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# The Effects of Using Differentiated Math Stations on Students' Ability to find Meaningful and Challenging Work in a First-Grade Classroom

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# ABSTRACT

This study intended to determine the benefits of using differentiated math stations in a first-grade classroom. The goal was to learn if the levels of differentiated stations affected the first-grade students' ability to select meaningful and challenging work. Six students from my first-grade class were selected as participants for a purposeful, stratified sample. All participants were volunteers. A research action design method was used to observe participants' level selections and strategies. Participants interacted with three differentiated math stations in one rotation for a total of four rotations during three weeks of observations. An exit slip completed by students noted their feelings during stations, confidence in selecting appropriately challenging levels, and their favorite part of math stations. Exit slip responses were completed at the end of each rotation. The study supported students in attempting challenges, trying to find appropriate tasks, and expressing their mathematical understanding through the use of exit slips. The data suggested important benefits of differentiated math stations, but more research is needed regarding participant's choice. Limitations such as the pandemic, health and safety precautions, the duration of stations, as well as the predetermined challenge levels used during the study could explain the outcomes.

# SECTION ONE

## Introduction

As a first-grade teacher, I am introduced to twenty-something new students every August. Each student brings their own personal interests, experiences, and strengths to our classroom. In addition to these individual characteristics, their academic abilities are also varying and unique. Students may be identified as needing support with the English language, they may require additional reading support, or they may already have an Individualized Education Plan. Within the first month of school, students are assessed district-wide in the subjects of reading and math using a universal screener. These assessments are intended to provide small, yet specific data points for me to better understand my students' academic strengths and areas of improvement.

For the first few years I taught in the district, I reviewed and analyzed the results of the reading assessments to make adaptations, differentiated small group lessons, and pinpoint additional supports for my students as readers. The reading points are used as important factors for the beginning of a student's journey in a grade-level and can determine the level of intervention necessary. The math points, in first grade, are not as significant and play little role in determining necessary support. This is attributed to the lack of extra math support and staff for lower elementary grades kindergarten through second. So, while I focused on their unique reading needs, I continued to teach math from a district-approved curriculum in a whole-group setting. Every student, regardless of ability, participated in the same lesson, with the same numbers, learning the same way. This traditional method of a predetermined curriculum was at times too simple for groups of students, and at times too fast-paced for others. I struggled to watch my students'

disengagement, knowing that some needed challenge while some needed repeated practice. I repeatedly heard from students that the math curriculum was too easy and from parents of high-performing students that their child was bored with the simple material. I feel I know how to help the students who require additional support, but I found a problem with how to appropriately challenge and stretch the high learners during math instruction. This problem is relevant not only within my classroom but is also an issue facing my grade-level teammates and other teachers in the building. We spend time dedicated to various reading support, however, we continue to teach kindergarten through second-grade mathematics in a traditional, whole-group model.

Little et al. (2009) state, “differentiated instruction grows from the recognition that students learn at different paces and find challenge and stimulation in different types of tasks” (p. 36). Other research from Tomlinson (2001) and Tomlinson and McTighe (2006) support the use of differentiated instruction to engage students with appropriately challenging, meaningful tasks to increase motivation. There are benefits to using differentiated instruction with all students, including advanced learners, as it finds a pace, learning style, and level of engagement to meet their needs. I know students’ math understanding, ability, and comfort-level varies in first grade, however, I have had difficulty finding the best way to incorporate differentiation into my current math instruction to ensure the advanced learners feel challenged. I do not believe I should eliminate whole-group instruction, but instead differentiate by finding appropriately challenging and stimulating math tasks by using math stations throughout the week.

Andreasen and Hunt (2012) defined math stations as locations, or stations, around a classroom where students practice math skills using different activities. Diller (2011)

defined math work stations as an opportunity for students to work around the classroom with a partner using materials and manipulatives to expand upon their mathematical learning. My goal is to differentiate tasks within math stations so students who need a challenge may find meaningful and stimulating work, while others who need repeated practice may also find meaningful and stimulating work at their level. I intend to offer six differentiated math stations to my first-grade students. Within each math station will be three levels of an activity or task; working towards the mathematical expectation, meeting expectation, and above expectation. During student participation with math stations, I will be collecting data through anecdotal notes and exit slips. Field notes will include the task level participants select and their interactions with the materials. Exit slips will be completed after each math station rotation, four times in total, in order to document participants' feelings, confidence in their math station level selection, and their favorite part of the activities. The purpose and motivation of this capstone project is to determine an answer through instructional inquiry to the following question: How do differentiated math stations, provided at three different skill levels, benefit students' ability to select meaningful and appropriately challenging work?

# SECTION TWO

## Literature Review

In this literature review, I will present why and how differentiated mathematics instruction is essential to ensure meaningfully challenging work for students in the classroom. First, I will provide an overview of differentiated instruction and the need for it in our current heterogeneous classrooms. I will address how differentiation is beneficial for all students and learners. Next, I will define the three forms of differentiated mathematics, as well as provide several strategies, methods, frameworks, and curriculum that can be used to differentiate mathematics. Then, I will present three approaches of math stations to be used as differentiation in elementary K-5 classrooms. Finally, I will examine differentiated mathematics instruction specifically in first-grade classrooms. By the end of this review, you will understand the direction I plan to take in researching differentiated math stations in first-grade to support students finding meaningful and challenging work.

### Differentiated Instruction: An Overview

Since the very beginning of schools, instruction and curriculum have been differentiated (Anderson, 2007). Anderson (2007) noted that a one-room schoolhouse was the first example of meeting the educational needs of all students present. Students in today's classroom have commonalities such as being children in the 21st century, yet differences in their hobbies, interests, and learning styles to make them individuals (Tomlinson, 2001). The idea of differentiation considers these interests, learning styles, struggles, and individual differences of each student. Students bring many experiences,

varying skills, specific learning needs, and a variety of factors to the classroom (Rubenstein et al., 2015; Tomlinson & Eidson, 2003; Tomlinson & McTighe, 2006). Language, gender, prior knowledge, ability, learning preferences, parental support, and motivation are simply a few examples of “factors that students bring to school with them in almost stunning variety” (Tomlinson & McTighe, 2006, p. 1). How teachers successfully meet students’ needs, is related to implementing differentiated instruction in their classrooms (Little et al., 2009; Tomlinson, 2001; Tomlinson &Eidson, 2003; Tomlinson & McTighe, 2006).

Tomlinson and Eidson (2003) define differentiated instruction as a teacher’s “understanding of how teaching and learning occur, and it responds to varied learners’ needs for more structure or more independence, more practice or greater challenge, a more active or less active approach to learning, and so on” (p. 2). The goal of differentiated instruction is for teachers to bring emphasis and attention to the different processes that ensure meaningful and successful learning for each student. George (2005) concluded that differentiated curriculum, instruction, and assessment are best used within a heterogeneous, mixed-ability classroom for a multitude of reasons. Through a heterogeneous classroom, students are preparing for “important interpersonal and social knowledge, skills, and attitudes essential to success in adult life, while simultaneously providing opportunity for varied types and degrees of academic achievement” (George, 2005, p. 186). This means that teachers must have a firm understanding of the curricular goals of the district, school, and classroom, as well as expectations on what skills students should master in order to correctly differentiate instruction (Tomlinson & McTighe, 2006). Heterogeneous classrooms encourage racial integration, emphasize the

significance of perseverance and persistence to attain success, affirm student learning and growth, as well as decrease labeling, classifying, and stigmatizing of student performance (George, 2005). Tomlinson and McTighe (2006) believe building awareness of student growth means teachers are constantly learning, observing, and reflecting as "hunters and gatherers of information about what best propels learning for each student" to provide successful opportunities and experiences for students in the classroom (p. 47). Differentiation allows students to take ownership of success and find meaningful work.

Differentiation can occur in the content, process, or product. For example, Tomlinson (2001) describes how a kindergarten teacher differentiates the product of a neighborhood and community project. Students are encouraged to select work based on their interests so that everyone selects a community member to interview, some students design signs for buildings, and each student focuses on a neighborhood within the model of their town. The teacher differentiates the product by ensuring both student-selected and teacher-selected tasks are completed based on readiness and interest (Tomlinson, 2001). So, whether students are gifted learners or students with learning disabilities, differentiation in curriculum and instruction maintains that learning is "personally meaningful, satisfying, transferable, and long lasting" (George, 2005, p. 191). As such, students will begin to learn that different students doing different work should be expected in the classroom (Tomlinson 2001; Tomlinson & Eidson, 2003; Tomlinson & McTighe, 2006). They will understand different standards still mean learning success for everyone, including themselves, and why differentiated instruction is beneficial for all learners (Tomlinson, 2001).

**Benefits of Differentiated Instruction for All Learners**

Research supports each learners' educational success is attributed to the implementation of differentiated or responsive instruction within a classroom (Anderson, 2007; Ismajli & Imami-Morina, 2018; Tomlinson, 1999; Tomlinson & McTighe, 2006). It is important to note that differentiation is focused on meaningful learning for all students, rather than individualization or separate levels (Tomlinson, 2001; Tomlinson & McTighe, 2006). Tomlinson and McTighe (2006) believed that attending to the specific needs, backgrounds, and interests of students through differentiation, contributed to their enthusiasm, academic growth, and connection to their learning environment. They suggested teachers can benefit many more students through implementing patterns of differentiated instruction. Some patterns of instruction Tomlinson and McTighe (2006) noted were presenting several ways for students to explore and communicate their learning, meaning students' understanding is represented in varied forms and products; and providing multiples forms of instruction like modeling, demonstrations, whole-to part explanations, or stories. By developing positive teacher-student relationships through attention to and appreciation for learning needs as well as patterns of differentiated instruction, students are encouraged to take risks through the learning process and when challenged (Tomlinson & McTighe, 2006). Little et al. (2009) noted the value of differentiation increases as a response to students' readiness and ability to participate in challenging tasks. They state, "when given appropriately challenging tasks, students may be more engaged and less likely to be off task or disruptive" (Little et al., 2009, p. 36). Tomlinson (2001) affirms differentiated instruction should include motivating and significant learning experiences to ensure the most effective, student-centered,

meaningful work. Students benefit from differentiated instruction concentrated on quality work matching the nature of an individual's needs, rather than giving a student twice as much work. Every student in a classroom does not progress at the same pace and does not respond to the same types of instructional techniques or learning styles (Tomlinson, 2001; see also Ismajli &Immami-Morina, 2018). In fact, through Ismajli and Immami-Morina's (2018) research, they found that students with different academic abilities preferred learning in different ways. The authors discovered using differentiated instructional strategies such as classroom discussions, group, or partner work were effective and evident in the students' active readiness while engaging in classroom activities (Ismajli & Imami-Morina, 2018). Tomlinson and McTighe (2006) stated teachers who incorporate small-group instruction as part of daily or weekly teaching routines, as well as allowing students the option to work alone or with a peer, positively impacted the learning for students.

Research demonstrates support for differentiated instruction as a benefit for advanced learners, too (McAllister & Plourde, 2008; Tomlinson, 2001; Vantassel-Baska, 2017). Students labeled as advanced learners need differentiated instruction and challenge to reach their learning capacity. This challenge is necessary to avoid becoming mentally lazy or focused on praise rather than stretching their intellectual ability (Tomlinson, 2001). Gifted students, as McAllister and Plourde (2008) stated, cannot be neglected in school instruction and curriculum, as it is detrimental to their learning, self-esteem, and future engagement within schooling. VanTassel-Baska (2017) noted that all gifted learners do not require "advanced instruction in all areas of learning", but rather need differentiated curricula and instruction that piques their interest in order to maintain

and increase their motivation for learning (p. 63). Differentiated instruction and curriculum is effective in addressing the learning needs of all students (Ismajli & Imami-Morina, 2018; Tomlinson, 1999; Tomlinson, 2001; Tomlinson & Eidson, 2003; Tomlinson & McTighe, 2006), including gifted learners (McAllister & Plourde, 2008; Tomlinson, 2001; VanTassel-Baska, 2017).

**Differentiated Math Instruction and Curriculum**

Based on current elementary schools placing students within heterogeneously grouped classrooms, math instruction and curricula must be differentiated to meet the mathematical needs of all students (McKeen, 2019; Stand Cary et al., 2017). Andreasen and Hunt (2012) emphasized that the diversity within students related to their abilities, language demands, educational needs, and cultural backgrounds present increasing challenges for teachers to deliver efficient and beneficial mathematics instruction. Differentiation in mathematics instruction is essential in meeting students' needs as well as equity in education. "Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students" (National Council of Teachers of Mathematics [NCTM], 2000, p. 2). In addition to equity in education, effective mathematics instruction is vital to successfully support and challenge students. "To be effective, teachers must understand and be committed to students as learners of mathematics. They must know and understand deeply the mathematics they are teaching and be able to draw on that knowledge with flexibility in their teaching tasks" (NCTM, 2000, p. 2). Differentiation in mathematics instruction is not a new concept, however, it can seem complex.

### *Three Forms of Differentiation*

Differentiation can occur in three forms: process, content, or product (Andreasen & Hunt, 2012; Tomlinson, 2001). Andreasen and Hunt (2012) stated process differentiation in mathematics entails teachers providing several options for students to gain an understanding of new concepts through practice, instruction, and assessment. They noted this form of differentiation could include students at a learning station with a teacher, using computer programs in small groups, or online resources to extend their thinking. Content differentiation employs teachers to offer more than one input, or what students learn, to make sense of mathematics content in practice or assessment. For example, a teacher may provide multiple interpretations of mathematics content being learned to support struggling students develop their understanding, but also deepen the understanding for other students. Little et al. (2009) stated that mathematics instruction in a classroom looks different from day to day and unit to unit. Their study focused on middle school mathematics, where teachers provided "hard tasks" and "easy tasks" for independent practice, then observed students during their work. Little et al. (2019) concluded that by carefully evaluating activities for levels of difficulty, teachers can recognize appropriate work for students based on individual needs, and then construct various forms of such tasks that are both specific and engaging for each level. They found the strategy of tiering to be useful in differentiating mathematics content, as the teacher can appropriately provide "challenging tasks while ensuring sufficient scaffolding for struggling students and reducing repetition for more advanced students" (Little et al., 2009, p. 36). Finally, product differentiation refers to the opportunity for students to

demonstrate their content understanding through alternative practice, instruction, or assessment.

### *Flipped Classrooms*

Differentiation in mathematics classrooms should employ multiple strategies such as questioning, extension tasks, opportunities for a ‘flipped classroom’, and quality teaching, according to Ollerton (2014). He noted the importance of providing extension tasks to practice mathematical skills rather than deletions, as it impacts how students could develop varying degrees of understanding and complexity. Ollerton (2014) stated differentiation during whole-class discussions is essential to encourage the depth of student understanding. “Questioning strategies which do not require a traditional ‘hands-up’ approach can be powerful in terms of keeping everyone on their toes, and for creating the expectation/culture that everyone has something to offer” (Ollerton, 2014, p. 45). A flipped classroom is defined by Ollerton (2014) as an opportunity for students to teach their peers after they have researched, discussed, and gained understanding related to a topic. Flipped classrooms emphasize students taking responsibility for their learning, encourage independence, and focus on the interests of individuals. Ollerton (2014) concluded that to ensure quality, differentiated mathematics instruction, teachers must carefully plan, encompass problem-solving approaches to encourage open-ended thinking, and provide extendable stimuli to deepen student understanding.

### *Balanced Mathematics*

Christenson and Wager (2012) focused on the implementation of a pedagogical framework for teaching differentiated mathematics named Balanced Mathematics. The

framework was created by the staff from the Madison Metropolitan School District in Wisconsin. The framework is comprised of four components including inspecting equations, number work, problem solving, and fluency or maintenance, to support differentiation, access, and participation in mathematics. Inspecting equations and number work activities are intended to be completed with the whole class to warm up students with exercises. “These problems are designed to have multiple entry points to support differentiated learning. As a result, even though these activities are presented in large mixed-ability groups, students are able to participate at their own level” (Christenson & Wager, 2012, p. 196). Problem solving is intended as small group instruction where participants work, investigate, and learn from each other, while fluency or maintenance can be individual practice or learning centers. Christenson and Wager (2012) concluded that the use of Balanced Mathematics offer students the opportunity and access to differentiation in number sizes, types of mathematic problems, and the style of activity that meet their needs and encourage greater participation.

***Pre-Differentiated Math Curriculum***

Rubenstein et al. (2015) proposed a pre-differentiated and enriched mathematics curriculum to multiple school districts in many states. They believe the creation of a pre-differentiated and enriched mathematics curriculum is necessary as school districts assume general education teachers have time, resources, and the ability to differentiate to meet the needs of high-ability students. Rubenstein et al. (2015) based the pre-differentiated mathematics curriculum on three major curricular concept models. The curricula included mathematical concepts including algebra, geometry, measurement, graphing, and data analysis. During the study, students were regarded as mathematicians,

used language related to mathematic concepts, shared their learning through discussions and physical examples, solved practical problems, and participated in tiered activities or enriched tasks through flexible grouping. Researchers found three triangulated themes with the use of the pre-differentiated curriculum. The first theme centered on the use of differentiation in the classroom with the use of provided preassessments. Rubenstein et al. (2015) noted teachers were able to determine students' existing knowledge, manage grouping practices, and discuss the growth of student learning. The second theme was an unexpected amount of reflection from teachers and administrators. Following the study, teachers recognized the intention and a necessary focus on student development, discussions, and investigation during mathematics instruction. They noted the need for higher expectations for students, as they tended to limit their possible potential. The final theme Rubenstein et al. (2015) discovered was the amount of irritation teachers experienced due to the importance of state standards and assessments, and the stress of connecting the state and study's suggested curricula. These authors determined that the use of a pre-differentiated and enriched mathematics curriculum to include a focus on high-ability students is beneficial for educators to meet the needs and levels of all students with appropriate challenges.

***Flexible Grouping in Mathematics***

Flexible grouping is characterized as including a variety and mixture of strategies such as peer learning and teacher-direct instruction. Groupings can be student-led or teacher-led depending on the interest, ability, and content mastery of the students within each group (McKeen, 2019). During teacher-led groupings, the instructor, noting any additional instruction or different strategies necessary, monitors students' learning and

success immediately. Compared to teacher-led groups, student-led groupings enable peers to learn from one another, which encourages collaboration and independent control over learning (McKeen, 2019). Allowing for flexible grouping throughout math instruction will ensure students are improving their individual skills with the teacher and with their peers (Benders & Craft, 2016; McKeen, 2019; Tomlinson & Eidson, 2003).

Since flexible grouping is a recent instructional concept, McKeen (2019) studied the impact of its use connected to the mathematical success of students' CRCT (Criterion-Referenced Competency Test) scores at the end of the school year. She noted that with the use of flexible grouping, students' scores were elevated within grades one through three. She discovered that through the use of flexible grouping, teachers were able to enhance individual student math knowledge, understand the unique needs of groups, and effectively and efficiently improve math instruction. Flexible grouping allocates for small-group instruction as the teacher gets to know their students (Benders & Craft, 2016; McKeen, 2019; Tomlinson & Eidson, 2003). Teachers can supply instruction focused on student interests, set individually high expectations, and deliver specific and purposeful feedback. McKeen (2019) stressed teachers should also introduce motivating learning experiences that afford students to discover real-world applications aside from pre-determined curriculum. This method of grouping and instruction may release the potential for greater student achievement within math instruction, in addition to overall higher student performance (McKeen, 2019).

## Math Stations as Differentiation in Elementary K-5 Classrooms

The following examples of differentiation are used for math instruction and have similarly connected concepts to one another. Math stations, math workshops, and math work stations emphasize the importance of student interaction with materials, manipulatives, and working collaboratively with their peers; however, each instructional model represents its own unique specifications to differentiation.

### *Math Stations*

Andreasen and Hunt (2012) suggested math stations as one form of differentiation teachers can use within their classrooms. Although the authors did not limit the use of math stations to a grade-level range, they provided an example of the model using elementary lessons and content standards. Andreasen and Hunt (2012) defined math stations as locations, or stations, around a classroom where students practice math skills using different activities. Activities pertaining to the same mathematical concept, however, are differentiated by focusing on the three forms of differentiation: content, process, or product. Typically, four stations can be used to differentiate practice or assessment. The authors listed the four stations as the ‘Teacher’s station’, the ‘Shop station’, the ‘Practice plaza station’, and the ‘Proof place station’. The ‘Teacher station’ allows for educators to see small groups of students to provide additional support or enrichment in a specific mathematic topic. This station differs as students’ needs and concepts change. It is more individualized compared to other stations, where students practice mathematic skills. The ‘Shop station’ focuses on students finishing projects, correcting mistakes or misconceptions, and written explorations of example problems. The third station, the ‘Practice plaza station’, allows for multiple differentiated practice

opportunities for students. Students may practice differentiated content with a new demonstration or strategy, or use a differentiated process with a new tool and previously taught representation. The fourth station is the ‘Proof place station’. Students at this station are presented with a mathematical situation that requires them to use tools, models, and strategies to solve problems, explain their thinking, and justify their answers. To plan for math stations within the classroom, Andreasen and Hunt (2012) recommended teachers to follow four main steps. Teachers should reflect on the mathematical content being presented in the classroom, as well as students’ understanding of the content. Based on these considerations, teachers should then determine the types of differentiation needed at each station. To establish an appropriate grouping of students, teachers should use classroom assessments, observations, and other indicators. These small groups can be flexible and will change throughout the year. Finally, teachers need to create or construct the activities and tasks students will encounter at each station. Andreasen and Hunt (2012) believe “using math stations to differentiate instruction is a mechanism that maximizes learning for all students while minimizing the need for individual accommodations” (p. 245). Students benefit from differentiated math stations as different learning styles and representations of knowledge are encouraged.

### *Math Work Stations*

Diller (2011) defined math work stations as an opportunity for students to work around the classroom with a partner using materials and manipulatives to expand upon their mathematical learning. Students work on activities that extend previously instructed concepts to encourage students to understand deeper mathematical thinking and

understanding. She explained that math work stations afford students time to, "practice problem solving while reasoning, representing, communicating, and making connections among mathematical topics as the teacher observes and interacts with individuals at work or meets with a small group for differentiated math instruction" (Diller, 2011, p. 7). Through note taking and observations of stations, Diller (2011) stated that teachers can make more informed, effective differentiation in instruction and curriculum to meet the exact needs and interests of individual students. Using notes and observations, teachers create flexible groups and plan for small-group instruction. Diller (2011) reiterated the importance and value of each small group looking slightly different and instruction tailored to be specific to student needs as the main benefit of math stations, as this is the framework of differentiated curriculum and instruction. Diller's (2011) text is dedicated to the specific use of math work stations within the Kindergarten through second-grade classrooms.

### *Math Workshops*

Similar to the other two math station models is the math workshop approach by Sharp et al. (2019). The math workshop approach is structured into four main components of instruction. The first component is dedicated as an introduction or opening to the current mathematical concept. This component requires a few moments for the teacher to introduce a focus for the workshop and spark interest in a math question or inquiry. The second component entails teachers to present a mini-lesson to the class. This mini-lesson provides the opportunity for explicit instruction regarding the problems, specific concepts, or necessary skills students will need during their work time. Work time is the designated portion of the workshop where students work collaboratively with each other to complete a variety of mathematical tasks. Students may work in pairs or as

part of a small group to develop learning and understanding through exploration together. Students communicate their way of thinking or method of finding a solution to teach their peers. During this time, teachers can circulate and listen to student groups and their thinking. Teachers are provided the opportunity to value students' progression through learning, appreciate their mathematical thinking, and recognize areas or possible ways to challenge them in the future. It is also a "critical time to engage students in differentiated, discovery activities designed to 'promote deeper thinking'" (Sharp et al., 2019, p. 76). Finally, the math workshop closes with a time for discussion and reflection on student learning. Students may share their successes, as well as their mistakes to help the growth and mindset of the classroom community. Closure time was seen by teachers as a chance for informal assessments collecting data through the use of exit tickets, discussions, quizzes, journal entries, or surveys.

Mathematic educators in elementary, middle, and high schools who participated in Sharp et al.'s (2019) study, commented on the positive effects the math workshop approach had within their classrooms. They found the use of the math workshop approach transformed the regular math instruction classroom into a community of math learners and student instructors. Specifically, they mentioned the community of learners establishes a sense of unity, where all students can learn, share, and grow from each other's mistakes and failures (Sharp et al., 2019). When providing teacher support for the students, educators believed to be coaching as well as modeling the advancement of exemplar math talk. Teachers believed that responding to student questions with additional questions rather than explicit answers, allowed students to share the role of leader and encouraged open communication of math thinking. Participants noted that

planning for math workshops allowed them to include activities based on the needs and interests of their students aligned to state-based standards. Using a math workshop approach as an effective math instruction to teach and learn mathematics in the elementary classroom inspires students to be active 21st-century learners (National Education Association [NEA], n.d.; Sharp et al., 2019). They become a part of a learning community that has to communicate, collaborate, be creative, and think critically with one another through grade-level math concepts (NEA, n.d.).

Each of the instructional methods, math stations, math work stations, and math workshops, encourage differentiated instruction through their own models. They provide similar goals and objectives, while also maintaining unique characteristics and differences. For example, math stations used by Andreasen and Hunt (2012) utilizes four locations around the room allowing students varied opportunities to practice their math skills. Math work stations used by Diller (2011) encourages movement, collaboration, and the use of authentic materials or manipulatives. Math workshops by Sharp et al. (2019) promotes students to become active participants in their learning through small groups and a community of peers. Using the similarities of the three instructional methods for a future research direction would be beneficial for the development and differentiation in a first-grade math station approach.

## Math Differentiation in First Grade

Just like every other grade level, students entering first grade are not all on the same “academic playing field” (Benders & Craft, 2016, p. 7). Strand Cary et al. (2017) stated that as early as kindergarten and first grade, student achievement gaps are already significantly apparent between the typical student and students with a poor understanding

of mathematical concepts or a lack of mathematical experiences and learning difficulties. Teachers are challenged with the task of effectively engaging their students with early mathematical concepts, as they are the building blocks and foundation of future advanced learning or challenging math concepts (Strand Cary et al., 2017).

### *Explicit Instruction on Participation and Math Procedures*

Perry et al. (2011) questioned how to get first graders engaged and participating in their mathematics learning. Three veteran first-grade teachers were studied at three points throughout the course of a school year to determine how students were explicitly or implicitly taught to behave as students and learners of math. Perry et al. (2011) found through their observations that teachers provide explicit instruction on classroom rules, procedures, expectations, routines, and how to learn mathematics. Explicit instruction on procedures such as paying attention, asking students to follow along, reminders on how to raise their hand, and speaking up to be heard are important as students are beginning school. These types of explicit instruction provide students the expectations on how to be successful participants in the classroom, as well as what behaviors are considered appropriate. Teachers in the study taught mathematics in a whole group setting not only to meet standards or instruct curriculum but to also provide a space for first graders to experience how to properly participate and respectively engage in the learning together. Instruction specifically related to learning mathematics centered around what students should look at, how they should think before they solve, shared responsibilities between the teacher and the students, as well as enforcing the benefit of working together. Perry et al. (2011) found these explicit instructions beneficial for how students learn math because they provide students with a direct understanding of how their actions can affect the

classroom's learning environment and how they can develop new mathematical knowledge. Successful mathematics learning should encourage first graders to explain their understanding, contribute to the classroom community, gain ownership of problem-solving, and be flexible in their thinking to provide multiple strategies and answers. First graders need to share their thinking with others to demonstrate their understanding of concepts and practice explaining the process of their solutions. Perry et. al (2011) believe "teachers have the power to impact and structure the learning environment, just by what they say and how they ask questions, in ways that will serve students long past first-grade math class" (p. 298).

With the use of explicit instruction during whole group settings to develop classroom procedures and expectations, math stations and flexible grouping could be beneficial to address differentiated tasks for smaller groups of students. Tomlinson (2001) noted the importance of instruction in a classroom representing a blend of teaching to include whole-group, small group, and individual times. She also stressed classroom management to consider how to carefully create and deliver instructions for small group tasks to avoid confusion, process possible problems, and balance the amount of clarity and challenge students will experience. Tomlinson and McTighe (2003) stated responsive and differentiated teaching are nearly impossible without the development, implementation, and support of learned routines and procedures. A differentiated classroom may have a multitude of activity happening simultaneously to support movement and student-centered learning. Tomlinson (2001) believes that giving students responsibility for their learning, provides the opportunity for meaningful work choices and accountability. This is also a strategy on how to manage students within a

heterogeneous classroom. By splitting students into smaller groups, it is important to understand that differentiation does not mean keeping and maintaining the same groups throughout the school year. Tomlinson (2001) suggested flexible grouping to allow fluid movement of students through groups based on skill levels in each unit.

***Flexible Grouping in First Grade***

Based on Benders and Craft's (2016) findings, the implementation of flexible student grouping used in a first-grade math curriculum, also known as Guided Math, strengthens a student's math skills. Guided Math is the use of scores and data collection that drives educators to find the appropriate level of readiness and skill for each individual student (Benders & Craft, 2016). Teachers then instruct students based on these skills, delivering the right amount of intervention at an individually successful pace. Flexible grouping in a first-grade classroom allows students the opportunity to grow and develop their mathematical skills throughout the year, rather than the use of ability grouping for the academic year (Benders & Craft, 2016). Throughout the math curriculum, students are reassessed using formative and summative unit tests and are regrouped based on their growth. Benders and Craft (2016) noted that "flexible grouping provides students an opportunity to learn at their level and proceed to higher levels of achievement" than the traditional methods of instruction, as well as allows the educator the chance to, "efficiently manage instructional time and focus on smaller group needs" (p. 3). The authors also suggested that no two first grade students possess identical difficulties within math, as their strengths and weaknesses differ from concept to concept (Benders & Craft, 2016). Benders & Craft (2016) concluded that by using flexible grouping in a first-grade classroom, the teacher is able to differentiate their instruction to assist the struggling students, the students

needing additional support with one skill, as well as the students, possibly gifted learners, who require new challenges as they progress through the curriculum quickly.

### *Cognitively Guided Instruction*

Hoosain and Chance (2004) documented the use of Cognitively Guided Instruction (CGI) math instruction within a first-grade classroom. CGI is a research-based approach to teach mathematical problem-solving. The instruction focuses on the understanding of the learner to encourage problem-solving strategies and flexible thinking. The role of the teacher changes to that of a facilitator to promote the freedom for students to create individual strategies. CGI in a mathematics classroom develops independence and accountability for student learning at their individual level. Hoosain and Chance (2004) stressed the importance of solving a problem followed by students writing an explanation of their thinking and sharing in a discussion. They noted that first graders can become creative in their thinking and problem-solving when given the opportunities to select strategies and methods of solving equations. This finding supports the use of math stations employing different levels of appropriately challenging work in order to encourage different strategies and representations. Through CGI and selecting appropriately challenging problems, students are more motivated, interested, and actively engaged (Perry et al., 2004). Using CGI's method of purposeful math problems within math stations will allow students to develop meaningful understanding and successfully apply individual strategies. The use of math stations to differentiate meaningful work for first graders is a beneficial strategy for classroom teachers to meet the needs of their students.

## Research Direction

For years, teachers have searched for and desired effective teaching methods to address the wide variations in student abilities. With the implementation of differentiated instruction, teachers can educate and meet the diverse learning needs of each student (Little et al., 2009; Tomlinson, 2001; Tomlinson & Eidson; 2003; Tomlinson & McTighe, 2006). In a mathematics classroom that uses differentiation, students are engaged in their learning (Little et al., 2009; Tomlinson, 2001), participating in instruction (Christenson & Wager, 2012; Ollerton, 2014; Perry et al., 2011), and experiencing successful and meaningful challenges based on their exceptional needs (Anderson, 2007; George, 2005; Little et al., 2009; McAllister & Plourde, 2008). As such, differentiated math instruction is beneficial for all students and learners. Flexible grouping allows teachers to observe and assess student performance, spend more time with small groups, as well as focus and pinpoint the unique needs of individual students (McKeen, 2019; Benders & Craft, 2016). Three differentiated mathematics instructional methods that utilize flexible grouping and simultaneously meet the math needs of each student are math stations, math workshops and math work stations. These methods develop a learning community within the classroom as students take ownership of their successes, participate in meaningful independent work, persevere through mistakes, as well as develop critical thinking and problem-solving skills with the support of the teacher in differentiated small group instruction (Andreasen & Hunt, 2012; Diller, 2011; Sharp et al., 2019). While the research within this chapter shows the use of math station examples to differentiate practice and assessment through various observations of classroom teachers, teacher feedback, and teacher reports, there are limitations and

differences in how researchers look at student learning. For example, studies such as Benders and Craft (2016) focused on the growth of students, especially in the below-level group, wondering if station time is transferrable to increase all math achievement in a school year; where as McAllister and Plourde (2008) used a pull-out program to work with a small group of identified elementary students, who require more challenge and enrichment, through inquiry-based learning, discovery, and open-ended problem-solving. There are several articles, texts, and studies focused on the benefits of differentiated math instruction within the education system and early childhood education field. Based on the collected literature I decided to focus on the use of math stations with similarities to those reviewed within this section. To truly determine the effect of differentiation in math instruction, it is essential to specifically examine, further research, and ask: How do differentiated math stations, provided at three different skill levels, benefit students' ability to select meaningful and appropriately challenging work?

# SECTION THREE

## Research Design and Method

### Setting and Student Population

The purpose of this study is to determine if differentiated math stations provide the opportunity for first-graders to select meaningful and appropriately challenging work. I developed an instructional inquiry project using action research which will be described within this section.

The math stations study is being conducted in a Midwestern, large suburban elementary school within a self-contained first grade classroom during the 2020 – 2021 school year. The school district currently contains fifteen elementary schools, five middle schools, and four high schools. The K-12 student population for the district is 21,723. Demographics within the school district include 70.4% white, 4.3% black, 3.9% Hispanic, 15% Asian, 6% multiracial, 13.4 % students with disabilities, 6.3% students economically disadvantaged, and 2.1% English learners. The elementary school in the study consists of grades kindergarten through fifth, totaling 671 students. Each grade level consists of three to four sections, which consist of 19-26 students per section.

Due to the global coronavirus pandemic, the attendance model for the district changed for the school year. Students with a last name beginning with letter A – K come on a rotating schedule of Monday, Thursday, and alternating Wednesday. Students with a last name beginning with the letter L – Z come on a rotating schedule of Tuesday, Friday, and alternating Wednesday. Students attend school on their pre-determined days, while completing online lessons or tasks on the other days. This hybrid learning schedule is

maintained in every elementary, middle, and high school in the district, with only a few exceptions for students with particular needs.

**Process of Participant Selection**

The participants in this study include 18 first-grade students of the 20 total students in my class. It is important to note that participation in the study was voluntary and written consent was provided by the families of 18 participants. The students within my classroom are primarily white, with two Asian, three multiracial, and one Hispanic student. Three students are English learners. The school identifies one of my students with learning disabilities. This student was not included in the study, as they are not present during a majority of my math instruction. Of the 18 participants, nine are girls and nine are boys ranging in age from 6-7. In order to focus my observations during the study, I decided to select a purposeful, stratified sample (Patton, 1990) of six students. Patton (1990) states that samples of participants can be nested within other samples based on purposeful, key characteristics. This is done to make effective use of resources or cases, and may be smaller in size. This type of sampling is appropriate for my study due to the class size. Rather than observing all 18 participants during each math station and rotation, I will focus my observations on six. I selected particular participants according to the key characteristic of their math skill level, in order to sample a range of math ability. Students' skill level was based off prior observations, assessments, classroom practice, and my knowledge of them as a learner in my first-grade classroom. The selected sample included three girls and three boys to represent the varying levels of mathematical skill and performance, high, average, and low.

## Method

Educational action research is a structured process of exploring and investigating done by educators with a sincere interest in teaching and learning. According to Mertler (2018) in the text *Introduction to Educational Research*, action research is done by educators for themselves in order to examine their own practice, follows a particular framework, and includes reflection as an essential component of the process. It can be implemented by an individual teacher, team of teachers, counselors, or administration. Mertler (2018) describes action research as a cyclical process centered around the collection of data and active reflection of findings. Specifically, action research is divided into four stages that include planning, acting, developing, and reflecting. Two types of action research are noted by Mertler (2018), participatory and practical. The purpose of practical action research is to identify and solve particular, relevant problems in the classroom, school, or community. Ultimately an action plan, or a strategy for implementing any findings, is the goal of an action research study. Mertler (2018) states "action research offers a process by which *current* educational practice can be changed to *better* practice" (p. 135).

I used an individual, practical action research methodology to address a specific problem in my classroom. During my action research, I planned, acted, developed, and reflected on any benefits of providing three differentiated levels of math tasks and activities to first-grade students.

***Planning stage.*** I identified a relevant problem within my teaching, then began gathering and reviewing information on the use of differentiated math stations. I planned six math station tasks focused on specific content, differentiated the stations, and

organized how participants would interact with the materials. Each station had one task or activity that was differentiated at three levels of mathematical skill; high or above expectation, average or meeting expectation, and low or below expectation. For example, students participated in a station rolling dice and moving a plastic counter from one to 120. The higher level of the station had students roll three dice and add the numbers before moving. The average level had students roll two dice, and the low level had students roll one die. I planned for the high-level materials necessary for several station's task or activity to be color coded as blue, average colored as green, and low colored as yellow. This was done to help me as the participant observer, and classroom teacher, during my anecdotal notes as well as for students to correctly replace materials once a task was completed and rotated to the next table.

***Acting stage.*** I implemented my math station plan by giving student participants 10 to 12 minutes to select, manipulate and work on a station task or activity. The participants interacted with three math stations per rotation. One or two rotations were completed each week for three weeks total.

***Developing Stage.*** After observations of the first two rotations, I noted the need to revise or replace one of the math stations. I changed one of the station tasks for a different addition skilled task. This new station was used with five previous stations as an improved action plan, continuing for the final two rotations. Due to safety precautions during the pandemic, information arose that would affect future plans of my fourth math station rotation. The district decided to alter the attendance model to remote learning, causing the completion of the final rotation to occur immediately following the third rotation in the third week of data collection.

***Reflecting Stage.*** After each math station rotation, I reflected on my observations and student interactions. These reflections helped revise my plan within the developing stage. By collecting, analyzing, and reflecting on the findings at the end of the study, I will be able to summarize the results and share them with my first-grade team, school staff, administration, and educational community.

## Procedure

For this study, I followed the following procedure. First, I gathered a total of six tasks or activities with a focus on number sense and addition practice. Next, I copied necessary materials on specific colored paper based on differentiated levels. I also copied enough materials for each student to have their own individual supplies for the three differentiated levels. This was done due to coronavirus safety precautions. Then, I determined my select sample of students to observe during math stations. After that, I introduced and explained each station to the class as a whole. While the students participated in station tasks or activities, I recorded anecdotal notes on how the sample students selected, manipulated, and worked on their differentiated level. During this time, students may have played one, two, or all three levels of a task. At the end of station time, usually 10 to 12 minutes, an alarm went off to clean up and rotate materials. Due to safety precautions, students stayed at their assigned table place while materials for each math station were brought to them. Students also had to hand sanitize in between each station. After rotating three math stations, I had students complete an exit slip on how they felt during math stations and their favorite part. A whole-class discussion was used to explain how students were to complete the slip and explain the range of feelings they might have experienced. At the end of each math station rotation, I reflected on my

observations. My reflections after the second week of rotations caused me to change out one of the stations for another addition skill activity. This new station activity was used, with five from the previous rotations, for the final two rotation observations. Due to district-wide attendance changes, I completed the fourth math station rotation immediately after the third rotation, during the third week of observations.

**Materials**

***Math Station Selection.*** The math station tasks and activities included in the study, I selected and prepared weeks before observations. The task or activity for each station came from Kristen Smith's (n.d.) Teachers Pay Teachers webpage, A Day in First Grade. Smith (n.d.) differentiates each activity, however I also provided additional differentiation with the use of multi-sided dice for one station and the use of a 100s or 120s chart for others. Every station task or activity focused on number sense or addition, as these were two content standards the first-grade team was teaching at the time of the math station study.

***Math Station Tasks and Activities.*** To present a snapshot of the math stations used in the study, I created a table to name each station, provide the learning target associated with the station, and summarize the station's differentiated levels. Table 1 also includes the differentiation color code. The yellow color-coded lower level task or activity is referred to as Y, the green color-coded average task or activity as G, and the blue color-coded high-level task or activity as B.

**Table 1 (continued)**

*Math station differentiated levels, learning targets, and descriptions*

| Station | Level | Learning Target | Activity Description |
|---|---|---|---|
| Number Search | Y | Add within 20, fluently within 10 | Look for combinations of 10 |
| | G | | Look for combinations of 10 |
| | B | | Look for combinations of 20 |
| Race to 120 | Y | Relate counting to addition | Move counter according to result on one die |
| | G | | Move the counter according to sum of two dice |
| | B | | Move counter according to sum of three dice |
| Shake, Shake, Drop | Y | Represent and solve problems involving addition | Solve for the sum of two 6-sided dice |
| | G | | Solve for the sum of two 8-sided dice |
| | B | | Solve for the sum of two 12-sided dice |
| Missing Number | Y | Identify and solve for unknown numbers in all positions | Solve missing addend with sums up to 12 |
| | G | | Solve missing addend with sums up to 15 |
| | B | | Solve missing addend with sums up to 20 |
| Cut it Up! | Y | Extend the counting sequence | Puzzle pieces of 100s chart with resource support |
| | G | | Puzzle pieces of 120s chart with resource support |
| | B | | Puzzle pieces of 120s chart without support |
| Number Puzzles | Y | Use place value understanding to find 10 more or 10 less, 1 more or 1 less than a given number | Select from given numbers 11 to 50 |
| | G | | Select from given numbers 50 to 100 |
| | B | | Select from given numbers 80 to 120 |
| Domino Fact Family | Y | Apply properties of operations as strategies to add (commutative property of addition and subtraction) | Make fact family with domino addends 0-7 and sums 3-15 |
| | G | | Make fact family with domino addends 0-10 and sums 4-16 |
| | B | | Make fact family with domino addends 0-10 and sums 4-17 |

A detailed description of stations (Appendix A) provides additional specifics regarding the differentiations of each station, usage during the three-week study, and the classroom materials used. During study observations, I noted students may have needed additional support with the Number Puzzles station. A 100s and 120s chart was provided, however, I ultimately noted a need to switch and offer a different math station task to replace it. Students were not independently ready to practice the learning target or were confused by the lack of directions. The station Number Puzzles was used for the first two rotations, while the station Domino Fact Family was used for the last two rotations in its place.

## Data Collection

As described through my procedures, there were multiple measures gathered for data collection. The measures included my anecdotal notes for observations and the exit slips each student completed after a math station rotation.

***Anecdotal notes.*** During student participation with math station tasks, I used a chart to record observations. These field notes included a student from the selected sample, the date, along with space to note their selections and interactions with the materials. I logged which level of task they selected, how they completed the task, what strategies they used to solve any problems, if they were successful in their solutions, and if the student selected a new level of the task during the math station rotation.

***Exit slip.*** Participants completed exit slips (Appendix B) after each math station rotation, for a total of four times, to reflect on how they felt during math stations and express their favorite part of stations in writing. To record participant's feeling during

stations, students selected a smiley face ranging from happy to sad. Student's also selected a smiley face ranging from happy to sad to record if they found station levels at their "just right" or appropriate level. These exit slips were evaluated for the level of engagement through feeling, to gauge the participants awareness or confidence in selecting appropriate tasks, and to determine if participants were finding meaning in math stations.

**Data Analysis**

After collecting all the data, I used spreadsheets to organize my observations and group exit slip reflections to determine if any connections developed over time. My field notes detailed the selection and manipulation of a participant's choice task level, while the exit slips reflected the student's perception of their work and meaning. These exit slips were evaluated for the level of engagement through feeling, to gauge the participants awareness or confidence in selecting appropriate tasks, and to determine if participants were finding meaning in math stations. Level of engagement through feelings of math stations could range from happy to sad. Gauging the participants awareness or confidence in selecting appropriate tasks, termed "just right", could range from confident to average. Students could comment on a range of meaning-making or learning opinions in the favorite part section of the exit slip. I analyzed each exit slip, a total of four per student participant, and recorded the data in a spreadsheet.

# SECTION FOUR

## Results and Analysis

The data and results of my anecdotal notes and exit slips make up the content of this section. This section is organized around the research question guiding the work of the study: How do differentiated math stations, provided at three different skill levels, benefit students' ability to select meaningful and appropriately challenging work? This section examines the students' ability and confidence to correctly select an appropriately differentiated station, their feelings related to math stations, and how they make meaning or process the stations through the written response of their favorite part.

### Station Selection and Meaningful Work

After collecting and reviewing exit slips (Appendix B) from participants within the purposeful sample, I created a table to specifically document students' written responses regarding their favorite part of math stations. These responses allowed me to determine if participants were finding meaning in a station they selected, analyze their learning opinions, and review strategies students used to help make meaning of the math station task or activity. I discovered themes throughout their twenty-four responses and narrowed down reasonings to their favorite station as being fun, easy, or "other". The "Other" category consisted of a variety of answers pertaining to strategies, connections, and celebrations students developed to support their reasoning for a favorite station. Table 2 indicates the number of responses for the category themes fun, easy, and "Other" during each math station rotation. A math station is an individual task or activity. A math station rotation consisted of three math stations. Four rotations were completed during

the study. Six exit slip responses were analyzed after each math station rotation, for a total number of 24 responses following four rotations.

**Table 2**

*Exit slip themes based on participant's favorite part of math stations*

| | Fun | Easy | Other |
|---|---|---|---|
| Math Station Rotation 1 | 2 | 3 | 1 |
| Math Station Rotation 2 | 2 | 1 | 3 |
| Math Station Rotation 3 | 1 | 0 | 5 |
| Math Station Rotation 4 | 2 | 1 | 3 |

Responses that were included within the "Other" category pertained to strategies, connections, feelings, and skills the participants noticed. Specific responses related to using strategies were, "I used 1 dice", "it is like a number bond", and "I have a strategy". Participants used feelings to explain their favorite part with responses like, "I like it", "I love it", "I went to 120", "I [was] good at it", and "it made me think". Responses also invoked participant celebration of skills like, "I did half [of the math station]" and "I could finish it". While the theme of participants finding their favorite math station fun throughout all four rotations stayed relatively consistent, their reasoning for a station being "easy" decreased from the initial responses after math station rotation 1. The other responses compiled of feelings, strategies, and celebrations increased as math station rotations continued.

My anecdotal notes also included participants' feelings, strategies, and celebrations throughout all four math station rotations. I noted participants using a wide

range of strategies during station tasks and activities, both mentally and physically with manipulatives. Table 3 and Table 4 indicate the mental strategies and tools each participant was observed using and at which station. Not all strategies were recorded in my anecdotal notes. All names of participants are pseudonyms. In table 3 and 4, K stands for Kyle, E – Esther, D – Derek, V – Valerie, S – Sam, and T – Tessa.

**Table 3 (continued)**

*Mental strategies used by participants during math stations*

| Strategy | Station | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1[a] | 2[b] | 3[c] | 4[d] | 5[e] | 6[f] | 7[g] |
| Use of commutative property (example: 5 + 2 = 2 + 5) | | | | | | | KSE T |
| Counting on from the larger number (example: 7 + 2 is "seven, eight, NINE") | | S | | | | | S |
| Doubles (example: 8 + 8 = 16) | | V | | | | | |
| Place value of tens and ones (example: 19 is one ten and 9 ones) | | | | | EDV SK | V | |
| Use of TouchPoints (example: each number 1-9 has points corresponding to the digit's value. 1-5 have single Tough Points. 6-9 have double TouchPoints, which means you touch/count each point twice.) | | | V | T | | | |
| Make a ten (example: 7 + 3 = 10, or 9 + 3 is "9 plus 1 is ten, plus two more, TWELVE") | KVS TED | | | | | | |
| Subitize (example: identify number in set quickly) | | KD | | | | | |
| Add two numbers, then a third (example: 4 + 2 + 3 is "four plus two is six, plus three more, NINE" | | VS | | | | | |
| Mental math or calculations | | | | T | | | |

[a] Number search station. [b] Race to 120 station. [c] Shake, shake, drop station. [d] Missing number station. [e] Cut it up! station. [f] Number puzzles station. [g] Domino fact family station.

**Table 4 (continued)**

*Manipulatives or physical strategies used by participants during math stations*

| Strategy | Station | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1[a] | 2[b] | 3[c] | 4[d] | 5[e] | 6[f] | 7[g] |
| Use of a 100s or 120s chart | | | | DS | | KVS TD | |
| Counting pips on dice or domino | | ESK VD | K | | | | ED |
| Use of unifix cubes | | | | SED K | | | |
| Use of fingers to count | | | EKD | DVS TK | | | |
| Place numbers in order from 1 - 120 | | | | | TS | | |

[a] Number search station. [b] Race to 120 station. [c] Shake, shake, drop station. [d] Missing number station. [e] Cut it up! station. [f] Number puzzles station. [g] Domino fact family station.

Table 3 and 4 indicate participants wide use of mental mathematical strategies and physical tools during math stations. Each participant may not have used multiple strategies, however as a sample they used many. Table 3 shows participants using a singular mental strategy at the math station Number Search. The math station's learning target was for participants to locate number combinations to 10 for differentiated levels yellow and green, and combinations to 20 for the blue level. The strategy of making a ten, therefore, was an appropriate strategy to use during this station. Table 3 also shows a majority of participants, five out of six, using the mental strategy of place value during the station Cut it Up! Only two participants used a physical strategy of placing puzzle pieces in number order. A majority of participants, four out of six, made more use of a mental strategy for the math station Domino Fact Family. Overall Table 4 indicates that participants more frequently used tools or physical strategies and manipulatives during math stations. It is important to note the table includes only the strategies I documented

participants using or observed them manipulating. Therefore, some participants did not show a strategy being used during some stations.

Based on my anecdotal notes as well as table 3 and 4, participants used strategies at all three differentiated levels of stations to help make meaning of tasks and activities. I noted celebrations from the first rotation through the fourth and final. Participants were excited when they finished a level and moved to another, some seemed to gain confidence as they worked and progress through levels, and other's self-assurance grew when they found a strategy that worked for them.

Tomlinson (2001) believes that giving students responsibility for their learning provides the opportunity for meaningful work choices and accountability. Based on my results, participants were accountable and used multiple strategies to complete math station tasks or activities. I noted they used similar strategies to develop meaning across all three differentiated levels. Diller (2011) argued that math work stations provide students the chance to practice problem-solving, make connections, communicate their thinking, and interact with meaningful independent work. Thus, Diller (2011) uses math work stations daily as an integral part of math instruction. The length and time period of my study could have impacted the outcome of the results. Diller (2011) heeds the use of commercially made math stations, as they typically do not generate the anticipated results for student investigation and deeper thinking. It is undeterminable if the use of pre-differentiated task and activity levels in my study affected the participants' ability to confidently find challenge.

## Station Selection and Feelings

To further my analysis, I disaggregated the exit slip (Appendix B) data by how participants answered about their feeling during math stations, to understand the impact of their emotion with possible meaning-making or learning. Simple clipart of a smiling face, a flat-mouthed face, and a frowning face were used to help students report their feelings. These faces are included in table 5, as well. Table 5 shows the number of happy, average, or sad participant responses during each math station rotation.

**Table 5**

*Exit slip results by participant's feelings*

| | Happy  | Average  | Sad  |
|---|---|---|---|
| Math Station Rotation 1 | 4 | 1 | 1 |
| Math Station Rotation 2 | 6 | 0 | 0 |
| Math Station Rotation 3 | 6 | 0 | 0 |
| Math Station Rotation 4 | 6 | 0 | 0 |

The results indicate that during the first math station rotation, four of the six participants in the selected sample reported feeling happy. One participant reported feeling average and one reported feeling sad. The other three math station rotations had all six participants reporting they felt happy during math stations. To gain a better understanding of the participant's average and sad responses, I asked them to explain their thinking once exit slips were turned in. I wanted to determine if the feelings they

reported were related to one specific math station task or activity, the entirety of the experience, or a math skill level.

The participant who reported feeling average was Sam (all names are pseudonyms). When asked to elaborate on his feeling, he said, "I felt a little bit sad about the blue one racing to 120. I had to use 3 dice and counting up was hard". I referred to my anecdotal notes during math stations to find the station Race to 120 was his first activity. My notes indicated that Sam initially picked the yellow level requiring one die to roll and proceed along spaces until reaching 120. Sam switched to the green level to roll two dice because he finished the first level quickly. Sam's strategy was to identify the larger number of the two dice rolled and then count the pips of the other dice to count on. I noted that he had time to move up to the blue level before that math station ended. I believe it is important to note that Sam also wrote on his exit slip that his favorite part of math stations was the station Race to 120 because he 'got to use one die'.

The participant who reported feeling sad was Valerie. When asked to elaborate on her feeling, she said, "I felt sad when I tried blue levels of ten more, ten less (Number Puzzles) and race to 120. They were too hard". I referred to my anecdotal notes to find the station Race to 120 was her second activity. My notes indicated that Valerie initially selected the blue level, the most challenging, as it requires participants to roll three dice and add before moving their counter. Valeria had a strategy of looking for doubles facts first and then adding the third number. When there were not doubles facts present, she counted the pips on the three dice and then moved. I also noted that she went down to the yellow level to only roll one di once she made it to 120 with the blue level. I believe it is important to note that Valerie also wrote on her exit slip that her favorite part of math

stations was the station Race to 120 because it was fun. Valerie's third math station activity was the station Number Puzzles. She initially selected the yellow level of this task. I recorded in my notes that she seemed hesitant on how to use a 100s chart in the beginning. Valerie was able to find the number selected from a baggie on a 100s chart based on the ten's place. Due to her confusion, I reiterated how to look from right to left, above and below the number to help determine the missing pieces. I recorded that Valerie jumped to the blue level with more confidence after trying a few more numbers.

The results from Sam and Valerie's cases suggest that while they seem to make meaning at math stations, use strategies, and report a station is their favorite, their feelings of the entire math station rotation time can be affected by selecting a level that may be too challenging or inappropriate for their skill level. Both Sam and Valerie enjoyed a math station as their favorite, however, did not feel successful at a particular level due to their ability and understanding. These results coincide with the second part of the research question regarding how students benefit from appropriately challenging work.

**Student Selection and Challenging Work**

After collecting and reviewing exit slips (Appendix B) from participants within the purposeful sample, I created a table to specifically document students' confidence in finding an appropriately challenging level of work. Before math station rotations began, as well as during the completion of each exit slip, I explained to the students what a "just right" level is for them. The wording "just right" is used on the exit slip. For first graders, it is easiest to use familiar examples, so at times we used the story of *Goldilocks and the Three Bears* to help with the analogy of finding work that is not too hard and not too

easy. Participants were also reminded not to pick a station based on their favorite color, but based on math skills and numbers they are comfortable with. Table 6 displays the number of responses indicating student confidence after each math station rotation. Simple clipart of a smiling face, a flat-mouthed face, and a frowning face were used to help students report their confidence level. These faces are included in table 6. Six responses were analyzed after each rotation, for a total number of 24 responses following four rotations.

**Table 6**

*Exit slip results by participant's confidence in selecting appropriately challenging work*

| | Confident  | Average  | Not Confident  |
|---|---|---|---|
| Math Station Rotation 1 | 5 | 1 | 0 |
| Math Station Rotation 2 | 5 | 1 | 0 |
| Math Station Rotation 3 | 5 | 1 | 0 |
| Math Station Rotation 4 | 5 | 1 | 0 |

The results show that during all four math station rotations, five of the six participants in the selected sample reported feeling confident in finding a "just right" level. During all four rotations, one participant reported feeling average in their confidence at finding a "just right" level. Participants Sam and Esther reported an average level of confidence after a rotation, while Valerie reported an average level of confidence after two rotations. I did not ask the participants about the reasoning behind their

answers, although I did overhear Valerie say while completing the third exit slip that the numbers were too hard for her. Overall these results indicate that five out of six participants consistently felt confident finding appropriately challenging work for themselves.

With most participants feeling confident about the levels they selected, I disaggregated my anecdotal notes to examine the exact levels of challenge participants were selecting. All participants made an initial selection of a task or activity level. At times, participants maintained at that level throughout the whole station time. At other times, participants switched between levels to find a more appropriate one due to skill level, sets of numbers, or completion of the station task. When participants switched between task levels, they may have gone progressively through, beginning at the easiest and working their way up to the hardest, regressed through, beginning at the hardest and working their way down to the easiest, or they jumped across task levels.

No apparent themes emerged relating to the switching of task challenge levels, so I decided to analyze the percentage of specific levels chosen by each participant. In section three I explained that I selected particular participants according to the key characteristic of their math skill level. This was done to sample a range of math abilities. Students' skill level was based on prior observations, assessments, classroom practice, and my knowledge of them as a learner in my first-grade classroom. The selected sample included three girls and three boys representing varying levels of mathematical skill and performance as high, average, and low.

To document the percentage of level selections, I created a table including participants of the selected sample, as well as the three differentiated levels they could

have chosen; yellow, green, or blue. In section three, I explained that low-level materials necessary for station tasks or activities would be color-coded as yellow, average colored as green, and high colored as blue. This was done to help me as the participant-observer, and classroom teacher, during my anecdotal notes, as well as for students to correctly replace materials. Table 7 indicates the percentage of levels selected for each student. Again, all names are pseudonyms.

**Table 7**

*Percentage of differentiated math station level selections*

| | Yellow Level | Green Level | Blue Level |
|---|---|---|---|
| Kyle | 69% | 23% | 8% |
| Esther | 57% | 36% | 7% |
| Derek | 38% | 31% | 31% |
| Valerie | 41% | 24% | 35% |
| Sam | 19% | 25% | 56% |
| Tessa | 44% | 6% | 50% |

Based on the results, some themes emerged based on the math station levels participants favored. These percentages include the participants making an initial selection of a level during a math station, as well as if they changed levels throughout the station time. Several times participants did not change levels from the one they initially chose, while other times they moved through all three task levels. My notes indicated that switching between levels was done because they had finished the task at that level, they were experiencing difficulties with larger numbers, or they found the numbers and task too easy.

Using the results of Table 7 and my prior observations of the students, their level selections are relatively what I would have expected. For example, Kyle selected the yellow level of a math station task or activity 69% of the time. He chose 13 total levels during 12 stations, switching only one time from his initial selection. Based on my knowledge of Kyle and experiences with him in the classroom, I would have thought the yellow, or lower, level would be an appropriately challenging level for him. This is also true for Esther, although she selected the yellow level of a math station task or activity 57% of the time. Esther did switch levels twice for a total of 14 levels during 12 stations.

Both Derek and Valerie were students I selected to represent average mathematical skill levels. Derek seemed to equally split his math station level selections between the three challenge levels; 38% yellow, 31% green, and 31% blue. He switched 16 total times during 12 stations. I noted during my observations that Derek selected the green level or blue level more often during the second half or last set of rotations. This could indicate growth in his confidence in math skills and ability to find appropriate challenges based on this confidence increase. Valerie, however, seemed to favor the yellow level slightly more than I expected. She switched 17 levels during 12 stations, tending to jump between yellow and blue tasks more than progressing up or down through the challenge levels.

The two participants I sampled to represent a higher math skill level are Sam and Tessa. Sam chose the blue level of a math station task or activity 56% of the time. He chose 16 total levels during 12 stations. Tessa chose the blue level of a math station task or activity 50% of the time. Tessa switched levels the most amount of times for any participant for a total of 18 levels during 12 stations. Similar to Valerie, Tessa also

frequently jumped between the yellow and blue levels of a task or activity, rather than progressing through. Specifically, she selected the yellow level of a task 44%, the blue level 50%, and the green level only 6% of the time. Based on my knowledge of Sam and Tessa, plus experiences with them in the classroom, I would have thought the blue, or higher, level would be the appropriate, yet challenging level for them.

I used this table to help document the math stations selected because I predicted that students would be able to find appropriate task and challenge levels through the four rotations based on their participation, prior math assessments, and classroom practice. Therefore, I thought I would see a trend of higher percentages in certain challenge levels for certain participants. However, results concluded that all students do not consistently select the most appropriate or challenging task.

Diller (2011) defined math work stations as the opportunity for students to work around the classroom with a partner, using materials and manipulatives to expand upon their mathematical learning. Similarly, Sharp et al. (2019) believed the math workshop approach encouraged students to work collaboratively together to develop new learning and understanding through exploration. In their study, Sharp et al. (2019) found the math workshop approach transformed the regular math instruction classroom into a community of math learners and student instructors. However, as a part of my study, students were limited to math station tasks and activities at their individual tablespaces due to health and safety precautions during a pandemic. Students did not have the chance to play, manipulate, or work with a partner or small group because they needed individual materials. Their inability to learn with and from another peer may have impacted the participant's ability and willingness to find challenging work, just above their academic

comfort level. It also affected the participants' chance of learning new or useful math strategies from a partner while sharing in a challenging task.

Hoosain and Chance (2004) documented the use of Cognitively Guided Instruction (CGI) math instruction with a first-grade classroom and noted that first graders can become creative in their thinking and problem-solving when given the opportunities to select strategies and methods of solving equations. This finding supports the use of math stations employing different levels of appropriately challenging work to encourage different strategies and representations. While my study did not allow for students to become as independent facilitators in their learning as Hoosain and Chance's (2004) study did, students did find freedom in their ability to select strategies and methods of solving math tasks that kept them feeling confident and happy.

Taken together, the results here suggest that while a majority of participants were happy during math stations, found meaning within their tasks, and felt confident in choosing appropriate levels, they do not consistently select challenging tasks for themselves. Equally important, the data did not suggest that students can find the appropriate challenge at the right task level. Therefore, these inconclusive results suggest that further research would be necessary and helpful to completely answer the research question.

# SECTION FIVE

## Discussion and Conclusion

This study aimed to determine the benefits of using differentiated math stations in a first-grade classroom. The goal was to discover if the levels of differentiated stations affected the first-grade students' ability to select meaningful and challenging work. The research question that guided this study was: How do differentiated math stations, provided at three different skill levels, benefit students' ability to select meaningful and appropriately challenging work?

The results from this study suggested that while a majority of sample participants developed meaning within their task levels and felt confident in their ability to choose an appropriate level of work, they did not consistently select challenging tasks. These inconsistencies are based on my selection of participants through a stratified, purposeful sample (Patton, 1990) to represent a range of students' mathematical performance levels of high, average, and low. Participant's selected levels that did not consistently compare to the level I anticipated them to select. For example, the participants I anticipated selecting the higher-level tasks did not consistently do so. Equally important to note is the data did not suggest that students could or could not find appropriate challenge in their selected task level. Some individual cases indicated that students could confidently select the appropriate challenge level of a provided math station task or activity. Those results showed a positive impact on student's confidence and accuracy in their selection. The data suggest important benefits of differentiated math stations, but more research is needed regarding learner's choice.

Additionally, a majority of participants reported being happy during math station rotations and developed knowledge and meaning through their work. Their meaning was expressed through an explanation on an exit slip. Although participants mentioned strategies and celebrations within their explanations, this might not have been the best way to measure if their selected work was meaningful. Instead, I believe that meaningful work might be measured through a list of possible math problem-solving strategies for students to select. For example, providing participants with a checklist on the exit slip to mark strategies they found meaningful or helpful, as well as simple celebrations they may have accomplished. These checklists would help first-grade students, especially in the first few months of school, when writing complete thoughts is not an expected skill.

In the end, I learned that math stations could still be beneficial for all students regardless of math ability. Simply providing the opportunity for participants to find challenge or meaning within new station tasks and activities increased their excitement and interest in math instruction. The stations reiterated math strategies students had learned during whole-group instruction and encouraged students to find an individual strategy that worked for them. It's important to note a majority of students felt confident and happy through the station time. The study supported students in attempting challenges, trying to find appropriate tasks, and expressing their mathematical understanding through the use of exit slips. While this research does not fully support the benefits of math stations for students to select meaningful and challenging work, some limitations from the study could explain these outcomes.

## Limitations

Several possible limitations could have impacted the results of this study, including a global pandemic, health and safety precautions, limited movement within my classroom, the duration of the math station rotations, and the predetermined challenge levels used from Smith's (n.d.) Teacher Pay Teachers webpage. The first limitation, a global pandemic, contributed to most of the limitations within the study. The school district where the study was conducted changed the attendance model in order to limit the number of students present within the building on designated days. They adopted a hybrid model based on student's last names. Students attended school on their pre-determined days and completed online lessons or tasks on other days. The hybrid model also limited the number of students present within my room. To maintain the social distancing guidelines from state, local, and district officials, I had ten students on alternating days. My classroom setup limited the number of students at each table to two. Each table had plexiglass shields to divide the two students.

Another possible limitation is the amount of additional health and safety precautions taken during the pandemic, affecting the time spent at each station rotation. As mentioned, two students sat at each table. Before math stations could begin and materials were touched, students needed to hand sanitize. Initially, I prepared for each station to be placed within a plastic sleeve to help with erasing completed work, in addition, to help with the cleaning of supplies by using a sanitizing wipe. I found the number of times a plastic sleeve would need to be wiped off, allowed to dry, and then reused was counterproductive. In fact, the plastic sleeve was not able to be entirely cleaned after a few uses because of the smears and discoloration from dry erase markers.

During the study, I switched to students using hand sanitizer between each station to cut down on some of the time lost exploring and completing station task rotations. Before the study began, I spent time copying and creating enough individual math station supplies so students did not need to share. Even with hand sanitizing between each station, I prepared multiple pieces and ensured students had personal supply boxes they could easily access if necessary for a task. These supply boxes held writing tools and math manipulatives needed for stations, as well as other classroom materials.

An issue with limited movement around the classroom was also a possible limitation of the study. As stated due to the pandemic, the number of students within my room on each day was restricted to ten. Two students were seated at each classroom table. The students were not allowed to travel between tables to limit additional cleaning and contact. Since they did not travel between tables, I created tubs containing station materials to rotate. These station tubs held two sets of each station task or activity. While students were hand sanitizing and putting away some supplies, I brought the next station tub over to them. Even though both students at a table worked on the same station, they may have selected differing challenge levels or number sets. Andreasen and Hunt (2012), Diller (2011), and Sharp et al. (2019) prioritized students traveling and moving throughout a classroom during a math station exploration time. They also emphasized the importance of collaboration between peers to increase learning and understanding. Since students in the study stayed at their assigned seats for most of the day, unable to freely move or switch seats, their ability to collaborate was affected.

As discussed in the previous section, the duration of the math station study could be a limitation. Instead of several rotation options within each week of the study, I

repeated math stations twice a week so students within my selected sample and both classes were able to participate. I collected data twice during a week, while students experienced one rotation of stations. I planned for the study to take place over four weeks, with a total of eight rotations of data. I was still able to collect eight rotations of data, however, the attendance model for the district changed to completely remote during the intended last week of the study. Rather than only gathering three rotations of observations, I moved the final set of rotations to occur immediately following the third. The duration and proximity to the third rotation could have impacted the observations of the fourth. Diller (2011) believes that math stations are an essential portion of daily math instruction, however, I felt the need to limit station time due to the infrequency and inconsistency of providing a full math curriculum to students during the hybrid schedule.

Finally, the use of predetermined differentiated levels through the use of Smith's (n.d.) Teachers Pay Teachers webpage guided math stations may also be a limitation. Diller (2011) warns against the use of commercialized station tasks as they may affect the learning results a teacher desires for their students. Diller (2011) explains simple classroom materials that students encounter and understand how to use are more beneficial. Commercial materials or stations may cause confusion compared to the quality, practiced classroom supplies. Students can experience confusion or misunderstandings trying to read the directions or understand expectations. Before the study began, I introduced all station tasks and activities to the class. Due to the duration of the study and limited time spent with each station, students did need reminders on task expectations and directions. This supports Diller's (2011) recommendation on using math work stations daily.

**Next Steps**

Through my observations of differentiated math stations and the varying range of students' abilities, I believe movement and collaboration with peers are vital. The chance for students to participate in math stations with others would be beneficial and encourage them to persevere through challenging tasks. Students in math stations would have support from a partner to work through directions, differentiated levels, and enjoy the learning process. Math stations would also be a better intervention at providing meaningful and challenging work if it was used more consistently throughout math instruction. It is also interesting to consider if the sequence of math stations would affect participants' ability to develop more meaning, increase use of multiple strategies, or build upon new learnings. Allowing for additional free choice when selecting from math stations versus teacher-imposed stations, might encourage students to attempt challenging work and develop a strong sense of meaning through their learning.

As a result of this study, further research should explore an increase in the length of time stations are implemented, possibly using stations more frequently throughout weekly instruction. A future research study using an action research design could be implemented to compare how math stations affect lower-achieving students paired with their higher-achieving peers to increase their math perseverance and ability over an extended period of time. Differentiated math station tasks or activities would still be used, but the collaboration of peers could be tracked through observation charts, confidence prompts in exit slips, and strategy checklists.

I would like to share the findings from this study with my colleagues, so they can better understand how math stations could work within their classroom. My study may

directly affect how they can implement math stations in their first-grade classrooms. Since we experience the same issues with heterogeneously grouped first graders, I believe they will also have students with varying levels of mathematical ability and performance in their classes. Communicating my results will hopefully encourage and support them to differentiate our math curriculum through the use of leveled math tasks and activities. By taking the time to share the meaningful, challenging, and appropriately leveled work with them, all future first graders could stand to benefit.

I would also like to share my findings with the staff at my building. I feel the need for differentiated mathematics instruction is present in all elementary grades, kindergarten through fifth. I believe my research and project could inspire other teachers to implement similar instructional strategies or methods in their classrooms. Since our building does not identify gifted students until third grade, I would like to share my findings with the gifted teacher as well. I believe she could support the differentiation of a few tasks, games, or activities in lower grades.

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# Appendix A

## Math Station Task and Activity Descriptions

The math station named Number Search was used in all four rotations. Students were presented with the task of locating two numbers next to each other on a chart that would total a given number. The lower level, yellow-colored materials, required participants to look for combinations of 10. This level provided a 6x6 square chart with numbers ranging from zero to 10. The average level, green-colored materials, required participants to look for combinations of 10. This level provided a 7x7 square chart with numbers ranging from zero to 10. The higher level, blue-colored materials, required participants to look for combinations of 20. This level provided a 7x7 square chart with numbers ranging from zero to 20. Within the math station were two bags of materials, each bag holding the three levels of the task. Each level was placed inside a plastic sleeve protector so they could be easily cleaned and shared. Due to material restrictions during the pandemic, each participant used their own dry erase marker to connect number combinations and a felt eraser to make corrections or clean. Both of these items are kept in a personal supply box, accessible during all math station tasks if necessary.

The station named Race to 120 was used in all four rotations. Students were presented with the task of rolling dice, adding the numbers, and moving a counter across a 120 chart until reaching the end. The lower level, yellow-colored material, asked participants to roll one di and move their counter that number of spaces. The average level, green-colored material, asked participants to roll two dice together, add the numbers together, and move their counter that number of spaces. The higher level, blue-colored material, asked participants to roll three dice, add the numbers together, and move their counter that number of spaces. Typically, participants are encouraged to play against a partner, however due to safety precautions students played individually. Within

the math station were two bags of materials, each bag holding the three levels of the task. Students used dice that were kept in a personal supply box.

The station named Shake, Shake, Drop was used in all four rotations. Participants were asked to roll two dice together, record each number in an equation, and solve for the sum. The lower level task had students roll two of the six-sided dice from within their personal supply box. The average level task had students roll two eight-sided dice that I provided for them within the math station tub of materials. The higher-level task had students use two 12-sided dice that I provided within the math station tub. Each level used the same equation form placed inside a plastic sleeve protector so they could be easily cleaned and shared. Due to material restrictions during the pandemic, each participant used their own dry erase marker to record the numbers they rolled and a felt eraser to make corrections or clean. Both of these items are kept in a personal supply box.

The station named Missing Number was used in all four rotations. Participants had to select a level of equations where they solved for the missing addend when given one addend and the sum. The lower level task had students solve for equations with sums was up to 12. The average level task had students solve for equations with sums up to 15. The higher-level task had students solve for equations with sums up to 20. Each level used an equation form placed inside a plastic sleeve protector so it could be easily cleaned and shared. Within the math station were two bags of materials, each bag holding the three levels of the task. Due to material restrictions during the pandemic, each participant used their own dry erase marker to record missing numbers and a felt eraser to make corrections or clean. Both of these items are kept in a personal supply box. During

observations I noted students may have needed additional support, so cubes from within their personal supply box were also used at times.

The station named Cut it Up! was used in all four rotations. Students used provided cut, Tetris-like pieces of a 100 or 120 chart to correctly piece together and complete the task. The lower level, yellow-colored materials, were cut pieces of a 100 chart that needed put together. Students were provided with a copied, full version of a 100 chart as support. The average level, green-colored materials, were cut pieces of a 120 chart that needed put together. Students were provided with a copied, full version of a 120 chart as support. The higher-level, blue-colored materials, were cut pieces of a 120 chart that needed put together. Students were not provided with a 120 chart as support. Within the math station were two bags of materials, each bag holding the three levels of the task.

The station named Number Puzzles was used in the first two rotations. Students were provided with a bag of numbers and a chart. In the center of the chart is a square to place a selected number card. There is a square located above, to the left, to the right, and below this center square. Participants must select a number to place within the center. Then, they will use a dry-erase marker to determine ten less than the number, ten more, one less than the number, and one more. Students can then select a new number. The lower level, yellow-colored materials, used numbers ranging from 11 to 50. The average level, green-colored materials, used numbers ranging from 50 to 100. The higher-level, blue-colored materials, used number ranging from 80 to 120. Each set of numbers were included in separate bags for participants to select their preferred level and return to the correct location.

The station named Domino Fact Family was used in the last two rotations. Participants were asked to select a domino, use the two numbers as addends of an equation, solve for the sum, and complete a fact family triangle. A fact family includes two addition equations and two subtraction equations that use the same three numbers. The lower level, yellow-colored materials, used dominos with addends ranging from zero to seven and sums ranging from three to 15. The average level, green-colored materials, used dominos with addends ranging from zero to 10 and sums ranging from four to 16. The higher level, blue-colored materials, used dominos with addends ranging from zero to 10 and sums ranging from four to 17. Each level used a fact family triangle placed inside a plastic sleeve protector so it could be easily cleaned and shared. Due to material restrictions during the pandemic, each participant used their own dry erase marker to record domino addends and the sum, as well as a felt eraser to make corrections or clean. Both of these items are kept in a personal supply box.

## Appendix B

## Exit Slip

## Exit Slip

**Math Stations**

**Today at math stations, I felt:**

**I found a level that was "just right":**

**My favorite part was ____________________________________________________**

**because______________________________________________________________**

**_________________________________.**