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About the Journal

Founded in 2013, the Journal of Teacher Action Research (ISSN: 2332-2233) is a peer-reviewed online journal indexed with EBSCO that seeks practical research that can be implemented in Pre-Kindergarten through Post-Secondary classrooms. The primary function of this journal is to provide classroom teachers and researchers a means for sharing classroom practices.

The journal accepts articles for peer-review that describe classroom practice which positively impacts student learning. We define teacher action research as teachers (at all levels) studying their practice and/or their students' learning in a methodical way in order to inform classroom practice. Articles submitted to the journal should demonstrate an action research focus with intent to improve the author's practice.

Editorial Team

MATHEMATICS STATIONS IN A THIRD GRADE CLASSROOM: ARE THEY WORTH IT?

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Abstract Mathematics stations allow for students to complete tasks individually and in small groups using a variety of manipulatives, games, and technology to practice the same mathematical content. The purpose of this study was to gain a deeper understanding of teacher and student perceptions of the use of mathematics stations in a third grade classroom, and how mathematics stations shaped student feeling toward mathematics. The author collected data through student survey, teacher and student interviews, observations, and a personal research journal. After analyzing the data by using the constant comparative method the author found four major themes. These themes included evidence of student engagement perceived by the teacher and students, peer conflicts that act as barriers, meeting student needs, and finally, the teacher perceptions of behavior management during stations. This study may provide useful information to other educators who are deciding if they would like to implement mathematics stations into their classroom.

Keywords: teacher action research, math stations, student engagement, student perceptions

Introduction

The researcher and the classroom teacher simultaneously laughed and shook their heads as they both reflected on the journey it had been implementing mathematics stations into the classroom for the first time this year. During mathematics stations, it is common to see small groupings of students spread around the classroom, whether that is lying on a large carpet, sitting on pillows, working at desks, or even standing with clipboards all working on tasks of mathematical content. There is a hum of problem solving, questions being asked, laughter, and possibly loud voices coming from the mathematics game small group. The researcher asked Mrs. Oliver (all names are pseudonyms), the third-grade teacher, "What would you say is the best part about implementing math stations into your classroom this year and why?" This was her response:

"Well, I am going to sound like a broken record, but really just the students' engagement, the students' *want* to do the stations, to learn. In stations, they are learning, and if they want to do math stations, then they are wanting to learn, even if they don't quite understand that, or know that this is fun, this is a game, but that they are learning. And I am like, 'yeah, we can play a game all day long if you are learning.' So, I think that has been the best thing, watching them take ownership of their own learning, and watching them problem solve between each other, and … I watched them figure it out together, and something that I think stations has brought out in them. I would say that is the best part."

Purpose. Mathematics can often be a subject that is daunting for teachers to teach because of personal or students' feelings of anxiety towards the subject. As a way to change these negative associations with the subject, mathematics stations are a different way students can learn while interacting with their peers and hands-on materials. Mathematics stations are areas set up around a classroom where students can practice the same mathematical content, but in a variety of ways. With various manipulatives and opportunities to use different learning styles, students rotate through the stations in groups of their peers to practice their learning (Diller, 2011). During this study, I was a graduate student completing a one-year clinical teaching placement in a third-grade classroom at Seaside Elementary (all location names are pseudonyms). Seaside was a Title I school that served a diverse population of approximately 450 students in grades K-5 on the east side of Clarence Independent School District home to around 122,000 people. The student body of Seaside Elementary is represented by 31.5% African Americans, 38.7% Hispanic, 25.9% White, 1.2% Asian, 0.2% Pacific Islander and 2.5% two or more races. Eighty-four percent of the Seaside Elementary population is economically disadvantaged, 18.5% are English Language Learners, and 5.9% are considered special education. The school has a mobility rate of 24.4%.

My cooperating teacher used mathematics stations for the first time this year, and I wanted to know if after all of the time, work, and set-up, are mathematics stations a method that students and teachers enjoy? Since there was not a lot of research about the student and teacher perceptions of math stations in elementary classrooms, the results of this study may impact the way teachers go about using mathematics stations in their classrooms.

My research questions included:

- What are teacher and student perceptions of the use of mathematics stations in a third grade classroom?
- How do mathematics stations shape student feelings towards mathematics?

Literature Review

In a mathematical setting, the use of multiple stations can focus on the same curriculum content goal by using different manipulatives, activities, games, or technology (Van de Walle, 2016). Students can complete the task within the station independently of the teacher, while working with a variety of materials either independently or within a small group (King-Sears, 2007). There must be explicit instruction of the mathematical concept along with clear expectations for station time before the students are released to rotate through the stations as a form of guided or independent practice (Van de Walle, 2016). Stations, "benefit students and teachers by maximizing instructional opportunities through simultaneously providing varied tasks and activities for students with diverse learning needs to practice what they have learned" (King-Sears, 2007, p. 147). Tasks in stations often include activities that resemble playing when compared to an independent worksheet assignment. Wing (1995) found that if students can complete an activity that is more play-like, then it might allow for the student to feel more ownership over the task than they might have felt with a more work-like task. While students know the difference between work and play, simulating tasks that can merge the two together in a work-play scenario, lends itself to a greater degree of pleasure (Wing, 1995). If this need for a more play-like structure is greater for one student over another, teachers can benefit those students by catering their instruction that is the best fit for them.

Teachers have the ability to differentiate instruction to meet the needs of their students within the mathematics stations. This differentiation can be through the design of the tasks in each station as well as the organization of small groups within the workshop model. In her research, Ashley (2016) described creating differentiation by assessing what the students already know and then deciding how to provide instruction that will meet each of their needs. Combining student academic needs, their learning styles, and how they show their understanding, all play a part in the differentiation in mathematics stations (Andreasen, 2012). Stations could look like a teacher table where students get additional help with a specific part of the lesson or enrichment on the topic based on their need. Other stations could include the use of manipulatives with pencil to paper problems, and a computerized game with audio and visual practice, or hands-on games with peers (Andreasen, 2012).

Specifically chosen small groups are used by teachers during mathematics stations to organize their students based on mathematical instructional need. Benders and Craft (2016) explained in their study that the flexibility a teacher has in creating small groups allows for changes to be made when students' academic needs improve or require more attention. Through their study, they saw that the use of small groups allowed for attention to be paid, "to the students having difficulty with just one skill or concept, to those who are advancing quickly through the material and need new challenges" (p.7). Benders and Craft (2016) suggested that heterogeneous grouping allows for peer support and learning from one another. Ding, Li, Piccolo, and Kulm's (2007) study showed that teachers should allow for interactions and teaching between peers to occur and encourage their students to use their peers as resources. There has to be a balance between allowing students to struggle while solving a mathematical problem either independently, or in a small group before the teacher steps in and redirects (Ding et. al, 2007). For those students having more difficulty with the mathematical content, there is often mathematics anxiety involved. In Harari's (2013) exploratory study of mathematics anxiety, two thirds of adults stated that they have negative associations with mathematics. From a tough concept to a mean teacher, mathematics anxiety can begin as early as the primary elementary grades (Harari, 2013). When students are working within homogenous grouping, Merritt's (2017) findings suggest the students' mathematics skills, confidence and attitudes improve. Teachers can intentionally match students with greater needs, whether academic, social, or emotional.

The results of the previous studies suggested that the use of the mathematics stations model may be helpful in encouraging a work-play mindset while interacting with mathematical content in various ways. Increasing differentiation of instruction can help meet the individual needs of students through small group pairing and peer collaborations. While the research has shown success in the use of mathematics stations, this study will give insight into student and teacher perceptions and feeling towards the use of mathematics stations when practicing mathematical content. This research is unique because very few studies have been conducted on understanding if students and teachers enjoy using stations as a tool for practicing mathematics. Greater knowledge on student and teacher perceptions of mathematics stations can help inform educators on why or why not to use mathematics stations in their classroom.

Methodology

Within the third-grade classroom where I was clinical teaching, I conducted my action research study on student and teacher perceptions and feelings towards the use of mathematics stations as a way to practice mathematical content. During the study, I was both a teacher and a researcher, so the students were comfortable with my role as both.

Participant Selection. There were 19 students total in the third-grade class where I was doing my clinical teaching. There were seven females and 12 males who varied in ethnicities and academic abilities. Since the entire class rotates through the stations, I wanted to have all 19 students (if applicable) respond to the surveys and be eligible to be observed. There were 11 students who returned their signed forms to be able to participate in the research study. After my cooperating teacher signed the consent form, I interviewed her on her perceptions and feelings of the use of mathematics stations in our classroom.

I choose a sample of students that represented the makeup of our class for the interviews. This method of intentionally selecting interviewees is described by Patton (1990) as purposive sampling, which is a method of selecting participants who will best contribute to the achievement of the research objectives. The answers to the surveys informed who was selected for the student interviews; specifically, I looked for six students who would give the most information in their interview answers.

Data Collection. One survey was given to each participant. As a form of inquiry data, the survey asked about the students' perceptions of the mathematics stations, and how the students felt about using mathematics stations to practice mathematical content. More than half of the class was reading below grade level when I began designing this research study, so I believed that the students would be able to give me the most information if they could answer the survey questions by using a Likert scale (see Appendix A). I added two open-ended questions to the end of the survey, and I gave them the option to answer the question at their writing ability level. Since mathematics stations had been introduced in the fall semester, I gave the surveys at the beginning of my research in the spring semester because the students already had time to form opinions and feelings towards the use of mathematics stations from the previous semester. The surveys were given in the beginning of my study so that I could use them to inform my decision of which students I would interview.

I conducted one, 30-minute, semi-structured interview (Hendricks, 2017) with my cooperating teacher (see Appendix B). I had the freedom to ask the teacher to expand on her answers or asked additional questions that naturally came up from our conversation. Since my cooperating teacher had previously decided to try using mathematics stations this year, and then had a full semester of using them, the interview occurred during the beginning of my study.

After reviewing the survey results, I choose six students for one (10-15 minute) semi-structured interview each to give me a better representation of the class, and to be prepared if someone moved or could not participate in the study (see Appendix C). I looked for six students who gave me the most information in their answers regarding their perceptions and feelings towards the use of mathematics stations. I interviewed two students whose perceptions and feelings showed they liked the stations, two who felt ambivalent, and two who disliked the mathematics stations. These interviews were semi-structured (Hendricks, 2017) as I asked the students to expand on their answers given in their survey in addition to planned interview questions.

In addition to survey and interview data, I observed the mathematics station rotations for three days a week for two weeks so that I saw a complete rotation of the stations twice. In the second week, I saw the students interact with new content and materials that differed from the first week. There were two 13-minute rotations of mathematics stations a day, with six stations to visit, each group would rotate through all six stations after three days. It was important for me to see each group go to each station because of the variation of academic levels within each small group. I continued to interact with the students and hosted my own small group station during the rotations. Because I wanted to continue with my normal interactions with students, I conducted head notes (Hendricks, 2017) during the observations and then made more detailed notes after school that same day. I observed the students' conversations, engagement, use of the materials, etc. while in the stations.

I wanted to keep a research journal while conducting this research because I was curious of whether I would want to use mathematics stations in my future classroom. Through my personal journal notes, I believed that my perspective of the use of mathematics stations would offer a unique side to the data as a clinical teacher using mathematics stations for an entire year in a third-grade classroom. I reflected later in the evening on the six days that I observed the mathematics stations.

Data Analysis. The constant comparative method (Hubbard & Power, 2003) was used to analyze the data collected, which includes the coding of patterns and themes that I categorized. After coding, I analyzed about twenty percent of the data, and then I used those codes to code each of the surveys, interviews, observations, and the research journal from my study. Approximately 15 level I codes emerged from my data. These codes show what is on the surface of the data; they are basic actions within the data and require little analysis of the data to understand (Tracy, 2013). Once I discovered that a code had repeated itself multiple times throughout the data, I created level II codes. These codes require analysis and explanations of patterns within the data, and I organized my data based on the major themes that arose (Tracy, 2013). I had four level II codes, and I wrote memos describing them, which aided me in understanding their meanings and connections to the other data I had collected (Tracy, 2013). These codes were created into a codebook (see Table 1) that listed each code, definition and an example.

Table 1: Explanation of Codes

Code Name	Level	Definition	Example
Positive peer relationships	I	Any instance of students were working well together	"I like working with my group of three because they are all my friends and they are funny!"
No independent practice	I	Student's request to not have to go to the independent practice station and complete the independent task	R- "...you said if you could add or change anything it would be independent practice…" K- "NO independent practice!"
Peer Conflict	II	Negative interactions between students within the class	"I don't like my group at all! I just want to get out of there" "We don't get along that good…"
Student engagement	II	Favorable student beliefs or impressions of math stations	R- "Excited! Why are you excited during math stations?" M- "Cause during the whole day, it is the thing I really want to go to." R- "So if we told you, 'no math stations, never again! What would you say?" S-"Mmm I would say, 'dang I love math stations."
Student engagement	II	Any instance students are focused on their task at hand	"I want to say engaging… I see my students engaged when they are doing it, I will watch them, and I am like they are having too much fun over there, but then it's with the game..."
Pacing	I	Amount of time spent during each rotation of station or amount of time spent on specific content	"And now we have gotten to the point where we can do two, 15 minute stations because this doesn't take us as long to

			transitions, students know what to do, where to go, how to use the materials…”
Positive teacher perceptions	I	Favorable teacher beliefs or impressions of math stations	“I just see them all engaged, so I have gone from feeling frustrated to finding something that works, to wanting to get to all three stations, to wanting to get to make sure that we have time for stations just because of the joy that it brings!”
Problem solving skills	I	Students exhibiting actions towards figuring out an academic or social problem	“I think allowing them that time to talk and problem solve in their stations, I see them...wanting to talk about things on the carpet during a whole group lesson, and wanting to figure things out.”
Meeting student needs	II	Able to provide instruction and materials that can assist the student at their academic level and their pace	“...I’m doing everything I can to reach them where they are at, and I have seen a lot of progress…”
Flexible grouping	I	Students are organized in small groups based on academic level or social needs	“I kind of just based it off of formative assessment, what I noticed what the students were understanding, what they weren’t understanding… from that data we collected I created my groups, and the groups are flexible, like I can move them whenever.”
Behavior management	II	Teacher actions towards class control or setting expectations	Mrs. Oliver gave a warning to the small group at the math game station saying that all students need to be sitting up (instead of lying down or sitting in a comfy chair) and they need to be playing the game. Students adjusted accordingly.
Differentiation	I	The way the teacher plans and responds to students’ needs	“... like when I know that they are struggling, I can find different ways to teach it…”
Teacher-student relationships	I	Any instance of positive teacher and student interactions	“…like I am able to help them… I think they know that. I think they see that we want to help them... I have seen a lot of difference in their attitudes, um, you know, by building that relationship, like not only teacher to student, you know like that trusting, caring relationship, but really academics like I want to help you with this…”

Leader in Me	I	School-wide program that teaches leadership and life skills to students and creates culture of empowerment. The 7 Habits are principles in which the program stands	Mrs. Oliver- "...watching them take ownership of their own learning and watching them problem solve between each other, and figuring something out, like you know, I, we are a Leader in Me school and I found myself on Tuesday saying, okay go think Win-Win, you and your partner working together, I am not doing it, and I watched them figure it out together…" S-"...you can use one Habit and then um it would be easy to resolve it…"
Flexibility	I	The ability to change content, time frames, or groups at any time during stations	"Yeah, yeah I mean and sometimes it is very flexible, like I have something planned, I have a worksheet or I have this, and then they, or something comes up in our conversation, on the first problem and I am like oh we are not ready, we need to backup and then I can change it on the spot."
Outside support & resources	I	Materials used and colleague or administrative support for the classroom teacher	"finding someone who is an expert on it, and then looking through materials, and books, I mean I googled things… just being able to talk to people on how to make it better was just really the most important thing for me to like keep that persistence…"
Doesn't like Fast Math	I	Students' opinion of a technology-based math program that tests their fact fluency.	C-"On Fast Math they have to do a typing challenge, and it gets really annoying" R- "So how would you describe your mood during math stations…" W- "Mad, on Fast Math."
Prodigy!	I	A technology-based math program that students speak positively of. They complete mathematical questions in between adventures in a virtual world	S- "Technology (station), I like technology the most" R- "...what is the other game you get to play?" S- "Prodigy!" R- "So if you had to pick between Prodigy and Fast Math which one would you pick?

			C- "Prodigy, definitely."
Negative student perceptions	I	Opposing student beliefs or impressions of math stations	R- "...so if we told you that we are not doing math stations anymore… K- "WOOOHOOOO (laughs) I would be so happy! Cause I don't want to do math stations."
Setting expectations	I	Teacher setting up what the students can and cannot do during math stations	...there was a very strict conversation about respect and expectations. With that, she said that if there is any off-task behavior or a teacher has to correct behavior during stations, then the student will just go back and sit at their desk. That was their warning and then she released them into their stations. The students moved quickly and began setting up their activity or area.

Results and Discussion

As themes and patterns within the data came to the surface, I organized the findings into four level II codes: student engagement, peer conflict, meeting student needs, and behavior management. Within each of the following sections, I unpack the evidence from the student surveys, both teacher and student interviews, and observations and my personal research journal that relates to these level II codes.

Student Engagement. Right from the beginning of collecting data I saw that students were engaged in mathematics stations. This code stemmed from the evidence that students were focused on their tasks, wanted to participate in mathematics stations daily, and were completing what was assigned to them. The student surveys were my first data point, and 73% of students who completed the survey said that they felt very happy or a little happy about learning mathematics through mathematics stations. Similarly, 82% of students said that they either felt very happy or a little happy about going to mathematics stations each day (see Table 2). From the information in the surveys, I was able to interview six students about their perceptions and feelings towards mathematics stations and how mathematics stations shape their feelings towards mathematics. The students discussed with me different games, skills or mathematics activities that they enjoyed and learned from during stations whether they said, "I learned this specific mathematical concept" or not. Station activities included similar ideas to those outlined by Van de Walle (2016) such as using different, engaging manipulatives, activities, games, or technology as students rotate through the stations as a form of guided or independent practice. In his interview, a student named Spencer mentioned that the material he got to learn and practice during mathematics stations helped him later on in the week when there was a quiz. More specifically, he stated that in the fact fluency station he got to practice his multiplication flash cards, and he saw how that helped him during his “sixes” quiz they had the previous Friday. Another student, Key Key said that during mathematics stations, “you are still learning stuff, and you are having fun as well!”

Table 2: Survey Analysis

	Very Happy	A Little Happy	A Little Upset	Very Upset
1	64%	9%	18%	9%
2	64%	18%	18%	0%
3	36%	27%	36%	0%
4	27%	9%	18%	45%
5	45%	0%	18%	36%
6	27%	0%	27%	45%
7	36%	9%	18%	36%
8	55%	0%	36%	9%

In addition to student feedback, Mrs. Oliver recalled multiple times when students made comments about liking mathematics stations. She had seen that they seemed to be doing good work in their stations, which seemed to be motivating to her students. Mrs. Oliver spoke about moments where she had heard specific conversations about mathematical content or saw what seemed like off task behavior or having too much fun. She quickly realized that the students were just playing the game, or that they suddenly understood the material better and then excitement arose from that. Wing (1995) found that when students were engrossed in play-like activities, then it gives the illusion of more play than learning while the result is quite the opposite. While the students feel like they are playing during mathematics stations, their level of learning and engagement increases. Mrs. Oliver said that sometimes the students were so engrossed by the game aspect of the station activity that they did not even realize that they were learning; she said, “Yeah we can play a game all day long if you are learning!” She had seen the students wanting to talk and problem solve in their stations and that they appreciated the time to talk through their mathematical problems with their peers. Mrs. Oliver said she had seen greater engagement arise within the whole group lessons once the students had interacted with that same content during math stations the previous day.

Based on the students' engagement in tasks during mathematics stations, their desire to go to mathematics stations daily, and the teacher's evidence of their engagement, I would say that most students had positive perceptions of the use of mathematics stations in their class. Mrs. Oliver recalled that if there was a changeup in the schedule where mathematics stations could not be completed that day, the students asked, "Well, are we going to do math stations? Why aren't we doing stations?" Ultimately, the students were learning in every station that they went to, and sometimes they did not even realize it. They might not have told me, "Hey I love math now," but I saw in this study that students were laughing and socializing and producing answers to mathematical problems while they were in stations, and so their engagement helped shape their feelings towards mathematics.

Peer Conflict. Peer conflict began as a level I code and then quickly became a prominent level II code because of the 14 times that I coded peer conflicts within the data. I defined peer conflict as an instance when there were negative interactions between students within the class - when students were not getting along, not synergizing, or working well with one another. One of the open-ended questions from the student survey asked the students to tell me about how they felt about working with their peers during mathematics stations. During the time that the survey was given and the first week of my observations of mathematics stations, Key Key and Spencer were in a small group together for stations. Based on their survey responses, I asked them to expand on their specific feelings and experiences with their peers during mathematics stations. The biggest conclusion from those two interviews was that the students would have liked to change who was in their small groups since they had been in the same groups for quite some time.

When I asked two other students about their peer interactions or experiences, Chester said when in a group of four there is more to talk about, which usually resulted in more drama. He said that when their group was not synergizing together, then he would say that his group was his least favorite part about mathematics stations. Warren said that he would have liked to work in partners instead of groups of four because people argue a lot when in a bigger group. When I asked Mrs. Oliver about the size of the groups, she suggested that the ideal group is actually just partners when she stated, "Groups of four is just too many… behavior gets in the way of their learning… two people working together is manageable." The biggest barrier to having partners for stations was that there is not enough space or supplies for multiple groups to be doing the same task at the same time, so groups of three or four worked for us, at the time.

Five out of the six students that I interviewed mentioned something about peer conflicts during mathematics stations, whether it was something they personally encountered or that they had seen from other groups. In a combination of the student interviews, week one's observations and experiencing some of the poor relationships, Mrs. Oliver and I saw that there was a problem with peer conflict that we needed to address. In between my first and second week of my observations, Mrs. Oliver and I decided that it was necessary that we switch around some of our small groups. Ding, Li, Piccolo, and Kulm's (2007) study showed that teachers should allow for interactions between peers to occur, however there has to be a balance between allowing students to struggle while solving a mathematical problem before the teacher steps in and redirects. We found, however, in our classroom, that the times that we needed to step in the most were for social issues instead of a lack of understanding of a mathematical concept. In the second week of my observations, I saw fewer instances of peer conflicts once the small groups were changed.

Peer conflicts allowed for more negative student perceptions of math stations. If they were distracted by a peer in their small group or sometimes from another disruptive group, then that was taking away from their learning during mathematics stations. I could see how the social aspect of mathematics stations could create negative feelings towards mathematics. Due to the social and relational aspects of mathematics stations, students could very easily associate negative social experiences with negative mathematical experiences. On the other hand, while students were having conflicts between their peers, they were also learning and using problem solving skills that might not have other opportunities to be used within the classroom. While peer conflict was evident within our model, it was not always a negative addition to mathematics stations.

Meeting Student Needs. From the intentional grouping of the students, to the teacher-student interactions, meeting student needs was evident throughout our model of mathematics stations. Mrs. Oliver mentioned multiple times about the advantage she had when getting to know her students on a more personal level and at a quicker pace because of the model of stations. At the beginning of the year, it was hard to know right away the needs of each learner and what they did and did not know. With the small groups visiting the teacher station more than once a week, Mrs. Oliver said that they could not hide if they were struggling. She was able to directly see their misconceptions or even what was no longer challenging for the students, and then she could adjust accordingly. With the flexibility of mathematics stations, Mrs. Oliver and I were able to go back and reteach a concept, dive deeper into a student's question, or offer higher order thinking depending on the small groups' needs on that day during that station.

Since the students were typically grouped at similar academic levels, the small group and teacher were able to problem solve together through the differentiation Mrs. Oliver was able to offer her students. Andreasen (2012) stated that while creating differentiation, student academic needs, their learning styles, and how they show their understanding, are all necessary to consider in their grouping. Mrs. Oliver mentioned that often, teachers have to move on after multiple lessons within whole group settings. If a student does not understand, those issues might not be addressed right away, but since our stations followed the whole group lesson, Mrs. Oliver was, "able to slow down and build the foundation with them before piling other things on them." Benders and Craft (2016) also saw in their study that the use of small groups allowed for attention to be paid, "to the students having difficulty with just one skill or concept, to those who are advancing quickly through the material and need new challenges" (p.7). They exercised their flexibility in making changes to their small groups based on their student's needs (Benders and Craft, 2016).

There were two specific times during observations where I saw differentiation and flexibility based on what the student needed. One student had recently failed an assignment, so at her table for stations, Mrs. Oliver was able to go back to that content from the previous week and work on that material with the student even though the whole group lesson was about new content. Mathematics stations also allowed for opportunities to extend learning. For example, at my teacher table during stations, I had a student who was able to label all of the assigned fractions on number lines, so I was able to challenge her to label new number lines while the other three people in her group continued to work at their level of understanding. A student, Mary, described in her interview that mathematics stations helped her because if she did not understand something from the whole group lesson, once she did it in mathematics stations she would be like, “ohhh, now I understand it!”

Mrs. Oliver’s perception of mathematics stations was that they were useful tools to help her better teach her students at the levels that they needed; she was given the opportunity weekly to meet in a small group setting with each student and understand where they were in their learning process. Based on the student interviews and the surveys, the students overwhelmingly did like the stations and materials that we already had for stations. There were multiple suggestions for more time in the popular technology station, or more computers to use. The perceptions of Mrs. Oliver and myself were that we were able to close some academic gaps while we worked with our small groups during mathematics stations.

Behavior Management. While student engagement was high during our stations time, there was still a need for setting expectations and giving reminders for students who needed more structure and prompting to stay on task. From the observations, there were instances when either of the two teachers had to tell a student to adjust their behavior because they were not following station expectations, or they were off task. Reminders from the teacher were needed across the six days of observation for running, yelling, talking to another group, not doing the task in that station, and not working well with others. At the beginning of stations, before we released the students from the carpet, the expectation was set for the time ahead, and often reminders were given about behavior based on how the day was going, or if there was something that went wrong in the previous rotation - like running during transitions. During both weeks of observations, I noticed the amount of time that Mrs. Oliver and myself needed to spend redirecting behavior or being interrupted at our teacher tables by students’ behavior or their questions. Examples of this included answering questions, reminding students to stay on task, and helping students solve peer conflicts. Once I was more aware of the amount of times either she or I were interrupted at our small group table or had to address the other groups around the classroom, it was surprising how many times we did have to avert our attention.

I wrote in my research journal about what it could look like to set more concrete expectations and consequences during stations, possibly using CHAMPS charts for each station. On one of the days when the expectations were set more explicitly, there were no behavior issues during the entire stations rotations; on most days, students often had a smooth transition in between the two rotations of stations when they could get cleaned up and seated on the carpet within the 45 second timer. Mrs. Oliver said that she had seen improvements in the students' problem-solving skills, and she had not had to step in to solve as many problems as she did in the beginning of the year. Through mathematics stations, student's diverse learning needs can be emphasized when students are given expectations and structure (King-Sears, 2007). Students can complete tasks independently of the teacher, while working with a variety of materials either independently or within a small group (King-Sears, 2007).

Managing behavior is a main part of stations. Mrs. Oliver talked about challenging behaviors that occurred at the beginning of the year and that if she did not persist, she could have very easily given up on mathematics stations. She said she needed to find what worked best for her and the students in order to continue using this model. Mrs. Oliver highlighted that it was important to, "begin with the end in mind, and really believe that this is going to benefit my students, and that it is going to benefit me." While there was still a lot of behavior managing that had to occur even when expectations were set, it was possible for the students to be successful even when they needed reminders to fix their behavior. Through the interview with Mrs. Oliver, I could already see her perceptions going from a more negative outlook because of the unsuccessful beginning of mathematics stations, to more positive as she had been able to get to know her students better as learners and as they were beginning to get used to the routine of stations.

Shaping Student Attitudes. One of the research questions was how do mathematics stations shape student feelings towards mathematics? There was a balancing act between student's positive and negative attitudes during this study. Student's attitudes were positively shaped towards mathematics when they were feeling engaged in the content within each mathematics station, or more importantly, understanding the concept they were learning and practicing. During student interviews and the observations of stations, it was evident that students were enjoying mathematics when they cheered in excitement during a mathematics game, or told me about a time they were successful on a quiz after practicing that concept during mathematics stations. It was also clear that students who were grouped based on their same academic level were more likely to have success in their small group. When students are working within homogenous grouping, Merritt's (2017) findings suggest the students' mathematical skills, confidence, and attitudes improve.

I am disappointed that there were not more concrete examples of how the students now have more positive attitudes towards mathematics because of mathematics stations. I would have liked for the students to have talked more about how they once hated mathematics, or they experienced a lot of mathematics anxiety, and now they are feeling a more positive attitude about mathematics because of their participation in stations. This could have been from a lack of pre-station data since my research study was conducted in the second semester of using mathematics stations.

In instances where I saw the greatest evidence of negative shaped feelings towards mathematics were involving peer conflicts within the small station groups. There was a lack of learning when students were distracted by a disruptive member or off-task behavior. During interviews, five out of six students shared about negative interactions between peers. Regardless of the social issue the students were explaining, the simple fact that there was an association between mathematics stations and form of conflict was discouraging. If the social and relational side of mathematics stations was negative, then I understand how that could easily shape negative feelings towards mathematics because of those experiences.

Implications

In her interview, when asked about what advice she would give to a teacher who is wanting to use mathematics stations, Mrs. Oliver said,

> "I would say definitely give it a try, I mean even if it is half class, half class … something that will just help you see the benefit of it and then just finding what works best for you … think: would this be something that would fit into my classroom? … Even after having it fail the first few weeks, you know I was ready to give up, but just keep an open mind and try something new … I am a firm believer that I will be doing math stations just because of the growth I have seen in my individual students, but also the individual differentiation that I can do."

Teachers are often looking for new ways to keep their students engaged in academic content, and how to best meet their students' needs. Mathematics stations allows for teachers to meet in small group settings with their students at least once a week and then for students to work on skills like problem solving, working with their peers, and interacting with a variety of materials to practice the same concept. If my future students have the potential to be engaged in various activities that help them learn in the way that our students were engaged this year, then I would fully support implementing mathematics stations into my classroom. Even through reminders and strict behavior management, the level of student engagement and interactions with materials was higher during stations than what we saw during whole group instruction.

When students work closely together every day independently of the teacher, it is possible that there are going to be problems. Mrs. Oliver and I have had the discussion multiple times of how we could switch up the small groups because of peer conflicts when we strategically have students grouped based on academic need. For most of the year, we struggled with moving students to different groups because of their levels; however, we found that in week two of observations that the students benefited from being able to work with new people. With any groups of students, a teacher will need to use their own discretion on how they group their students based on academic need and student relationships. Every class is different so finding what works best for you, as the teacher and your students during mathematics stations will take trial and error. A balance between how much the teacher steps in to help students with their conflicts and then leaving the students to problem solve on their own is another necessary task for any teacher. Peer conflicts are going to happen between students when they are given more independence and responsibility apart from teacher interactions.

Through differentiation, a teacher is able to offer direct teaching to the academic need of the student at that moment. When there are greater small group opportunities within the classroom, the teacher is able to understand what students are struggling with or how they are excelling, and then adjust their teaching accordingly. Not only does a teacher have the ability to group her or his students based on their needs, but also at the teacher station, differentiation can occur specifically between those few students in that group. There were moments that Mrs. Oliver and I both had students within a small group working on different problems at the same time depending on what they understood about that concept. Sometimes our students need reminders that it is acceptable that they are working at their own pace as their minds have gotten clouded by competition and unnecessary comparisons.

Being able to instill independence in the students during mathematics stations takes a lot of managing of their behavior. First, setting up how they should behave during stations, what the process looks like, and what is expected of them takes time and practice. Continuing to assist them with problems that they have in their groups and individually requires behavior management to still be ever present during stations. In our classroom, we experienced a great number of interruptions because of questions that our students had about a station or task. Establishing the expectation that the teacher table cannot be interrupted while a small group is meeting would allow for more focus for all parties. If the students do have a question or concern, there could be a designated student that they can talk to. This student will be one who is specifically chosen because he or she knows what is expected during each station and what the additional directions for that time are. Setting clear expectations and reinforcing those expectations allows for the students to know what is expected of them, and how they can be successful.

A lingering question is the following: do mathematics stations affect academic performance? While this could have been something that I researched, I was more focused on the perceptions and feelings towards mathematics stations. However, when considering whether or not to implement mathematics stations, a teacher must think about how this is going to help his or her students practice and retain mathematical concepts. Is there a connection between the number of station options that students have and how that affects their ability to remember the material? If a student is able to practice her or his mathematics through a game, using technology and with the teacher table, does that increase their chances for academic success?

Conclusion

As I was researching teacher and student perceptions of the use of mathematics stations, I was very aware of what my personal teacher perceptions were of this model. I discovered that in seeing the student engagement and the ability to meet students at their individual academic levels, I could not imagine practicing mathematics content in any other way.

Like Mrs. Oliver encouraged, teachers should try at least one element of mathematics stations to better differentiate and appeal to the different learning preferences of their class. While this model might not be for everyone, I have seen the benefits of trying mathematics stations for the first time, and the effect has been impactful.

About the Author

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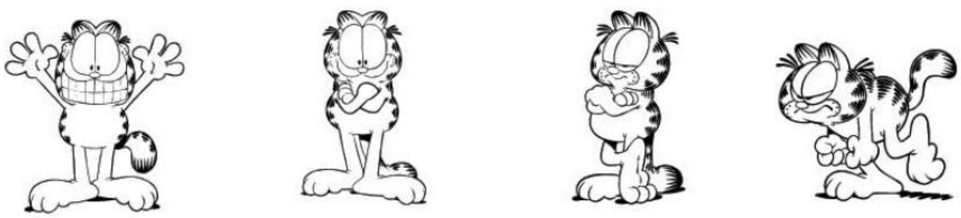
Appendix A: Student Survey

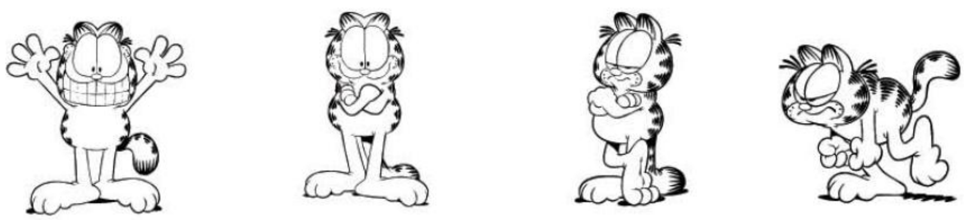
Math Station Survey

1. How do you feel about learning math through math stations?



Very Happy | A Little Happy | A Little Upset | Very Upset

2. How do you feel about going to math stations each day?



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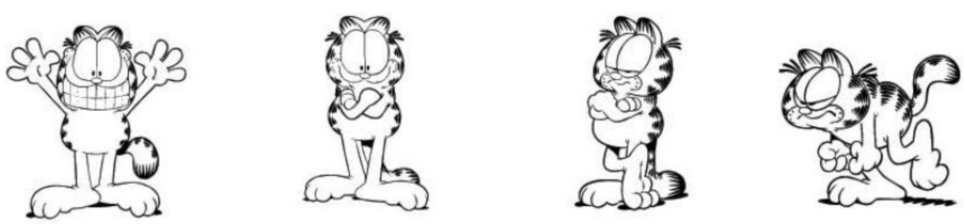
3. How do you feel about the variety of stations we have?



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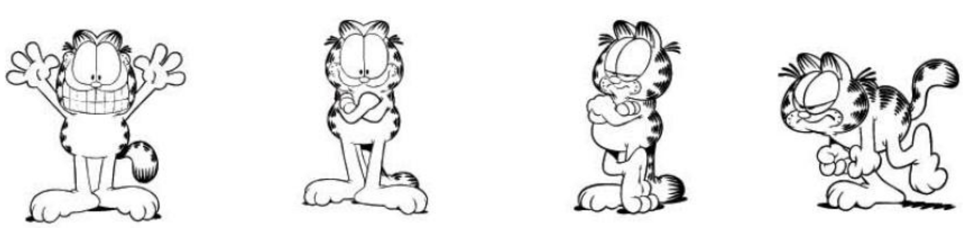
4. How would you feel about not having math stations?



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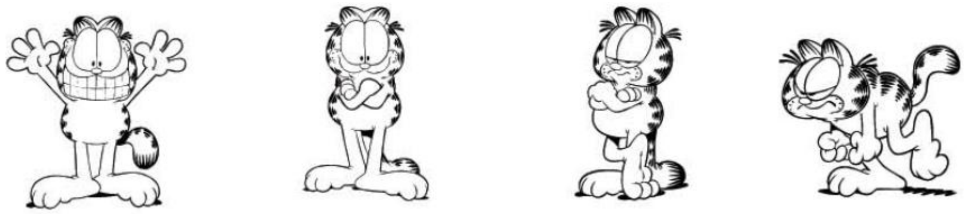
5. How would you feel about doing whole group practice instead of stations?



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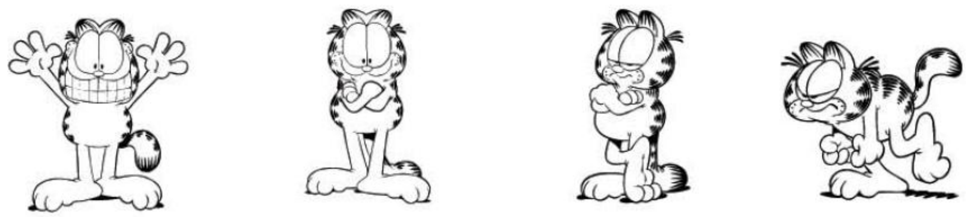
6. How would you feel about having less stations to go to?



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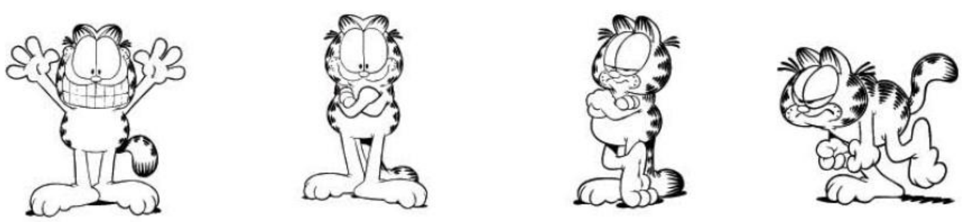
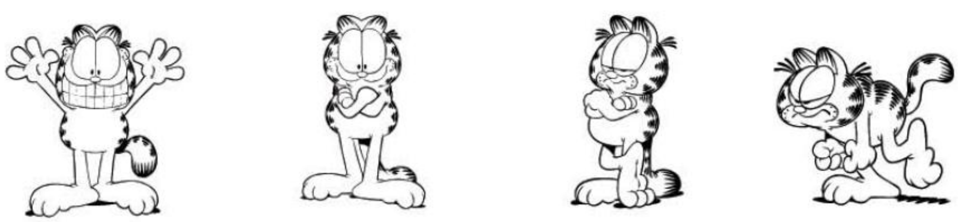
7. How would you feel about having less materials/games to learn math with?



Very Happy A Little Happy A Little Upset Very Upset

8. How do you feel about the length of time spent in each station?



Very Happy A Little Happy A Little Upset Very Upset

9. If you could change (add or take away) anything about math stations, what would you change?

10. Tell me about how you feel about working with your peers during math stations.

Appendix B: Interview Protocol for Student Interview

One-on-one Student Interview Protocol

1. What is your favorite part about math stations? Why?
2. What is your least favorite part about math stations? Why?
3. What would make math stations more enjoyable?
4. How would you describe your mood when you are in math stations?
5. What kind of changes would you like to see in math stations?
6. Tell me about how you feel about working with your peers during math stations?
7. Talk to me about how you feel your understanding of the material is once you go through the different stations?
8. Do you think that math stations help you learn better? Why?
9. Do you think that learning math on the computer, then playing a game, then working on a journal activity, etc. helps you understand the material better? Why?
10. Why do you think that it is important to work with different materials or games to learn the same math content?

Questions may vary and additional questions may be asked depending on the answers of the participants.

Appendix C: Interview Protocol for Teacher Interview

Teacher Interview Protocol

1. Why did you choose to introduce math stations this year?
2. Do you think the students enjoy practicing and learning the math content through stations? Why?
3. What would you change in the future based on how this year of math stations is going?
4. Do you think that there should be less or more stations? Why?
5. Do you think there should be more or less time spent in each station? Why?
6. How would you describe your mood during math stations? Why?
7. What changes have you seen in student engagement or understanding of math content since using math stations?
8. How has the use of math stations impacted your math teaching?
9. What has been the best part about implementing math stations into your classroom this year? Why?
10. What has been the most challenging part about implementing math stations into your classroom this year? Why?
11. What advice would you give to a teacher that is wanting to begin using math stations in his or her class?
12. How do you think interacting with the math content in a variety of ways has impacted the students in other subjects or outside of the classroom?
13. Are you happy you decided to implement math stations into your classroom this year? Why?
14. Talk to me about how you decided to group your students? Why did you group them in this way? Will you or would you change up the groups in the future? How and why?

Questions may vary and additional questions may be asked depending on the answers of the participants.