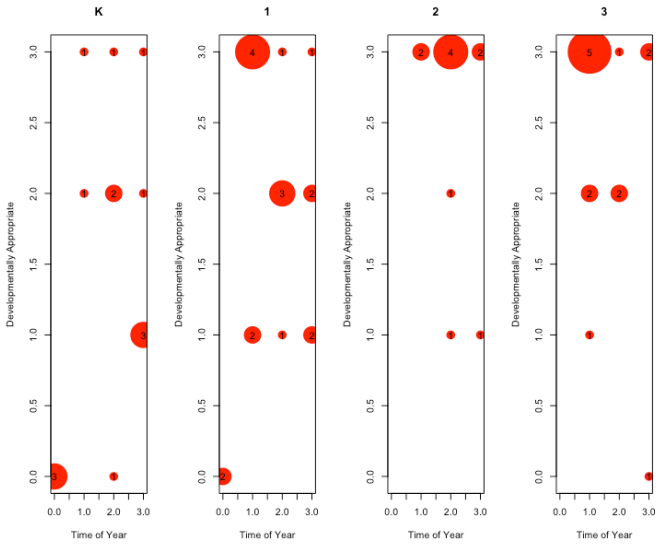


B.6.a



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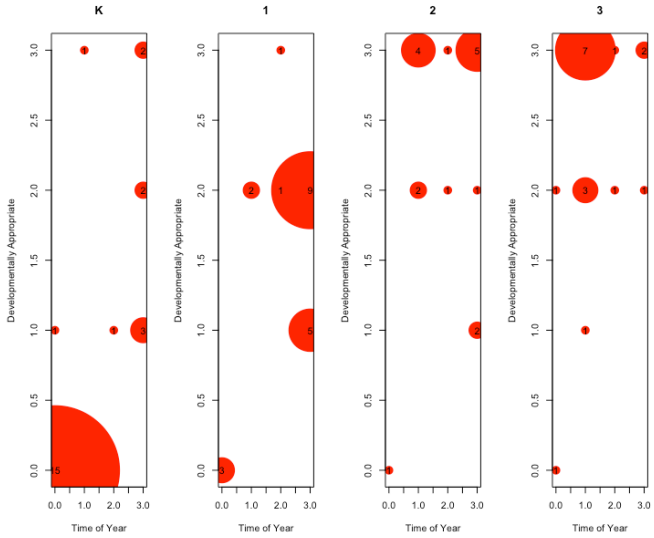

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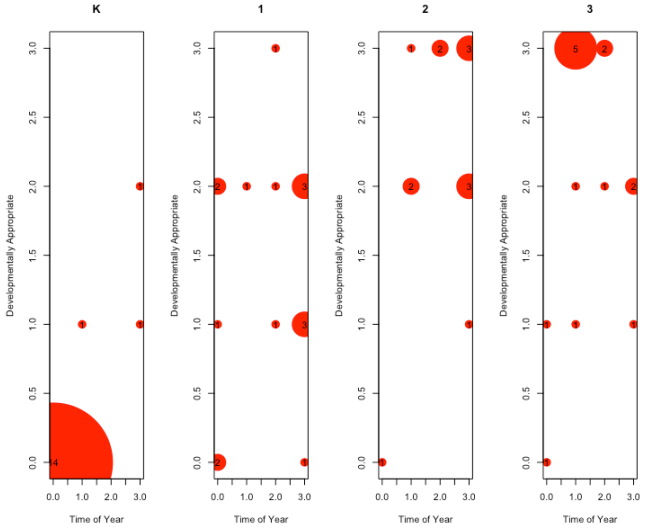

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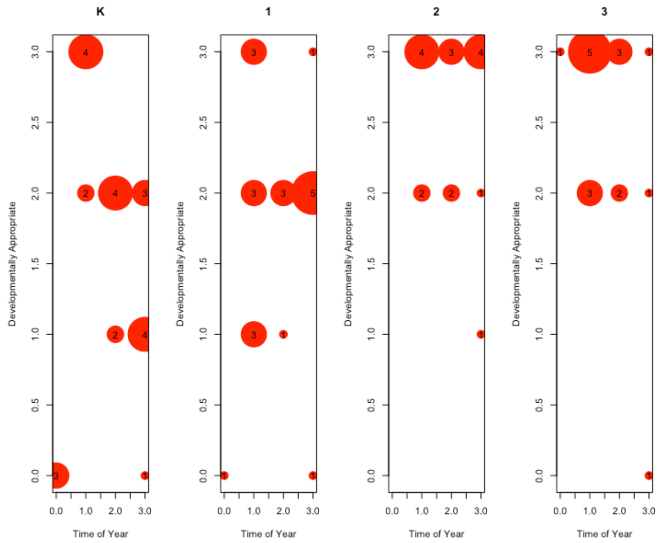

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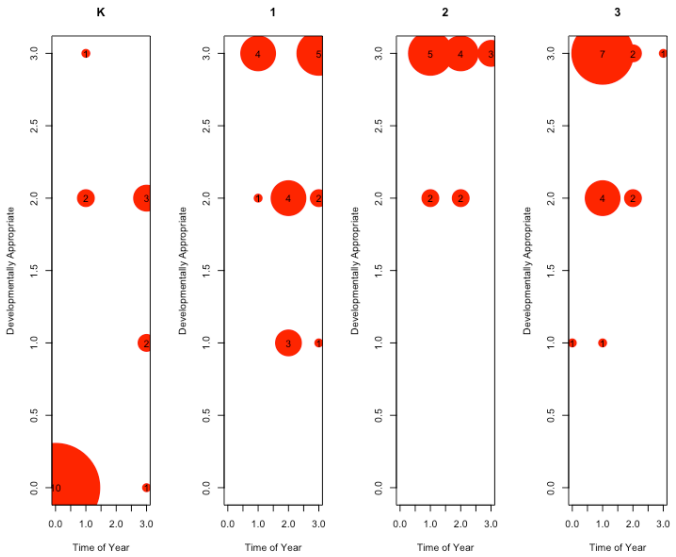
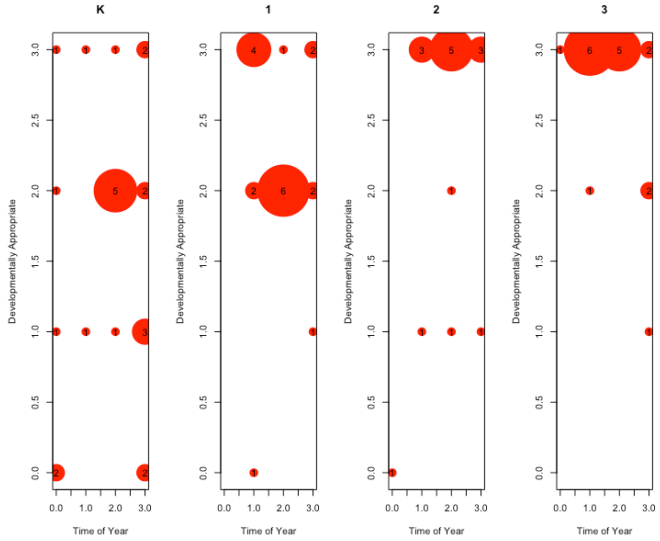


B.6.f



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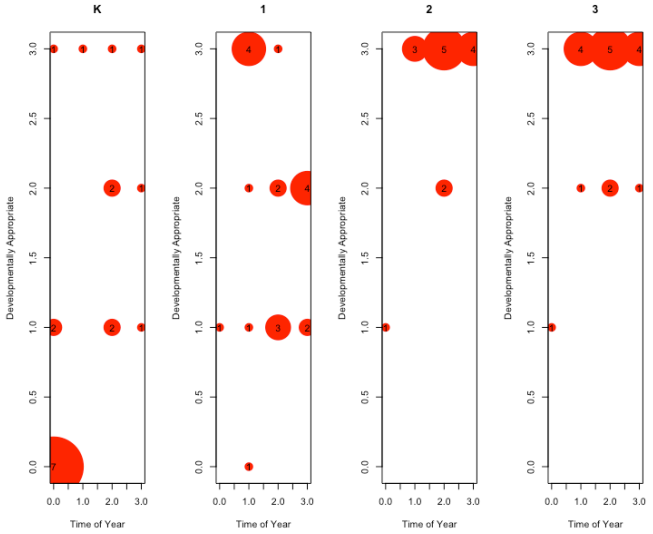
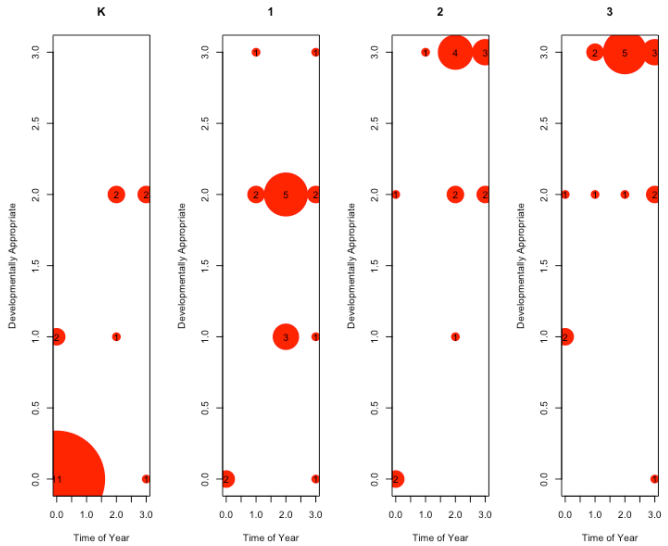
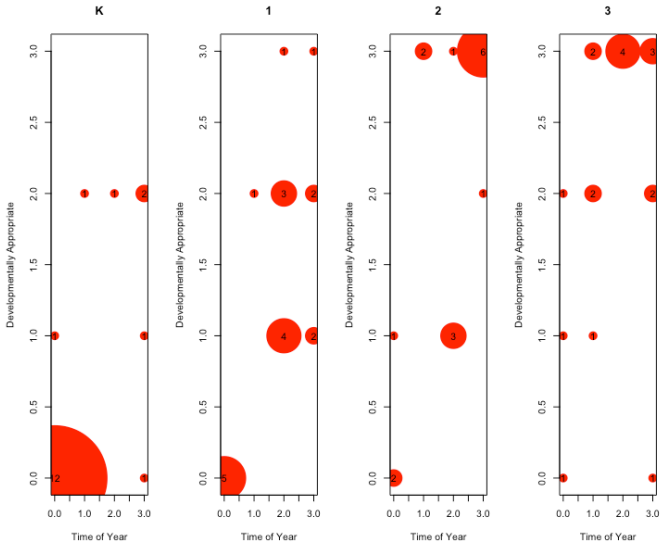


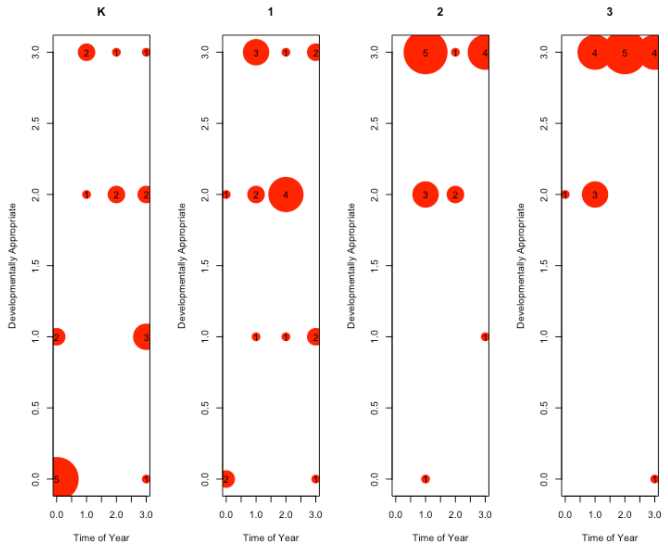
B.7.b



B.7.c



B.7.d



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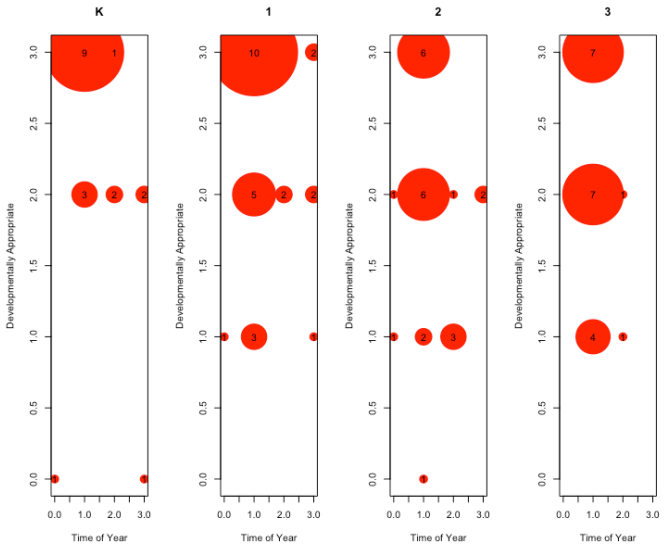
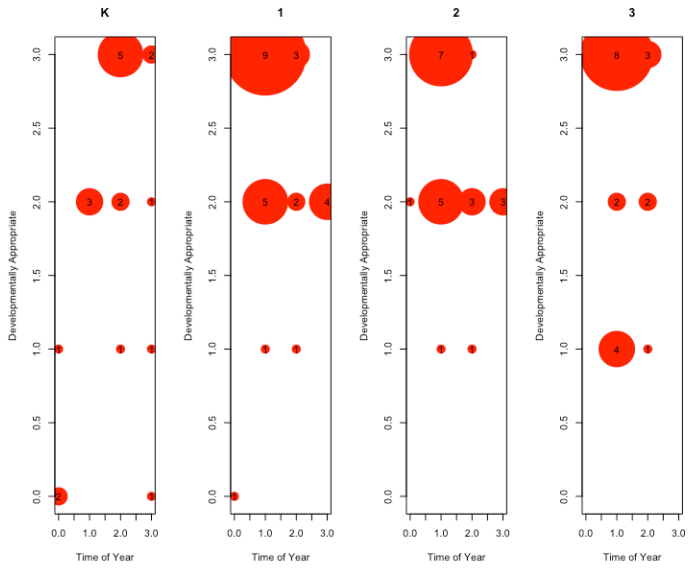
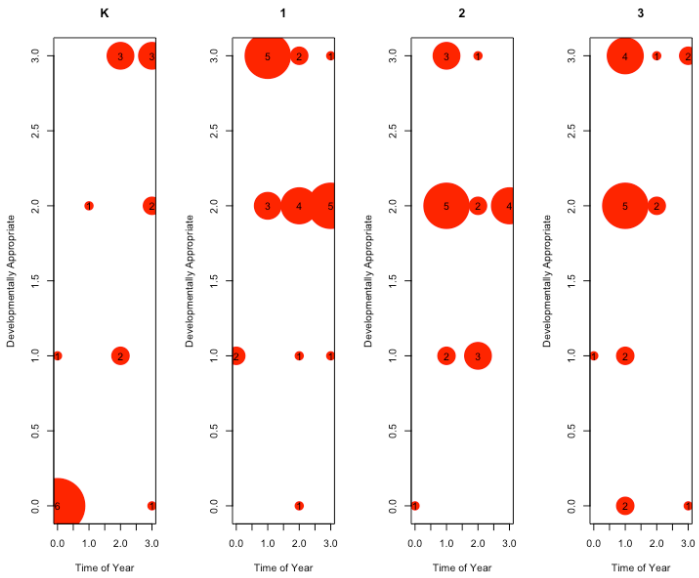


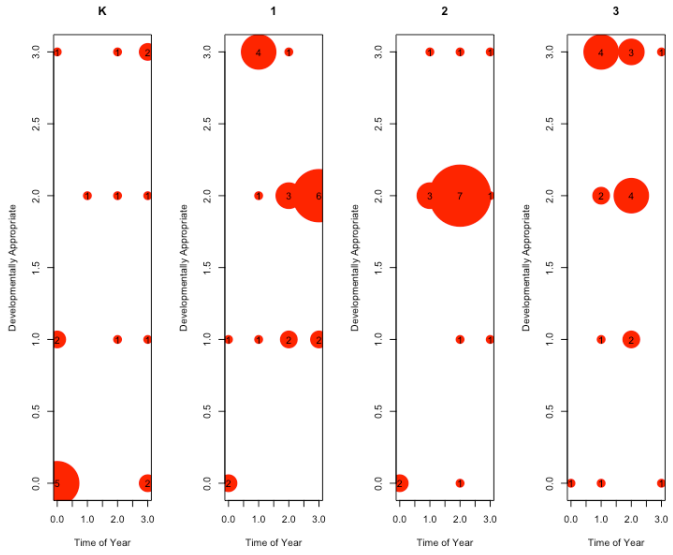
C.8.a



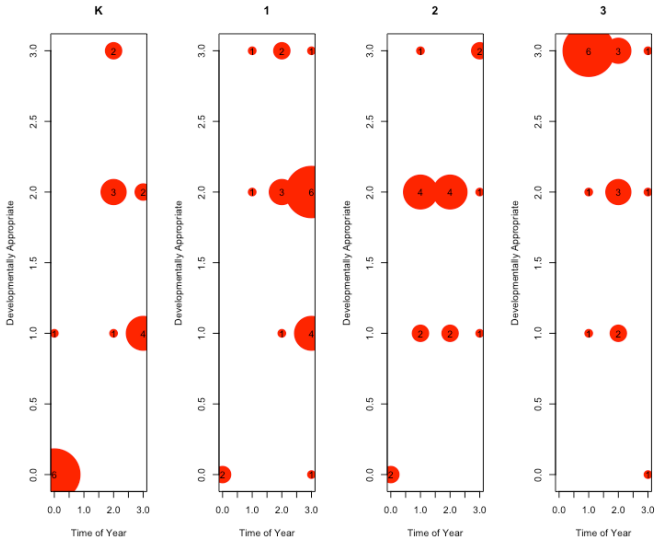
C.8.b



C.8.c



C.8.d



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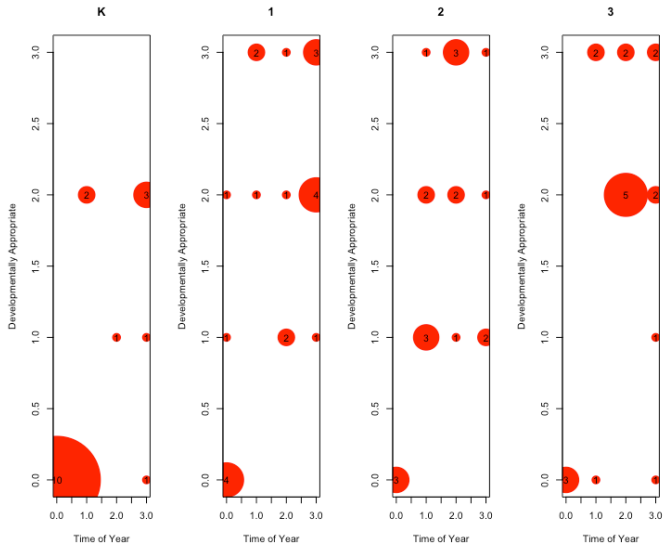

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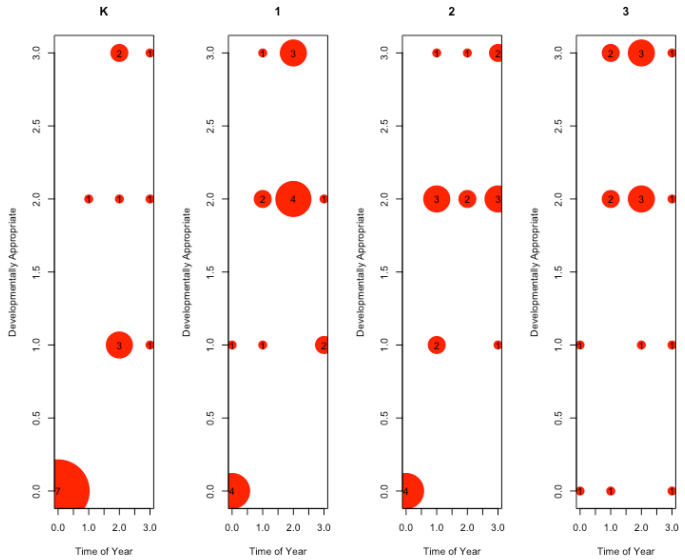
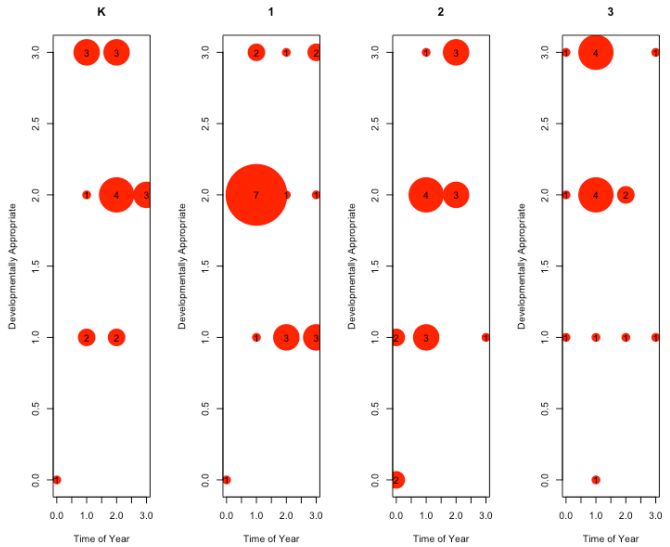


C.8.g



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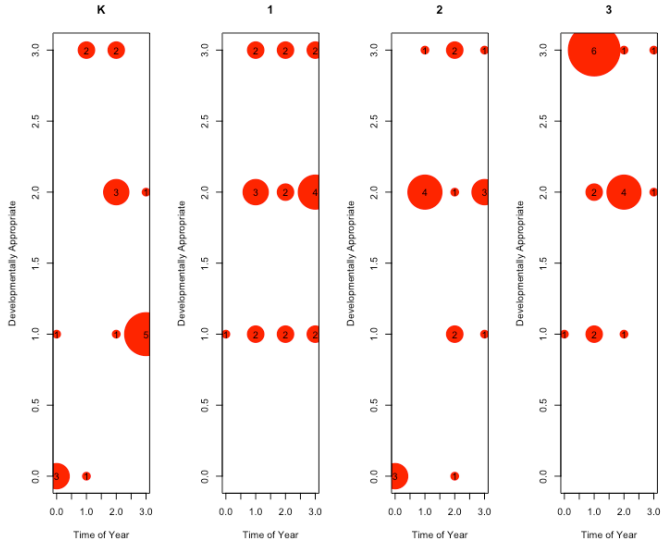

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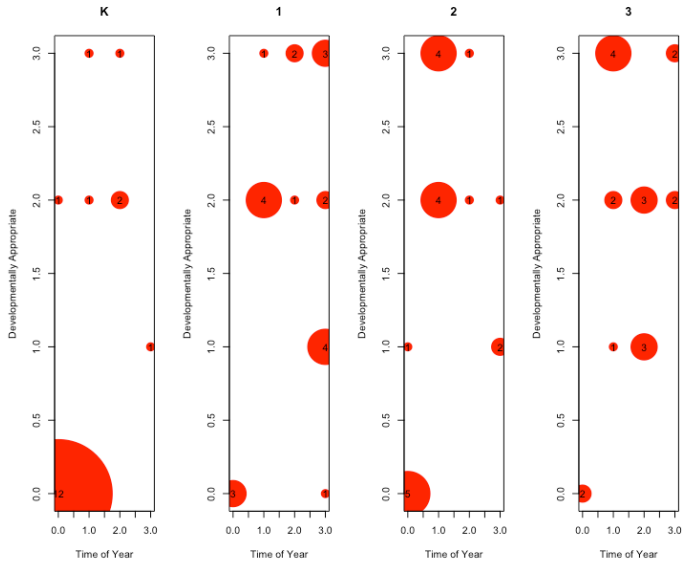

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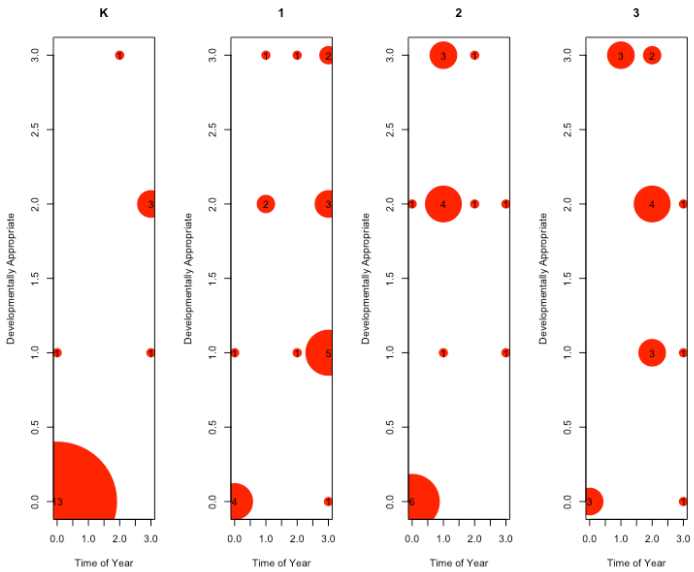
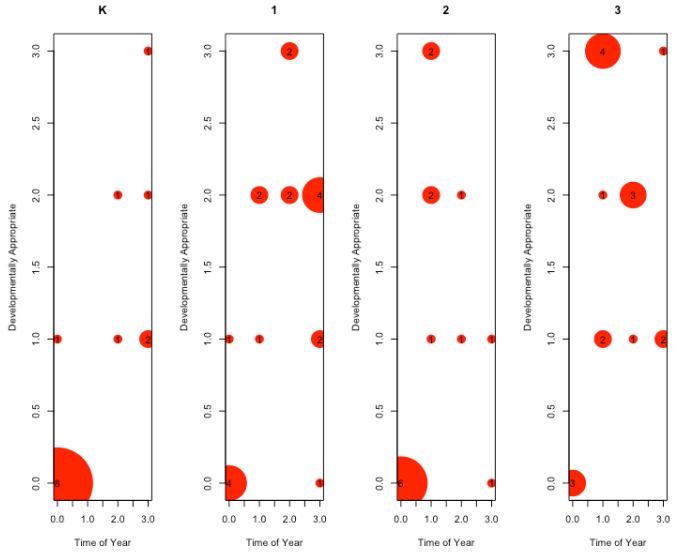


C.9.d



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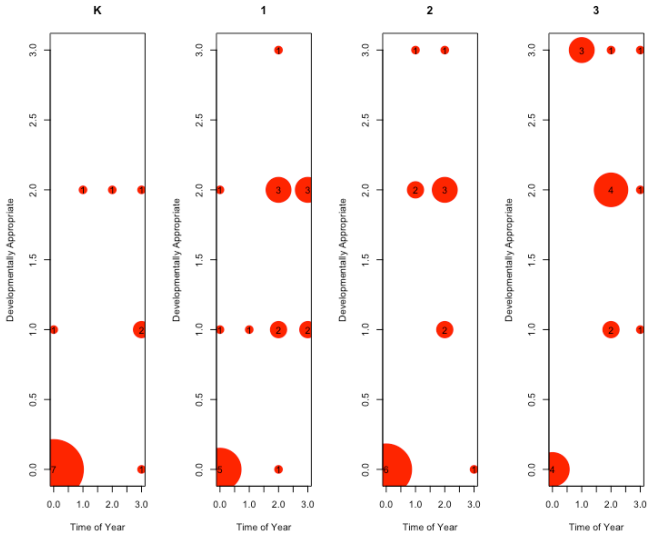

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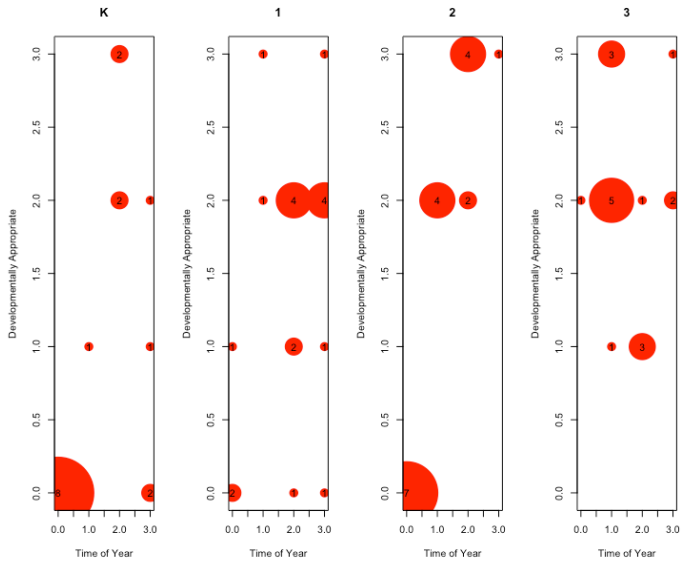

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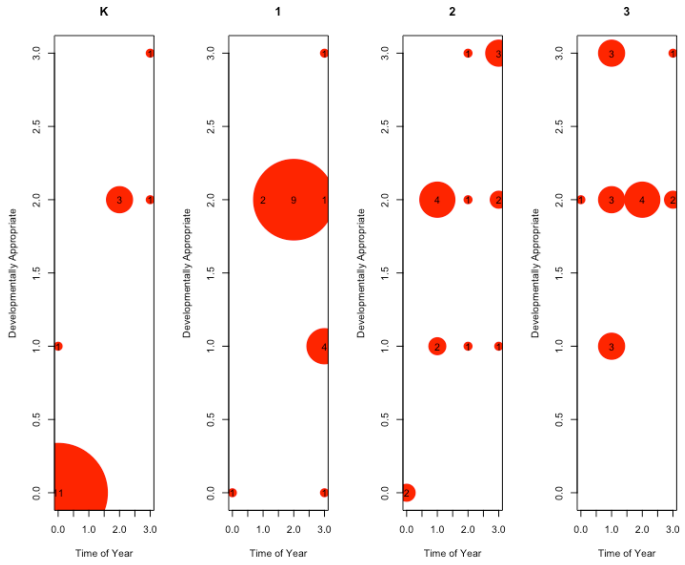

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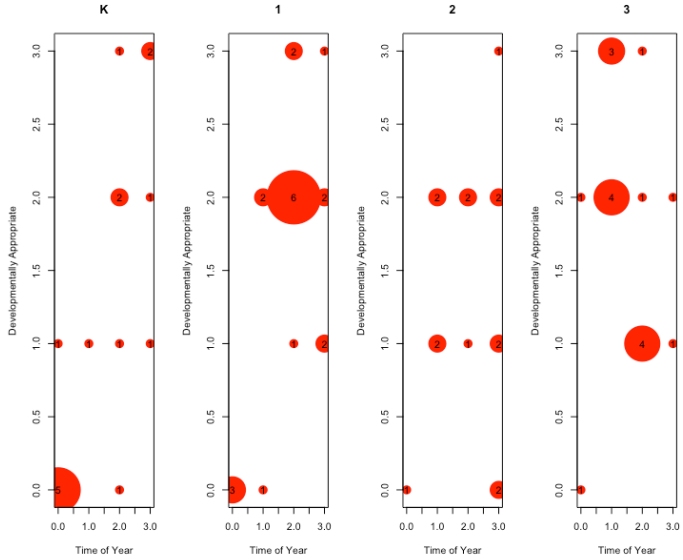

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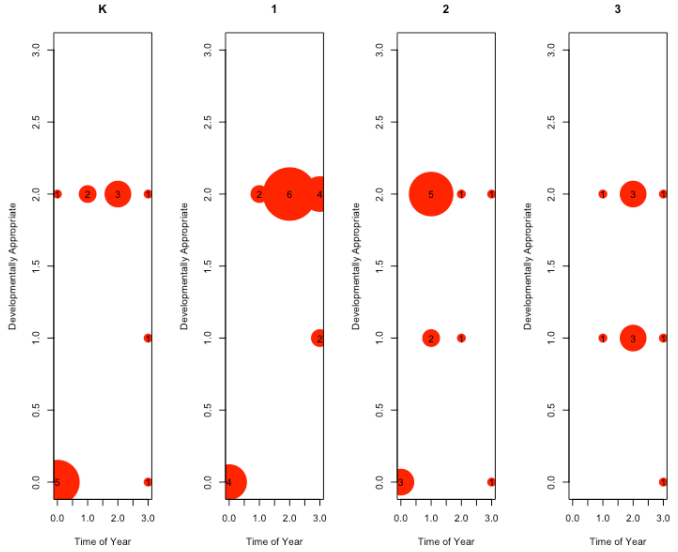
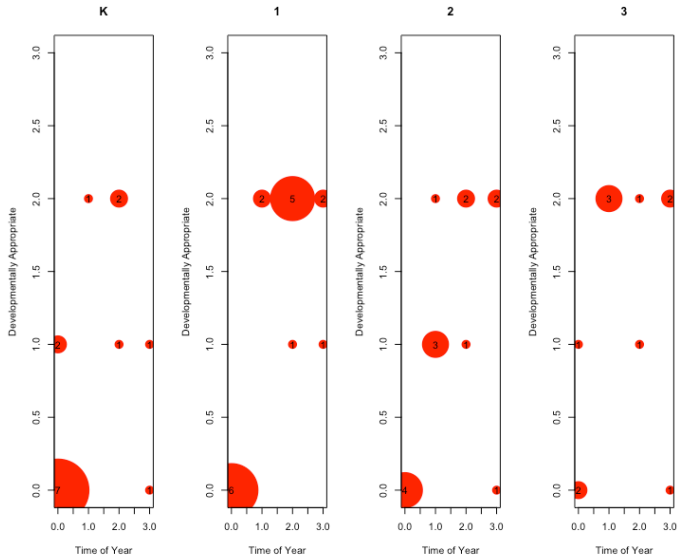
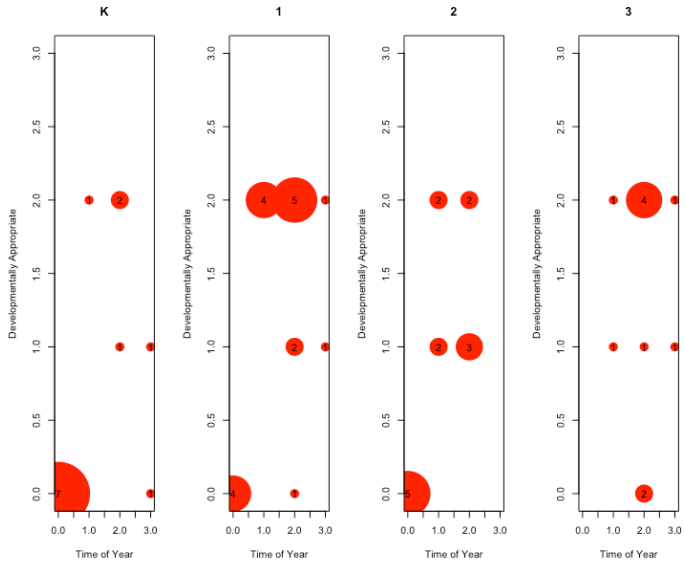


C.11.b



C.11.c



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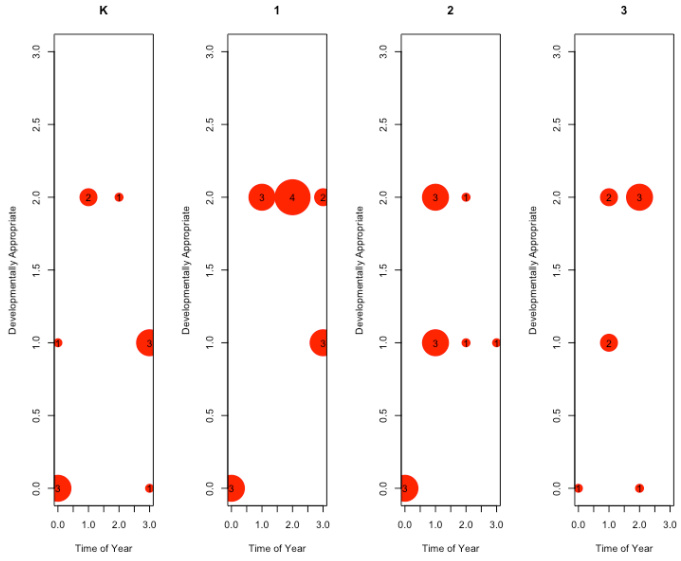

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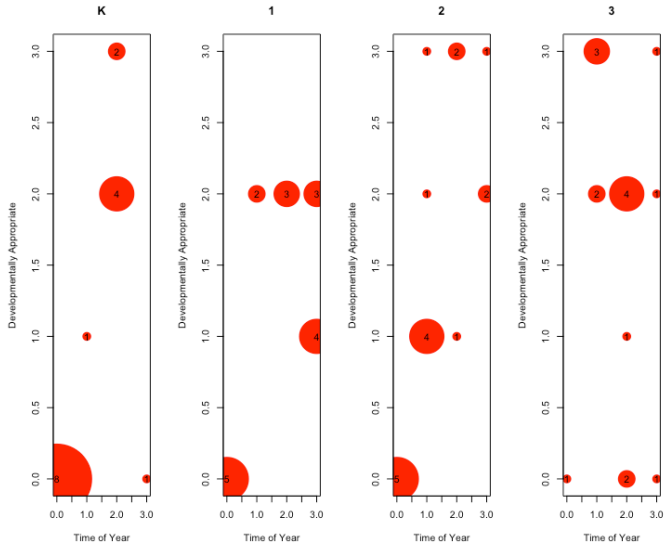
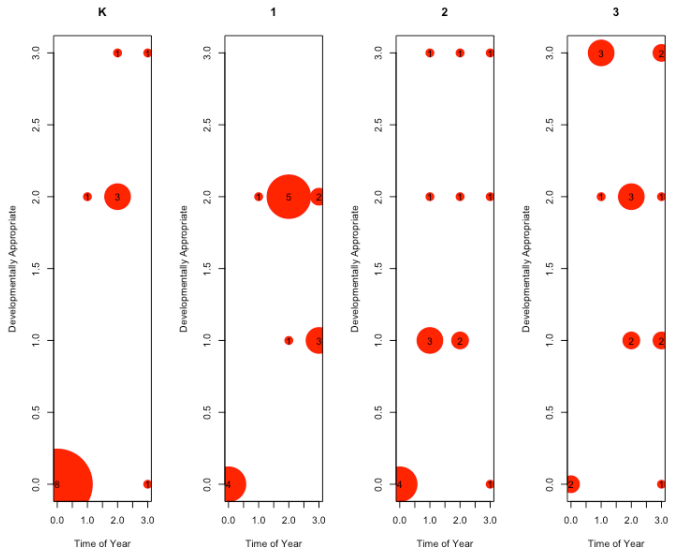


C.11.f


K
1
2
3
Developmentally Appropriate
Time of Year
0.0
0.5
1.0
1.5
2.0
2.5
3.0

C.11.g

Appendix H – Frequency of Teaching

Relations: Teaching frequency of skill statements by grade level

Skill Statement	Grade Level	N	Not Taught	2-3 Times per year	2-3 times per month	2-3 times per week	Fisher test results
A.1.a	K	15	0	2	3	10	p = .464
	1	25	0	6	7	12	
	2	23	1	2	11	9	
	3	25	1	3	11	10	
A.1.b	K	15	2	10	1	2	p = .024
	1	25	4	17	0	4	
	2	24	10	10	4	0	
	3	25	3	17	4	1	
A.1.c	K	15	4	2	5	4	p = .182
	1	25	9	4	7	5	
	2	23	3	4	12	4	
	3	24	1	8	8	7	
A.1.d	K	14	5	2	1	6	p < .001
	1	23	10	5	3	5	
	2	23	1	11	4	7	
	3	23	1	3	11	8	
A.1.e	K	15	1	3	4	7	p = .49
	1	24	0	3	13	8	
	2	23	0	6	10	7	
	3	22	0	2	11	9	
A.1.f	K	13	8	0	3	2	p < .001
	1	24	2	8	6	8	
	2	23	1	7	9	6	
	3	23	2	5	10	6	
A.1.g	K	15	8	4	2	1	p < .001
	1	23	0	4	7	12	
	2	23	0	4	13	6	
	3	23	0	5	6	12	
A.2.a	K	15	1	4	5	5	p = .905
	1	23	3	6	6	8	
	2	22	4	6	7	5	
	3	21	5	6	7	3	
A.2.b	K	13	2	1	3	7	p = .187
	1	22	6	1	6	9	
	2	21	2	4	10	5	
	3	23	6	6	7	4	
A.3.a	K	15	1	9	3	2	p = .043

	1	21	3	12	4	2	
	2	22	2	14	6	0	
	3	22	10	7	5	0	
A.3.b	K	11	3	4	1	3	p = .366
	1	20	4	4	6	6	
	2	20	4	7	6	3	
	3	21	6	1	7	7	
A.3.c	K	14	4	6	2	2	p = .682
	1	22	9	11	1	1	
	2	20	9	8	3	0	
	3	20	7	11	2	0	
A.3.d	K	12	3	3	5	1	p = .813
	1	21	2	6	8	5	
	2	21	1	10	7	3	
	3	21	3	7	8	3	
A.3.e	K	13	5	4	3	1	p = .087
	1	21	3	7	6	5	
	2	21	0	10	7	4	
	3	21	0	7	9	5	
A.3.f	K	14	8	3	2	1	p < .001
	1	20	6	6	5	3	
	2	19	2	3	11	3	
	3	22	1	5	7	9	
A.4.a	K	15	1	3	6	5	p = .780
	1	20	0	4	7	9	
	2	21	1	8	6	6	
	3	21	3	5	6	7	
A.4.b	K	13	2	3	3	5	p = .636
	1	20	0	3	8	9	
	2	22	1	7	9	5	
	3	21	2	4	8	7	
A.4.c	K	15	3	3	4	5	p = .084
	1	20	0	3	9	8	
	2	21	0	3	13	5	
	3	21	2	2	5	12	
A.4.d	K	15	3	3	3	6	p = .143
	1	20	0	3	11	6	
	2	21	1	3	7	10	
	3	22	0	1	9	12	
A.4.e	K	14	9	3	1	1	p < .001
	1	21	7	5	5	4	
	2	20	3	3	11	3	
	3	22	0	4	14	4	

Composition/Decomposition: Teaching frequency of skill statements by grade level

Skill Statement	Grade Level	N	Not Taught	2-3 Times per year	2-3 times per month	2-3 times per week	Chi-square results
B.5.a	K	26	1	3	6	16	p = .018
	1	23	1	5	8	9	
	2	19	1	9	2	7	
	3	21	1	3	12	5	
B.5.b	K						
	1						
	2						
	3						
B.5.c	K	25	17	3	1	4	p < .001
	1	21	2	8	7	4	
	2	18	1	0	8	9	
	3	21	1	5	10	5	
B.5.d	K	26	7	5	6	8	p = .017
	1	21	0	5	8	8	
	2	18	0	2	5	11	
	3	21	1	4	12	4	
B.5.e	K	22	8	4	1	9	p < .001
	1	22	1	4	9	8	
	2	19	0	2	5	12	
	3	20	0	3	10	7	
B.6.a	K	25	2	5	4	14	p = .198
	1	21	0	5	7	9	
	2	17	0	1	7	9	
	3	19	0	3	10	6	
B.6.b	K	14	3	5	4	2	p = .194
	1	18	3	5	4	6	
	2	11	0	3	3	5	
	3	14	0	2	9	3	
B.6.c	K	25	17	4	2	2	p < .001
	1	21	3	11	4	3	
	2	17	1	0	8	8	
	3	18	2	3	9	4	
B.6.d	K	17	14	3	0	0	p < .001
	1	16	5	6	4	1	
	2	13	1	3	5	4	
	3	15	2	3	7	3	
B.6.e	K	23	3	10	4	6	p = .228
	1	21	1	7	8	5	
	2	17	0	2	7	8	
	3	17	1	6	7	3	

B.6.f	K	19	10	5	1	3	p < .001
	1	20	0	3	7	10	
	2	16	0	0	2	14	
	3	18	1	3	8	6	
B.7.a	K	23	5	6	8	4	p = .005
	1	19	0	5	5	9	
	2	16	1	0	3	12	
	3	18	1	4	9	4	
B.7.b	K	19	10	4	4	1	p < .001
	1	20	1	6	7	6	
	2	15	1	1	3	10	
	3	18	1	4	8	5	
B.7.c	K	19	13	2	2	2	p = .003
	1	18	2	5	8	3	
	2	16	3	0	8	5	
	3	18	3	4	7	4	
B.7.d	K	19	13	2	1	3	p = .021
	1	19	5	3	8	3	
	2	16	3	2	7	4	
	3	18	3	4	9	2	
B.7.e	K	20	7	4	3	6	p = .018
	1	20	2	5	5	8	
	2	17	0	2	5	10	
	3	18	1	2	11	4	

Properties of Operations: Teaching frequency of skill statements by grade level

Skill Statement	Grade Level	N	Not Taught	2-3 Times per year	2-3 times per month	2-3 times per week	Chi-square results
C.8.a	K	19	1	2	7	9	p = .088
	1	26	2	13	7	4	
	2	23	2	10	7	4	
	3	20	0	11	5	4	
C.8.b	K	19	3	3	6	7	p = .284
	1	26	1	9	12	4	
	2	22	1	4	8	9	
	3	20	0	4	11	5	
C.8.c	K	19	7	2	5	5	p < .001
	1	25	2	12	5	6	
	2	21	1	6	8	6	
	3	20	1	5	10	4	
C.8.d	K	18	8	4	4	2	p = .004
	1	23	3	13	4	3	
	2	19	2	4	8	5	
	3	20	0	12	7	1	

C.8.e	K	19	7	3	6	3	p = .031
	1	22	2	12	5	3	
	2	19	2	4	7	6	
	3	19	0	6	6	7	
C.8.f	K	18	10	5	3	0	p < .001
	1	21	6	9	2	4	
	2	19	3	4	8	4	
	3	19	4	2	8	5	
C.8.g	K	17	7	2	7	1	p = .165
	1	19	5	7	4	3	
	2	19	4	4	6	5	
	3	18	2	3	5	8	
C.9.a	K	19	1	12	2	4	p = .239
	1	22	1	11	6	4	
	2	19	4	4	6	5	
	3	18	2	8	2	6	
C.9.b	K	19	3	7	6	3	p = .704
	1	22	1	10	5	6	
	2	19	3	5	4	7	
	3	19	1	5	6	7	
C.9.c	K	19	13	2	2	2	p = .013
	1	21	3	8	5	5	
	2	19	6	3	4	6	
	3	19	2	4	7	6	
C.9.d	K	19	14	3	1	1	p < .001
	1	21	4	12	2	3	
	2	19	7	3	5	4	
	3	18	3	3	11	1	
C.10.a	K	15	9	2	3	1	p = .553
	1	19	5	7	5	2	
	2	15	6	4	4	1	
	3	17	3	6	5	3	
C.10.b	K	14	8	3	3	0	p = .451
	1	20	7	7	5	1	
	2	16	6	3	4	3	
	3	17	4	3	6	4	
C.10.c	K	17	8	3	3	3	p = .081
	1	19	3	8	5	3	
	2	18	7	2	7	2	
	3	17	1	5	5	6	
C.10.d	K	17	12	0	2	3	p < .001
	1	19	1	11	6	1	
	2	17	2	6	5	4	
	3	17	1	3	8	5	
C.11.a	K	16	6	3	3	4	p = .337

	1	20	3	5	8	4	
	2	15	1	6	6	2	
	3	17	2	2	7	6	
C.11.b	K	17	6	3	3	5	p = .206
	1	19	4	6	7	2	
	2	18	3	7	4	4	
	3	17	0	5	7	5	
C.11.c	K	17	9	2	5	1	p = .550
	1	18	6	2	7	3	
	2	16	4	5	4	3	
	3	16	3	3	6	4	
C.11.d	K	15	7	2	3	3	p = .220
	1	19	4	6	4	5	
	2	17	5	4	4	4	
	3	16	0	5	7	4	
C.11.e	K	17	4	2	4	7	p = .872
	1	17	3	5	5	4	
	2	17	3	4	6	4	
	3	16	1	4	5	6	
C.11.f	K	16	8	2	3	3	p = .207
	1	17	5	7	3	2	
	2	17	5	6	3	3	
	3	16	1	4	7	4	
C.11.g	K	15	8	1	3	3	p = .184
	1	16	4	7	3	2	
	2	16	4	7	3	2	
	3	17	2	5	7	3	

Appendix I – Understandability

Relations: Clarity of skill statement language

Skill Statement	Grade Level	N	Does not Understand	Mostly Understands	Understands	Fisher's test results
A.1.a	K	16	0	3	13	p = .206
	1	25	0	7	18	
	2	24	1	1	22	
	3	26	1	3	22	
A.1.b	K	15	0	2	13	p = .628
	1	25	0	4	21	
	2	24	0	3	21	
	3	26	1	1	24	
A.1.c	K	15	0	3	12	p = .649
	1	25	0	4	21	
	2	24	0	2	22	
	3	26	1	2	23	
A.1.d	K	15	1	3	11	p = .115
	1	25	1	4	19	
	2	23	0	3	20	
	3	25	1	0	24	
A.1.e	K	15	0	2	13	p = .014
	1	24	0	0	24	
	2	23	0	0	23	
	3	24	2	0	22	
A.1.f	K	15	2	1	12	p = .049
	1	24	0	5	19	
	2	23	0	0	23	
	3	24	1	3	20	
A.1.g	K	15	0	1	14	p = .320
	1	24	0	0	24	
	2	23	0	0	23	
	3	24	1	0	23	
A.2.a	K	15	0	4	11	p = .267
	1	23	0	5	18	
	2	23	1	2	20	
	3	24	3	2	19	
A.2.b	K	15	2	4	9	p = .185
	1	23	0	3	20	
	2	23	1	1	21	
	3	24	1	4	19	
A.3.a	K	15	0	3	12	

	1	22	1	3	18	p =
	2	22	0	2	20	.528
	3	24	2	1	21	
A.3.b	K	15	4	3	8	p =
	1	22	2	6	14	.556
	2	22	2	3	17	
	3	24	3	3	18	
A.3.c	K	15	1	1	13	p =
	1	22	0	4	18	.173
	2	22	2	0	20	
	3	24	4	2	18	
A.3.d	K	15	3	0	12	p =
	1	22	0	6	16	.097
	2	22	1	2	19	
	3	24	2	3	19	
A.3.e	K	15	2	2	11	p =
	1	21	0	4	17	.509
	2	22	1	1	20	
	3	23	2	3	18	
A.3.f	K	15	1	4	10	p =
	1	21	1	0	20	.087
	2	22	3	1	18	
	3	23	1	1	21	
A.4.a	K	15	0	3	12	p =
	1	21	1	1	19	.640
	2	22	1	1	20	
	3	23	2	3	18	
A.4.b	K	15	2	1	12	p =
	1	21	1	2	18	.398
	2	22	0	0	22	
	3	23	2	1	20	
A.4.c	K	15	0	4	11	p =
	1	21	1	1	19	.090
	2	22	1	1	20	
	3	23	2	0	21	
A.4.d	K	15	0	2	13	p =
	1	21	1	1	19	.762
	2	22	1	0	21	
	3	23	1	1	21	
A.4.e	K	15	1	2	12	p =
	1	21	0	4	17	.619
	2	22	2	2	18	
	3	23	1	1	21	

Composition/Decomposition: Clarity of skill statement language

Skill Statement	Grade Level	N	Does not Understand	Mostly Understands	Understands	Fisher's test results
B.5.a	K	27	0	6	21	p = .061
	1	23	0	4	19	
	2	19	0	5	14	
	3	21	0	0	21	
B.5.b	K	26	0	8	18	p = .461
	1	23	0	3	20	
	2	19	1	4	14	
	3	21	0	4	17	
B.5.c	K	26	1	11	14	p = .361
	1	23	2	4	17	
	2	19	1	4	14	
	3	21	0	5	16	
B.5.d	K	26	0	9	17	p = .131
	1	23	2	2	19	
	2	19	1	6	12	
	3	21	0	4	17	
B.5.e	K	26	3	6	17	p = .363
	1	23	1	4	18	
	2	19	0	5	14	
	3	21	0	2	19	
B.6.a	K	25	0	2	23	p = .692
	1	23	2	2	19	
	2	19	1	3	15	
	3	20	0	2	18	
B.6.b	K	25	11	5	9	p = .566
	1	23	5	7	11	
	2	18	7	3	8	
	3	19	4	4	11	
B.6.c	K	25	0	9	16	p = .084
	1	23	2	4	17	
	2	18	1	1	16	
	3	18	0	2	16	
B.6.d	K	25	8	5	12	p = .480
	1	23	6	6	11	
	2	18	5	1	12	
	3	18	3	2	13	
B.6.e	K	24	1	3	20	p = .867
	1	22	1	5	16	
	2	18	1	2	15	
	3	18	1	1	16	

B.6.f	K	24	4	3	17	p = .310
	1	22	2	3	17	
	2	18	2	1	15	
	3	18	0	0	18	
B.7.a	K	23	0	6	17	p = .104
	1	22	3	1	18	
	2	18	2	1	15	
	3	18	0	2	16	
B.7.b	K	23	4	5	14	p = .340
	1	22	2	6	14	
	2	18	3	2	13	
	3	18	0	2	16	
B.7.c	K	23	4	5	14	p = .131
	1	22	4	3	15	
	2	18	2	0	16	
	3	18	0	2	16	
B.7.d	K	23	4	5	14	p = .663
	1	22	3	5	14	
	2	18	2	4	12	
	3	18	0	3	15	
B.7.e	K	23	3	3	17	p = .689
	1	22	2	4	16	
	2	18	1	1	16	
	3	18	0	3	15	

Properties of Operations: Clarity of skill statement language

Skill Statement	Grade Level	N	Does not Understand	Mostly Understands	Understands	Fisher's test results
C.8.a	K	19	0	2	17	p = .691
	1	26	0	6	20	
	2	24	0	6	18	
	3	22	0	5	17	
C.8.b	K	19	0	1	18	p = .459
	1	26	0	0	26	
	2	23	0	1	22	
	3	20	0	0	20	
C.8.c	K	19	0	0	19	p = .245
	1	26	0	2	24	
	2	22	0	0	22	
	3	20	0	0	20	
C.8.d	K	19	1	3	15	p = .506
	1	25	0	5	20	
	2	21	1	2	18	
	3	20	0	1	19	

C.8.e	K	19	0	8	11	p = .005
	1	23	0	7	16	
	2	20	1	1	18	
	3	20	0	1	19	
C.8.f	K	19	1	4	14	p = .331
	1	22	1	3	18	
	2	20	1	2	17	
	3	19	0	0	19	
C.8.g	K	19	2	5	12	p = .357
	1	22	3	4	15	
	2	20	0	7	13	
	3	19	1	2	16	
C.9.a	K	19	0	0	19	p = .026
	1	22	0	0	22	
	2	19	0	3	16	
	3	19	1	0	18	
C.9.b	K	19	0	1	18	p = .127
	1	22	0	1	21	
	2	19	0	4	15	
	3	19	0	0	19	
C.9.c	K	19	0	2	17	p = .644
	1	22	1	1	20	
	2	19	0	2	17	
	3	19	0	0	19	
C.9.d	K	19	0	1	18	p = 1.00
	1	22	1	1	20	
	2	19	0	1	18	
	3	19	0	0	19	
C.10.a	K	19	4	5	10	p = .898
	1	22	3	5	14	
	2	19	3	5	11	
	3	18	1	4	13	
C.10.b	K	19	5	2	12	p = .408
	1	22	2	7	13	
	2	18	2	6	10	
	3	18	1	4	13	
C.10.c	K	19	1	3	15	p = .095
	1	22	2	5	15	
	2	18	0	6	12	
	3	18	1	0	17	
C.10.d	K	18	1	3	14	p = .314
	1	21	1	1	19	
	2	18	1	4	13	
	3	18	1	0	17	
C.11.a	K	18	2	1	15	

	1	20	0	4	16	p =
	2	18	3	4	11	.343
	3	18	1	2	15	
C.11.b	K	18	1	3	14	p =
	1	20	1	2	17	.544
	2	18	0	5	13	
	3	18	1	1	16	
C.11.c	K	18	1	6	11	p =
	1	20	2	3	15	.191
	2	18	2	7	9	
	3	18	2	1	15	
C.11.d	K	18	3	4	11	p =
	1	20	1	5	14	.519
	2	18	1	5	12	
	3	18	2	1	15	
C.11.e	K	18	1	5	12	p =
	1	20	2	3	15	.216
	2	18	1	5	12	
	3	18	2	0	16	
C.11.f	K	18	2	6	10	p =
	1	19	2	6	11	.698
	2	18	1	6	11	
	3	18	2	2	14	
C.11.g	K	18	2	7	9	p =
	1	19	3	6	10	.348
	2	18	2	7	9	
	3	18	1	2	15	