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Implementing Student-Centered Accommodations in Mathematics

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Abstract

This project explores the necessary need to create and implement accommodations for low achieving learners and high achieving learners in mathematics, specifically addition and subtraction at the kindergarten level. Currently, there are no accommodations provided in the mathematic curriculum to support these groups of students and ensure they continue to succeed and grow. Research data was collected and analyzed to determine the types of accommodations that are most beneficial to these two groups of learners. Through the research findings, accommodations were discovered and included in the final project to create a student-centered learning environment called the Rainforest Math Cove. The student-centered learning environment encourages students to become responsible and independent of their own learning while instilling pride in conquering their own misunderstandings when solving the problems. This project contains all of the necessary components that an educator would need in order to implement the student-centered learning environment. It is recommended that upon implementation of the Rainforest Math Cove, the educator or an observer monitor the effects this student-centered learning environment has on student achievement.

PART 1: INTRODUCTION, LITERATURE REVIEW AND METHODOLOGY

Chapter 1

INTRODUCTION

This chapter provides an overview of a qualitative research study that explores the perceptions, backgrounds, and experiences of kindergarten level students to show evidence of benefitting from accommodations to heighten performance in Common Core mathematics. In particular, the study focuses on the need for accommodations for both under-performing and over-performing students. Because I seek to make recommendations to better serve students from this study, I thought it appropriate to begin with a narrative of how I became interested in the topic. I then provide a background to the problem, a brief overview of the literature on the diverse needs of our students in mathematics instruction, and the purpose of the study and research questions. In this chapter, I also provide an overview of the theoretical framework, the methodology, and assumptions of the study. The chapter ends with an overview of how the thesis is organized and the definitions of terms used.

Forging a Research Topic: My Narrative

Every Sunday my father and I would dress in our Sunday best and worship at our local church. He would drop me off at Sunday School with my cousins while he attended service on the first floor with his mother, father, brothers, sister, aunts, uncles, and many other family members and others within the community. One particular Sunday the teacher discussed the importance of always keeping the love of the Lord with us in our hearts and on our minds. At this time, we were 10 years old and were excited to soon start attending the service with our

parents on the first floor. Our teacher knew this transition for us was coming soon and she wanted to prepare us for what teenage years would bring.

She had an honest talk with us about how friendships change, for the good and the bad, and that no matter what we experience as we continue to grow as Christians, the Lord would always love us for who we are. She shared a few personal stories to better demonstrate how loving the Lord and keeping His love with us would help us get through the tough times that were sure to come. Then, she shared a passage from Proverbs 22:6: "Start children off on the way they should go, and even when they are old they will not turn from it." She finished her discussion saying that if, as Christians, we take everything our church has taught us since we started Sunday School and apply it to our daily lives and keep the Lord's love with us, we will know what to do in tough situations. That passage made a profound impact on me that day.

I already knew I wanted to be a teacher, but that passage solidified my dream and gave my dream a powerful purpose. I had so many wonderful teachers, both in public school and within my church, who inspired me to serve any student who would enter my classroom. Growing up having a sister with a disability further motivated me to ensure that every student in my classroom was successful regardless of what unique challenges they had. This internal drive to ensure my students begin their educational journey on the right path all stems from the Proverbs 22:6 passage that my Sunday School teacher read to me 17 years ago.

This passage and my internal drive have led me to look for a solution to a problem that is preventing countless kindergarten students to be successful in addition and subtraction, in part due to Common Core. With every day that goes by in a school year, I know that we are not

starting students off in the way we should. It crushes my heart knowing that I am not living up to Proverbs 22:6 that ignited my passion to serve all of my students.

Contextualizing the Problem

A severe problem is imbedded within the kindergarten Everyday Math curriculum, and this problem needs an immediate solution before more students are underserved by the program. Since the implementation of the Common Core State Standards, all students are expected to achieve at the same level throughout the course of a school year without individualization or modifications for those who may need a remedial or more challenging approach to the skill. This lack of individualization and modification is most apparent within the skills of addition and subtraction.

According to the curriculum, teachers are supposed to continue teaching these students without any supports given, explained, or provided. Students, who are struggling with the taught method of how to add two numbers together, must continue to struggle without understanding how to solve the problem and lack the understanding of why their answer is incorrect. The same is true for subtraction. The curriculum only introduces one method for how to solve addition and subtraction with no guidance for how to remediate or increase the challenge of the skill.

Several researchers and parents have discovered and agree that the Common Core State Standards "are more rigorous than their [school's] previous standards" (Kober & Renter, 2012, p.3). While having rigorous standards allows students to improve their overall skills in mathematics, schools are struggling to find adequate resources to support all of their students who are performing at varying degrees within one classroom (Kober & Renter, 2012). The lack of resources to benefit all of our students is a problem, and it is greatly impacting our struggling

learners. Cogan, Schmidt, and Houang (2013) interviewed parents after the implementation of Common Core State Standards at their children's schools and found that the majority of the parents felt there would be negative impacts for students who struggle to learn.

Furthermore, Baroody (1999) found that addition and subtraction are not easily taught to kindergarten students. Baroody also found that these complex mathematical skills should be taught with various strategies and opportunities to help a child advance at their own pace, rather than be held to one method or pace of advancement. This research suggests that there is a serious and urgent need for a product to be made to benefit our struggling kindergarten students with addition and subtraction.

Not only is there a vast amount of support for a remedial product to aid in teaching our struggling students how to add and subtract, but there is research indicating that not enough is being done to challenge our high performing students within these same areas. Firmender, Gavin, and McCoach's (2014) stated in their research findings, "Young students should be actively engaged in a curriculum that is challenging and in-depth and allows them to investigate mathematical content" (p. 216). Dimitriadis (2016) focused on several schools' abilities to challenge their higher performing learners and examined the methods schools use to do so. Dimitriadis' research indicated that there is a consistent gap between a school's practice for teaching high performing students and the developments in gifted theory and research. To challenge our high performing kindergarten students in addition and subtraction, the strategies teachers use must change the pace according to the student's readiness, and the skill must be taught through more abstract and accelerated methods to avoid student boredom and lack of growth (Dimitriadis, 2016). Dimitriadis supported Firmender et al., findings when he summarized that, even if a student is not considered "gifted" by their school, their learning

experience should still be individualized and challenging for them to continue to show growth and advancement. By having students more engaged in challenging activities, their mathematic achievement and conceptual development of addition and subtraction will increase, therefore allowing the student to continue to grow and progress at a higher level.

This research shows the dire need for a product to help our struggling kindergarten students learn addition and subtraction at a pace that is more appropriate and uses different strategies. The research also demonstrates the paramount need for a product to help our high-performing kindergarten students to be challenged when learning addition and subtraction to prevent boredom and a disinterest in learning. With this research must come a product that will benefit both groups of kindergarten students and their teachers alike.

Purpose of the Project

This research project looks to address the design of accommodating strategies that will boost kindergarten performance in mathematics more specifically, in addition and subtraction. By creating a small physical space in the classroom and using common everyday items, a series of best practices for remedial addition and subtraction, and best practices for advanced addition and subtraction will be afforded to every child in the class. This child-friendly physical space allows accommodations to be given to any student performing on any level without the requirement of the teacher doing it one-on-one, as it typically happens now in most classrooms. This physical space is designed as an independent workspace that, once provided to the students with an explanation how to use the space, students will have the independence to visit this space to access the accommodations they need without having to wait for a teacher's help. This

physical learning space will allow students to implement research-based strategies to help grow in of addition and subtraction. Additionally, there is a built-in rewards system that incorporates every student in the classroom. The physical space also allows educators to serve all of their students without singling out students and allows all students to continue to succeed at their own pace using research based strategies.

Methodology

The focus of this project is to gather research-based strategies to inform how struggling and high-performing kindergarten students can improve in the areas of addition and subtraction and have immediate access to accommodations that have been proven to be beneficial. This project will focus on gathering numerous research-based accommodations to allow kindergarten teachers to better serve and teach their students on a daily basis without worrying how to help their students understand addition and subtraction skills.

To gather and obtain the research-based accommodations that have already proven to be beneficial, I will use several different research methods to develop this tool. First, I will use research that is current and has significant support and statistical evidence to demonstrate the effectiveness of the accommodation. This research will include input from educators who implemented these accommodations and are able to attest to the benefits of the accommodation. This research will also include statistical evidence that shows student achievement before and after the accommodation was introduced and used by the student on a consistent basis until the student became more knowledgeable in the skill.

Secondly, I will refer to research that details accommodations for English language learners in the areas of addition and subtraction because the language in mathematics instruction

can be a factor in a student's achievement level for remedial learners. Employing methods that are suggested for English language learners will allow kindergarten teachers to understand how they can create accommodations to benefit all of their students when they are implemented. This research will be extremely beneficial in discovering and organizing strategies to help our under-performing learners.

The data obtained from the research will be organized using a criteria analysis grid. This grid will allow for easy organization of information discovered in these five categories: (a) math vocabulary, (b) manipulatives, (c) questions/prompts, and (d) partner talk. The title of the articles in the grid will be presented vertically, while the criteria will be presented horizontally across the top. Direct quotes and paraphrased information will be recorded next to the corresponding article and under the correct category. Using criteria analysis grid will allow for information to be grouped based on which criteria the information fits into and will allow simple implementation into the final product to occur.

Definition of Terms

The following definitions are contextually descriptive of this research. Terms may be defined differently in other research as several of these words are ambiguous in origin. Thus, the following definitions are presented here for the reader of this manuscript to lend a better understanding of the context of the study and the research informing this thesis.

1. *Common Core State Standards* is a set of U.S. educational standards for teaching and testing English and mathematics between kindergarten and 12th grade.
2. An *accommodation* is the alteration of an environment, curriculum format, or type of equipment that allows an individual with a disability to gain access to content

and/or complete assigned tasks. It allows students with disabilities to pursue a regular course of study.

3. *English language learners* are students who are unable to communicate fluently or learn effectively in English. These students typically require specialized or modified instruction in both the English language and in their academic courses.
4. An *individualized education plan* (IEP) is a plan or program developed to ensure that a child who has a disability identified under the law and who is attending an elementary or secondary educational institution receives specialized instruction and related services.
5. A *504 plan* is a plan developed to ensure that a child who has a disability identified under the law and is attending an elementary or secondary educational institution receives accommodations that will ensure their academic success and access to the learning environment.

Chapter 2
LITERATURE REVIEW

This project fulfills a need for remedial learners and high-performing students to maintain success and growth in learning addition and subtraction during their kindergarten year. The literature showcases the need for students to constantly be challenged on their own ability level while continuing to experience success; however, the Common Core State Standards have caused all curricula to become narrowed to only allow success for our average performing students. This immense challenge has resulted in teachers becoming increasingly frustrated with how to educate all of their students and meet all of their students' needs when the strategies and materials are only provided for students who are performing at their grade level. There is a substantial lack of materials and strategies for students who are struggling and for students who are performing at a much higher level.

This chapter is divided into four main sections. The first section examines the importance of students learning to use mathematical vocabulary when problem solving and explaining their mathematical reasoning. After examining the importance of teaching students mathematical vocabulary and how to use it, the second section discusses the critical need for students to talk with a partner during the mathematical-problem solving process. Student interaction allows students to understand from their peers how to add or subtract two numbers. When all students use the same mathematical vocabulary during their partner talk, students are hearing how the language can be used in a mathematical conversation. The third section focuses on how kindergarten math teachers should be asking questions and prompting students when working with them in small groups or one-on-one. The way teachers ask students questions is vital to improving a student's understanding of addition and subtraction. Lastly, the importance of

manipulatives will be discussed. The need visual and kinesthetic learners have in mathematics is just as strong as it is in other subject areas. Students need to have manipulatives to aid in their addition and subtraction skills to create a deeper understanding of what is truly taking place within the problem.

Mathematical Vocabulary

Children learn how to communicate at an early age and become comfortable with speaking about familiar topics. When children become students in their earliest, formal school setting, the amount of vocabulary they are exposed to, quickly becomes extensive and can be confusing or overwhelming. This is especially valid in reference to addition and subtraction. Often the vocabulary used in mathematics can have multiple meanings with which students may not be familiar, causing immediate confusion. Firmender et ., (2014) argued that kindergarten teachers create and use a mathematical vocabulary wall so students can reference the vocabulary being used.

Kindergarten classrooms already have a word wall that contains the weekly words that students are learning how to read, therefore adding a wall for mathematical vocabulary will allow the students to have access to this terminology consistently. This mathematical vocabulary word wall should contain words that are relevant to the current unit of study so that students are able to maintain focus and reference to the current terminology (Firmender et., 2014). Mathematical vocabulary should also be displayed with visual representations so the students can make visual connections with the terminology. This is extremely beneficial for students who are struggling readers because they can make a visual connection with the word that represents that terminology, and in return, create a better understanding.

For students who are struggling in mathematics, "student verbalizations of math concepts and strategies had a large effect on student math achievement" (Clarke, Doabler, Nelson, & Shanely, 2015, p. 259). Having students become familiar and comfortable using mathematical vocabulary on a daily basis allows the students to apply the terminology to what they are learning and to understand their own thinking when solving addition and subtraction problems. Emphasizing the importance of a consistent use of mathematical vocabulary also prepares students to explain their thinking when they are asked to do so. By creating a mathematical vocabulary wall, modeling its use, and encouraging students to use it, will create students who are more comfortable to give a specific and accurate answer when asked to explain the task at hand, how they are solving the task, and their solution to the problem (Warren & Miller, 2015).

One great method to encourage and allow all students to become more comfortable and familiar with using mathematical vocabulary is through playing barrier games. Caniglia, Borgerding and Medaows (2017) wrote, "Barrier games require the students to express themselves using correct mathematical vocabulary and general academic language". These barrier games ensure that students from any background are using the same mathematical vocabulary to explain their process of solving a problem. This allows all students to have the same access to what their peers are sharing and also ensures that all students are understanding the mathematical vocabulary in a similar way. Barrier games are a great method to use for any classroom, especially classrooms with students who are English language learners because all students are learning the same mathematical terminology and what the terminology means.

Using mathematical vocabulary is not just beneficial for our struggling students. Encouraging our high performing mathematical students to use mathematical vocabulary encourages these students to participate in elevated discussions about their problem-solving

process. Too often, higher performing students are given a more challenging addition or subtraction task without any follow-up or discussion to demonstrate their understanding of the task. By encouraging our higher performing students to use mathematical vocabulary, these students are continuing their learning process by having to explain their thinking and logical reasoning for their choices, and are given tools to defend their answer (VanTassel-Baska & Johnsen, 2016). Giving these higher performing students the terminology needed and forcing them to share their mathematical reasoning like the rest of their peers are doing allows these students to be challenged and for their understanding of mathematics to continue to grow.

While the idea of using and encouraging mathematical vocabulary can be daunting for some teachers, most realize they are already doing it. Now, they just need to put the terminology into more consistent use. Some of the vocabulary that is encouraged includes repeat and check, think time, add on, agree/disagree and why, and partner talk. These few phrases immediately tell the students what they need to do and encourage them to examine their own mathematical thinking and reasoning. Once these phrases are modeled and taught to students, a teacher can incorporate them seamlessly into their instruction while knowing that their students are growing in their mathematically skills. “Math verbalizations are opportunities students receive to express their mathematical thinking and understanding” (Clarke et al., 2015, p. 259). Increasing our student’s mathematical abilities and helping our students create a better understanding of their mathematical thinking is vital to their success.

Partner Talk

Research has not only supported the modeling and encouragement of consistent and daily mathematical vocabulary to increase student achievement in mathematics, but also having the students incorporate mathematical vocabulary in their discussions with other students. Most adults who have been around children know they have an innate need to communicate with one another; instead of trying to prevent this dialogue in the classroom, kindergarten teachers should encourage it. Implementing partner talk with the use of mathematical vocabulary allows students to listen to and share their mathematical thinking and reasoning behind solving problems with a peer.

Firmender et al. (2014) wrote "Students should be provided opportunities to construct viable arguments and critique the reasoning of others as well as communicate precisely to others" (p. 217). Affording students the opportunity to use their mathematical vocabulary with their peers allows students to express their mathematical thinking with one another using language with which all students are familiar. Implementing partner talk also provides all students with the ability to share their thinking and to be heard by another individual. This, in return, gives the teacher an opportunity to listen to countless students instead of restricting the number of responses to just a few students in a whole group setting. Partner talk also encourages the students to use the appropriate and correct mathematical vocabulary so their partner understands what is being shared and can use the same mathematical vocabulary to give feedback and/or challenge their reasoning (Firmender et al., 2014).

Partner talk is especially beneficial when students are working within the areas of addition and subtraction. Regardless of the achievement level in these skill areas, all students can

benefit from partner talk. Students can verbalize with their partner what the "parts" are of the addition problem to then lead to a partner discussion on how to find the "whole" of the problem. Likewise, when students are solving subtraction problems, the partners discuss the whole and the given part of the problem before discussing and reasoning how to find the missing part of the problem. This type of partner talk can greatly improve and reinforce the connection of "part-part-whole" in addition and subtraction (Baroody, 1999). Encouraging partner talk during these problem-solving opportunities also allows for students to be actively engaged in curriculum that is challenging on their level and to investigate and later share their new mathematical knowledge (Firmender et al., 2014).

A method to incorporating the use of partner talk with mathematical vocabulary is to pair students of different ability levels together. When struggling students listen to their higher performing peers use mathematical vocabulary while watching them solve an addition or subtraction problem, these struggling students hear how the terminology is used while seeing what the terminology means at the same time (Pyle, Pyle, Lignugaris/Kraft, Duran, & Akers, 2017). This also allows for peer-to-peer communication in which students can ask questions and receive an explanation from a fellow peer. Encouraging students to use the appropriate mathematical vocabulary in peer-to-peer interactions allows for significant mathematical growth and achievement for all students (Firmender et al., 2014). The struggling students can actively hear a peer use the vocabulary while modeling the definition, just as the higher performing student is ensuring that the mathematical vocabulary that they are using is accurate and correct for what they are showing their peer.

Newton, Geller, Umbeck, and Kasmer (2012) advocate that the consistent use of partner talk has led to students establishing a strong foundation in mathematics and the reasoning behind

how are problems are solved rather than just memorizing a set of prescribed procedures. Partner talk encourages the students to explain their mathematical reasoning and thinking behind the problem they are solving so the answer is justifiable. The process of explaining ones thinking forces the students to think on a rigorous level and communicate their actions clearly using appropriate mathematical vocabulary, further deepening their understanding of mathematics.

Literature continues to support the implementation and consistent use of partner talk and mathematical vocabulary because of the academic growth with which it is associated. Papadakis, Kalogiannakis, and Zaranis (2016) found that when students are actively involved in the learning process and are given opportunities to share their mathematical thinking and reasoning, with both adults and their peers, the development of a child's mathematical ability drastically increases. Providing opportunities for partner talk allows the students to express their thinking and reasoning while improving their understanding of the skill.

Teacher Questioning and Prompting

While the questions and prompts teachers give to their students during mathematical instruction may not seem that important, especially within addition and subtraction, this idea can have a tremendous impact on the students' growth and understanding. According to Firmender et al. (2014):

> A teacher who implements such instructional practices listens to students' ideas and challenges students' thinking by asking them to justify their ideas. In addition, the teacher pursues certain ideas in more depth, provides additional information as necessary, and monitors students' participation in discussions. (p. 217)

This idea of the teacher challenging the students thinking by changing how they question and prompt their students is not new it just takes time and practice to know how to ask the students the right questions or give the best prompt.

Students who are struggling in addition and subtraction require more direct questioning and prompting. These students will not benefit from open-ended questions because they do not yet understand the reasoning or methodology behind addition and subtraction (Doabler et al., 2016). Struggling students need more direct questioning followed by more concrete and simplistic answers to build on the foundation of what addition and subtraction is. Dyson, Jordan, Beliakoff, and Hassinger-Das' (2015) research recommended that teachers only use addition or subtraction questions that contain numbers of 5 or less. Implementing this questioning strategy promotes a greater understanding of number sense and the reasoning behind addition and subtraction with less emphasis on fact fluency. Teachers must be cognizant of the questions and prompts they are using with their struggling learners so the student's working memory is focused on learning the process and reasoning of addition and subtraction before challenging the reasoning with more complex problems (Fuchs et al., 2015). As their students develop a better understanding and begin to reason their mathematical thinking, teachers will be able to ask deeper, more thought provoking questions to this group of students.

Students who are high achieving in addition and subtraction require more abstract and deeper questioning to promote their academic growth and to prevent boredom (Dimitriadis, 2016). Just as students who struggle with addition and subtraction, this group of high performing students must have carefully thought-out questions and prompts that will encourage growth and achievement within them (Adelson, McCoach, & Gavin, 2012). If these higher performing students are not having their learning extended and challenged in a meaningful way then the

work they are completing will not have a full effect on the student (Dimitriadis, 2015). Students who are in need of a challenge in addition and subtraction should be receiving problems that are more open-ended and project based. These types of questions and prompts encourage these students to apply their mathematical vocabulary, dissect their own mathematical thinking, and explore the possible methods to finding a solution (VanTassel-Baska & Johnsen, 2016).

Regardless of which group of students a teacher may be trying to target with their questions and prompts there are a few methods that can be implemented with any group of learners, including creating meaningful questions, guided play, and symbolic prompting. The first method meaningful questions requires the teacher to get away from the idea of basic addition and subtraction worksheets so that students are practicing these skills in ways that are relevant to them. Papadakis et al. (2017) found that when students are asked problems in the form of familiar stories and daily activities, such as visiting a toy or grocery store or toy store, the students were much more interested in the activity and could able to better explain their mathematical reasoning. Giving students addition or subtraction questions in which they must choose items to "purchase" from a store, and then add up their total and subtract the total from their given amount of money, gets the students actively involved with the skill through practice. This involvement and excitement also creates better number sense and a better understanding for how the skills of addition and subtraction are important to their daily lives (Chard et al. 2008). This method can be easily adapted for struggling students by only allowing them to have a certain amount of "money" to spend while giving higher performing students more money to spend therefore creating more challenging addition and subtraction problems.

Guided play is another method discussed in the literature as an effective way to increase student achievement in addition and subtraction. Guided play is not direct instruction where the

students listen while the teacher is talking; in fact it is the exact opposite. Guided play is when an adult partner (teacher) follows a child's lead in play and asks questions to help children discover information (Zosh, Hassinger-Das, Hirsh-Pasek, &Golinkoff, 2016). Guided play allows the student to actively solve their addition or subtraction problem while the teacher quietly watches and provides appropriate-level questions or prompts to encourage the student to engage in verbal reasoning about what they are doing. Again, this method can be used for all ability level students since the only aspect that changes is the level of the questions and prompts that are used. In fact, students who learned addition and subtraction through guided play extended their learning more than those who learned through didactic instruction (Zosh et al. 2016). Teachers can also teach this method of questioning and prompting to their students, and when the students are ready, they can use this method of guided play in partner exercises to further enhance mathematical reasoning and the use of the mathematical vocabulary.

A third method that can be used with appropriate questions and prompts is symbolic prompting. This method gets the students actively involved with the activity and enhances their mathematical vocabulary and understanding. Baroody (1999) supports this method for students who are learning addition and subtraction simultaneously. In this method, students are prompted to circle the whole and underline the parts in both types of problems. This method of giving a symbolic meaning to the parts of addition and subtraction allow students to create and expand on their mathematical reasoning for the relationship between part-part-whole and addition and subtraction.

Regardless of which method a teacher chooses to use when incorporating appropriate questions and prompts there are two tasks a teacher should always include: (a) the appropriate use of mathematical vocabulary, and (b) engaging the students in a summary discussion. First,

teachers must be cognizant of the vocabulary they are using in their questions and prompts when working with the students. When teachers consistently model appropriate mathematical vocabulary in their questions and prompts, students will gradually incorporate the vocabulary into their own thinking and reasoning (Firmender et al. 2014). The appropriate use of mathematical vocabulary forces students to maintain a form of language that is familiar to all of the students and allows all students to continue to grow when participating in the answer of questions.

Second, teachers should always end each addition and/or subtraction lesson with a summary discussion. Newton et al. (2012) showed that summarizing after each addition and/or subtraction lesson gives students a chance to share their new mathematical understanding. This type of summarizing discussion allows the students to build on their own understanding by hearing how their peers have progressed. These discussions also provide more opportunities for students to incorporate mathematical vocabulary into their mathematical reasoning and sharing. Summarizing at the end of every lesson also allows for any confusion that may be lingering to be absolved so that students end their time with mathematics clear minded and confident in their skill level.

Incorporating the appropriate questions and prompts in addition and subtraction can be time consuming, especially when a classroom has students at various ability levels. However, these questions and prompts will allow all students to grow and enhance their mathematical understanding. Individual student growth and understanding is vitally important to every student to maintain their interest and excitement in learning.

Manipulatives

Approximately 70% of learners are either visual learners, kinesthetic learners, or a combination of both (Louis, 2017). This large percentage means that teachers need to be using manipulatives and visuals when teaching their students how to add and subtract. The use of visuals and manipulatives get the students engaged with the curriculum and allows students to create meaningful connections and understanding with the content and skill at hand (Doabler et al. 2016). Visuals and manipulatives can be used in many different ways, and the availability of manipulatives and visuals will vary from school to school, but there are common visuals and manipulatives teachers can create for their students.

A manipulative and visual to which teachers have immediate and direct access are their fingers. Dyson et al. (2015) research supported the idea of students using their fingers to solve addition and subtraction problems. When students use their own fingers as a manipulative, they improve their fluency and physically see how the action of addition or subtraction is affecting the number of fingers they have "up." For years and years students have used and relied on their fingers to solve addition and subtraction problems and finally there is literature that supports this use as a valid method for students to solve addition and subtraction problems.

A number line serves multiple purposes as a visual and a manipulative. The display of a number line allows students to visually see the count sequence and the relationship of any two numbers (Chard et al. 2008). Number lines can be displayed in a large format on a wall in the classroom and can serve as a reminder or number lines can be printed in a smaller format and be available to students in multiple ways. Students can have number lines taped to their desktops or simply know where number lines are located in the classroom and have the freedom to obtain

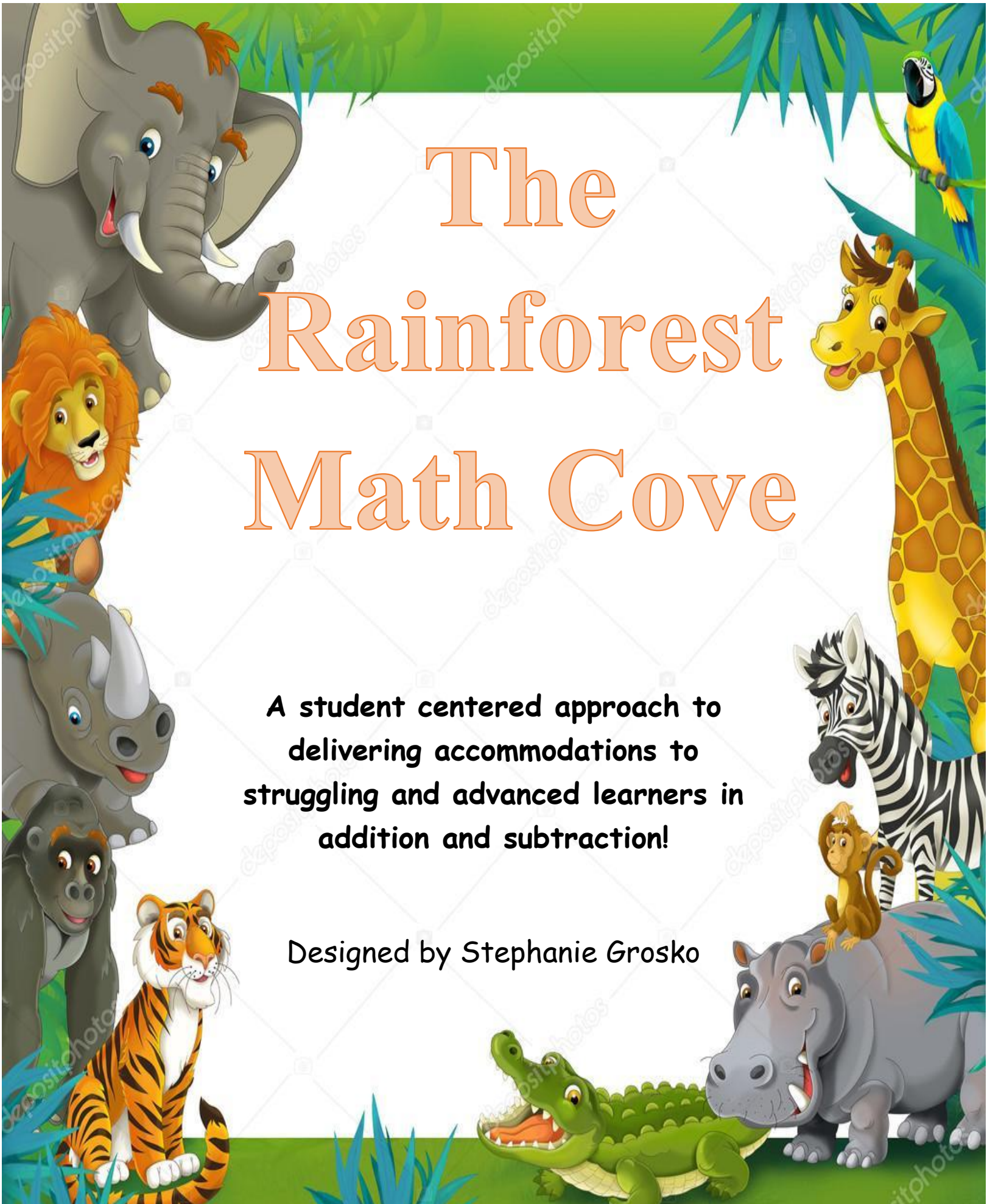
one when needed. The use of number lines when adding and subtracting allows students to see the process of giving more or getting less. This visual and manipulative allows the students to enhance their mathematical understanding of numbers and the value that each number holds.

Another simple manipulative and visual that a teacher can make is a hundreds chart. Chard et al. (2008) research supported the use of a hundreds chart because it allows higher performing students to understand the relationship between larger numbers. The hundreds chart also becomes a new tool for learners to use when solving more challenging addition or subtraction problems. Again, a hundreds chart can be displayed in a large version within the classroom and can be created in a smaller format so all students have access to it as needed. The hundreds chart also enhances the students' number sense, which can be used when explaining their mathematical reasoning. The combination of a number line and a hundreds chart allows students to see patterns in numbers as they increase in value. The increase in number sense enhances the student's mathematical understanding and reasoning, thereby allowing them to develop a deeper understanding of what their addition or subtraction problems really mean.

For students who are struggling with addition and subtraction the use of manipulatives should be often and consistent. Osewalt's (2016) research found that when students who are struggling in addition and subtraction begin to learn through touch by way of manipulatives, there is a drastic improvement in their achievement. Learning through touch gives students a sensory input that allows them to be engaged and active with their learning and allows them to see the process of gaining more or getting less (Osewalt, 2016). Using manipulatives makes the addition or subtraction abstract and instead gives it a physical, concrete meaning because objects are either growing or decreasing in number. These learners need to understand what is happening when addition or subtraction is occurring before they can begin to reason their thinking.

A final manipulative and visual that can be used to improve student's addition and subtraction on any level is the use of a spinner. Spinners allow all learners to have access to them since any variation of numbers can be placed on them. When students use a spinner with numbers, they have control over what the addition or subtraction is, which further increases their engagement and excitement with the activity. For students who are struggling the spinner can have several ones and twos on it to create simple addition and subtraction problems so students continue to build their foundational knowledge of addition and subtraction. For students who are high-performing, their spinners can have double-digit numbers to increase the difficulty of their problems. An important aspect to using the spinner is that students verbalize the number they spun, place the number in their problem, and then read their mathematical sentence. This verbalization process enhances the students number sense and creates a stronger understanding and reasoning for how to solve the problem because they are reading the problem and hearing what action needs to be performed (Dyson et al. 2015).

The use of visuals and manipulatives is nothing new; however, using them in the correct format and changing how they are used so all ability-level learners have access to them is key in improving achievement in all students. For some students, the use of manipulatives and visuals will be a starting point that they eventually stop using as their thinking becomes more abstract. For others, manipulatives and visuals will be how they to make sense of their mathematical practices and will aid them in understanding the process that is unfolding. It is key for all teachers to ensure that all students have access to these tools as they are needed so that students maintain their mathematical reasoning and understanding.


The
Rainforest
Math Cove
A student centered approach to delivering accommodations to struggling and advanced learners in addition and subtraction!
Designed by Stephanie Grosko

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Chapter 3

PROJECT DESIGN

This chapter explores the need for an accommodation center to improve student's mathematical abilities in addition and subtraction, details how the project works and how to use it in the classroom, as well as the solutions this project provides in the areas of Special Education. The project discussed in detail below revolves around a child-friendly rainforest theme that utilizes animals that most kindergarten age students are familiar with while also providing positive incentives for students using the center effectively and responsibly. The project utilizes the student-centered mentality that allows for all students to better their own understanding of addition and subtraction using research-based accommodations.

The Need for the Rainforest Math Cove

With the current lack of accommodations to help our remedial learners experience success within addition and subtraction and the lack of challenging methods to expand the learning of our higher performing learners in addition and subtraction, the Rainforest Math Cove looks to solve both of these problems. Since the implementation of the Common Core State Standards (CCSS) math curriculum in kindergarten has become mainstreamed and students who are not performing on an "average" level are left either struggling or bored. When our lower performing students who need accommodations and reminders on the strategies to use to help them solve addition and subtraction are left feeling frustrated at their seat, their desire to continue trying diminishes and so does their will to learn. Likewise, with our students who are gifted, if the addition and subtraction instruction or practice is too simple for them, they will lose the motivation to keep learning and to discover new strategies and methods.

For these students who may not be performing low enough to qualify for a Learning Disability and an Individualized Education Plan (IEP), they are left in the dark wondering how to solve their addition and subtraction problems meanwhile their teacher is trying to help as many students as they can before needing to move on. Often times, these students who are struggling are left in the dark to try and make sense of the addition and subtraction skills on their own. While this independency with learning and exploring new methods can provide a positive learning experience our students, it also leaves the door wide open for wrong information to be interpreted and applied to their learning. These students are the group that slips through the cracks during their educational journey because they tend to get by just enough to avoid raising a concern. However, these are the students who need these accommodations and ability to receive feedback more frequently in order to feel more success to keep their drive for learning.

Our students who are performing at high levels in addition and subtraction but do not qualify for gifted programs are also left in the dark wondering why they are solving the same simplistic style problems over and over again. Their internal drive to continue learning and accepting the challenge of learning new material does not go away simply because they understand how to add and subtract on the kindergarten level. These students have the drive and motivation to learn more, learn how to apply their simplistic addition and subtraction skills to harder problems. Even when these students are introduced to more challenging material, there are still instances where they too need accommodations and teacher direction for how to solve their challenging problems. However, these higher performing students likely will not ask for the help because to them, it is supposed to be easy and asking for help means they do not understand it.

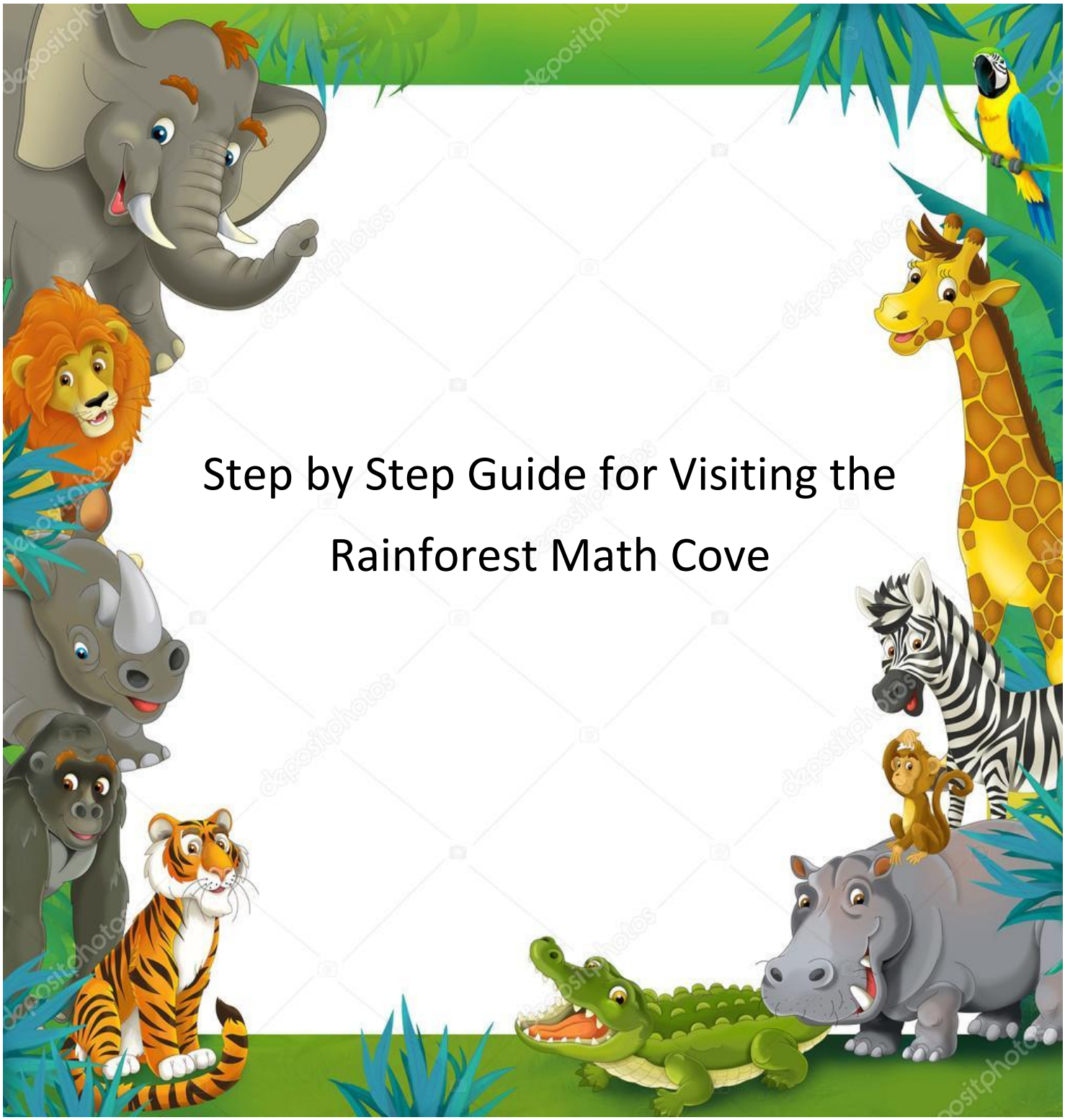
Both of these groups of students, the lower achieving and the higher achieving, need accommodations to continue feeling success and pride in their addition and subtraction skills. These are two groups of students who have the opportunity to stay out of the Special Education process if the appropriate accommodations are made that would allow for them to succeed at their own levels. This is a problem happening in most kindergarten mathematic programs. The new CCSS curricula is not meeting the needs of all students. The CCSS while great in other aspects, is letting our teachers and students down specifically in the areas of addition and subtraction. Teachers who are trying to help their lower achieving students simply are not given any materials or guidance for how to do so from their curriculum. Just as these same teachers are trying to challenge their higher performing students, but are left unsure what to do in addition and subtraction that would be the next developmentally correct next step for these skills. All of this leads to teacher frustration, student frustration and boredom, and parents wondering why their child may not be getting the education that they need in order to succeed. This is why the Rainforest Math Cove can completely alter how our lower achieving and higher achieving students are receiving their accommodations during their school day.

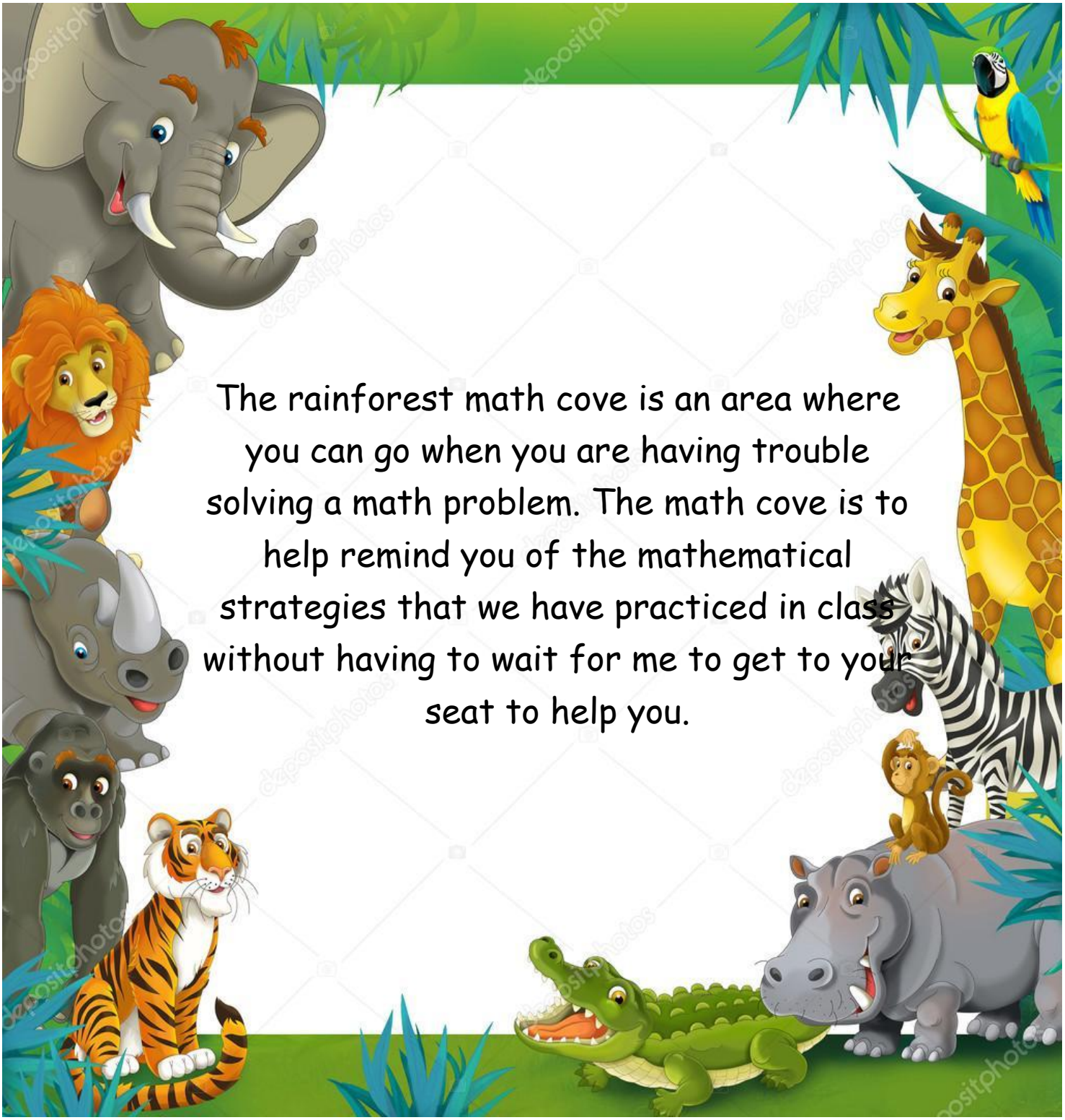
The Rainforest Math Cove in Action

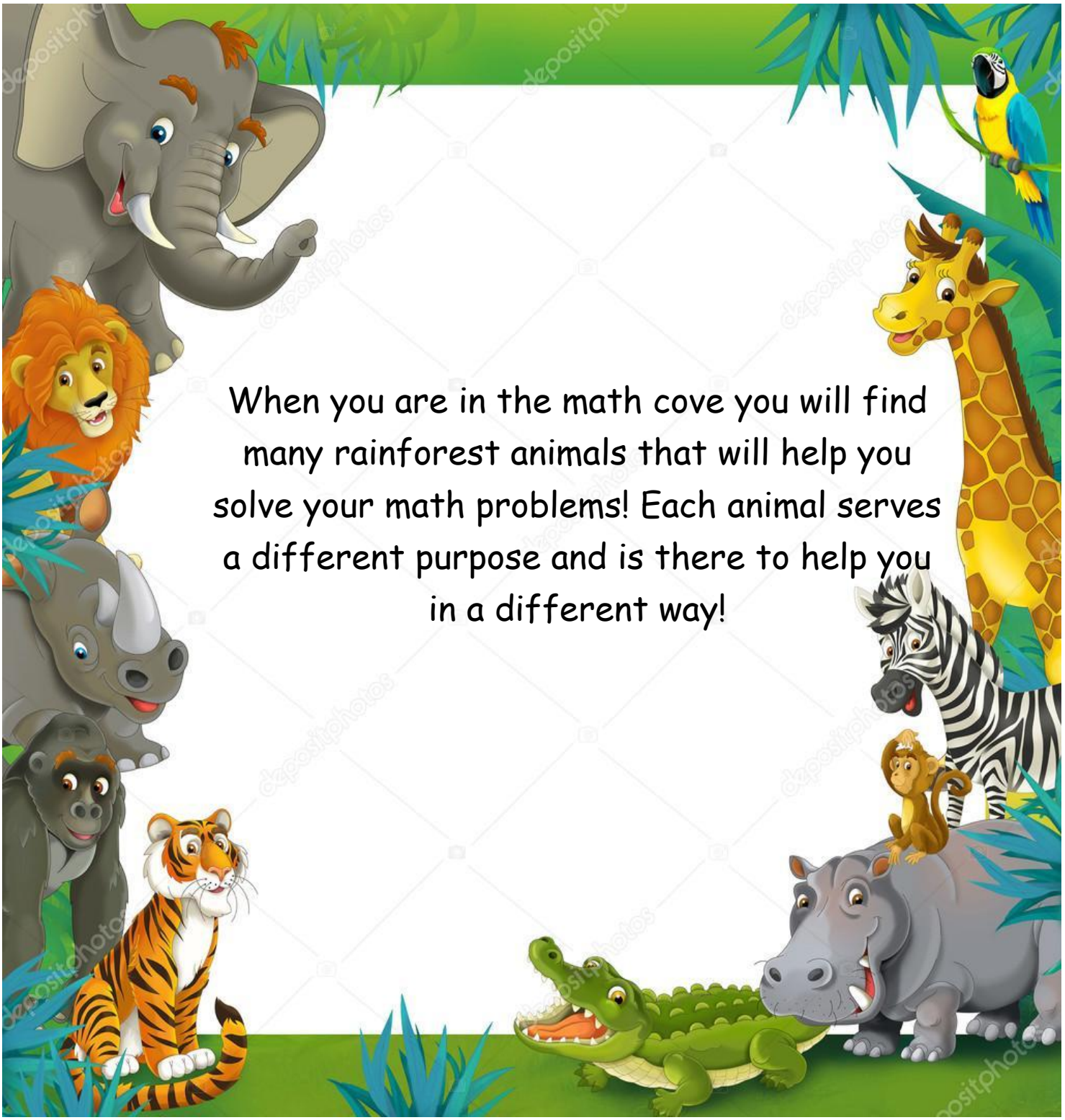
Teacher's Modeling Guide

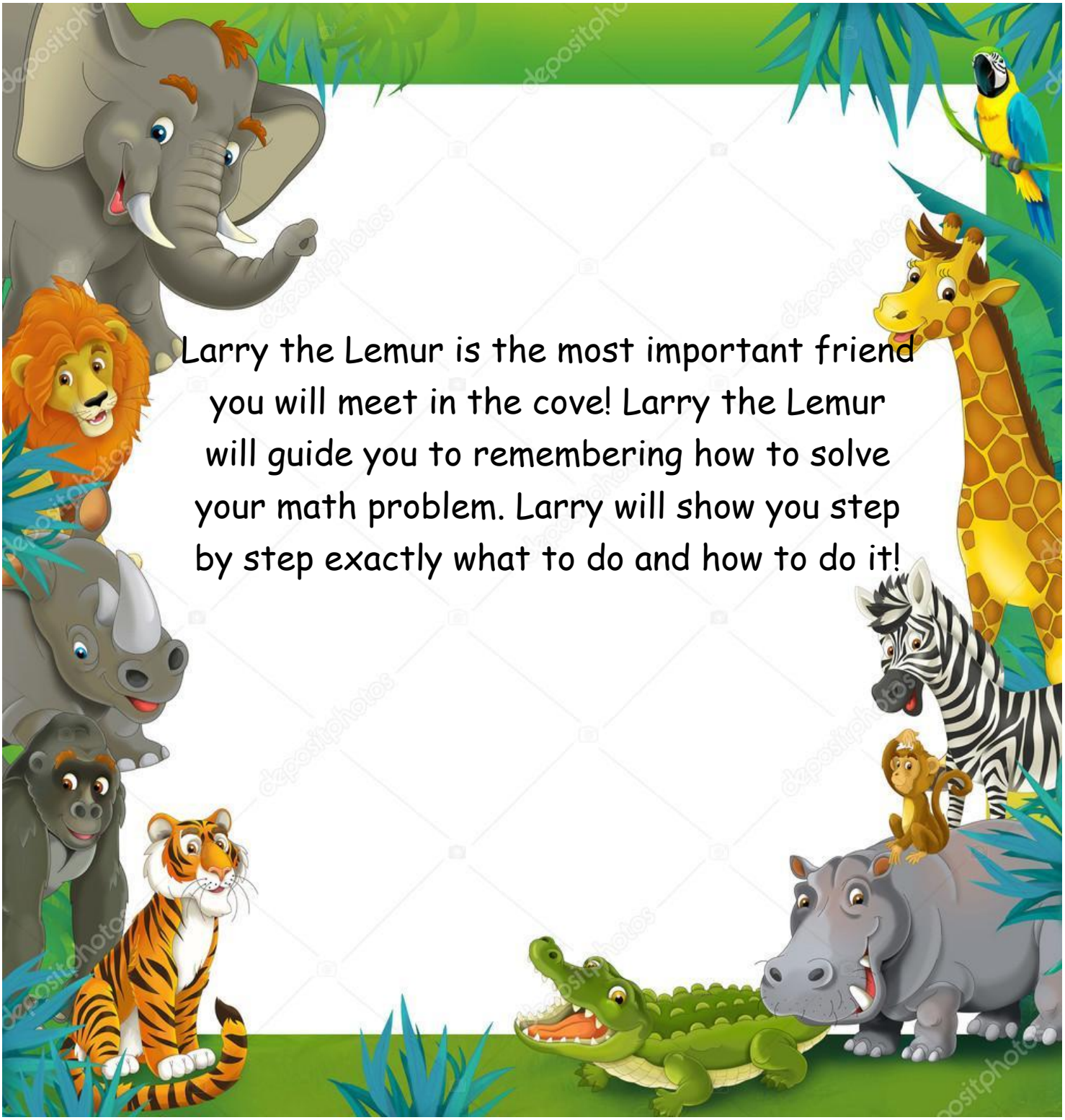
The Rainforest Math Cove (RMC) is a independent work station set up in a quiet area of the classroom that consists of two student desks and have rainforest décor to provide an appealing feel to the area for the students. The RMC is a child centered accommodations area for students to utilize when working on addition and subtraction by level of difficulty in the Rainforest Treasure Chest. The RMC is an area that is not introduced until the individual teacher

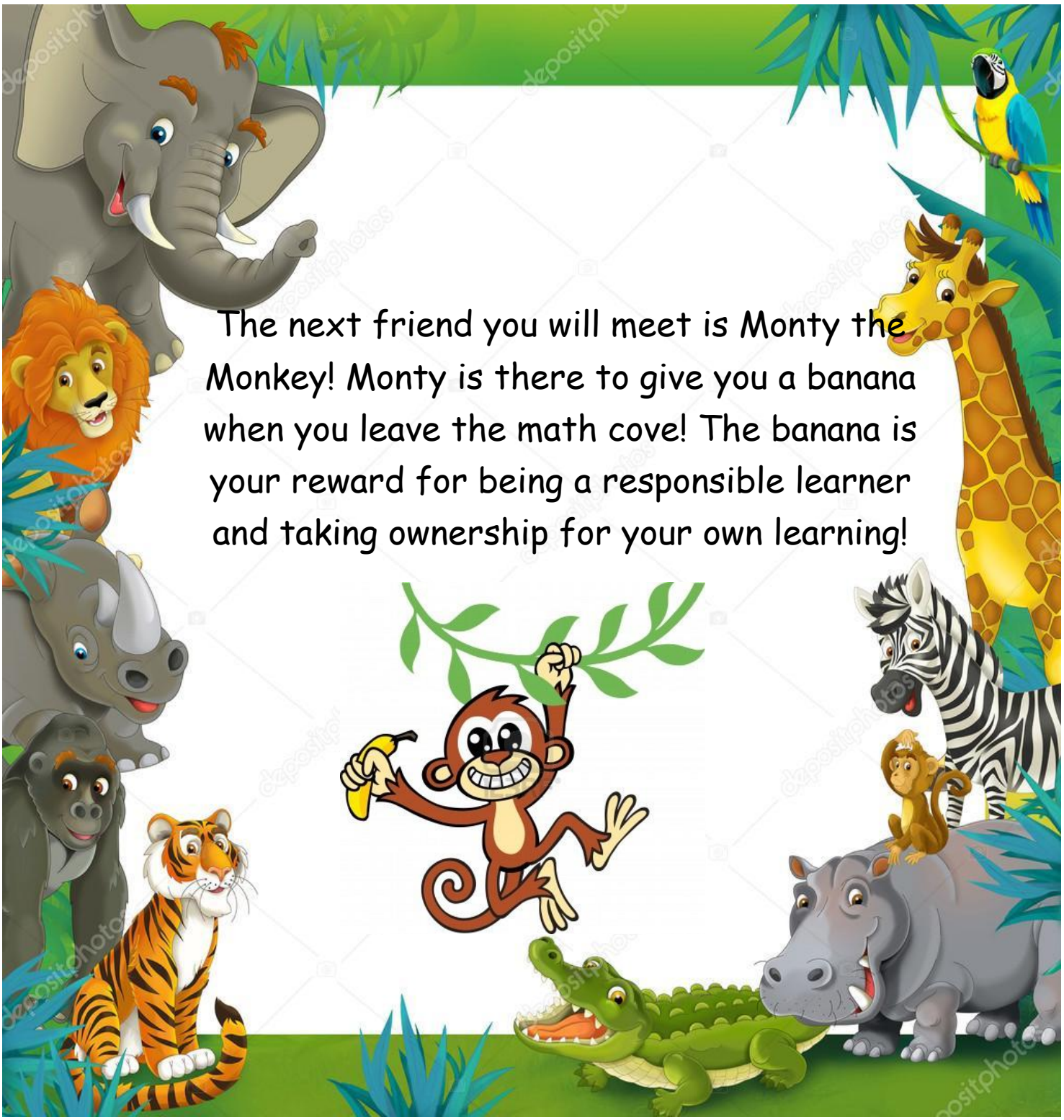
feels that their students are able to handle the mostly independent mathematic accommodations area. When the students are ready, the teacher will model how to use the RMC several times so that students understand the expectations when using the RMC and understand when and why they may visit the RMC.


Step by Step Guide for Visiting the
Rainforest Math Cove


The rainforest math cove is an area where you can go when you are having trouble solving a math problem. The math cove is to help remind you of the mathematical strategies that we have practiced in class without having to wait for me to get to your seat to help you.

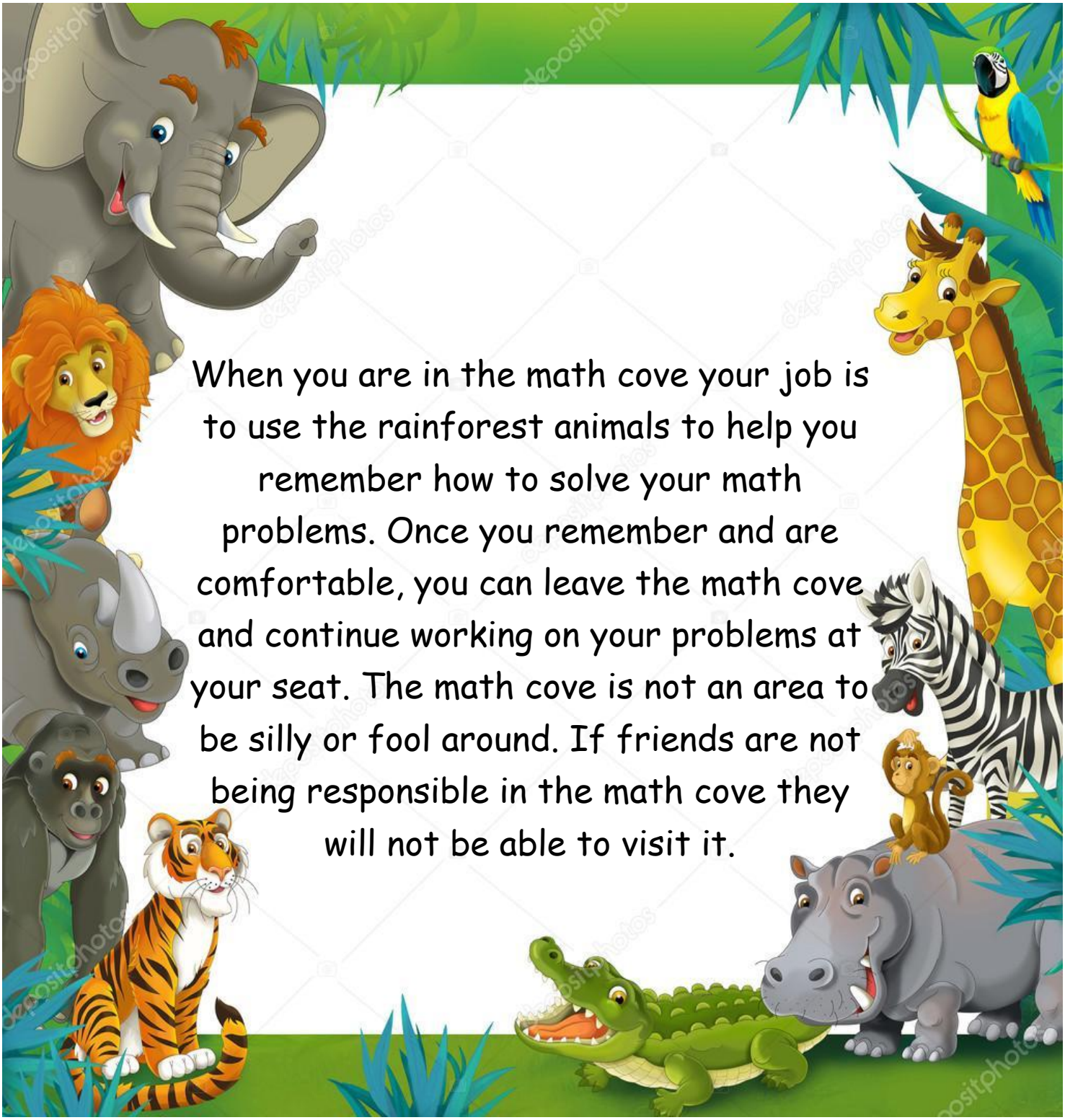

When you are in the math cove you will find many rainforest animals that will help you solve your math problems! Each animal serves a different purpose and is there to help you in a different way!

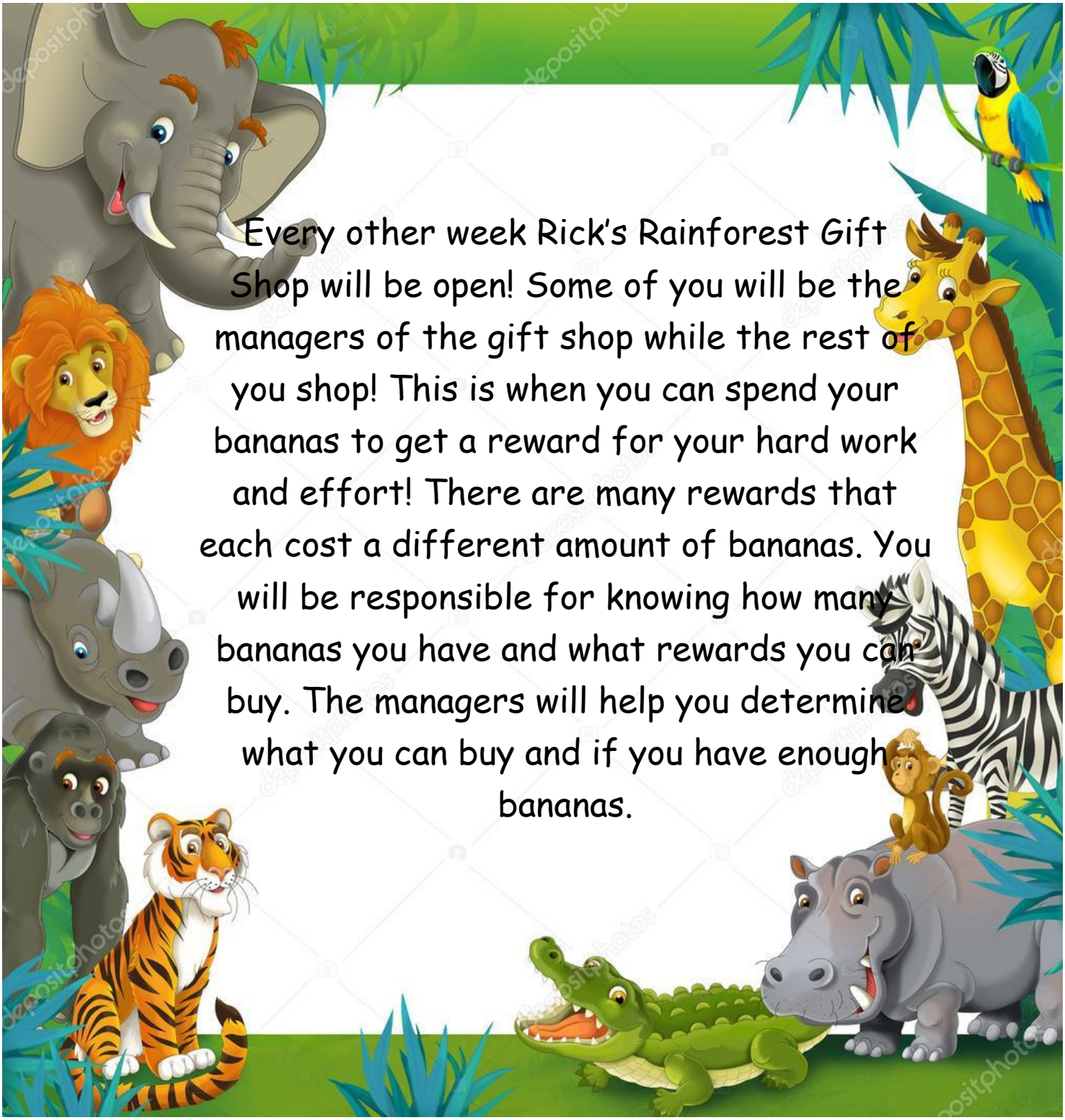

Larry the Lemur is the most important friend you will meet in the cove! Larry the Lemur will guide you to remembering how to solve your math problem. Larry will show you step by step exactly what to do and how to do it!

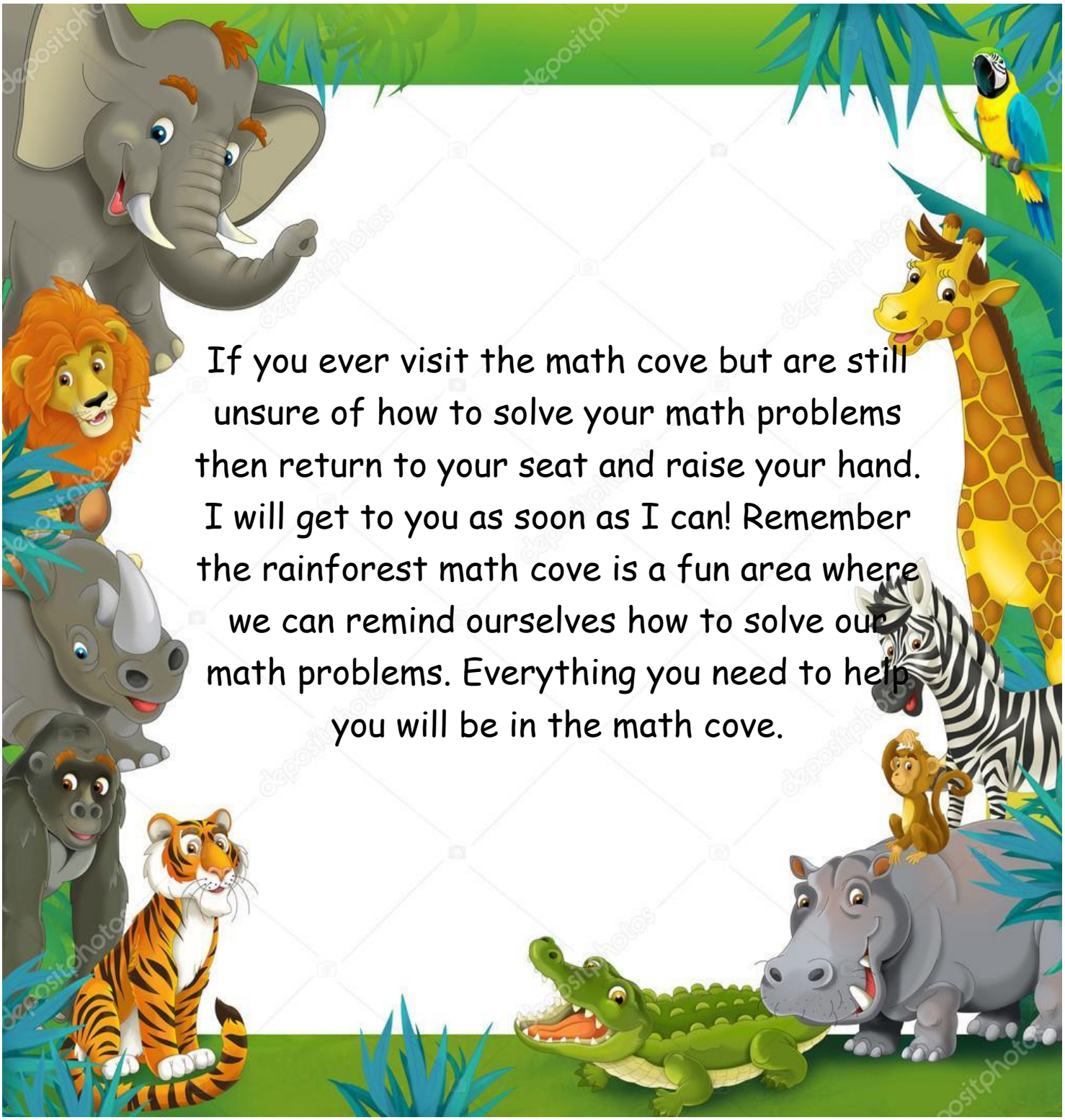

The next friend you will meet is Monty the Monkey! Monty is there to give you a banana when you leave the math cove! The banana is your reward for being a responsible learner and taking ownership for your own learning!


Whenever you get a banana you put it in your rainforest backpack! Your rainforest backpacks are located on the wall by the entrance to the math cove. Your bananas will stay here.


In the math cove you will also meet Pete the Parrot! Pete is there to give you support and encourage you to keep trying your best!


When you are in the math cove your job is to use the rainforest animals to help you remember how to solve your math problems. Once you remember and are comfortable, you can leave the math cove and continue working on your problems at your seat. The math cove is not an area to be silly or fool around. If friends are not being responsible in the math cove they will not be able to visit it.


Every other week Rick's Rainforest Gift Shop will be open! Some of you will be the managers of the gift shop while the rest of you shop! This is when you can spend your bananas to get a reward for your hard work and effort! There are many rewards that each cost a different amount of bananas. You will be responsible for knowing how many bananas you have and what rewards you can buy. The managers will help you determine what you can buy and if you have enough bananas.


If you ever visit the math cove but are still unsure of how to solve your math problems then return to your seat and raise your hand. I will get to you as soon as I can! Remember the rainforest math cove is a fun area where we can remind ourselves how to solve our math problems. Everything you need to help you will be in the math cove.

Larry the Lemur Instructor

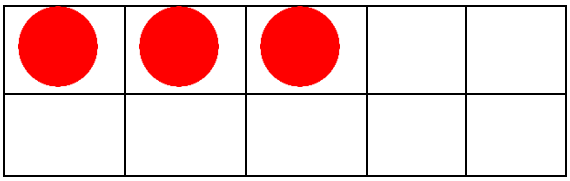
Within the RMC are accommodations that the teacher has provided before to the students of both the lower achieving and higher achieving groups. “Larry the Lemur” is the instructor showing the students step by step how solve an addition or subtraction using visual illustrations and simple kindergarten level language. The students follow Larry the Lemur’s instruction and solve an addition or subtraction problem using the steps they are being shown.

larry the Lemur’s Remedial Instructions.

These are Larry the Lemur's instructions for solving remedial addition and subtraction problems. Cut the entire group out in smaller rectangles to put in order. Print in color.

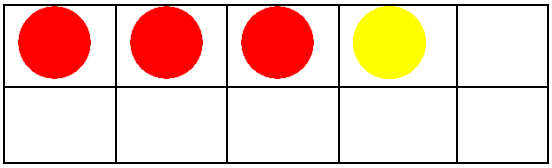
The first number is red counters.

3 + 1 = _____



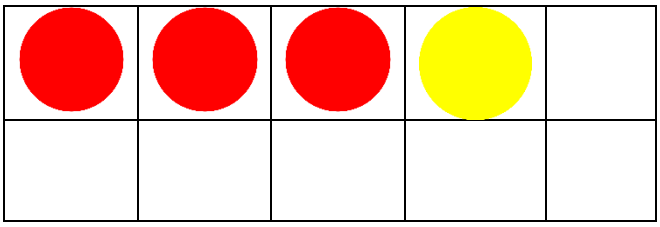
The next number is
yellow counters.

3 + 1 = _____



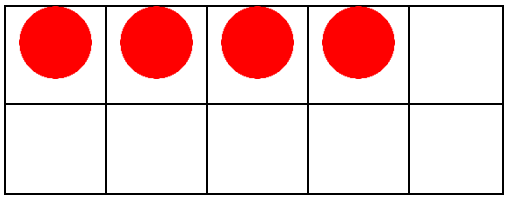
Count them all. Write your answer.

3 + 1 = ___**4**___



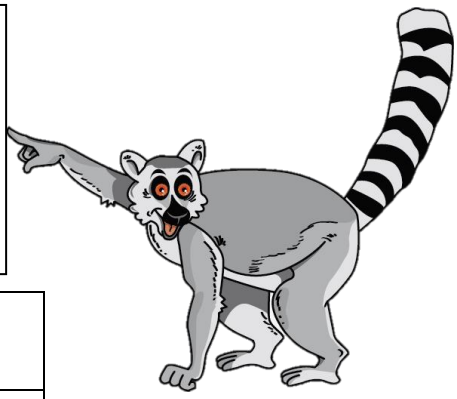
The first number is red counters.

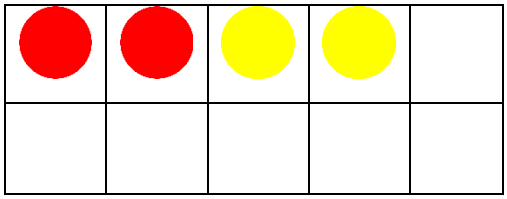
4 – 2 = _____



The second number is how many flip to yellow.

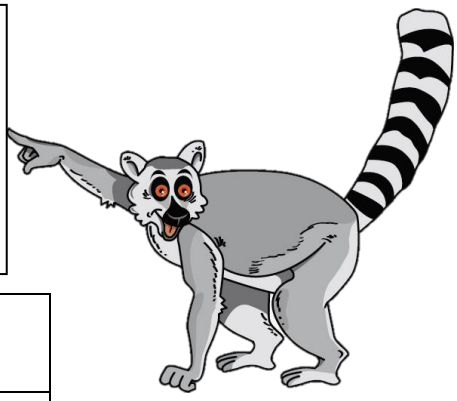
4 – 2 = _____

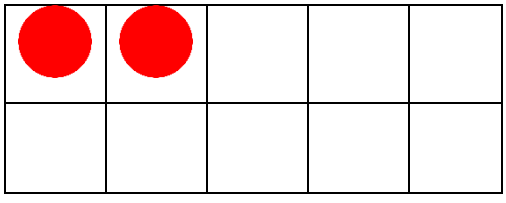


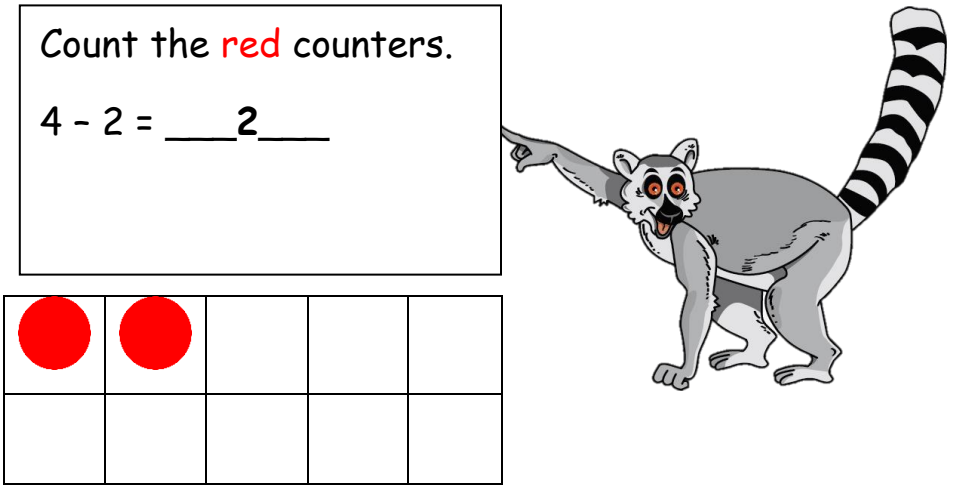


Take the yellow counters off.

4 – 2 = _____

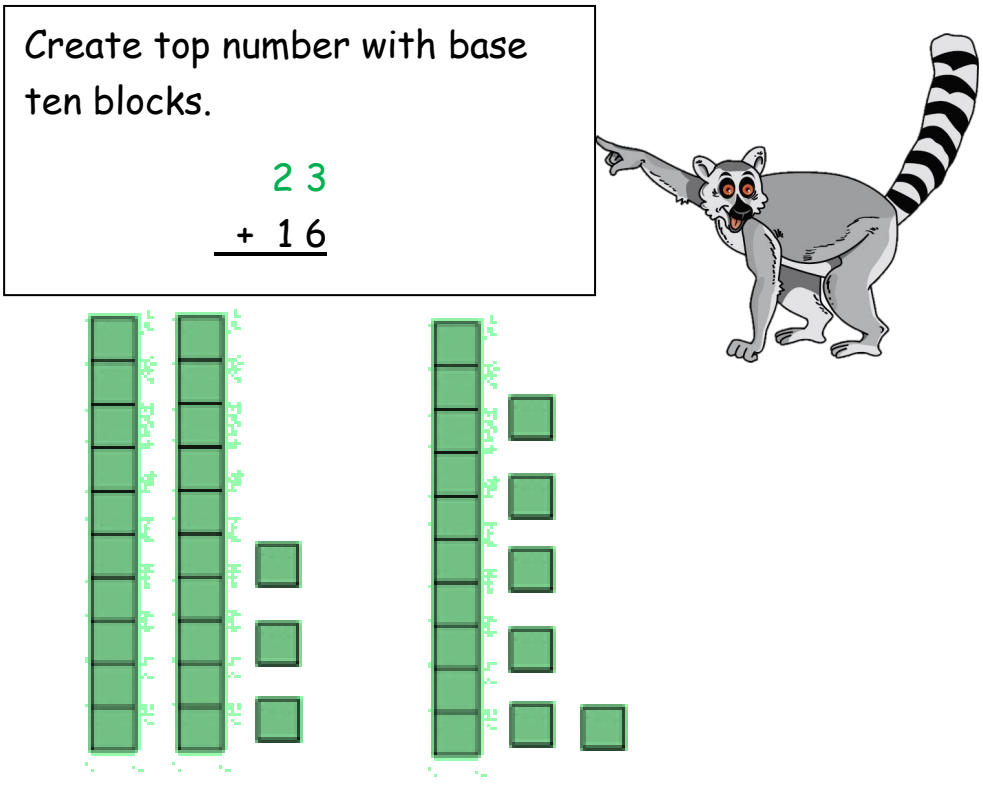






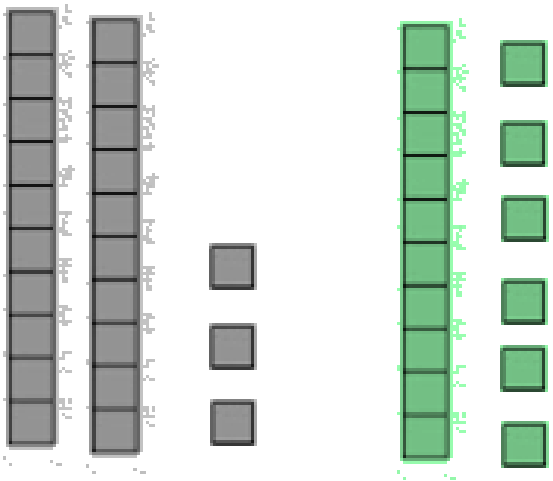
larry the lemur's advanced instructions.

These are Larry the Lemur's instructions for solving advanced addition and subtraction problems. Cut the entire group out in smaller rectangles to put in order. Print in color.



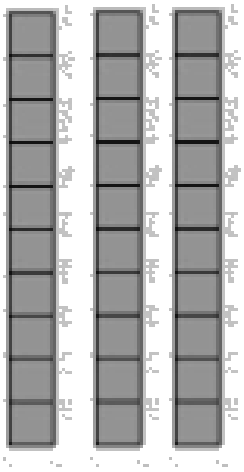
Create bottom number with base ten blocks.

$$\begin{array}{r} 23 \\ +\ 16 \\ \hline \end{array}$$



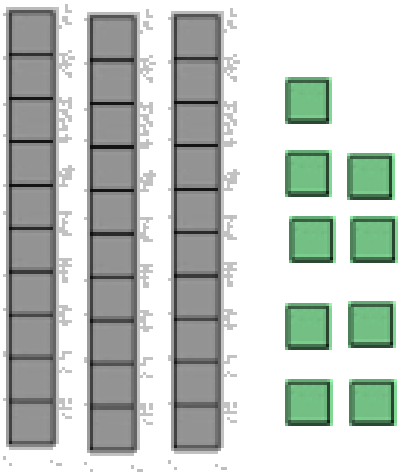
Put the sticks together.

$$\begin{array}{r} 23 \\ +\ 16 \\ \hline \end{array}$$



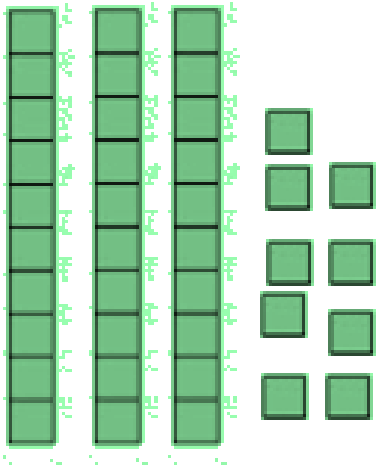
Put the ones together

$$\begin{array}{r} 23 \\ +\ 16 \\ \hline \end{array}$$



Count the sticks then the ones.
Write your answer.

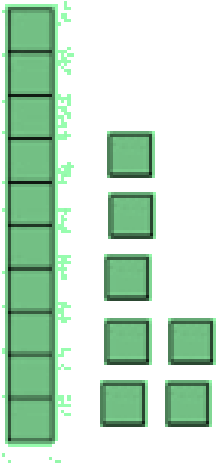
$$\begin{array}{r} 23 \\ +\ 16 \\ \hline 39 \end{array}$$



Make the top number

17

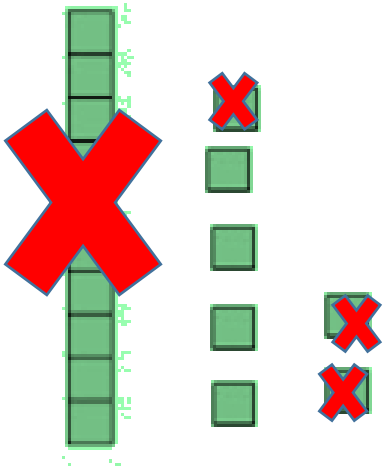
- 1 3



Take away the bottom number.

17

- 1 3

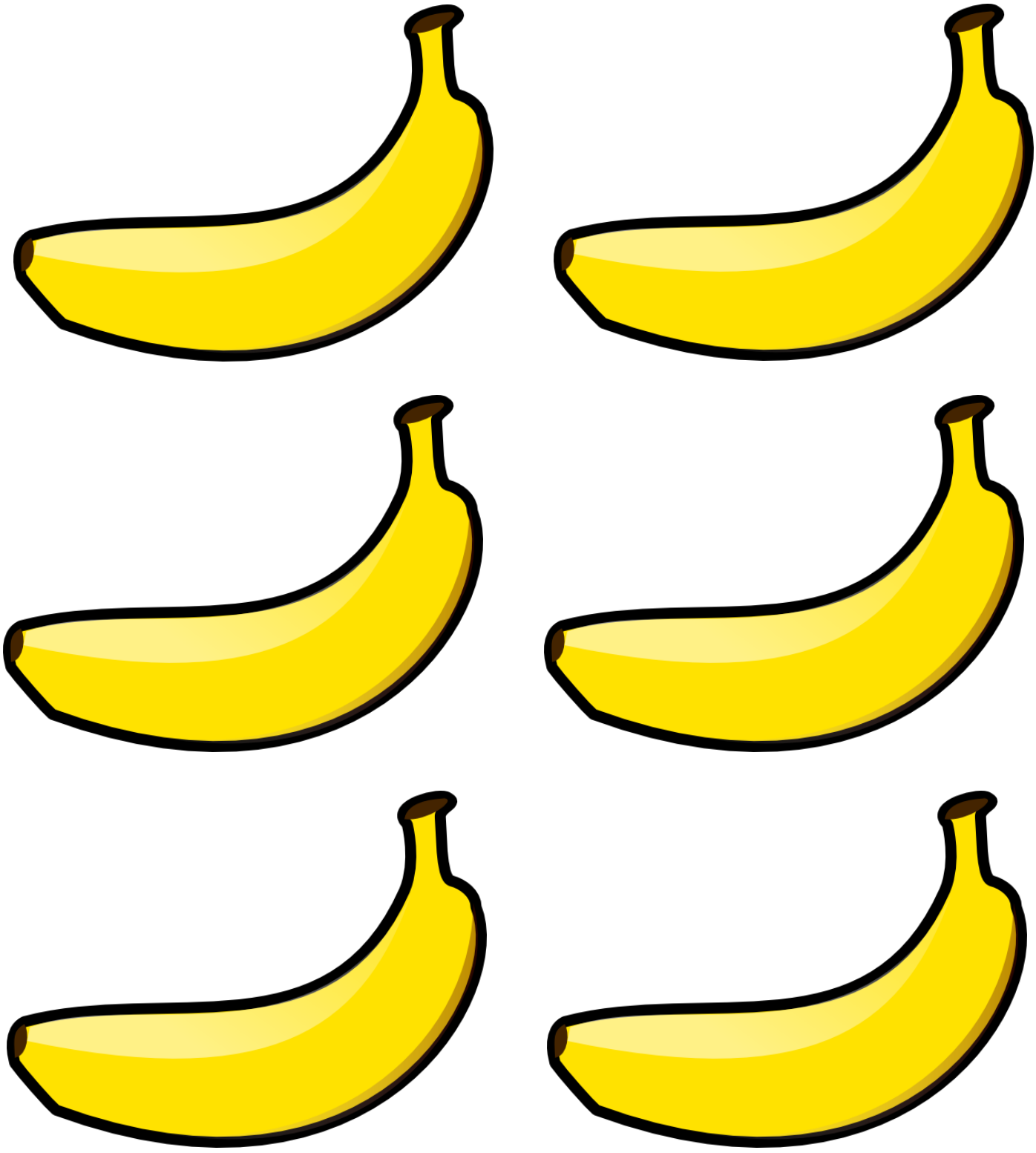


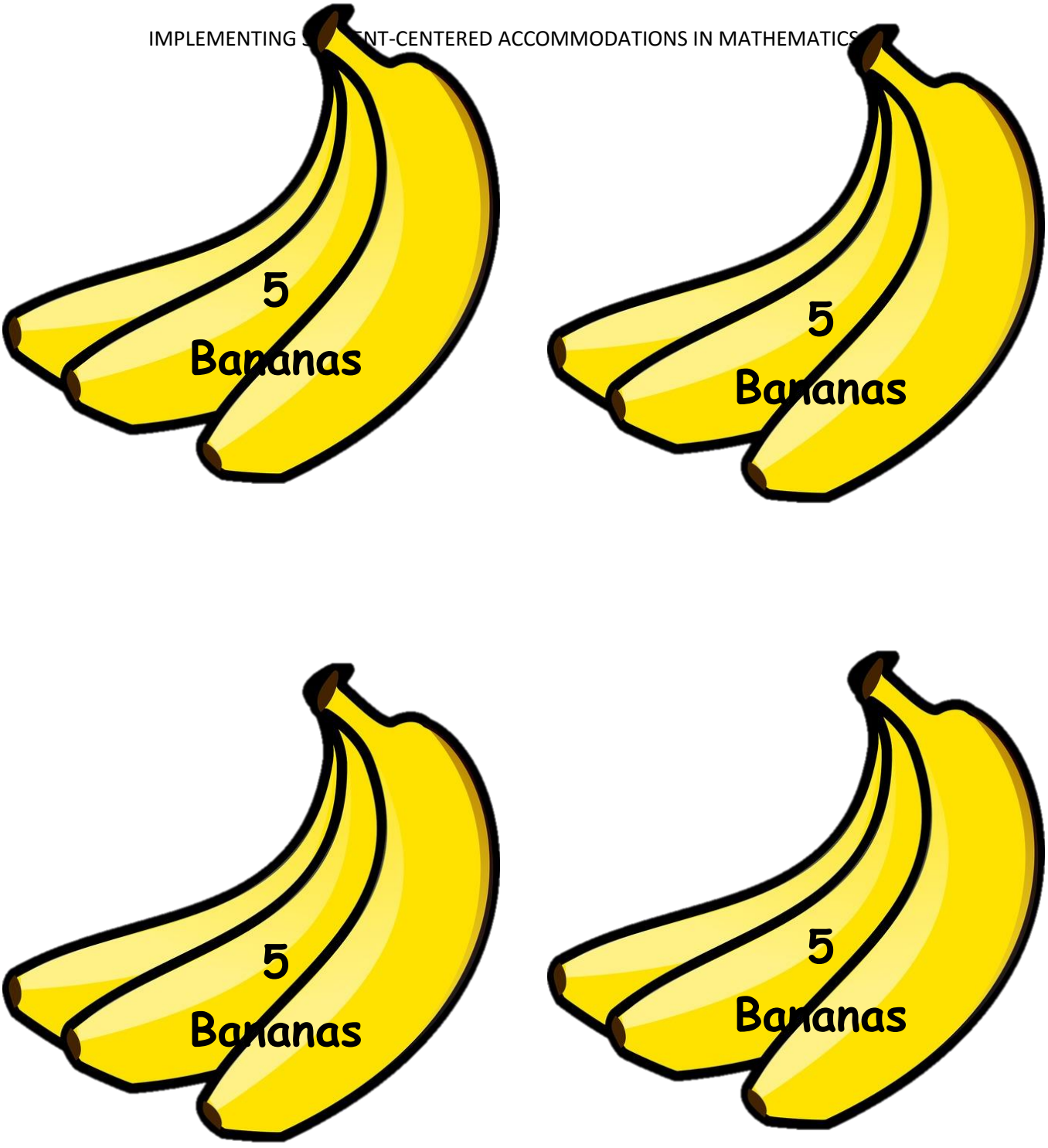
Count what is left.

$$\begin{array}{r} 17 \\ -\ 13 \\ \hline 4 \end{array}$$

Monty the Monkey and Banana Rewards

After the students move through the accommodation process and feel comfortable returning to their seat to continue working independently, the students receive a “banana” from Monty the Monkey and add it to their Rainforest Backpack. The banana’s they receive are just laminated bananas that they receive as a positive reinforce for using a learning tool to increase their understanding. The rainforest backpacks can be as simple as a pocket chart that each student has a pocket or a laminated envelope that they keep at their seat to store their bananas.




5
Bananas
5
Bananas
5
Bananas
5
Bananas

Pete the Parrot

Meanwhile at the RMC, Pete the Parrot appears throughout with positive messages and visuals to remind the students that it is okay to seek help to help them be successful in their addition and subtraction solving skills.


Keep up the great work!
Great job!
Keep trying!
You can do it!
Keep trying!
Mistakes help you learn and grow!

Gift Shop Calculation Worksheet and Rewards

These three characters allow the students to make connections with familiar animals and provide a different learning experience where the students are recreating their own understanding of learning without needing a teacher's guidance. The bananas that the students earn are then saved and can be used on a weekly or bi-weekly basis to "buy" rewards or items within the classroom from the Rainforest Gift Shop. During this "buying" process the higher achieving students serve as the managers of the store, add up the sum of the rewards that a student wishes to buy, and then must give them the correct amount of "banana change" by subtracting the buyer's total amount of bananas from the cost of the rewards. The lower achieving student's then watch the higher achieving students perform these mathematical steps in addition and subtraction and utilize their math language to ask the "manager" to explain the process. This allows all students to feel in control of the Rainforest Gift Shop and all play an important role. The rewards at the gift shop can be as simple as using markers to write instead of a pencil, sitting on an exercise ball instead of their chair, having a stuffed animal at their seat for a day, choosing their seat for a day, etc.

Ricky's Rainforest Gift Shop

Receipt

Item Bought:_____ **Cost:**_____

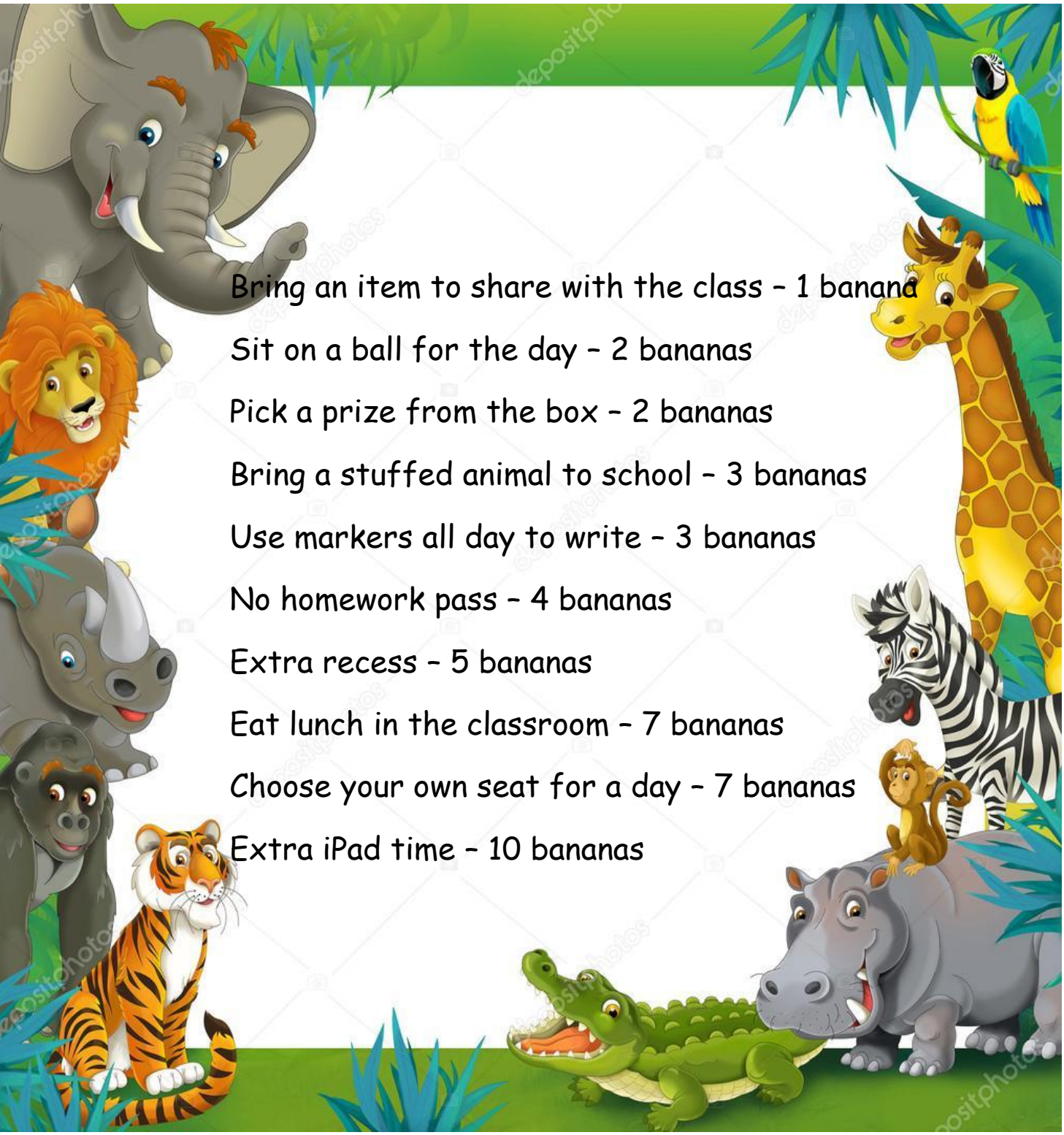
Item Bought:_____ **Cost:**_____

Item Bought:_____ **Cost:**_____

Total:_____

Bananas Given by Customer:_____

Banana Change:_____


Bring an item to share with the class – 1 banana
Sit on a ball for the day – 2 bananas
Pick a prize from the box – 2 bananas
Bring a stuffed animal to school – 3 bananas
Use markers all day to write – 3 bananas
No homework pass – 4 bananas
Extra recess – 5 bananas
Eat lunch in the classroom – 7 bananas
Choose your own seat for a day – 7 bananas
Extra iPad time – 10 bananas

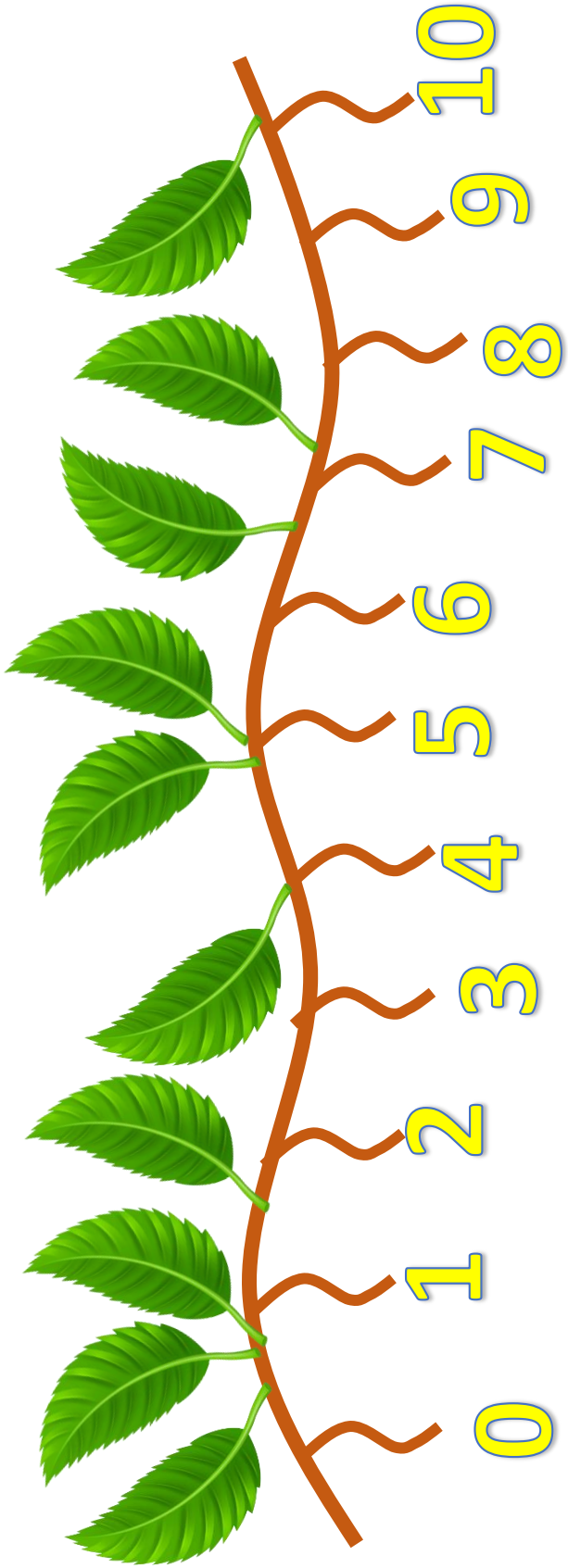
Like any learning tool, teacher monitoring is needed to ensure that students who are in the RMC are completing their work and are there for the purpose of gaining the help that they need and then returning to their seat when they are ready to do so. In the early stages of implementation, frequent teacher modeling and visits to the RMC will provide students with a better understanding of when to visit the station and what precisely should be happening when they are there. If the teacher takes the time in the early implementation stages to provide this feedback to the students, it will prove to be extremely valuable as the students become independent and are able to utilize another learning tool throughout the remainder of the school year.

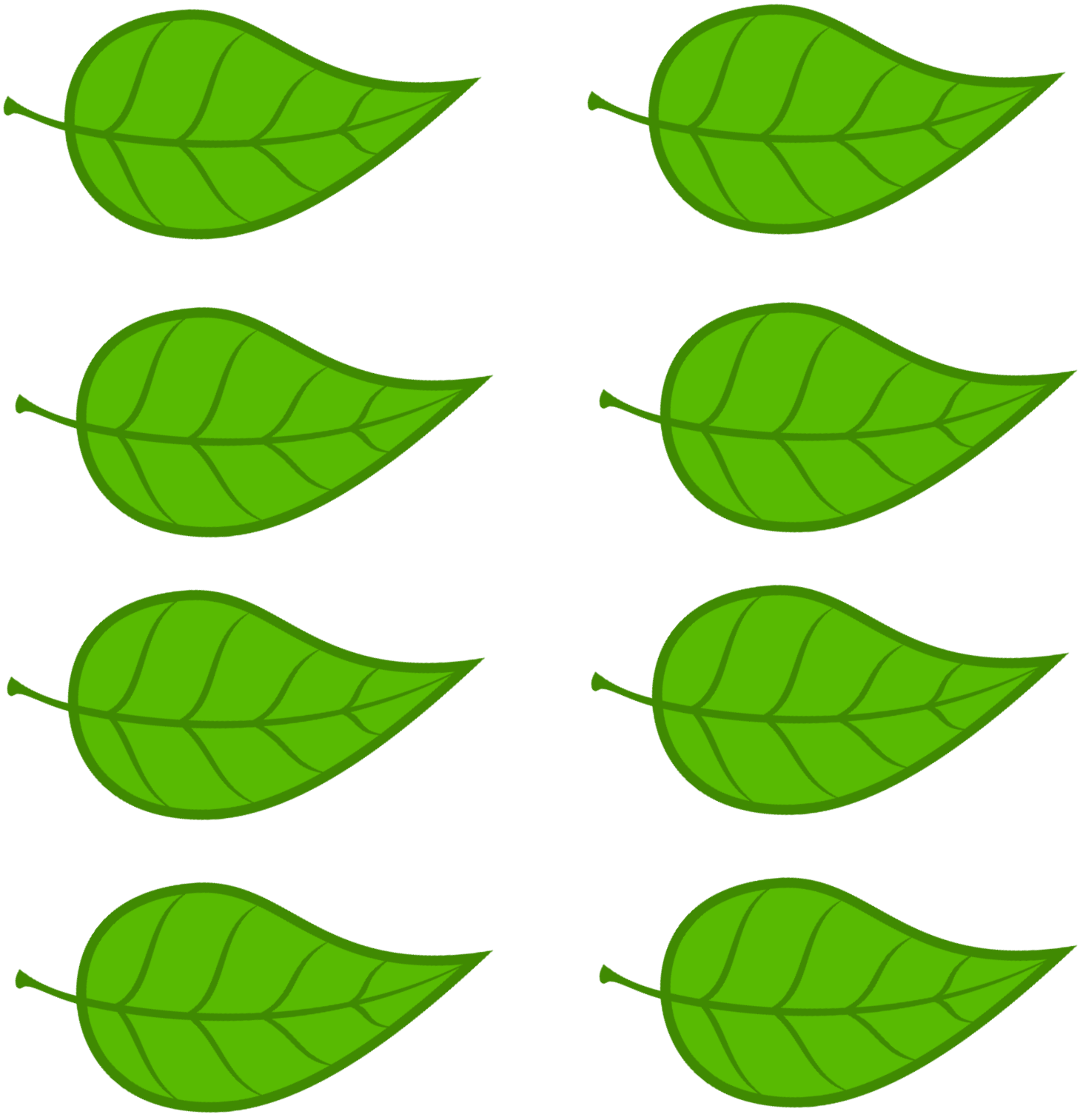
Within the RMC the accommodations that are implemented are all based on research that provide support for their use to increase student success in addition and subtraction. Just like any other learning tool, the accommodations included within the RMC can change as the teacher sees necessary to meet the needs for their students. The RMC allows the classroom teacher to continue helping students within the classroom who need assistance but it also allows students to seek out their own answers to their questions in order to build on their understanding of addition and subtraction. The RMC promotes learning independence and self-confidence in knowing that the can solve the problems without a teacher's help. The RMC allows all students to continue to expand their mathematical thinking on their own level while still experiencing success. This consistent feeling of success and witnessing their own growth will continue to inspire the students drive for learning.

Built in Accommodations

Finally, the RMC is solely based on research-based accommodations that have been founded and proven to improve a student's ability in addition and subtraction. Some of these accommodations are built into the décor of the Cove, namely Fact Family Trees that grow along the wall and hang from the ceiling, a Number Line Vine dangling between trees, and a Key Words Waterfall. Implementing these research-based strategies are a strong point that schools can use to reassure their families that their kindergarten child is getting instruction that is proven to be beneficial and proven to give their students the best start in addition and subtraction possible. When kindergarten teachers implement these research-based accommodations, they are able to maintain a consistency with all of their students and are able to show that the research is allowing their students to be successful and create a better understanding in mathematics.


Addition
Subtraction
Take away
Put together
Count
Counters
Ten Frame
Count on


10
9
8
7
6
5
4
3
2
1
0



Rainforest Math Cove to the Rescue

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Implementing the Rainforest Math Cove into a kindergarten classroom to aide students learning in addition and subtraction comes with many benefits and solves several problems within Special Education. The RMC allows the teacher the freedom and ability to differentiate their student's addition and subtraction instruction and independent practice because a learning station is set up to answer student questions while the teacher continues to instruct other students. This differentiation gives all students an equal access to the curriculum and it individualizes the content being taught so that all students are learning and benefitting from their time in mathematics.

Many students are entering schools with IEP's however, the RMC reaches the students who do not qualify for an IEP and gives them the same access to accommodations as their peers with an IEP. The RMC can help prevent students from needing an IEP or 504 plan because the easy access to accommodations can allow students to succeed at a faster rate since they are able to create a better understanding of their learning more immediately and apply that understanding to the rest of their practice. This project can alone improve a student's mathematical performance and remove them from the IEP or 504 discussion table, therefore utilizing our Special Education services for students who need them who have more specialized needs.

Many families send their children to school wanting to know how their child is going to be challenged on a daily basis so that they can continue to grow and learn and not fall behind or become bored with material that is too simple. The RMC allows every single child to receive an individualized mathematics curriculum and in turn, the parents can feel more confident knowing that their child's needs are being met, regardless of the achievement level of their child. The RMC also allows every child to receive their accommodations in a child friendly setting that makes mathematics feel fun, not scary or daunting as their parents may view it.

Math Cove References

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Chapter 4

Discussion

Implications to Theory

While reading through the literature about under-performing students, in early childhood schooling, in the areas of addition and subtraction, the notion is there is no urgency, state-wide or district- wide, to provide resources or programs to help these students experience success. Theoretically, students who under-perform have nowhere to turn for support and inevitably struggle to succeed in the new Common Core Math for early childhood learners. Unfortunately, there is also the notion that the state and school district are not providing supports for students who are achieving at a higher level and need a challenge to maintain their interest and engagement in the learning process. Thus, these two notions, students who under-perform and over-perform are academically ignored, is theoretically unconscionable. Nevertheless, a third notion arose from the research and that is, perhaps, the unconscionable can be rectified on the classroom level. After reviewing the literature, it became evident that the need for a project, a system, a classroom program, to provide the support for the students who under-perform and over-preform is doable, despite the notion that these efforts are not an academic priority on a state and district-wide levels.

In theory, the project will prepare children to initiate independent accommodations to allow them to be successful in the areas of addition and subtraction without always having to have the assistance of the teacher or another adult. Many variables will come into play that can interfere with student success, but the Rainforest Math Cove (RMC) is designed to be an extremely beneficial tool in the field of Special Education. Within Special Education, students are required to receive accommodations that allow them to continue to grow and learn while

being included in their regular education classroom. The RMC allows for these accommodations to be given to the child in an independent, self-initiation manner without always having to have the teacher next to them. This project promotes independence, self-regulation and responsibility for one's learning and it also improves a student's confidence in their ability to solve addition and subtraction problems independently.

Implications for Practice

This project will drastically alter how teachers administer accommodations and assistance to students who are struggling with addition and subtraction. This project will allow for learning to become more student centered and it will allow educators to check-in with more students during independent practice time. The RMC allows educators to ensure that their struggling learners are practicing how to solve addition and subtraction using the correct strategies because they are embedded throughout the RMC. Struggling learners will gain a new level of pride knowing that they were able to assist themselves in answering their own questions when trying to remember how to solve addition and subtraction problems. The entire project contains all of the instructions and examples of the materials needed to ensure the RMC is able to operate at its highest level. The RMC will require any educator who uses it to model how to use it appropriate several times before students are able to benefit from it on their own. A modeling guide is included within the project for that purpose and it walks the teacher and the students through the entire process of using the math cove so that there are no questions left unanswered.

Implications for Future Research

The RMC has the potential to expand in other subject areas with endless opportunities to provide various accommodations to students. If research to determine how effective the RMC is in administering accommodations to these students demonstrates a significant academic growth

by its users, then a literacy cove could be produced next. The literacy cove could include accommodations for struggling writers or readers, while still allowing the students to take control of their own learning and understanding. The idea of a math cove or literacy cove could even be examined to see how they could be recreated for cyber school students. This population of students do not have the ability to benefit from a teacher created center since their education is taking place in their own home. The future possibilities for how this project could benefit other academic areas and other populations of students is endless and could lead the way in truly making learning student centered.

Epilogue

This project has changed how I view mathematics instruction and practice. When I first began the research, I was passionate at finding research-based strategies that will help students learn how to add and subtract so that they are able to reach their grade level expectations, just as I was passionate at finding strategies to help my students that are achieving above grade level. Strategies in both of these areas is absent from our current curriculum which results in teachers, like I have been doing for years, to find ways to help these students learn and achieve the grade level expectations. This project has inspired me to actually implement this design into my classroom next year. I fully believe that this project has the ability to provide the necessary accommodations and support to the students who are struggling or need the challenge, without always having to right next to them. This project has changed how I plan to implement accommodations to my students so that the learning is more student focused and student driven.

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