An Evaluation of the Association Between the Use of the Ignite by Hatch™ Educational Gaming System and the Developmental Status of Young Children Participating in the 2023 Georgia DECAL Summer Transition Program

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Executive Summary

Closing the opportunity gap before a child enters kindergarten can change their academic trajectory for the rest of their life. Ignite by Hatch™ is designed based on research to support children's kindergarten readiness by providing learning experiences in several domains, including Mathematics, Literacy, and Language & Communication. The primary goal of this study was to examine the relationship between using the Ignite educational gaming system and assessments of the developmental status of young children participating in the Georgia DECAL Summer Transition Program. To meet this goal, researchers collected data on the extent to which children engaged with Ignite, the skill levels they achieved in the Ignite system, and teachers' external ratings of children's Literacy and Mathematics skills. All data was analyzed by a third-party psychometrician.

The data was collected in the Georgia Department of Early Care and Learning (DECAL) Summer Transition Program classrooms. The summer program had 3,752 children engage with the Ignite educational system across seven domains of development and learning. On average, the summer program had 5 weeks of Ignite playtime, for a recommended playtime of 150 minutes. At the end of the summer program, teachers assessed children's Mathematics and Literacy skills using rating scales developed by Hatch™ researchers based on the Georgia Early Learning and Development Standards (GELDS). About 45% of children in the summer program who engaged with the Ignite system were assessed using the provided rating scales. Advanced psychometrics were used to assess the validity, reliability, and developmental appropriateness of the rating scales. Correlational analyses and multilevel models were used to examine the relationship between the skill levels children achieved in the Literacy and Mathematics components of the Ignite educational system and their rated skill levels.

The psychometric analyses of the teacher rating scales demonstrated good promise of these scales as measures of developmental status. Additionally, results revealed a positive connection between the levels children achieved in the Ignite educational system and their skill levels rated by teachers. For Literacy and Mathematics, there was a gain, on average, in external assessment scores for every additional level achieved in Ignite. Children who achieved higher literacy levels in the Ignite educational system were rated by teachers as having stronger Literacy skills (.126). Similarly, children who achieved higher Mathematics levels in the Ignite educational system were rated by teachers as having stronger

Mathematics skills (.151). This connection between levels achieved in Ignite and children's rated Mathematics and Literacy skills did not vary by site or classroom. Therefore, there is a connection between children's Ignite engagement and their Literacy and Mathematics skills as measured by an external assessment.

Ignite by Hatch™ Third-Party Efficacy Study

Across all states, kindergarten teachers voice that a high number of their students enter school unprepared to engage with the curricular guidelines and meet the objectives (Goldberg, 2021). To further support students' kindergarten readiness, many preschools could benefit from alternate, highly engaging methods for preparing children for kindergarten (Stites et. al., 2021). When these alternate methods involve technology, they can enhance long-term retention of information and further enhance children's learning (Hao et al., 2021). Understanding the technological tools that can support student learning is critical because interventions that provide quality enhancements to existing preschool programming can support children's learning and achievement throughout their educational careers (McCoy et. al., 2019).

This study sought to investigate the role of Ignite, a highly engaging, technological tool, in promoting preschool children's kindergarten readiness. Researchers collected data that described the extent to which the children engaged with the Ignite system and the skill levels they achieved within the system. Teachers also externally rated the developmental status of the children using rating scales that focused on Literacy and Mathematics skills. For this study, a third-party psychometrician examined the validity and reliability of the external rating scales of developmental status, the connections between playtime in Ignite and Ignite levels achieved, and the relationship between using the Ignite educational gaming system and external assessments of the developmental status of young children participating in the Georgia DECAL Summer Transition Program.

SAMPLE

This study examined the full sample of children who used Ignite during the 2023 Georgia DECAL Summer Transition Program (N = 3,752). Of the entire group of children who used Ignite during the summer program, 45.3% (n = 1,700) of children were assessed by their teacher using an external rating scale for their Literacy skills, and 43.4% (n = 1,628) of children were assessed by their teacher using an external rating scale for their Mathematics skills. Additional demographic data or information on the features of the summer program school sites was not available.

METHOD

There were 234 schools in the Georgia DECAL Summer Transition Program who used Ignite. On average, the summer program had 5 weeks of Ignite playtime, with an average of 128.9 minutes (about 2 hours) of Ignite engagement per child over the course of the program. At the end of the summer program, teachers used two new assessment measures developed by researchers at Hatch to assess children's developmental progress. These measures were designed to evaluate the Literacy and Mathematics skills of preschool-aged children participating in the Georgia DECAL Summer Program. They offer a way for teachers to gauge a child's developmental progress based on specific instructional objectives aligned with the Georgia Early Learning Development Standards (GELDS). Each child is rated on a scale ranging from "Not Yet" to "Demonstrating," indicating their level of achievement in various skills. Appendix A of this report contains the instructional objectives from the GELDS that align with each developmental progression along with the full text of each progression.

ANALYTICAL APPROACH

Once Hatch received the Ignite and assessment data, the third-party psychometrician conducted several statistical analyses. First, given the novelty of the assessment measures, the psychometric properties of the measures were evaluated. Rasch modeling was used to determine whether the Literacy and Mathematics assessments each measured a single underlying skill. Item difficulty measures provided insight into the difficulty progression of the assessments and how the progressions aligned with children's developmental skills. Reliability measures were used to determine the extent to which the assessment can differentiate children's abilities, the consistency of the difficulty measures, and whether the measures were consistent across sites and used by teachers as intended.

In addition, correlational analyses were used to determine the connections between the time children spent with the system, their skill levels within the games, and their assessment scores. Finally, to understand how Ignite shapes children's development, we took a more detailed approach. We began by identifying the highest level that children achieved in both the Literacy and Mathematics domains in Ignite. Children who reached Level 4 or higher were grouped together because Level 4 signifies kindergarten readiness, and very few children reached Levels 5, 6, 7, or 8. Using this approach, the connection between levels and standard scores for both the Literacy and Mathematics assessments was examined.

We then compared two groups: those who engaged with Ignite but only reached Level 1 (the baseline group) and those who reached Level 4 or higher (the treatment group). To provide a more complete picture and control for site differences, we employed multilevel modeling. This approach considered the children's site (classroom or teacher) as a factor that might affect their progress. Consequently, Level 1 of the model included the maximum level a child achieved as the predictor variable and the standards score as the outcome variable, and Level 2 of the model included the site where children attended the summer program. Children who achieved Level 1 in Ignite were the baseline or comparison condition, and children who achieved Levels 2, 3, or 4 or higher were dummy-coded comparison groups treated as group-mean-centered, fixed-effects predictor variables. Using this model, we tested whether the effects of different levels achieved on developmental skills as measured by the external assessments were consistent or variable across sites.

RESULTS

Psychometric Properties of the Assessments

The analyses of the psychometric properties of the Literacy and Mathematics assessments revealed that the assessments showed strong promise as measures of children's developmental status. Separate exploratory factor analyses of the Literacy and Mathematics assessments revealed that each aligned with a single underlying construct, demonstrating the unidimensionality of the assessments. For the Literacy assessment, a single factor explained nearly 60.0% of the variance in the ratings, with factor loadings ranging from 0.610 to 0.836. For the mathematics assessment, a single factor explained approximately 60.9% of the variance in the ratings, with factor loadings ranging from 0.711 to 0.840. This indicates a strong alignment between the assessment and the expected developmental trajectory for preschoolers. In addition, the mean-square progression fit statistics fell within the acceptable range, demonstrating that each progression of both assessments contributes valuable information to the overall scores. Moreover, the reliability measures of both assessments exceeded the recommended thresholds, showing that we can expect consistent and reliable results when teachers use these progressions to assess the developmental skills of young children. Finally, as each rating scale category across both the Literacy and Mathematics assessments were assigned at least 100 times, teachers effectively used the rating scale categories, which contributes to the assessments' reliability as measures of development. In summary, our analysis demonstrates that the Literacy and Mathematics assessments used in this study are reliable tools for evaluating the developmental progress of preschool-aged children.

Exploring Correlations in the Ignite Educational Gaming System

The analyses indicated that the more time children spent engaging with Ignite, the more they engaged with both the Literacy (r (3734) = .942, $p < .01$) and Mathematics (r (3734) = .936, $p < .01$) games. Moreover, the longer children spent engaging with the Literacy and Mathematics games, the higher skills levels they achieved in those domains (r_{math} (3734) = .543, p < .01 and $r_{literacy}$ (3734) = .746, $p < .01$, respectively; see Table 1. For example, children who reached Literacy Level 4 played for an average of 90.93 minutes, while Level 1 players enjoyed 6.92 minutes of play (see Table 2). In Mathematics, children who reached Level 4 had an average playtime of 66.97 minutes, while those at Level 1 spent 19.98 minutes in Ignite (see Table 3). This indicates that meaningful engagement with Ignite is linked to skill development within the Ignite system.

Connection Between Ignite Achievement and Literacy and Mathematics Assessment Scores

Next, the connection between children's Ignite achievement and their Literacy and Mathematics assessment scores were examined. These results focus only on those students who were assessed by their teachers. The correlational analyses revealed that those children who reached higher Literacy levels in Ignite also achieved higher Literacy skill levels on the external assessments (r (1698) = .126, $p < .01$). Similarly, those children who reached higher Mathematics levels in Ignite also achieved higher Mathematics skills on the external assessments (r (1626) = .151, $p < .01$). Specifically, for every additional level achieved, there was a corresponding gain in children's standardized scores on both the Literacy and Mathematics assessments. For example, children who reached only Level 1 in Literacy had an average score of 479.03 on the Literacy assessment. Those at Level 2 had an average score of 502.77, those at Level 3 scored an average of 523.83, and those at Level 4 or higher reached an average of 536.83 (see Table 4). The same pattern emerged in Mathematics, with assessment scores rising as Ignite levels advanced (see Table 4).

Finally, the multilevel model, which controlled for site and classroom differences, showed a similar pattern of results. There was a significant positive association between time spent engaging with the Ignite educational system and children's external Literacy (pseudo r = .136) and Mathematics (pseudo r = .139) assessment scores. In addition, compared to children who remained at Level 1, those who reached Levels 2, 3, and 4 or higher displayed statistically significant effects for both Literacy and Mathematics. For Literacy, when considering site differences, the model predicted that children who achieved Level 2 would score

41.23 points higher than Level 1 children ($p < .001$), Level 3 children would score 77.03 points higher ($p < .001$), and Level 4 or higher children would score 92.66 points higher ($p < .001$). Similarly, for Mathematics, the model predicted that children who achieved Level 2 would score 18.92 points higher than Level 1 children ($p < .01$), Level 3 children would score 53.50 points higher ($p < .001$), and Level 4 or higher children would score 97.47 points higher ($p < .001$). Across both Literacy and Mathematics, when controlling for Ignite engagement time, the level achieved displayed a stronger association with assessment scores, suggesting that the level reached in the Ignite system had a more profound connection with assessment scores than the time spent engaging. Essentially, the amount of progress children make in Ignite is a more important predictor of children's external assessment scores than time spent engaging in Ignite. The model revealed that these results were consistent across sites. Figures 1 and 2 illustrate this consistency, indicating that the magnitude of the effects remained robust regardless of differences in teacher ratings or initial developmental levels of the children. Ultimately, these findings underscore the positive connection between the Ignite educational gaming system and children's development, demonstrating Ignite's potential as an effective educational tool.

CONCLUSION

This study offers encouraging findings regarding the Ignite educational system and its connection to children's Mathematics and Literacy skills as measured by external assessments. When children spend sufficient time with and make progress in Ignite, they also tend to demonstrate stronger external Mathematics and Literacy skills. However, the study highlights an essential point: spending time in the system is not enough to ensure progress. Children need to actively engage with the skills in Ignite in meaningful ways. Subsequently, children's progress in Ignite is reflected in their Literacy and Mathematics skills as measured by the assessment created by Hatch researchers.

Despite these promising findings, it's crucial to acknowledge some limitations. First, the assessment measures used in this study are relatively new, and more research is needed to establish their effectiveness for both research and instructional purposes. Additionally, this study was observational, meaning there was no random assignment of children to different groups. This leaves room for potential preexisting differences between children who achieved higher levels in the Ignite system and those who remained at Level 1. Future research should investigate whether children with higher initial skills are more likely to attain higher levels within the gaming system.

Moreover, because not all teachers completed the assessments, these results may not apply universally to all children. It's possible that teachers who did complete the assessments placed greater emphasis on using the Ignite system in their classrooms. Also, differences may exist between teachers who emphasize assessment and Ignite in their teaching, potentially leading to varying assessment practices. Future research should explore the consistency of teachers' assessments of child developmental status using measures like those employed in this study.

In conclusion, this study underscores the potential of the Ignite educational gaming system to support children's skill development when used effectively. However, it's important to recognize the need for further research to solidify the findings and address the identified limitations, especially in terms of the new assessment measures and the impact of the system on children's progress compared to no exposure to Ignite.

References

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Table 1

Correlations Between Ignite by Hatch™ Educational Gaming System Variables

	Total PT	Mathematics PT	Literacy PT	Literacy level
Mathematics PT	.936**			
Literacy PT	.942**	.824**		
Literacy level	.698**	.597**	.746**	
Mathematics level	.576**	.543**	.643**	.682**

Note. PT = playtime; SS = standard score; * = $p < .05$, ** = $p < .01$.

Table 2

Playtime by Maximum Literacy Level Achieved in Ignite

		Playtime	
Literacy level achieved	Number of children	Mean	*SD*
1	705	6.92	3.93
2	2,629	27.41	11.78
3	282	51.25	12.52
4+	120	90.93	39.02
Total	3,736	27.38	20.31

Table 3

Playtime by Maximum Mathematics Level Achieved in Ignite

		Playtime	
Mathematics level achieved	Number of children	Mean	*SD*
1	785	19.98	16.50
2	893	41.49	17.25
3	1,408	52.46	20.96
4+	374	66.97	32.83
Total	3,460	43.83	25.54

Table 4

Literacy and Mathematics Standard Scores by Level

Maximum Literacy level achieved	*n*	Literacy standard scores Mean	*SD*
1	218	479.03	112.38
2	1,153	502.77	97.80
3	117	523.83	82.08
4+	59	536.83	69.91
Total	1,547	502.32	98.72

Maximum Mathematics level achieved	*n*	Mathematics standard scores Mean	*SD*
1	293	479.73	103.47
2	381	495.63	105.20
3	628	511.55	94.02
4+	151	528.41	80.05
Total	1,453	502.71	98.75

Figure 1

Contrasts Between Literacy Standard Scores for Levels 1 and 4 by Site

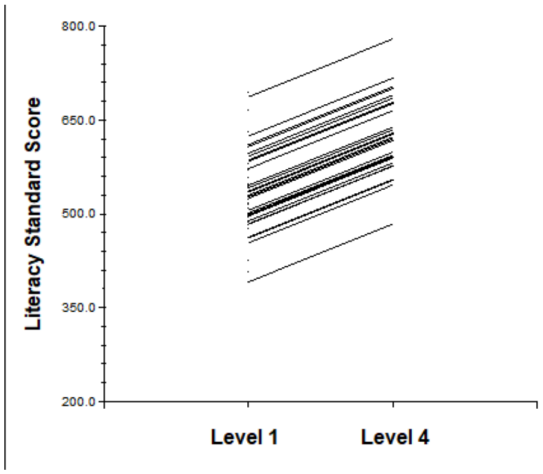
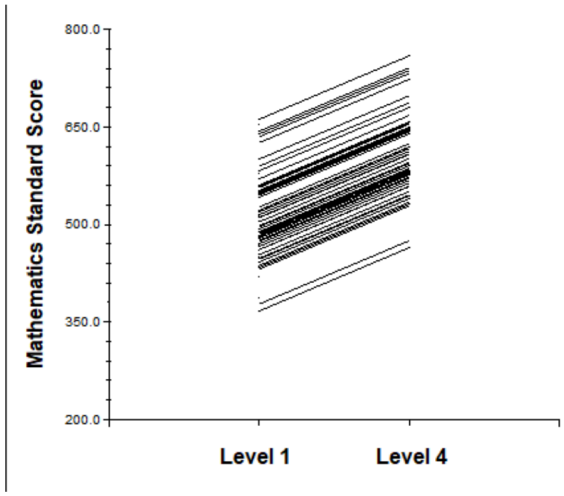


Figure 2

Contrasts Between Mathematics Standard Scores for Levels 1 and 4 by Site



Appendix A
Assessment Measures

LITERACY					
Early Reading		**Not Yet**	**Beginning**	**Developing**	**Demonstrating**
CLL5.4a	Prior to reading, uses prior knowledge, story title and pictures to make predictions about story content.		With educator support, can identify what characters may be doing in a story based on the illustrations. When an educator points to a picture on a page and says, "What do you think the characters are going to do now? They just put on their bathing suits and are near the water," the child may say, "They are going swimming."	With less educator support, can make predictions about what will happen next based on illustrations. When an educator turns the page and says, "What do you think will happen now that they have their bathing suits on?" a child may say, "They are going to go swimming."	Without educator support, can make predictions about what will happen based on prior knowledge and illustrations. A child may say, "They are wearing bathing suits. They are going to go swimming."
CLL5.4b	Retells familiar stories.		Can recall key events and people but may miss some details and require some educator support to follow a clear beginning, middle, and end.	Tells stories with a clear beginning, middle, and end with some details missing that may require educator prompts.	Tells stories with detail that cover the beginning, middle, and end without educator prompts.
CLL5.4c	Discusses books or stories read aloud and can identify characters and setting in a story.		With educator support, can identify either characters or setting.	With educator support or with a story they have read multiple times, can identify both the characters and the setting.	Without educator support, can identify characters and a setting.
CLL5.4d	Makes real-world connections between stories and real-life experiences.		Requires educator support. An educator may say, "It looks like the child in this story is sad. Have you ever felt sad?" A child may respond "yes" and recall a time they also felt sad.	Connects simple things from the story to their life. A child may say, "I have blue sneakers, too!"	Without educator support, recalls a familiar experience they had with the experience in a story. A child may say, "I once went to the zoo with my mom like the boy in the story, but I didn't see a tiger—I saw monkeys."
CLL5.4e	Develops an alternate ending for a story.		A child may choose a different ending based on options provided by an educator.	Without support, a child comes up with a unique ending for a story that may or may not be connected to the rest of the story.	Without support, a child comes up with a unique ending for a story that is connected to the rest of the story.
CLL6.4a	Listens and differentiates between sounds that are the same and different.		Without educator support, can identify and differentiate between a few consonant sounds.	With educator support, can identify and differentiate between some vowel and consonant sounds.	Without educator support, identifies and differentiates between some vowel and consonant sounds.

CLL6.4b	Identifies and produces rhyming words.		Can produce rhymes together with educator support during songs.	Can fill in a missing word in a song or sentence that rhymes without educator support.	Generates a rhyming word without educator support or decides that a word does or does not rhyme.
CLL6.4c	Isolates the initial (beginning) sounds in words with adult guidance.		Sings songs that isolate the beginning sounds.	Identifies two words that have the same initial sound.	With educator prompts, can produce the beginning sound in a word.
CLL6.4d	Segments sentences into individual words.		With educator support, can identify one or two words in a sentence.	Without educator support, can identify one or two words in a sentence.	Without educator support, can identify multiple words or all words in a sentence.
CLL6.4e	Segments words into syllables.		Claps along to syllables during songs with educator support.	Claps along or identifies the first syllables of rhyming words without educator support.	Claps along or sounds out a few or all of the syllables of individual words without educator support.
CLL6.4f	Manipulates and blends sounds (phonemes) with adult guidance.		With educator support, can change the initial sound of words to create new words during songs or rhymes.	With some educator support, can change the initial or ending sounds of words to create new words during songs or rhymes.	With some educator support or no educator support, can change the initial or ending sounds of words to create new words during songs or rhymes.
CLL7.4a	With prompting and support, recognizes and names some upper/lowercase letters of the alphabet.		With educator support, recognizes uppercase letters of the alphabet in their name.	With educator support, recognizes and identifies uppercase and lowercase letters of the alphabet in their name.	With some or no educator support, recognizes and identifies 5 to 10 uppercase or lowercase letters of the alphabet.
CLL8.4a	Demonstrates interest in different kinds of literature, such as fiction and nonfiction books and poetry, on a range of topics.		With educator prompts or guidance, flips through different kinds of books.	With peers, explores different types of books.	Independently seeks out different kinds of books.
CLL8.4b	Understands that letters form words. Understands that words are separated by spaces in print.		With educator support, identifies letters within words and can track words separated by spaces in print.	With some educator support, identifies letters within words and can track words separated by spaces in print.	Without educator support, identifies letters within words and can track words separated by spaces in print.
CLL8.4c	With prompting and support, tracks words from left to right, top to bottom and page to page.		With educator support, can point to a few words in a row on a page with one simple sentence.	With educator support, can point to a few words in a row on a page with multiple sentences and follow along.	With little or no educator support, can track a few words in a row on a page.

CLL8.4d	Recognizes and reads environmental print.		With educator support, identifies letters in their name in environmental print.	Without educator support, identifies letters in their name in environmental print.	Without educator support, recognizes familiar or common words in environmental print, such as stop.
CLL8.4e	Identifies the front, back, top, and bottom of a book. Points to the title of familiar books or stories and where to begin reading a story.		With educator support, can identify front and back and hold a book with the cover right side up.	Holds a book with the cover right side up and can identify front and back. May need educator support to identify a title and where to begin reading.	Without educator support, can identify a familiar book and flip through from front to back, holding it in the correct position.
CLL9.4a	Draws pictures and copies letters and/or numbers to communicate.		Makes lines, dots, or other markings that may symbolize numbers, letters, or images.	With educator support, makes numbers, letters, or images.	Without educator support, writes numbers, letters, or images.
Early Writing		**Not Yet**	**Beginning**	**Developing**	**Demonstrating**
CLL9.4b	Uses writing tools.		Holds writing tools with their whole hand and makes movements with wrist.	With educator support, uses a three-finger grip and makes movements more fluidly.	Without educator support, uses a three-finger grip.
CLL9.4c	Uses writing for a variety of purposes.		Makes lines, dots, or other markings that may symbolize numbers, letters, or images.	With educator support, makes numbers, letters, or images.	Without educator support, writes numbers, letters, or images.
CLL9.4d	Writes some letters of the alphabet.		Traces, connects the dots, or, with heavy educator support, writes letters.	With educator guidance, freely writes letters of the alphabet.	Without educator support, can write some letters of the alphabet.
MATH					
Number and Quantity		**Not Yet**	**Beginning**	**Developing**	**Demonstrating**
CD-MA1.4a	Recites numbers up to 20 in sequence.		Can recite some numbers in sequence independently but may miss some numbers, say numbers out of sequence, or stop before they get to 20.	With less educator support, can recite most numbers up to 20 in sequence. A child might say, ". . . 11, 12, 14," and after being reminded by the educator that 13 comes next in the sequence, the child can recite the remaining numbers in order.	Without educator support, can recite numbers 0–20 in order.

CD-MA1.4b	Recognizes numerals and uses counting as part of play and as a means for determining quantity.		Can recognize some numerals and uses counting during play but may not count as a means of determining quantity.	Can recognize numerals and counts as part of play. With educator support, can integrate counting as a means for determining quantity into play experiences.	Without educator support, recognizes numerals and counts to determine quantity during play experiences.
CD-MA1.4c	Matches numerals to sets of objects with the same number, 0–10.		With educator support, can count sets of objects and find the matching numeral 0–10.	With less educator support, can match numerals to sets of objects from 0–10.	Without educator support, can match numerals to sets of objects (from 0–10).
CD-MA1.4d	Describes sets as having more, less, same as/equal.		With educator support, can count two sets of objects and describe the relationship between the sets using more, less, or same/as or equal.	With less educator support, can count two sets of objects and describe the relationship between the sets using more, less, or same/as or equal.	Without educator support, can count two sets of objects and describe the relationship between the sets using more, less, or same/as or equal.
CD-MA1.4e	Quickly recognizes and names how many items are in a set of up to four items.		With educator support, can quickly count and identity how many items are in a set of up to four items.	With less educator support, can quickly identify how many items are in a set of up to four items.	Without educator support, can quickly identify how many items are in a set of up to four items.
CD-MA1.4f	Tells numbers that come before and after a given number up to 10.		With educator support, can identify the number that comes before or after a given number within the numbers 0–10.	With less educator support, can identify the number that comes before or after a given number within the numbers 0–10.	Without educator support, can identify the number that comes before or after a given number within the numbers 0–10.
CD-MA2.4a	Matches two equal sets using one-to-one correspondence and understands they are the same.		With educator support, counts two equal sets of objects using one-to-one correspondence.	Counts two equal sets of objects using one-to-one correspondence and, with educator support, understands that the two sets are equal.	Without educator support, counts two equal sets using one-to-one correspondence and recognizes that the two sets are equal.
CD-MA2.4b	Counts at least 10 objects using one-to-one correspondence.		Requires educator support to count objects using one-to-one correspondence.	Can count less than 10 objects using one-to-one correspondence. With less educator support (such as lining objects up or counting with the child), can count 10 objects using one-to-one correspondence.	Without educator support, can count 10 or more objects using one-to-one correspondence.

CD-MA2.4c	Practices combining, separating, and naming quantities.		With educator support, can combine and separate groups of objects and count the quantity of object sets.	With less educator support, can combine and separate groups of objects and identify the quantity of different object sets.	Without educator support, can combine, separate, and identify the quantity of different object sets.
CD-MA2.4d	Describes data from classroom graphs using numerical math language.		With educator support, can explore and talk about data from classroom graphs.	With less educator support, can talk about data from classroom graphs, using numerical math language (number, quantity, more/less, etc.).	Without educator support, can talk about data from classroom graphs, using numerical math language (number, quantity, more/less, etc.).
CD-MA2.4e	With adult guidance and when counting, understands and can respond with the last number counted to represent quantity (cardinality).		Can count a group of objects and, with educator support, recognize that the final number counted represents the quantity of the group (cardinality).	With less educator support, can count a group of objects and understand that the final number counted represents the quantity of the group (cardinality).	With minimal educator support, can count a group of objects and understand that the final number counted represents the quantity of the group (cardinality).
Measurement and Comparison		**Not Yet**	**Beginning**	**Developing**	**Demonstrating**
CD-MA3.4a	Uses mathematical terms to describe experiences involving measurement.		With educator support, can use mathematical terms to describe measurement experiences (heavier/lighter, longer/shorter, bigger/smaller, etc.).	With less educator support, can use mathematical terms to describe measurement experiences (heavier/lighter, longer/shorter, bigger/smaller, etc.).	Without educator support, can use mathematical terms to describe measurement experiences (heavier/lighter, longer/shorter, bigger/smaller, etc.).
CD-MA3.4b	Compares objects using two or more attributes, such as length, weight, and size.		With educator support, can compare two objects using one attribute (heavier/lighter, longer/shorter, bigger/smaller, etc.).	With less educator support, can compare two objects using two or more attributes (heavier/lighter, longer/short, bigger/smaller, etc.).	Without educator support, can compare two objects using two or more attributes (heavier/lighter, longer/shorter, bigger/smaller, etc.).
CD-MA3.4c	Uses a variety of techniques and standard and non-standard tools to measure and compare length, volume (capacity) and weight.		With educator support, can measure an object's length, volume (capacity), and weight using nonstandard measurement tools.	With less educator support, can measure an object's length, volume (capacity), and weight using nonstandard measurement tools and standard measurement tools (a ruler, a scale, measuring tape, etc.).	Without educator support, can measure the length, volume (capacity), and weight or two or more objects using nonstandard measurement tools and standard measurement tools (a ruler, a scale, measuring tape, etc.) and then compare those two objects based on those attributes.

CD-MA3.4d	Associates and describes the passage of time with actual events.		With educator support, can describe a simple timeline of actual events ("We ate lunch, then we played outside, then we took a nap.").	Can describe a simple timeline of actual events but may get the order of some events incorrect.	Without educator support, can describe a more detailed timeline of actual events ("First, I woke up at home. Then, I came to school to play. Then, we played outside, and after school, I got ice cream before I ate dinner.").
CD-MA4.4a	Independently orders objects using one characteristic and describes the criteria used.		With educator support, can order a small group of objects based on a characteristic (i.e., size, shape, color).	Without educator support Can order objects based on one characteristic (i.e., size, shape, color).	Without educator support, orders objects based on one characteristic (i.e., size, shape, color) and describes the criteria they used to order items.
CD-MA4.4b	Sorts and classifies objects using one or more attributes or relationships.		With educator support, can sort a small group of objects based on a one attribute or relationship (i.e., size, shape, pattern, type).	With some educator support, can sort objects based on one or more attributes or relationships (i.e., size, shape, pattern, type).	Without educator support, can sort a small group of objects based on one attribute. Independently, or with some educator support, can sort objects based on more than one attribute or relationship (i.e., size, shape, pattern, type).
CD-MA4.4c	Creates and extends simple, repeating patterns.		With educator support, can extend a simple, repeating pattern (ABAB, ABCABC, etc.).	Can extend a simple, repeating pattern. With educator support, can create a simple, repeating pattern (ABAB, ABCABC, etc.).	Without educator support, can create and extend simple, repeating patterns (ABAB, ABCABC, etc.)
Geometry and Spatial Thinking		**Not Yet**	**Beginning**	**Developing**	**Demonstrating**
CD-MA5.4a	Uses appropriate directional language to indicate where things are in their environment - positions, distances, order.		Requires educator support to follow directions using directional language (position, distances, order).	With less educator support, can follow directions using directional language (position, distance, order).	Without educator support, can give and follow directions using directional language (position, distance, order).
CD-MA5.4b	Uses deliberate manipulation and describes process for fitting objects together.		Independently, may use trial and error to make things fit without deliberate actions to manipulate objects. Requires educator support to deliberately manipulate objects to fit things together.	With less educator support, can practice techniques for deliberate actions to fit things together.	Without educator support, can manipulate objects to fit things together and describe or talk about their process.

CD-MA6.4a	Recognizes and names common two-dimensional and three-dimensional shapes, their parts, and attributes.		With educator support, can recognize and name common two- or three-dimensional shapes.	Can name common two- or three-dimensional shapes but needs educator support to identify the parts and attributes of shapes (sides, vertices, etc.).	Without educator support, can identify common two- and three-dimensional shapes and share details about their parts and attributes (sides, vertices, etc.).
CD-MA6.4b	Combines simple shapes to form new shapes.		Manipulates and plays with shapes without recognizing any new shapes that are formed.	With some educator support, can combine two or more simple shapes to make a new shape and names the new shape.	Without educator support, can combine two or more simple shapes to make a new shape and names the new shape.
Mathematical Reasoning		**Not Yet**	**Beginning**	**Developing**	**Demonstrating**
CD-MA7.4a	Estimates using mathematical terms and understands how to check the estimate.		With educator support, can make an estimate about the attributes of an object or a set of objects and use a mathematical strategy to check their estimate.	With less educator support, can make an estimate about the attributes of an object or a set of objects and use a mathematical strategy to check their estimate.	Without educator support, can make an estimate about the attributes of an object or a set of objects and use a mathematical strategy to check their estimate.
CD-MA7.4b	Uses simple strategies to solve mathematical problems and communicates how he/she solved it.		With educator support, can identify real-life mathematical problems and think through how to use math to solve those problems.	With less educator support, can identify real-life mathematical problems and think through how to use math to solve those problems.	Without educator support, can identify real-life mathematical problems, think through how to use math to solve those problems, and tell an adult how they came up with a solution.
CD-MA7.4c	Uses reasoning skills to determine the solution to a mathematical problem and communicates why.		With educator support, can use reasoning skills to solve math problems and communicate how they solved the problem using mathematical terms.	With less educator support, can solve simple math problems, communicate how they solved the problem using mathematical terms, and demonstrate how they came up with the solution.	Without educator support, can solve simple math problems using reasoning skills, communicate how they solved the problem using mathematical terms, and demonstrate how they came up with the solution.