5-2022

Parents and the Evolving Math Curriculum: Supporting One's Student in Elementary Mathematics

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BUTLER UNIVERSITY HONORS PROGRAM

Honors Thesis Certification

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Thesis title: Parents and the Evolving Math Curriculum: Supporting One's Student in Elementary Mathematices

Intended date of commencement: May 6, 2022

Read, approved, and signed by:

Thesis adviser(s) _____ 04.25.22
Date

_____ _____
Date

Reader(s) _____ 4/26/22
Date

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Date

Certified by _____ _____
Director, Honors Program Date

Parents and the Evolving Math Curriculum: Supporting One's Student in Elementary Mathematics

A Thesis
Presented to the Department of Mathematics
College of Education
and
The Honors Program
of
Butler University

In Partial Fulfillment
of the Requirements for Graduation Honors

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April 21, 2022

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Abstract

The current-day mathematics curriculum is evidently different from the traditional means of teaching math. Due to this, there exist disparities between a child's math education and their parent or guardian's math education. This thesis will present firsthand evidence on how these disparities affect a parent's perception of current-day curriculum, the extent to which parents can support their child in their learning of mathematics at home, and will strive to attend to the needs of both the parents or guardians as well as students in supporting the learning of these new concepts and strategies. With this, the research question asks: ***What are parents' or guardians' perceptions of current day math curricula, and how can I best support families in their understanding of the mathematics being taught?***

This research lies in the survey study that was sent to parents or guardians of kindergarten through sixth grade students from a specific school that I was associated with at the time. The results determined the need for educators to better support parents in their support of their children's mathematical understandings. Therefore, this thesis will provide educators with an understanding of parental perceptions and inquiries on mathematics as well as a plethora of resources, strategies, and examples that can be used as a stepping stone to bridge the gap between the "old" mathematics and the "new" mathematics.

Personal Connection

Imagine elementary school mathematics circa 2008. I was in the second grade and was breezing through timed tests, acing homework assignments, and felt like I could be the world's best mathematician. While I felt consistently successful in math, my best friend did not. She despised the subject and simply could not understand why she struggled so much. While I tried to empathize with her, I couldn't. That was until math changed. In the midst of third grade, the "new" math, the Common Core Curriculum, was implemented into the math curriculum. All of a sudden my traditional methods of solving addition and subtraction became "bad" strategies and number lines became "the best" strategy. As one could imagine, teachers having to learn and teach this new curriculum was tough enough. However, as a student, it seemed like a challenge I never asked for.

I have vivid memories of having loads of math homework to take home every night, especially from third grade on. After school, I would sit at the kitchen table while my mom made dinner and would ask her question after question regarding these new strategies. Truthfully, I am not sure why I kept asking because the answer I always received was, "I don't know how to do math this way" or "I'm sorry, I just can't help you." I remember nights where I'd cry so hard that my math homework would have tear stains. It was at this point that I finally could empathize with my best friend's inability to feel successful in this subject. For a period of time, it became my worst nightmare and most challenging obstacle. It wasn't until I finally got the hang of this "new" math that I felt successful in my mathematical endeavors.

Looking back at this now, I remember many of the good memories I have in math. Since I finally did get the hang of it, math became my favorite subject once again. However, this was

definitely not the case for all students. The tears at the kitchen table for many students began in the third grade and continued all the way through high school and possibly even into college. I believe this was in part due to the fact that when asked, parents could not support their child because of a lack of understanding. Thus, this is where my passions and research come into play; I am determined to get rid of the tears at the kitchen table if parents are willing to take that step alongside me.

Introduction

It is evident that disparities between a parent's education and a current day student's education exist. Historically, students attended school to learn curricula that differed drastically from more recent curricula, assessments and expectations. This has caused a mismatch between how parents remember learning mathematics and how their children are now learning mathematics. The one piece about mathematics that has never faltered is the fact that there is always a way to reach an answer. With that being said, this is also where guardians and children diverge in their learning. New ideas related to how one reaches an answer, what and how many strategies are used, the manner in which it is justified, and the strategies that have developed mathematically alongside state standards have emerged in recent years (Dixon, Nolan, Adams, Tobias, & Barmoha, 2016). These changes and additions to elementary mathematics have caused some to question, "Why can't my kid learn it the way I learned it?"

Through my time at Butler University, I have developed deep rooted passions in researching and understanding mathematics because of the widespread use this subject has on communities all around the world. Every single day, people use mathematics when handling money, budgeting expenses, sharing and partitioning items, timing a schedule, engaging in

real-world politics and current events, etc. Thus, the relevance for math is present and will always be present. Students need to learn mathematics starting at a young age and persisting throughout their educational lives until they reach independence where yet again, mathematics will be a constant. Although this may sound exciting to some, it may be another's nightmare. Regardless, students will often seek to find a support system who can help when they are stuck on a problem or mathematical concept; and often, this ends up being a student's parent, sibling or guardian.

Thus, my goal is to bridge the gap between the adults' understanding of mathematics in cohesion with what present day students are learning throughout the school day. This begins with introducing the mathematics curriculum being taught today and explaining and educating the public on how, why and in what ways this new form has taken the place of traditional forms of instruction. Once parents or guardians understand all of this, they will be more equipped to delve into all the ways they can support their young mathematician at home. Some of these ideas range from small-scale support like being positive toward mathematics and instilling confidence in their ability to learn the subject while other ideas are more large-scale such as sitting down with the learner to ask them to justify, explain and consistently practice the variety of strategies and skills they have been taught. Parents' or guardians' roles in education is vital to students and the outlook they have on education, especially when it highlights learning mathematics.

Research Question

Through these sources, it became evident that parents or guardians were previously skeptical about the change in standards and remain skeptical today. Therefore, this has led me to find my passions in researching how I can best support the parents or guardians of my students in

mathematics. While there exists much research already in ways that this co-construction can happen (e.g., Dixon, 2007; Hiebert, 1998), my research will focus on the question: ***What are parents' or guardians' perceptions of current day math curricula, and how can I best support families in their understanding of the mathematics being taught?*** As an educator, I recognize the dissonance that exists with the continually-evolving math curricula used today. However, I plan to research the reasoning behind parental concerns or struggles, gather data firsthand on their mathematical experiences, and discover ways that best allow me to educate and assist them on ways to support their students.

Literature Review

According to multiple sources (e.g., Fuglei, 2021; Mistreta, 2013), there exists a common negative stigma behind the "new"[1] math curriculum from older generations. Parents or guardians are frequently confused on why the education they received - typically based in rote memorization of standard algorithms (Schoenfeld, 2003) - is thought to be problematic (Walkowiak, 2015). The truth is nothing they were taught is wrong; rather, there are more prerequisite strategies that will developmentally aid students in their progression toward achieving the standard algorithms with understanding (Hiebert, Carpenter, Fennema, Fuson, Wearne, & Murray, 1998).

Alan H. Schoenfeld (2003), a well-known mathematician and educator in the field, highlights the history of mathematics and the challenges that have been overcome to achieve new standard mathematical practices. From the 1950s until the early 2000s, math curricula developed to emphasize the importance of conceptual understanding and practical application to the real

[1] While parents and guardians call the current math curriculum "new," the reality is that these standards are not new. Rather, the development of state standards has taken place over the past few decades leading to evolving mathematical practices that parents see as unfamiliar. Thus, parents and guardians equate them to being new.

world. This became an apparent necessity as students began to give up on problem solving after struggling for a few minutes; in other words, there was a lack of perseverance during the problem solving process. Therefore, the push for new standards became prominent to prepare young students with an abundance of strategies that would allow them to problem solve efficiently and in a way that makes the most sense to the learner. In response to these changes, teachers and guardians found difficulty in using what they had learned previously to support the curriculum their students were learning. Ultimately, this is the "Math War" that Schoenfeld argues is separating traditionalists from the radicalists (Schoenfeld, 2003).

Following the switch to this adapted curriculum, there has existed much backlash on the standards put in place as the public struggled to understand why changes were made (Kornhaber, Barkauskas, Griffith, Sausner, & Mahfouz, 2017). In a study on the promises and pitfalls of the Common Core[2] reform, researcher Mindy Kornhaber and her colleagues (2017) highlight the history of the Common Core curricula implemented in 2010, detail how these standards came to be used today, and follow this with two key promises and two key pitfalls that were highlighted in wake of the adoption of Common Core standards. One of the pitfalls discusses the "problems in the provision of instructional resources" which works in correspondence with Schoenfeld (2003) and other sources (e.g., Walkowiak, T, 2015; Pope-Edwards, C & Fleharty, H, 2013); in other words, although districts have adopted the same framework of mathematics, the variation in materials, teacher education, and support differs from student to student (Kornhaber, et al., 2017).

Thus, there exists two important roles in a student's mathematical education: the role the educator plays and the role the parents or guardians play. As stated, the amount and type of

[2] It is important to note that while Indiana did not adopt the Common Core curriculum, the state specific standards are quite similar and follow a similar trajectory in preparing students from grade level to grade level.

support differs from student to student which is a product of the important stakeholders in these children's developmental mathematical growth. Ideally, the learning of mathematics would take place with the educator in the classroom and then would transfer seamlessly into the applied practice of such learning at home in the presence of the parent or guardians. However, the problem that lies with this transfer is that the disparities in mathematics still exist leading to parental confusion, frustration and feelings of helplessness when it comes to supporting their child (Walkowiak, 2015). Walkowiak further presents three action steps as to how to alter the commonly negative script of the evolved mathematics. He states, "Strategy 1: Educate parents on the truths of the Common Core. Strategy 2: Take advantage of the power of videos posted on your school/classroom website and/or social media news feed. Strategy 3: Engage parents and community to build a math culture." Moreover, Walkowiak highlights the importance of teamwork, that is the role of educators and parents or guardians working together to help a student. This begins with teacher communication, education, and support in terms of what is being taught in the classroom, how the material is being taught (i.e. strategies being taught), and how parents or guardians can help ease this transfer of learning into their own homes (Walkowiak, 2015; Pope-Edwards, C & Fleharty, H, 2013).

While problems and skepticism have arisen from the evolving mathematics curricula, there are a multitude of articles that grant adults the opportunity to learn how to best support their child at home. First and foremost, parents or guardians and educators can best support a student's growth in math by being in communication and discussing the strategies being learned at school (Mistretta, 2013). Following this, families can support their child by working together to learn, asking their student for explanations and justifications on their math, and ultimately, to

refrain from teaching their student the methods they grew up learning until a developmentally appropriate time (Skinner, Louie, & Baldinger, 2019).

Purpose

The purpose for this study goes beyond promoting and encouraging parental support of elementary students in mathematics. The research illustrates the importance of the role of educators in this continuous math support, both during school and after school hours. Therefore, as an educator, my aspiration is to spark change for educators and guardians by providing a basis as to how to span the support chain from teachers to parents or guardians and ideally, to students at home. While the curriculum will continue to evolve, this study will conclude by providing printable, informational packets that will include explanations and examples on solving current-day grade level math problems with varying strategies (see Appendices B-H). With these resources provided, I hope educators will have a variety of resources to pass onto parents or guardians throughout the year to provide them with an initial understanding of the mathematics being taught. This research is two-fold as the research and resources of the methodology will be shared in order to make an impact on students and their understanding of mathematical strategies.

Context

At the school in which the research took place, there are approximately fifty students per grade level and two teachers per grade level. Furthermore, the building educates students in kindergarten through eighth grade. The school performs well overall as indicated by traditional measures such as test scores. According to standardized tests such as NWEA and I-Learn, students tend to score at or above the proficient level in math. This also measures the school to

be 77.6% in proficiency in mathematics per grade levels 3-8 in comparison to the 21% proficiency of the overall district and 47.8% proficiency of the state of Indiana (See https://inview.doe.in.gov/schools/[redacted]/profile[3] for more information). It is evident that the students and parents of focus in this study are exceeding expectations, however, this does not mean students are not struggling or reaching a state of frustration in their learning. Throughout the study, it also became apparent that parents or guardians are frustrated with their inability to understand or help support their students' mathematical learning at home. Therefore, the need for educators to support guardians in their understanding on the use of newer mathematical strategies is prevalent so that students can get the adequate support needed at home to further their learning. Overall, my belief is that if students can get this continuous support, they will form a more positive relationship with mathematics, find fascination and perseverance in solving mathematical problems, and as a product, will improve upon their mathematical test scores.

Data Collection

The research and writing of my thesis took place over two years and a variety of contexts. I began brainstorming, reading and researching during the 2020-2021 school year, prior to being in a classroom setting full-time. Upon starting my student teaching placement in an inquiry-focused public school within Marion county, I conducted my study by sending my survey, titled *Elementary Mathematics: Survey for Parents or Guardians,* out to Kindergarten through sixth grade parents in November 2021. The survey was designed in a google form and was open for one week. It was sent to approximately three-hundred and fifty families. Of these families, thirty responses were collected anonymously for this study.

[3] School name and number redacted to protect the anonymity of the school and students. Please contact the author for further information.

After conducting my survey and organizing the data collected, I was able to see many commonalities across responses, including those of different grade levels. I collected my data solely from survey responses and used this data to create a plan of action in response to recommendations given through the final survey question, "In what ways could educators better support families in assisting students in their mathematical growth?"

Data Analysis

With the collected survey responses, I was able to use data to help inform my research and provide guidance toward how educators can assist parents in their conceptual understanding of the mathematics curriculum and strategies being taught today. Each question of my survey contained important and interesting information that directed me toward my key findings of this study. With this said, I am not afraid to say that I am close with this data. Not only am I the researcher but I was also a student teacher at this school. It is likely that other researchers would find other consistencies throughout the survey responses. However, the focus of my research highlights the current day parental perception of how math is being taught and how educators can best support families supporting their child in mathematics. Therefore, with these survey responses, I was able to connect my own experiences at the school with the experiences of many other parents in need of assistance to brainstorm a way to make the understanding of these newer math strategies accessible to them.

To begin, the first section of my survey asked parents or guardians to reflect upon their own elementary mathematical experiences. When asked about how positive or negative their experiences were, there existed a range of responses. Around 3.3% responded that their experience was very negative and 10% responded that their experience was slightly negative. As

for positive experiences, 36.7% responded that their experience was slightly positive while 50% said their experience was very positive. In cohesion with this, parents explained their memories from their elementary school mathematics as well as their rankings. Those who experienced math to be more negative explained that they overall did not feel successful due to having the focus be on the correct answer, struggling to understand why they were learning the material, and a lack of understanding in terms of how the single strategy being used worked. As for those who expressed their positive experiences in mathematics, they felt successful because math class was enjoyable and over time they achieved their goals in timed tests as well as rote memorization of facts and strategies. These findings were interesting and not necessarily what I expected. However, it did suggest to me that those who enjoyed math when they were in elementary school are having difficulty understanding how and why math is taught the way it is today.

In relation to the first section, parents or guardians were next asked about their comfort toward their child's mathematics curriculum. This data was then supplemented with commentary on their ranked comfortability. It immediately became evident that parents see the difference in the way math is being taught. In fact, many parents or guardians seemed to be in-tune with the newer methods being used to teach this subject such as teaching various strategies, using hands-on manipulatives, for a conceptual understanding of number sense, and with an emphasis on reading and writing alongside mathematics. Out of the thirty that were surveyed, fourteen explained that they see the benefits of this newer curriculum. However, of these fourteen parents or guardians, only four stated that they felt comfortable with the new strategies being taught in school. Beyond this, one parent stated, "I can't help because I don't know how to do it" (Parent 19), and another expressed, "Since I don't understand the new way math is taught, I cannot teach her the appropriate steps the teacher needs to see at school" (Parent 7). Thus, this data gives me

enough evidence that there is a need for parental guidance and assistance with the curriculum that is foreign to them. In fact, one parent stated, “There should be some coaching for parents since the children need our help at home” (Parent 14).

Furthermore, this data was further established with the results from the questions regarding a fourth grade sample problem. The sample problem invited parents to view a variety of fourth grade strategies used to solve two-digit by two-digit multiplication. Then, they first were asked to select the strategies that made sense to them. This was followed by them being asked to select the strategies they would feel comfortable teaching their child at home. Out of all thirty responses, only one parent could make sense of all six sample strategies (partial products, area model, lattice multiplication, breaking apart method, traditional method, distributive method, and box method). Furthermore, not one parent responded that they would feel comfortable teaching all of the said methods. To add on to this notion, eleven parents selected that they would only feel comfortable teaching two of the six strategies, with one of them being the traditional method. This furthered my research by highlighting the dissonance between generational mathematics and supported the need for providing parents a means of understanding these strategies so they can feel successful in supporting their child.

In terms of understanding the role the teacher plays in all of this, one question invited parents to comment on how their child’s educator communicates with them on the ways math is being taught. Of the thirty responses, twenty-four responded that they receive minimal communication in this regard. The six who responded they received adequate communication explained that the teacher would either send home example problems and answers, explain it in their newsletter, or see the curriculum guides. In correlation to this, these six parents seemed to have a better general understanding of the fourth grade strategies as well as a more positive

outlook on this newer math curriculum. With this said, their commentary still offered that they were looking for more support beyond what they were receiving from their child's teacher.

To conclude the survey, parents or guardians were asked, "In what ways could educators better support families in assisting students in their mathematical growth?" Here, parents or guardians had free range to brainstorm and reason about the type of support that best fit their needs in terms of helping their student. This information gave me qualitative data on how I can structure the information I am looking to create for educators to send home for parental education and support. Ten parents requested that how-to guides or written information be sent home for them to learn; five parents requested links to resources, videos, or websites that could assist them; two parents requested parental support sessions in math; one parent requested answer keys to be sent home with homework; and the remainder of parents did not know what to request or felt that they did not need further assistance. Thus, this provides proof that for the most part, parents are not only struggling to support their child at home in math but are also seeking help from educators to be able to have a conceptual understanding of the strategies being used themselves to, therefore, help their child.

Key Findings

My examination of the data indicated three key findings about parents or guardians with respect to mathematics: their experiences shape their feelings toward math; they need help understanding the variety of strategies taught today; and they need ways to help their children with math. As anticipated, the disparities between how math historically was taught and the current day teaching of math is much too big of a gap for parents to be able to bridge on their own. Consequently, the need for educators to provide support in this subject area is prevalent and

could truly help today's students immensely in their conceptual understandings and feelings of success in mathematics.

Parents' or Guardians' Experiences Shape Their Feelings Toward Math

Throughout the study, the majority of parents expressed frustration toward math. As a researcher in this field, it seems so clear that the need for a change in math standards was to alleviate frustration and allow all learners of mathematics to use strategies that conceptually made sense and brought success to each in their own way. Knowing this, I assumed parents or guardians taking this survey would have felt that frustration with the older standards as they were taught with rote memorization. However, I was proved to be wrong as my data came back with an array of ratings, experiences and opinions on today's math curriculum. Of the thirty survey participants, fifteen reported they had very positive experiences in elementary math while eleven reported they had positive experiences. Their rankings were then supplemented with commentary explaining that they a) had limited memories of elementary math, b) being good at math facts and timed tests, c) doing some hands-on modeling and cross curricular lessons, and lastly, d) liking their teachers and having no homework. This commentary reminded me that the math that was taught to these parents or guardians was very traditional; therefore, there was no other option but to learn it and apply it which eventually led to feeling successful whether it be the day it was taught or years later. Due to these parents or guardians ultimately feeling successful, their experiences were ranked as positive because it shaped their feelings toward math.

On the other hand, of the thirty survey participants, one ranked their experience as being very negative while three others ranked theirs as being negative. In terms of their commentary, these individuals explained that their experiences were negative due to themselves and their

teachers not understanding why they did not understand, being forced to do mathematical concepts that are not useful outside of school, like long division, and being yelled at to get answers correct. Parent 1, who ranked their experience as very negative, stated, "I believe I was not understanding the concepts but no attempt was made to accommodate this. I was doing well otherwise and I believe it was thought that 'it was just a girl thing'...that I was bad at math." This provides evidence that a lack of a conceptual understanding can cause learners trouble and can lead to negativity towards math.

Parents' or Guardians' Need Help in Understanding the "New" Math

In connection to their child's mathematical experiences, these individuals again used a likert scale to rank how comfortable they feel with how their child is learning mathematics. The data provided interesting comparisons and contrasts to their own childhood experiences. It also provided a clear picture as to how and why parents and guardians are in need of help to understand the new concepts, strategies and ways of thinking. Of the original twenty six who ranked their own childhood math experience to be positive or very positive, fourteen ranked their comfort to be either slightly comfortable or uncomfortable. I want to acknowledge that many parents felt very comfortable and understood why it is now taught this way. However, when looking at the big picture, there still exists a disparity that separates these two generations as determined by almost half of the survey participants. This thesis is to help those parents or guardians: the ones who feel uncomfortable and helpless when it comes to working with their child.

In terms of the commentary from those who ranked their comfort level to be uncomfortable, parents or guardians explained that the way their child learns math seems

"awfully complicated and unnecessary" (Parent 2) or "foreign to me" (Parent 25). One parent stated, "I know how to do the problem, but they ask math questions in a completely different way. It's frustrating for the parent and the child as sometimes you know the answer, but they want you to figure it out using a particular method or strategy and explain how you got the answer. It's exhausting" (Parent 15). Overall, the commentary supported the generalization that some parents understand why the "new" math is taught but feel they cannot help with it or that others simply do not understand the need to teach in this new way. Therefore, while their experience in math may have been positive, this does not necessarily mean this same emotion translates to their emotions toward how their child learns math.

Furthermore, there existed a lack of confidence when it came to understanding current-day fourth grade multiplication strategies. In the latter part of the survey, participants were asked to review these strategies and select which strategies they felt they understood. Then, they were asked to select which strategies they felt they could help successfully teach their child. As anticipated, many of the participants selected a couple strategies they understood but when asked about teaching their child, they selected less. In fact, six of the thirty participants felt that they could only successfully teach the traditional method of multiplication, likely because that is the only strategy they were taught in their elementary mathematics. On the other side of the spectrum, there was not one participant who selected every strategy for either or both questions. In between these, there was a range of responses that suggested parents or guardians understood a few of the current-day strategies and could teach their child a select few as well. The data from these questions was also supported by the likert ranking of comfortability; in other words, those who felt very comfortable with how math is being taught to their child tended to select more

strategies in this question whereas those who felt uncomfortable generally selected less. Hence, there is a need for more parental understanding of the strategies and concepts being taught today.

Parents or Guardians Need Ways to Help Support Their Child in Math at Home

With parents or guardians lacking in their understanding of how math is taught today comes the need for support as to how they can help support their child in math at home. This need calls for educators to act as supporters to not only children in school, but also invites them to be stakeholders in supporting parents or guardians. The goal of this is to allow learning and the application of learning to translate from school to the home environment.

This key finding was a large component of the collected data as much of the commentary asked for more assistance, support and ways to learn the newer strategies and concepts. For example, when asked to comment on how their child's educator communicates about the ways math is being taught, there was a general theme: it is not being communicated effectively. Of the thirty participants, thirteen participants answered that they are receiving minimal communication regarding their child's math curriculum. These same parents also were the respondents who felt uncomfortable with the way their child is learning math and were only able to select a few strategies that they understand or could teach their child. Therefore, from this data, my theory is that the more curriculum is communicated and explained, the more tangible these new concepts and strategies are able to be grasped by parents or guardians.

The final summative question of the survey invited parents to offer advice or share what types of support they need to help them help their children in math. This commentary offered qualitative data that supported the idea that parents are in dire need of support and are willing to work hard to learn, adapt and become comfortable with the mathematics being taught. Of the

thirty responses, twenty respondents stated they would like more support and provided ideas such as video links, online resources, instructional pages, homework and answer keys, or holding parent education sessions. All of these ideas highlight the importance of parents or guardians being informed of curriculum being taught at school and ultimately, allowing them to learn alongside their child so they can best offer conceptual math support at home. For this reason, Appendices B-H will provide educators the ability to provide parents or guardians with printable grade-level strategies for them to see and analyze examples of current-day math problems and have step-by-step instructions in front of them to help them find a way that feels comfortable to support their child.

While this thesis explores the key findings of specific data, there were so many key findings and conclusions that could be made. Moreover, there are ideas that go beyond the scope of this paper. However, I consistently kept coming back to three key findings: Parents' or Guardians' Experiences Shape Their Feelings Toward Math; Parents' or Guardians' Need Help in Understanding the "New" Math; Parents' or Guardians' Need Ways to Help Support Their Child in Math at Home. Therefore, this paper focused solely on these three ideas in hopes of making an impact in this realm first before moving forward to work on other aspects of this data.

Conclusion

This study explores the disparities that exist between current-day students and their parents or guardians in the subject of mathematics as the standards and strategies have adapted over time. To explore this, I conducted a survey study that was sent to parents or guardians of K-6 students. These parents or guardians responded to multiple sets of questions both qualitatively and quantitatively to describe their elementary math experiences, how they feel

about their child's elementary mathematics experience, and offer firsthand commentary on how they would like to be better supported by their child's educator. As I am entering the profession, I wanted to do this research so that I, as a future collaborator with parents or guardians, can help them feel supported in a way that suits their needs. Therefore, the research question asks: ***What are parents' or guardians' perceptions of current day math curricula, and how can I best support families in their understanding of the mathematics being taught?***

In my research, my findings based on mathematical experiences of parents or guardians show the impact of said experiences in shaping their beliefs on the subject. The quantitative and qualitative data illustrated the range in how parents felt toward elementary mathematics in the current-day curriculum as well as when they were a student. While some responses indicated they felt confident in their ability to support their child at home in math, many others did not feel this same way.

This leads to the idea that parents or guardians need help in understanding the "new" math before attempting to help at home. Many parents expressed that they either did not understand the shift to how math is taught today, struggled to understand the strategies themselves and/or were challenged in offering support because of the lack of confidence there. Therefore, when presented with standard current-day fourth grade multiplication strategies, many felt uncomfortable and unable to accurately teach the said strategies at home. This alludes to the idea that parents do not have a conceptual understanding themselves, and this needs to happen first and foremost.

As for the final key finding, once parents or guardians are able to grasp the newer math strategies and concepts conceptually, they will next need educators to provide them ways to support their child. The data from the survey suggested that educators need to do more in their

communication and support in this regard. Therefore, this thesis seeks to provide educators, parents or guardians, and students with example strategies from each grade-level that can be used at home to support children in math or allow for the shared learning of the current-day strategies.

This study serves as an important document as it has the ability to educate and open the eyes of parents, guardians, educators, and many more individuals who have had experiences with elementary mathematics. The research in this survey provides so many avenues to explore in terms of how educators can act as a support in this subject area, to both students and parents or guardians. Thus, I am hopeful that parents, guardians, educators and administrators are able to see the disparities as clearly as I do and my goal is for them to take action, whether it be through materials I provide or their own materials, actions or education. It is evident that elementary mathematics is a critical developmental part of a child's education; thus, let's make it enjoyable and collaborative, transparent from school to the home environment to allow for feelings of success and obtainable in a sense that students feel supported in a way and in the place that best suits their needs.

Appendix A: Survey Questions

As it is evident that the parents and guardians have an impact on their students' education, I conducted and supported this research with a survey study (Anderson, Herr & Nihlen, 2007). This survey study allowed me insight into parents' or guardians' feelings toward their own mathematical experiences, how they view their children's mathematical experiences today, and allowed me to collect data on their needs as I research to best assist them. In other words, this survey allowed me to gather the current perceptions of adults in a district I am familiar with and work toward finding ways that I can best support them in their academic endeavors to help their growing learners.

In this survey, the following questions will be asked in order to collect sufficient and thorough information to best support my research:

- Likert Scale: On a scale of 1-4 (1 being very negative, 4 being very positive), rank your mathematical experiences in elementary school.

  1. On a scale of 1-4, rank your mathematical experiences in elementary school.

     Mark only one oval.

	1	2	3	4	
Very negative	◯	◯	◯	◯	Very positive

  - Long Response: What are some specific memories you remember from elementary school mathematics?

    2. What are some specific memories you remember from elementary school mathematics?

  - Long Response: In what ways did your family support your mathematical growth in elementary school?

3. In what ways did your family support your mathematical growth in elementary school?

- Long Response: How is the math your child is experiencing different from the math you experienced in elementary school?

4. How is the math your child is experiencing different from the math you experienced in elementary school?

- Likert Scale: On a scale of 1-4 (1 being very uncomfortable, 4 being very comfortable), how comfortable are you with the way your child is learning mathematics?

5. On a scale of 1-4, how comfortable are you with the way your child is learning mathematics?

Mark only one oval.

	1	2	3	4	
Very uncomfortable	◯	◯	◯	◯	Very comfortable

  - Long Response: Please explain your response.

6. Please explain your response from above.

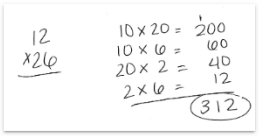
Long Response: In what ways have your child's educators communicated with you about the ways math is being taught?

7. In what ways have your child's educators communicated with you about the ways math is being taught?

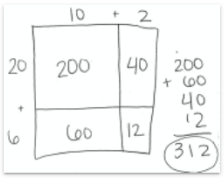
- Here is a typical 4th grade problem. The strategies below are some of the common strategies students use to problem solve. [Work samples will be included in fall 2021]
    - Multiple Choice: Click all that apply. Which of the following make sense to you?
        - Choices a-e being partial products, area model, lattice multiplication, breaking apart method, traditional method, distributive method, and the box method.

Which of the following make sense to you? Check all that apply.

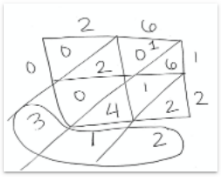
☐ Partial Products



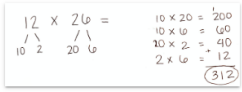
☐ Area Model



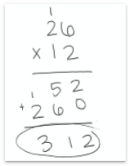
☐ Lattice Multiplication



☐ Breaking Apart Method

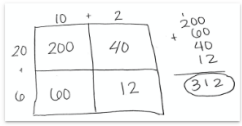


☐ Traditional Method



☐ Distributive Method

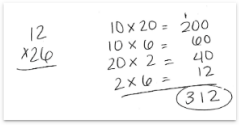
☐ Box Method



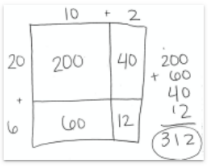
- Multiple Choice: Click all that apply. Which of the following would you feel comfortable teaching your child?
  - Choices a-e being partial products, area model, lattice multiplication, breaking apart method, traditional method, distributive method, and the box method.

Which of the following would you feel comfortable teaching your child? Check all that apply.

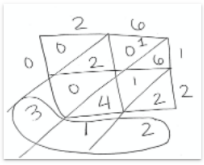
- [ ] Partial Products



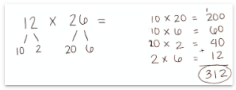
- [ ] Area Model



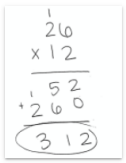
- [ ] Lattice Multiplication



- [ ] Breaking Apart Method

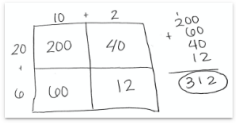


- [ ] Traditional Method



- [ ] Distributive Method

- [ ] Box Method



- Long Response: In what way could educators better support families in assisting students in their mathematical growth?

10. In what way could educators better support families in assisting students in their mathematical growth?

Appendix B

KINDERGARTEN & FIRST-GRADE STRATEGIES

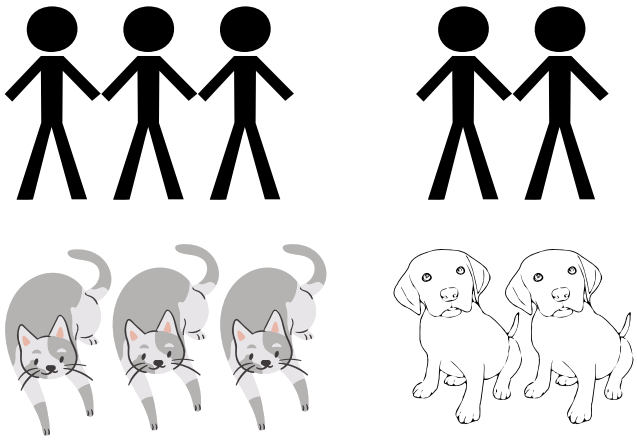
Kindergarten Goals (according to IN state standards):

- Understanding numbers within 10.
- Count up to 20 using a line, array or circle.
- Counting to 100 by ones and by tens.
- Representing scenarios with objects, drawings, pictures, etc.
- Knowing what one more than and one less than a whole number is.

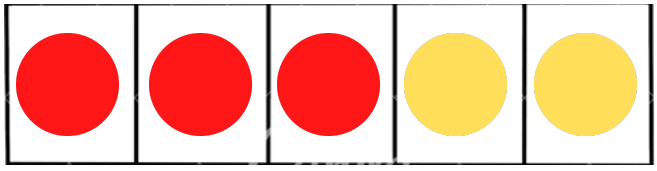
Manipulatives to Use:

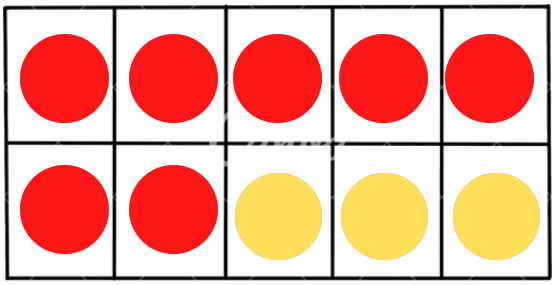
- Teddy Bear Counters
- Unifix Cubes
- Pictures
- Ten Frames
- Tiles
- People
- Pattern Blocks
- Tiles
- Bottle Caps
- Legos
- Mini Erasers
- Dominos

Adding and Subtracting Strategy:
Representing with Pictures

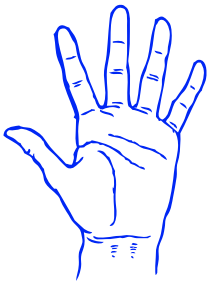


Adding and Subtracting Strategy:
Ten Frames [Make 5 or 10]



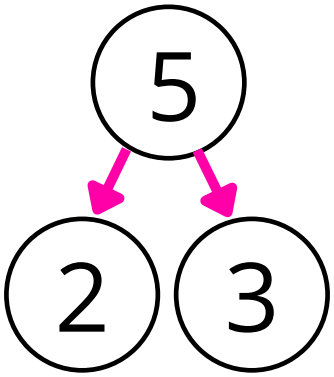


Adding and Subtracting Strategy:
Counting with Fingers

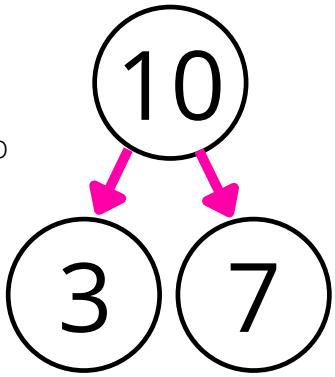


"Show me 3. Add 2 more. Now, how many do you have?"
"Show me 7. Take away 5. How many do you have left?"
"What is one more/less than 7?"

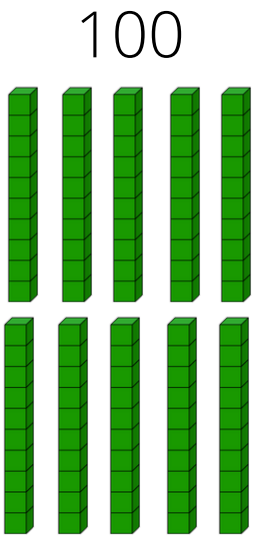
Addition Strategy:
Number Bonds



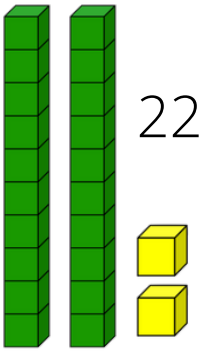
"What other number bonds can we make that equal 5?"
"What does 3 + 4 equal if you were to use a number bond?"
"Which two digits are you adding in this number bond?"
"Which is the sum in this number bond?"



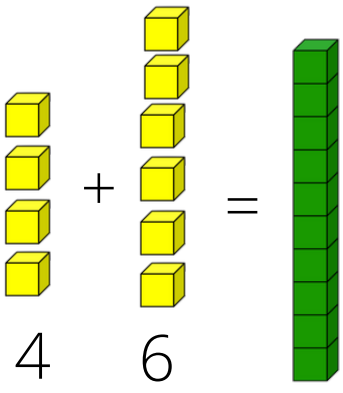
Adding and Subtracting Strategy:
Base Ten Blocks



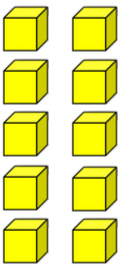
Counting by 10s



Representing Numbers



or



Addition within 10

First-Grade Goals (according to IN state standards):

- Adding and subtracting fluently within 20.
- Adding and subtracting within 100, specifically two-digit plus one-digit.
- Counting to at least 120 by ones, fives, and tens.
- Comparing two-digit numbers using place value and <, >, and = symbols.
- Solving real-world problems (measurement, coins, etc) and finding number patterns.
- Identify objects as 2D or 3D shapes and attributes of them.

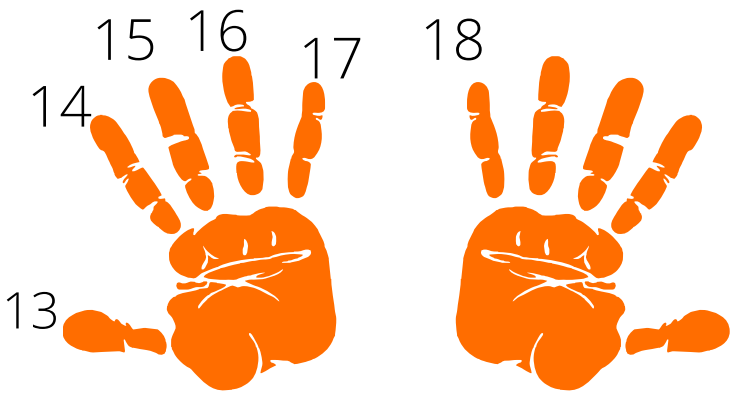
Common Student Strategies:

- Using manipulatives such as unifix cubes, base ten blocks, etc.
- Number Line
- Tally marks
- Using hands to count
- Counting on from a number
- Making ten
- Using doubles

Adding and Subtracting Strategy:

Counting On

12 + 6 =



Adding and Subtracting Strategy:

Make 10

7 + 8 =

5 2

First, 7 is decomposed into 5 and 2.

8 + 2 = 10

Next, 8 and 2 are used to make 10.

10 + 5 = 15

Last, the remaining 5 is added to get the sum.

Adding and Subtracting Strategy:
Doubles

$9 + 8 =$

1 8

First, 9 is decomposed into 1 and 8.

$8 + 8 = 16$

Next, doubles are used to add part of the problem.

$16 + 1 = 17$

Last, the remaining 1 is added to get the sum.

Adding and Subtracting Strategy:
Using a Known Fact

$9 + 4 =$

8 1

First, 9 is decomposed into 8 and 1.

$8 + 4 = 12$

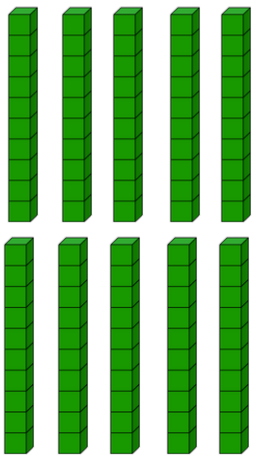
Next, the student knows 8+4 is 12 so they use this to get part of the sum.

$12 + 1 = 13$

Last, the remaining 1 is added to get the sum..

Adding and Subtracting Strategy:
Base Ten Blocks

100



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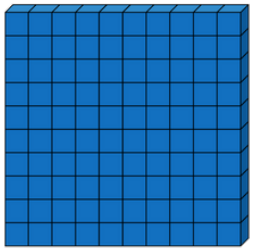
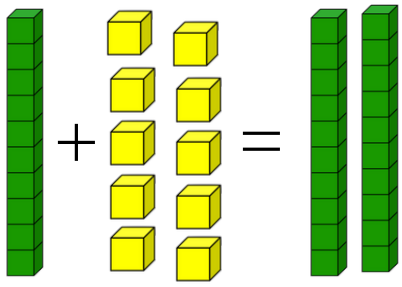


Representing 100s

Adding within 20

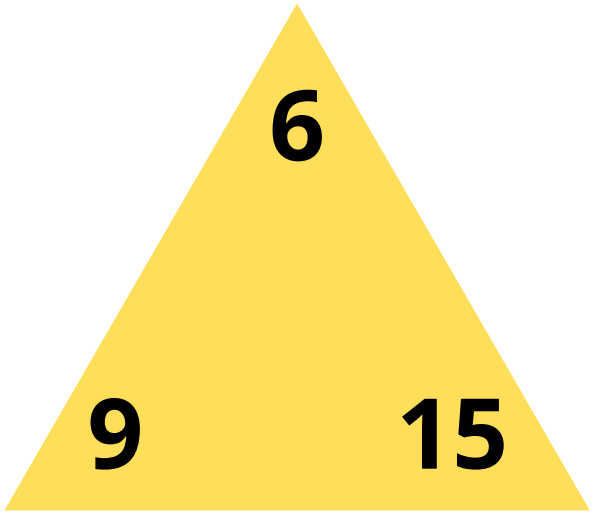


10 10 20

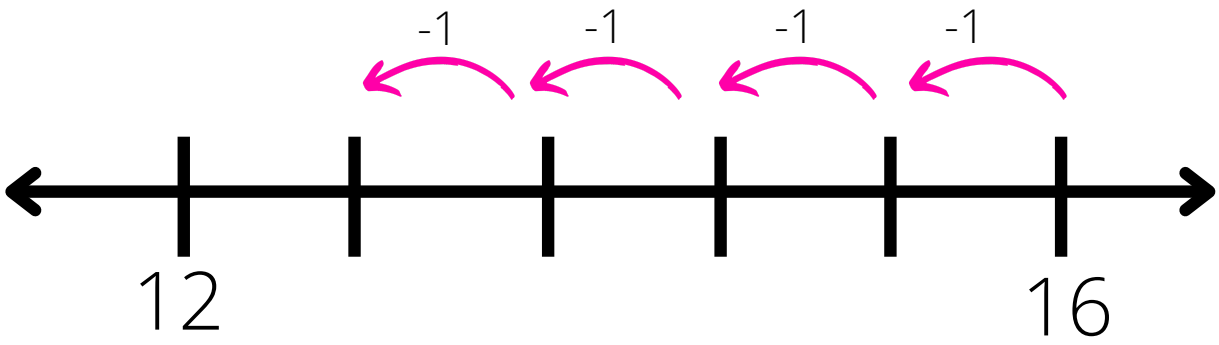
Adding and Subtracting Strategy:
Fact Families

Cover up one number to complete the addition or subtraction problem within the fact family.

Students will become familiar with related numbers in fact families.



Adding and Subtracting Strategy:
Number Line



Multiplying and Dividing Strategy:
Skip Counting

10	20	30	40	50	60

3	6	9	12	15	18

Appendix C

SECOND & THIRD GRADE STRATEGIES

Second-Grade Goals (according to IN state standards):

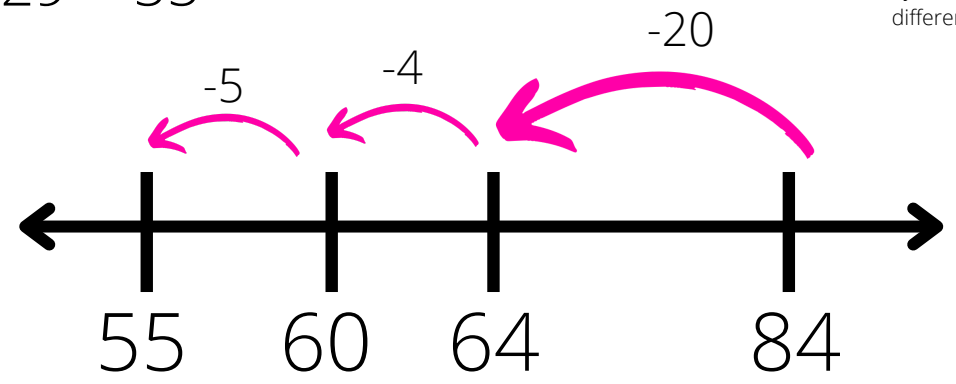
- Count by 1s, 5s, 10s, and 100s up to 1000.
- Understand place value up to the hundreds place.
- Add and subtract fluently within 100.
- Find the value of pennies, nickels, dimes, quarters and dollars.
- Continuing 1st grade strategies to work with larger numbers.

Adding and Subtracting Strategy:

Number Line

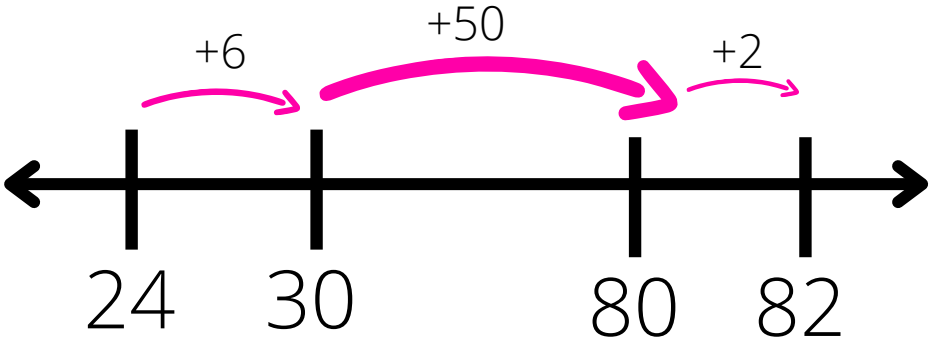
84 - 29 = 55

In this strategy, the first jump is the largest chunk of the number being subtracted. This is followed by smaller jumps to get to difference.



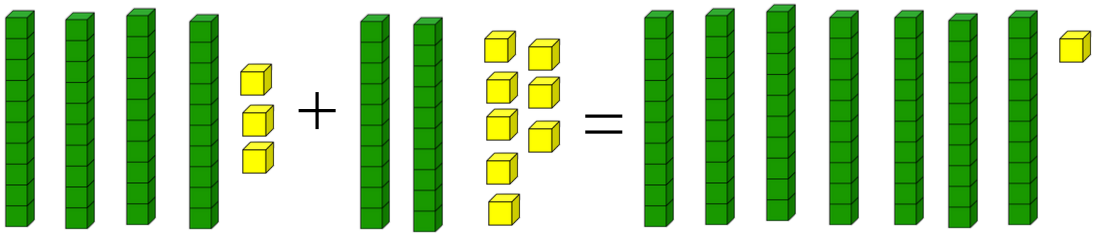
24 + 58 = 82

In this strategy, the first jump is small to get to a number that is a multiple of ten. This is followed by a large jump and then by smaller jumps to get to the sum.



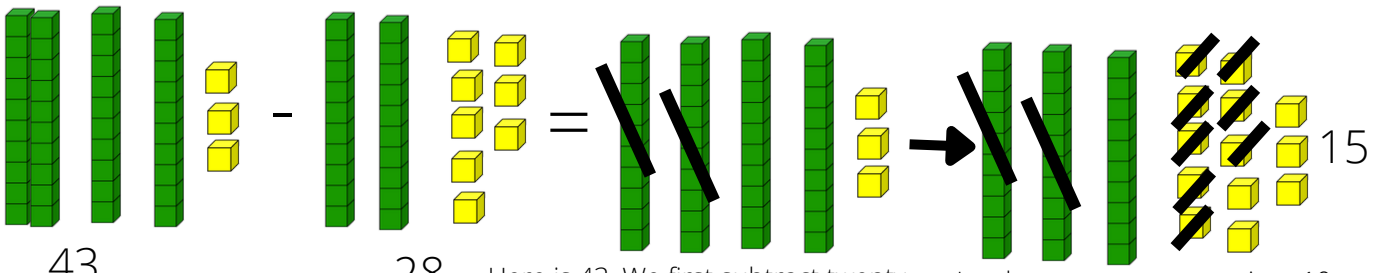
Adding and Subtracting Strategy: Base Ten Blocks

Adding within 100



43 28 71

Subtracting within 100



43 28 Here is 43. We first subtract twenty. We see the need to regroup. Lastly, we regroup a ten into 10 ones, and subtract out 8. 15

Adding and Subtracting Strategy: Arrow Strategy

33 + 12 =

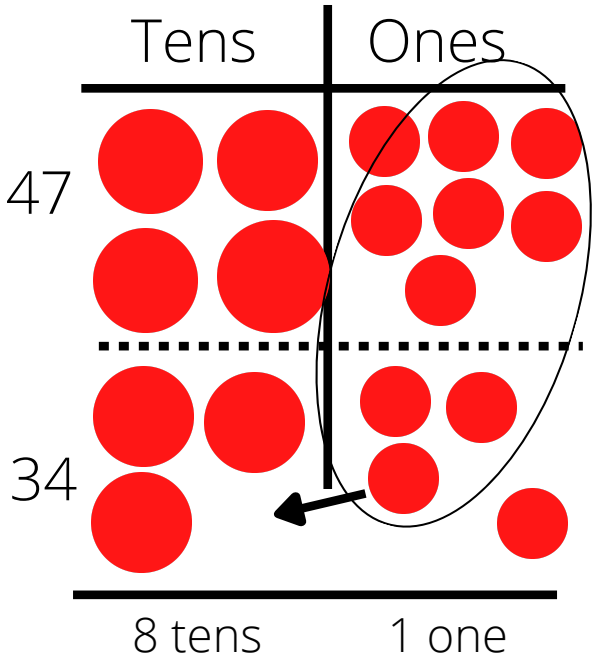
33 $\xrightarrow{+10}$ 43 $\xrightarrow{+2}$ 45

33 - 12 =

33 $\xrightarrow{-10}$ 23 $\xrightarrow{-2}$ 21

Adding and Subtracting Strategy: Place Value Disks

47 + 34 =

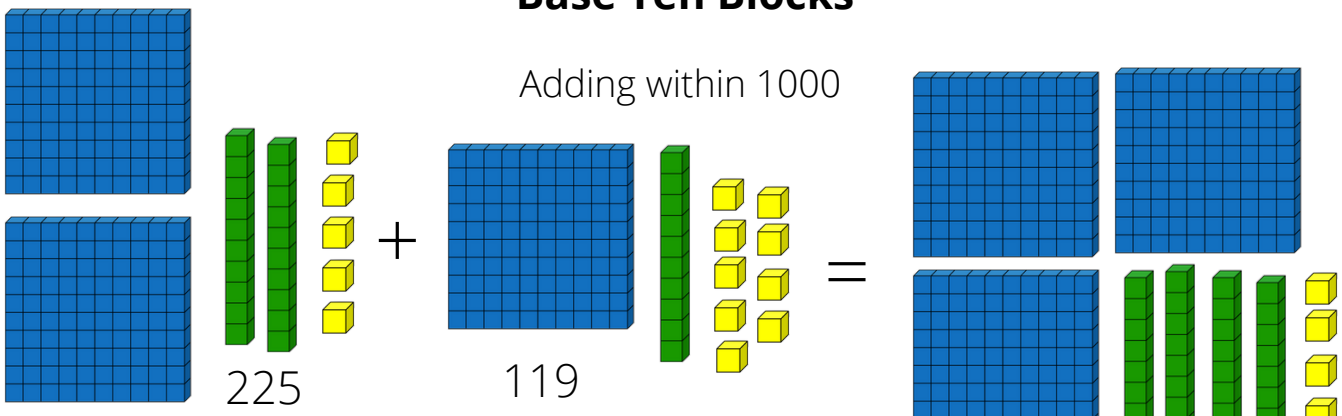


Third-Grade Goals (according to IN state standards):

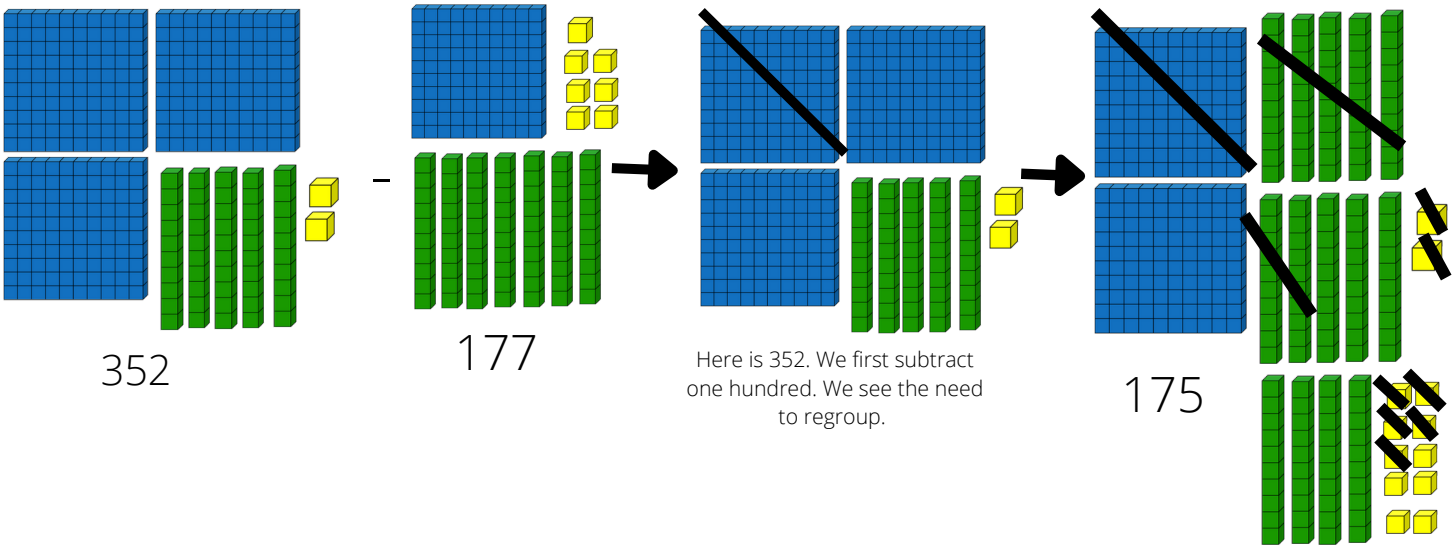
- Add and subtract within 1000.
- Multiply and divide numbers from 0 to 10.
- Understand fractions such as halves, thirds, fourths, sixths, and eighths.
- Round numbers to the correct place value.
- Find the area and perimeter of certain shapes.

Adding and Subtracting Strategy: Base Ten Blocks

Adding within 1000



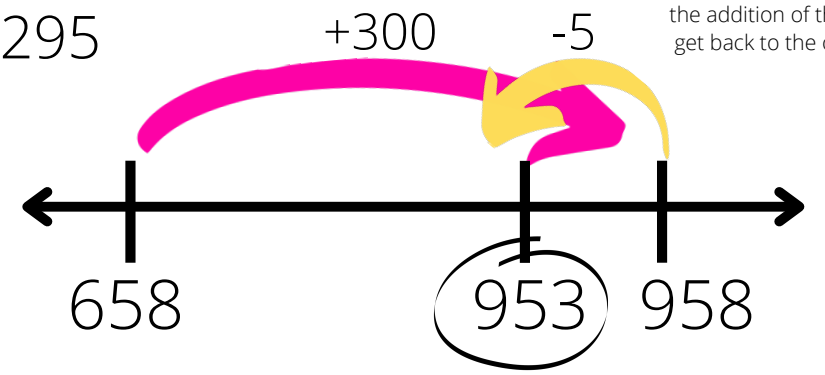
Subtracting within 1000



Next, we regroup a 100 block into 10 tens and subtract 70. Lastly, we regroup 1 ten into 10 ones and subtract 7.

Adding and Subtracting Strategy:
Number Line

658 + 295



In this strategy, the first jump rounds the addition problem to the nearest hundred. After the addition of this, we must subtract five to get back to the original subtraction of 295.

Adding and Subtracting Strategy:
Pull Down Method

246 + 631 = 877

800 70 7

813 - 542 = 271

300 -30 1

Make sure students know you CAN subtract 10 from 40. It just gives you a negative difference!

Adding and Subtracting Strategy:
Partial Sums and Differences

$$\begin{array}{r} 246 \\ +\ 631 \\ \hline 800 \\ +\ 70 \\ \hline 7 \\ \hline 877 \end{array} \qquad \begin{array}{r} 813 \\ -\ 542 \\ \hline 300 \\ +\ -30 \\ \hline 1 \\ \hline 271 \end{array}$$

This strategy sets up the problem like the traditional algorithm but focuses on adding or subtracting each place value. Students do not need to learn the traditional algorithm until 4th grade.

Fraction Strategy:
Using Visuals

Multiplying and Dividing Strategy:
Half Then Double

6 x 5 = 3 x 5 = 15

3 x 5 = 15

3 3

First, break one of the numbers in half. Then double the product.

15 + 15 = 30

Multiplying and Dividing Strategy:
Partial Prducts

7 x 5 = 4 x 5 = 20

3 x 5 = 15

4 3

First, decompose one of the number.
Then, use known facts to multiply.
Add the two products together.

20 + 15 = 35

Multiplying and Dividing Strategy:
Inverse Thinking

? x 8 = 56

How many groups of 8 make 56?
56 divided by 8 leaves me how many groups?

56 / 8 = ?

How many groups of 8 are in 56?
What multiplied by 8 equals 56?

Multiplying and Dividing Strategy:
Skip Counting and Repeated Addition or Subtraction

7 x 5
7 groups of 5

Skip Count Forward:
5, 10, 15, 20, 25, 30, 35

Repeated Addition
5 + 5 = 10, 10 + 5 = 15, 15 + 5 = 20
20 + 5 = 25, 25 + 5 = 30, 30 + 5 = 35

35 / 5
35 divided into 7 groups

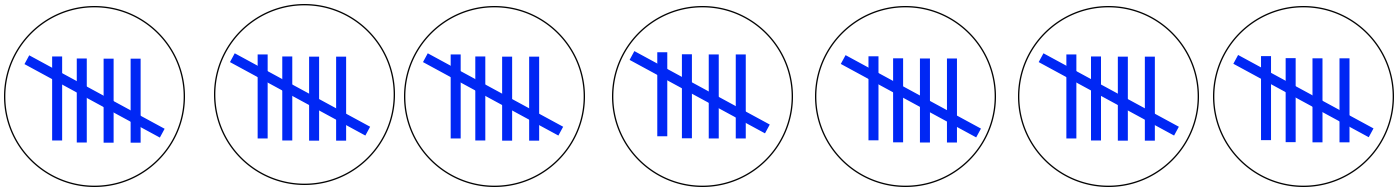
Skip Count Backward:
35, 30, 25, 20, 15, 10, 5, 0

Repeated Subtraction
35 - 5 = 30, 30 - 5 = 25, 25 - 5 = 20
20 - 5 = 15, 15 - 5 = 10,
10 - 5 = 5, 5 - 5 =0

7 x 5 =

Multiplying and Dividing Strategy:
Tally Marks

35 / 7 =



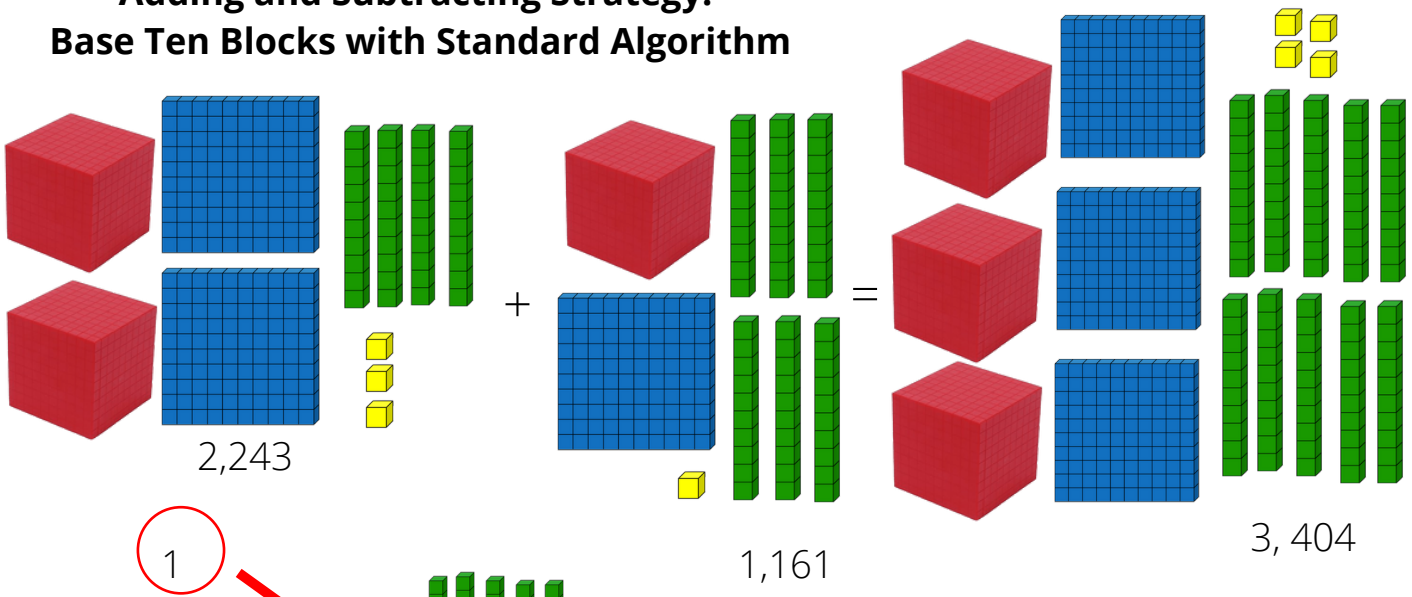
Appendix D

FOURTH & FIFTH GRADE STRATEGIES

Fourth-Grade Goals (according to IN state standards):

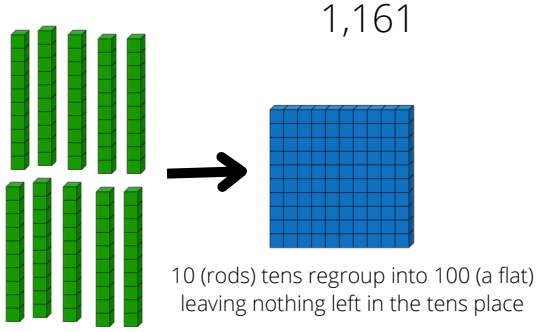
- Finding and comparing equivalent fractions to a given fraction
- Comparing and representing decimals as a visual
- Rounding multi-digit numbers
- Adding and subtracting using the standard algorithm
- Multiplying a four-digit by one-digit and a two-digit by two-digit
- Utilizing the commutative and associative property
- Identifying, drawing, and measuring geometric shapes such as a rhombus, trapezoid, and parallelogram
- Understand and use the metric system in given problems
- Calculating area and perimeter of both simple and complex shapes
- Measure angles using a tool such as a protractor

Adding and Subtracting Strategy:
Base Ten Blocks with Standard Algorithm



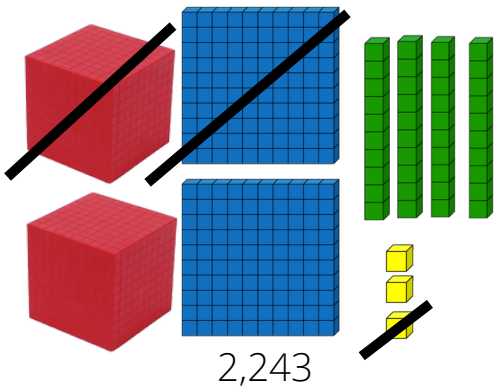
1
2, 243
+ 1,161

3,404



10 (rods) tens regroup into 100 (a flat)
leaving nothing left in the tens place

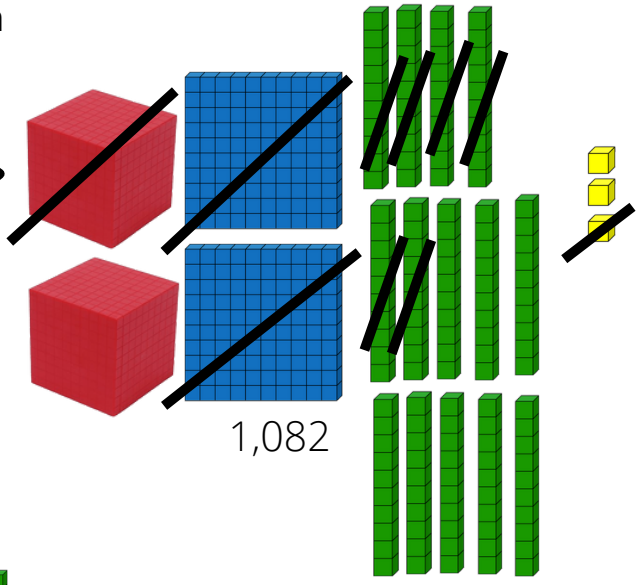
Adding and Subtracting Strategy: Base Ten Blocks with Standard Algorithm



2,243

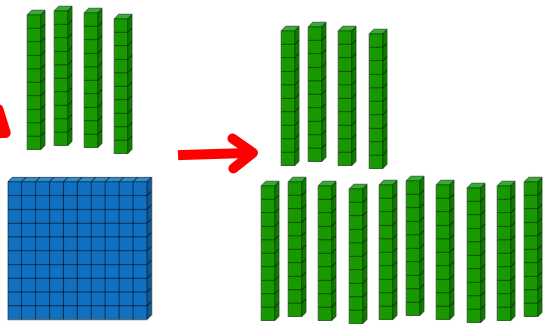
- 1,161

If we subtract 6 tens, we would get -2 tens. Therefore, we have to decompose 100 into 10 tens.



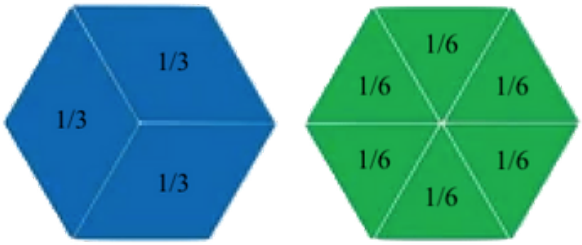
1,082

$$\begin{array}{r} {\scriptstyle 1}\,\,{\scriptstyle 14} \\ 2,\not{2}43 \\ -\ 1,161 \\ \hline 1,082 \end{array}$$

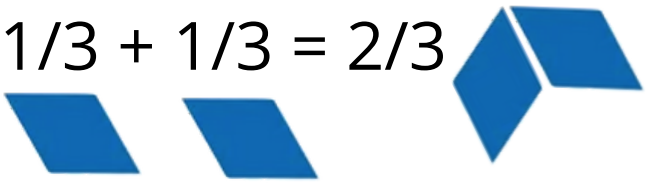


Here, 100 was regrouped into 10 tens to get 14 tens total. One flat, out of the two total flats, was used to do this so that is why a group of ten was regrouped to the tens place and taken away from the hundreds place.

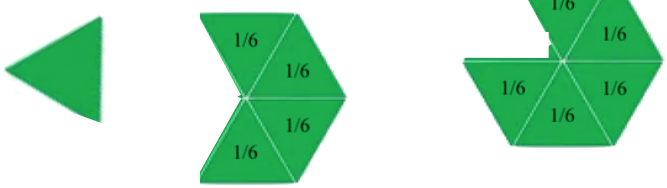
Adding and Subtracting Strategy: Adding Fractions with Common Denominators



1/3 + 1/3 = 2/3



1/6 + 4/6 = 5/6



Adding and Subtracting Strategy: Partial Sums and Differences with Standard Algorithm

$$\begin{array}{r} 246 \\ +\ 631 \\ \hline 800 \\ +\ 70 \\ 7 \\ \hline 877 \end{array}$$

$$\begin{array}{r} 813 \\ -\ 542 \\ \hline 300 \\ +\ -30 \\ 1 \\ \hline 271 \end{array}$$

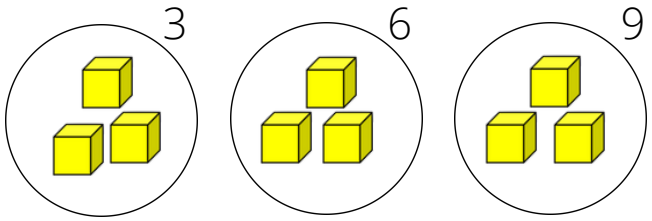
$$\begin{array}{r} 246 \\ +\ 631 \\ \hline 877 \end{array}$$

$$\begin{array}{r} {\scriptstyle 7}\,{\scriptstyle 11} \\ \not{8}\not{1}3 \\ -\ 542 \\ \hline 271 \end{array}$$

Use previous knowledge to teach the standard algorithm.

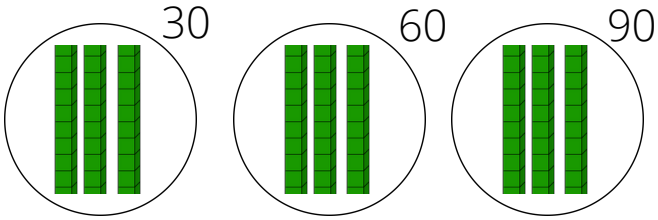
Multiplying and Dividing Strategy:
Equal Groups and Using Patterns

$3 \times 3 = 9$



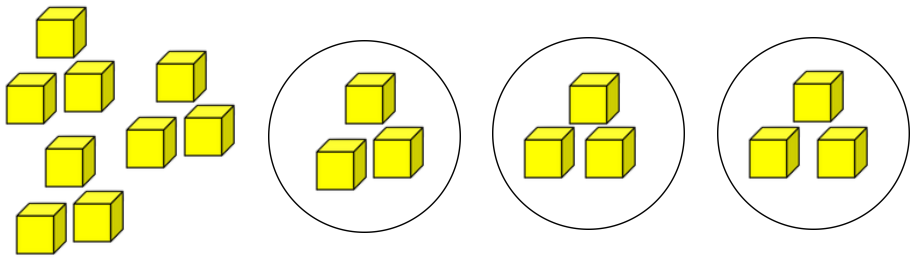
You can count the total or skip count.

$3 \times 30 = 90$



$9 \div 3 = 3$

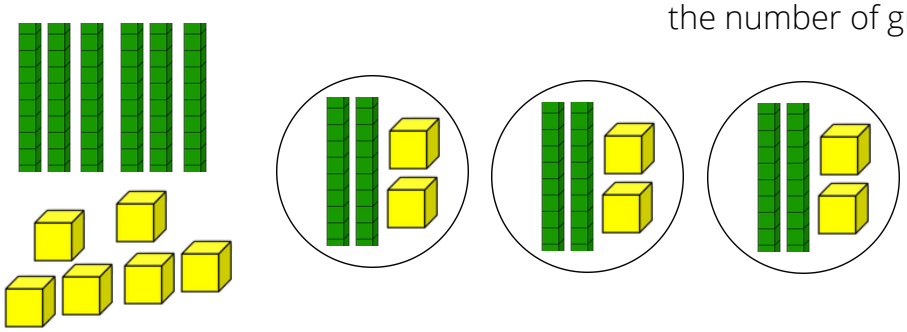
9 split into 3 groups



Evenly distribute across the number of groups.

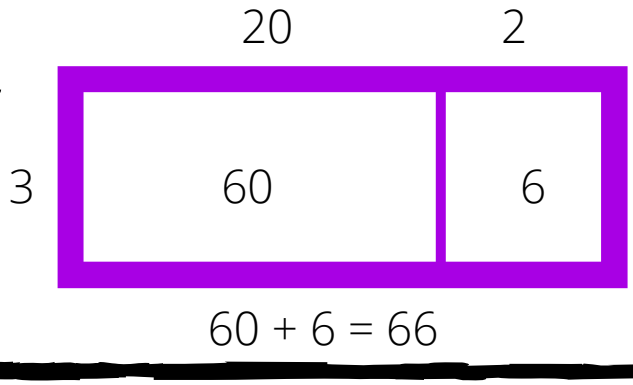
$66 \div 3 = 22$

66 split into 3 groups

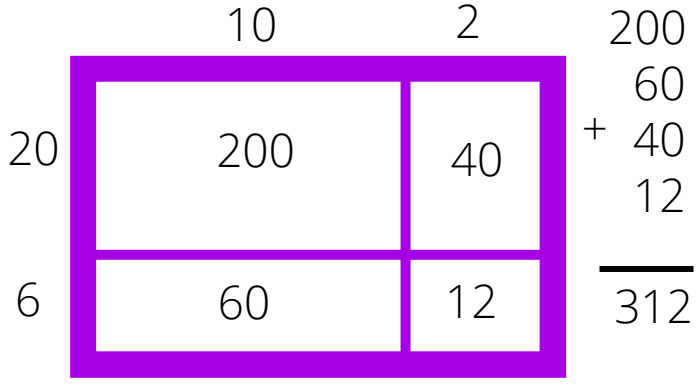


Multiplying Strategy:
Area Model / Box Method

3 x 22 = 66



12 x 26 = 312



Multiplying Strategy:
Partial Products

$3 \times 22 = 66$

$3 \times 20 = 60$
$3 \times 2 = 6$

Use parts of the product to multiply. Then, add.

$$\begin{array}{r} 22 \\ \times\ 3 \\ \hline 60 \\ +\ 6 \\ \hline 66 \end{array}$$

Multiplying and Dividing Strategy:
Ratio Table

3 x 22 = 66

Groups	1	2	3
Total	22	44	66

36 ÷ 12 = 3

Groups	1	2	3
Total	12	24	36

Multiplying Strategy:
Distributive Method

12 x 26 = 312

F - First
O - Outside
I - Inside
L - Last

F. 10 x 20 = 200
O. 10 x 6 = 60
I. 2 x 20 = 40
L. 2 x 6 = 12

200 + 60 + 40 + 12 = 312

Multiplying Strategy:
Break Apart

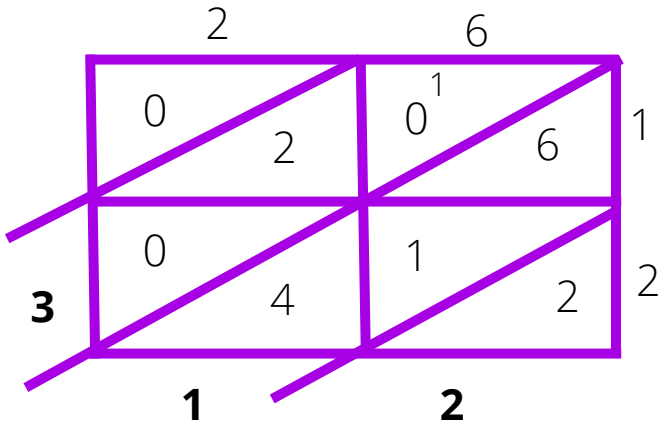
12 x 26 = 312

10 2 20 6

10 x 20 = 200
10 x 6 = 60
2 x 20 = 40
2 x 6 = 12

200 + 60 + 40 + 12 = 312

Multiplying Strategy:
Lattice Multiplication



Important Things to Remember

What you say is very important!

- You do not always need to start in the ones place.

- Use correct place value terminology when speaking about numbers.

- You can take a "big number" from a "small number." It will just become negative.

Fifth-Grade Goals (according to IN state standards):

- Ordering and comparing fractions, mixed numbers, and decimals
- Add and subtract fractions with unlike denominators or mixed numbers
- Understanding place value in numbers and decimals
- Calculate division problems with remainders
- Use visual fraction models to multiply or divide a fraction by a fraction or a fraction by a whole number
- Using the order of operations to compute
- Graphing points on a coordinate plane
- Identify, describe, measure and draw types of triangles and their angles
- Identify, describe and find the area of types of quadrilaterals
- Calculate the volume of rectangular prisms
- Understand and use mean, median, and mode

Adding and Subtracting Strategy: Pull Down Method

2.46 + **6.31** = **8.77**

8 **0.7** **0.07**

8 + 0.7 + 0.07 = 8.77

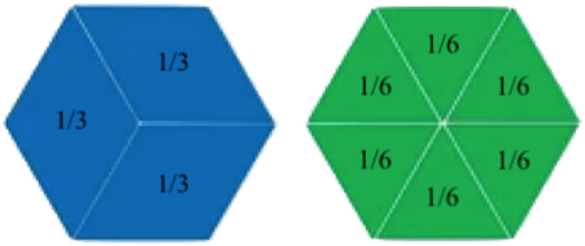
8.13 - **5.42** = **2.71**

3 **-0.3** **0.01**

3 + (-0.3) + 0.01 = 2.71

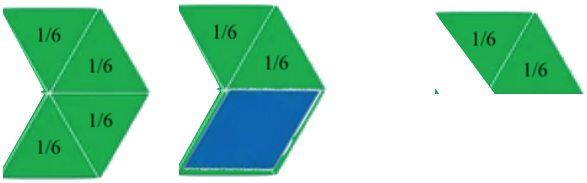
Make sure students have a solid understanding of ones, tenths, and hundredths.

Adding and Subtracting Strategy: Adding Fractions with Unlike Denominators



1/3 + 2/6 = 4/6 or 2/3

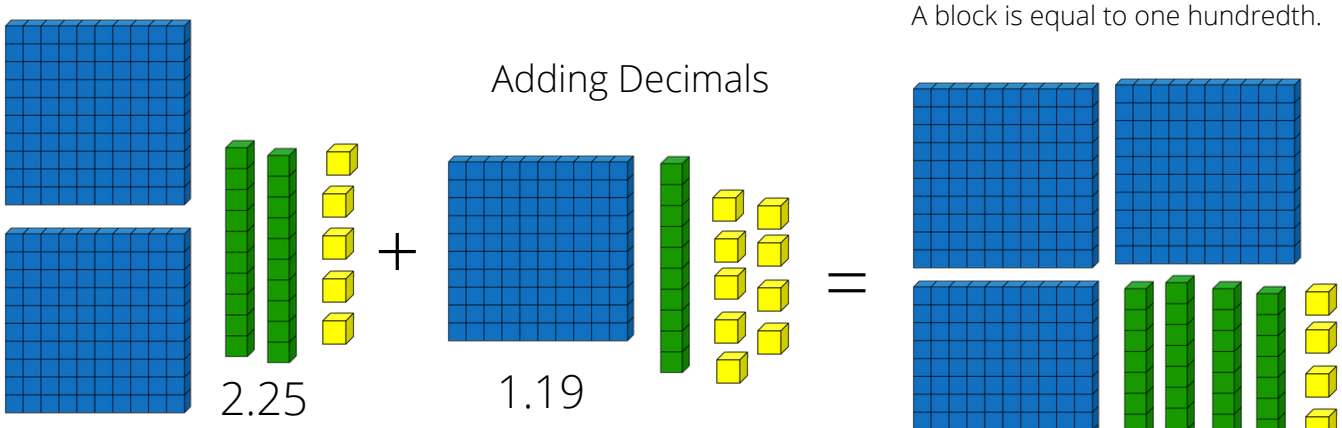
4/6 - 1/3 = 2/6 or 1/3



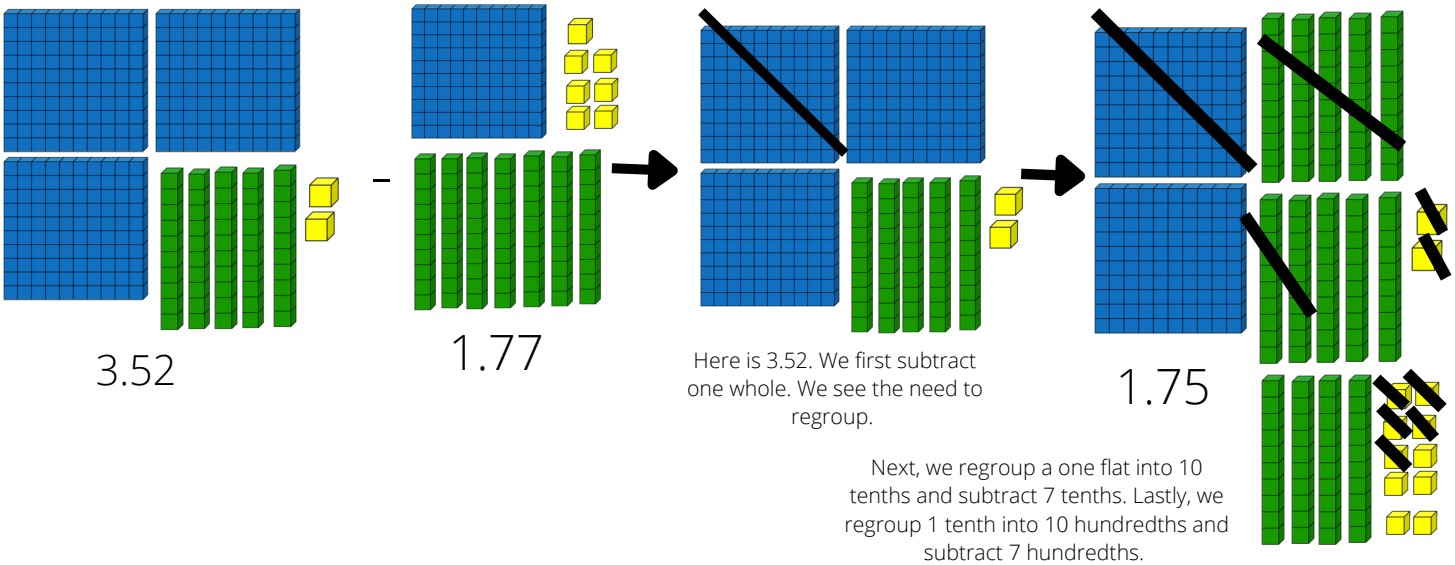
Adding and Subtracting Strategy: Base Ten Blocks

The value of the base ten blocks are now ones, tenths, and hundredths.
A flat is equal to one one or whole.
A rod is equal to one tenth.
A block is equal to one hundredth.

Adding Decimals



Subtracting Decimals

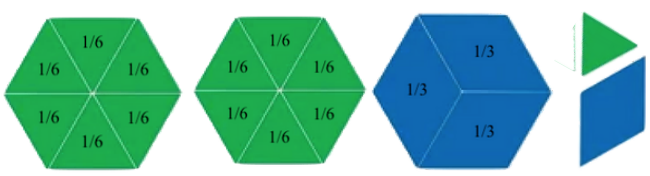


Here is 3.52. We first subtract one whole. We see the need to regroup.

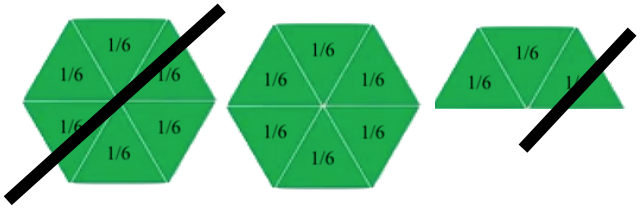
Next, we regroup a one flat into 10 tenths and subtract 7 tenths. Lastly, we regroup 1 tenth into 10 hundredths and subtract 7 hundredths.

Adding and Subtracting Strategy: Mixed Numbers

2 1/6 + 1 1/3 = 3 3/6 or 3 1/2



2 1/2 - 1 1/6 = 1 2/6 or 1 1/3



Dividing Strategy:
Partial Quotients

Division of Whole Numbers

1,496 ÷ 4 = 274

4 ⟌ 1,496

- 1,200 (4 x **200**)
- 296
- 200 (4 x **50**)
- 96
- 80 (4 x **20**)
- 16
- 16 (4 x **4**)
- 0

4 x **200** = 1,200
4 x **50** = 200
4 x **20** = 80
4 x **4** = 16

200
+ **50**
+ **20**
+ **4**
274

Use known multiplication facts and fact families to build until you reach the quotient.

Division of Decimals

4.68 ÷ 4 = 1.17

4 ⟌ 4.68

- 4.00 (4 x **1.00**)
- 0.68
- 0.2 (4 x **0.05**)
- 0.48
- 0.4 (4 x **0.10**)
- 0.08
- 0.08 (4 x **0.02**)
- 0

4 x **1.00** = 4.00
4 x **0.05** = 0.2
4 x **0.10** = 0.4
4 x **0.02** = 0.08

1.00
+ **0.05**
+ **0.10**
+ **0.02**
1.17

Don't forget to line up the decimal!

Help students see the relationship between multiplying numbers and decimals.

Multiplying Strategy:
Decimals Standard Algorithm

$$\begin{array}{r} 3.68 \\ \times\ 1.4 \\ \hline 1472 \\ +\ 3680 \\ \hline 5152 \end{array}$$

Use knowledge about multiplication to estimate.

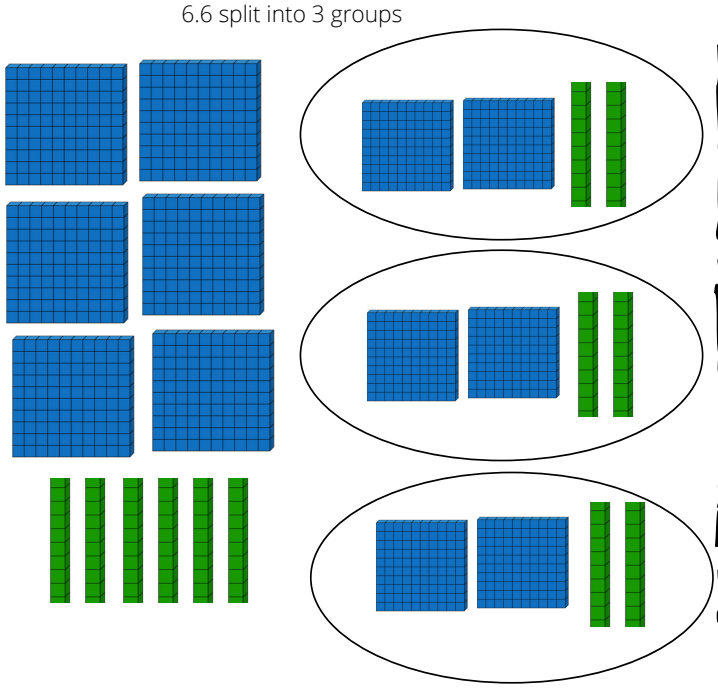
It should be close to 5.

3.68 x 1.4 = **5.152**

Multiplying Strategy:
Multiplying Decimals

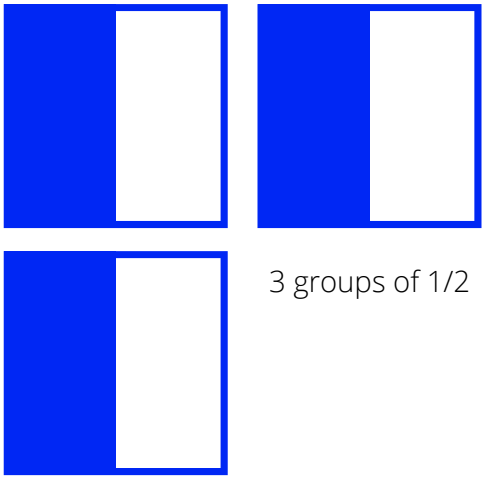
6.6 ÷ 3 = 2.2

6.6 split into 3 groups



Multiplying Strategy:
Whole Number x Fractions

3 x 1/2 = 3/2 or **1 1/2**



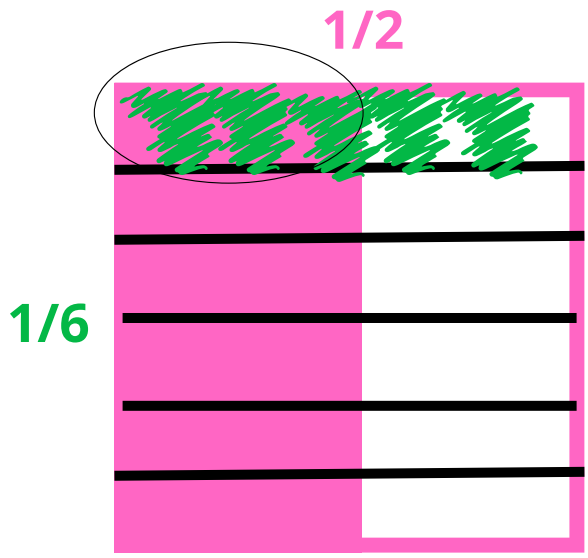
3 groups of 1/2

The shaded regions make up the product.

Multiplying Strategy:
Fraction x Fractions

1/2 x 1/6 = **1/12**

1/2 groups of 1/6

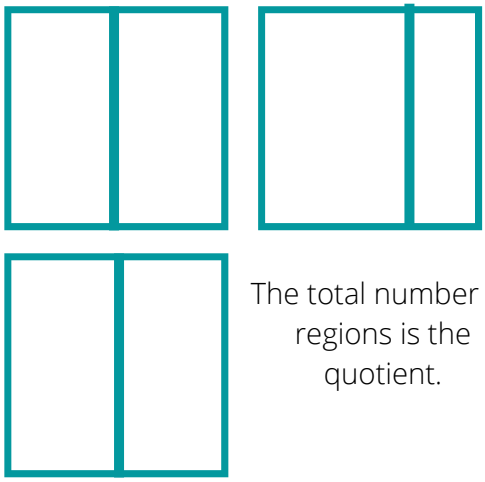


The overlapping region is the numerator and the number of total regions is the denominator.

Dividing Strategy:
Whole Number ÷ Fractions

3 ÷ 1/2 = **6**

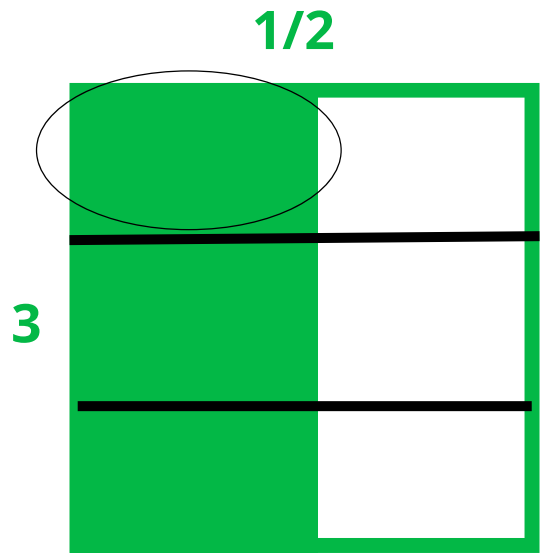
How many groups of 1/2 are in 3?



The total number of regions is the quotient.

Dividing Strategy:
Fraction ÷ Whole Number

1/2 ÷ 3 = 1/6



There is 1 piece shaded of each group of 3.
This makes up the numerator.
The total number of pieces make up the denominator.

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