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Differentiated Instruction for 1st Grade Advanced Learners in Mathematics

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Signature Sheet

This thesis, written under the direction of the candidate's thesis advisor and approved by the Chair of the Master's program has been presented to and accepted by the Faculty of Education in partial fulfillment of the requirements for the degree of Master of Science. The content and research methodologies presented in this work represent the work of the candidate alone.

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Abstract

Differentiated instruction is student-aware teaching, in which the students not only develop content mastery, but also take ownership of their learning. This study examined the results differentiated instruction in mathematics had on advanced learners perceived competence, persistence, and intrinsic motivation. Differentiation was implemented in a classroom through various activities that challenged student thinking. Students enrolled in a first grade class in an all girl school setting served as study participants. Data were collected on a total of 21 students in the class, but analysis focused on a subgroup. Results indicated that the participants' interest and engagement in math varied student to student after receiving 3 months of differentiated instruction. All 6 participants showed an increase in math ability.

Keywords: differentiated instruction, advanced learners, motivation

Chapter 1 Differentiated Instruction for Advanced Learners

My first year of teaching provided me with a chance to develop an enriched classroom experience. The purpose was to inspire students, to motivate them and foster a love of knowledge. During one math lesson that addressed an especially difficult concept for 1st graders to grasp, one of my high achieving students, Katie (a pseudonym) who was always successful in finishing her work with little assistance, began to struggle. Despite my efforts to calm her and explain the concept in a different way, she shut down and became emotional. She faced a challenging lesson, became distressed, and could no longer follow instructions.

On the other side of the classroom I noticed one of the students, one who had difficulty performing well academically, struggling to complete her work. Susie (a pseudonym) often had difficulty with mathematics and other subjects. Despite the challenges all academics brought for her, Susie consistently tried and worked harder in comparison to others. After additional explanation, Susie struggled with a difficult task, asked questions, used manipulatives, and every strategy she knew to try to understand this concept and solve the problem. Susie was eventually able to solve the problem with my help. Katie had given up and was busy sulking over her first defeat.

Thinking over the performance of these children helped me understand that I had not addressed individual needs of the students. This realization led to the focus of this study. Students who are advanced learners need to be challenged and therefore need differentiated instruction. Katie did not know what to do when faced with a difficult task. During her short six years of life, and 2 years of school, she was not challenged by academic tasks. When she eventually faced a challenge, she was not prepared and did not know how to persevere. Meanwhile, Susie spent every day facing challenging situations. She had received differentiated

instruction, scaffolding and extra one-on-one instructional time because she needed it to keep up with her peers. Katie always completed her tasks quickly and correctly. Teachers did not feel the need to differentiate for Katie or give her individualized time.

I reflected on my student teaching experience in a 5th grade Gifted and Talented Education (GATE) class. My experience in that classroom increased my awareness of students' potential when they are challenged. Students demonstrated traits of persistence and perseverance when faced with a difficult task. These gifted students were challenged everyday and, because of that, were not threatened by a difficult task. I realized I needed to find a way to instill that persistence, perseverance and motivation in Katie and other students.

Arguably, students should not need to be identified as eligible for GATE class to access challenging opportunities at school. All teachers should be able to provide their students with the opportunity to be challenged. This experience can help students practice persistence, learn different problem-solving practices, and build confidence and increase and interest in mathematics.

Statement of Problem

Children who are able to achieve success with minimal effort may tend to become mentally lazy. When they face difficult tasks they may become resentful and frustrated. Providing students with opportunities to participate in moderately difficult tasks maximizes intellectual development while increasing pride and satisfaction. As educators we need to do our best to ensure risk-taking opportunities occur frequently in class activities. By continuing to raise expectations and balancing difficult tasks between rigor and joy, we can help these advanced learners increase their resilience and persistence in problem solving.

Purpose Statement

The purpose of this action research project is to evaluate performance of advanced learners in demonstrating traits of persistence and perseverance when faced with challenging mathematical concepts. The intention of this study is to increase 1st grade advanced learners' motivation and engagement in mathematics through differentiated instruction.

Research Questions

What effect does differentiated instruction have on students' academic improvement and engagement in mathematics for advanced learners? How can 1st grade teachers implement differentiated instruction in a general education classroom to meet the needs of students who are identified as advanced learners? For the purpose of this study, the term "advanced learners" refers to the top 6 students in one first grade class who demonstrated their understanding of mathematical concepts taught as part of the curriculum. All students completed a self-assessment scale measuring their engagement and motivation after 3 months of receiving differentiated instructing both in the classroom as well as once a week in a small math enrichment pull-out group.

Theoretical Rationale

The basis of this thesis stems from Piaget's Theory of Cognitive Development. Piaget believed that children create an understanding of the world around them. He believed a child's experience differences between what they know and what they learn from their environment, then adjust their ideas accordingly (McLeod, 2015). Piaget's theory suggests that a child's motivation to learn increases when there is an interest or passion for the topic or subject that is

being learned. This thesis also looks at a study done by Danner and Lonky (1981) that builds upon Piaget's theory. Their study found that children at a very young age showed a preference for tasks that are just a bit beyond their ability. The importance of interest and challenge in the education of children are the main aims of this study.

Assumptions

Advanced learners who are not being challenged at a young age become disengaged in the classroom. Furthermore, when finally faced with a challenge, they do not know how to struggle through any difficult task, and, instead become frustrated and shut down. Teachers in many schools are making strides in implementing differentiating instruction and supporting students who perform below grade level. However, students who are advanced learners are often left bored and unchallenged. Students need challenging academic situations in order to practice persistence and improve their problem solving skills. Differentiating work for high achieving students is necessary to keep them challenged.

Background and Need

Danner and Lonky (1981) combined Deci's model of intrinsic motivation that suggests that children seek out challenging tasks in order to increase feelings of competence and self-determination, along with Piaget's equilibration model of cognitive growth that implies such tasks can only be defined in relation to a child's cognitive level. Danner and Lonky (1981) combined these two approaches in their prediction that children are interested in working on difficult tasks, just a bit beyond their developmental ability. Their experiment included 90 4-10 year olds, who were categorized into 3 cognitive ability groups based on their performance on various tasks. When these children were allowed to choose a center that differed in difficulty, all

3 groups spent most of their time in the centers that were just beyond their initial ability levels. They also chose the centers that they found interesting, and moderately difficult. This showed that at a young age, children show a preference for tasks that are just a bit beyond their ability. It is estimated that 20-50 percent of gifted students underachieve academically (as cited by National Commission on Excellence in Education in Danner & Lonky, 1981). If children inherently strive for a challenge, why is the percentage of underachievers among advanced learners so high?

Further research by Tomlinson (2001) showed some of the effects when students are not challenged. Tomlinson found that advanced learners could become mentally lazy. The brain, similar to any other muscle in the body, needs to be used. Evidence indicates that a brain loses capacity and tone without the vigorous use that occurs in challenging situations. When a student is able to achieve success without effort, potential brainpower is lost (Ornstein & Thompson, 1991). If students are typically successful with academic tasks, receive high grades without working hard, and learn that success requires minimal effort; they become frightened, resentful, or frustrated when faced with difficult work. Tomlinson also found that advanced learners who are not challenged may fail to develop study and coping skills. This becomes a problem for children as they progress through their schooling, when they are finally dealing with difficult academic tasks.

Summary

All students need challenges in their learning in order to develop perseverance, and flexibility in using problem solving skills. Often, advanced learners may not be challenged by the curriculum. If they are to develop strategies in dealing with difficult tasks, they need to learn

how to approach solving difficult problems. They need opportunities to experiment in the context of classroom-based learning.

Differentiated instruction is a common practice with students that are legally identified as children with special needs. However, advanced learners also need differentiated instruction. Differentiation for advanced learners to keep them constantly challenged and growing is especially important.

Studies have shown that young children seek out tasks that are a bit beyond their ability. These studies further state that "moderately difficult" tasks are a prerequisite for maximizing intellectual development and increases performance, persistence, perceived competence, self-knowledge, pride and satisfaction (Deci & Porac, 1978). Teachers need to give *learning* a high priority for students who demonstrate advanced intellectual ability. Chapter 2 is a review of the literature on differentiated instruction for advanced learners, the challenges of differentiating for this population, underachievement, cognitive development and motivation.

Chapter 2 Review of the Literature

Introduction

This chapter is an examination of the research literature on differentiated instruction: What is it? Why is it important? Why it is not occurring for many advanced learners? What are some of the challenges of implementation? This chapter also examines underachievement, and its common occurrence among advanced learners. Cognitive development and motivation are also explored to explain the effect of challenges that children experience at a young age and their impact on overall brain development. Information was gathered from academic library searches using online resources.

Differentiated Instruction For Advanced Learners

"Differentiation is about all children, because all children are different" (George, 2003, p. 76).

Differentiated instruction is defined as "the process by which curriculum objectives, teaching methods, assessment methods, resources and learning activities are planned to cater to the needs of individual pupils" (George, 2003, p. 76). Educators who differentiate instruction do "whatever it takes to ensure that struggling and advanced learners, students with varied cultural heritages, and children with different background experiences all grow as much as they possibly can each day, each week, and throughout the year" (Tomlinson, 1999, p. 3). In differentiating instruction, one makes "the whole curriculum accessible to all individuals in ways, which meet their learning need," (George, 2003, p. 76). Differentiation is important because it allows students to take ownership of their learning, and not simply focus on content mastery (Tomlinson, 2008). Teachers must be careful to adjust the actual nature of the assignment rather than merely assigning additional work for an advanced learner and less to a struggling student.

Instead, assignments need to provide students with multiple approaches to solving problems. Assignments need to take into account how students learn, what they learn, and how they show what they have learned (Tomlinson, 2001).

One important aspect to note when differentiating instruction is to ensure all students are engaged in meaningful work. It is important for all students to be challenged. Tomlinson states, "If work is consistently beyond a student's reach, that student becomes more occupied with escaping possible danger or humiliation than with learning. If work is consistently too easy for a student, the student develops strategies for marking the time rather than for addressing challenge. In both instances, the student's willingness to persist in the face of difficulty diminishes" (Tomlinson, 2008, para. 13). Teachers need to know their students in order to effectively design differentiated lessons (Tate & DeBroux, 2001).

Assessment should be routine in the classroom. By assessing throughout an academic year, teachers can readily identify students' needs (Tomlinson, 2001). These assessments should measure both what the students have learned, as well as identify weaknesses (Tomlinson, 2001). Teachers should also make sure these assessments are aligned with the ongoing instruction to gain a clear and accurate portrayal of student performance (Tomlinson, 2001). Once the data are collected, teachers can begin differentiating instruction. Differentiation may take the form of small-group instruction, reading partners, texts at varied reading levels, and specially designed homework assignments (Tomlinson, 2008).

Tomlinson (2001) noted that when it becomes apparent that students are able to learn more deeply, it is time to begin offering differentiated advanced learning opportunities. It is important that these advanced learning opportunities are designed to challenge students and not activities in addition to the regular curriculum. This avoids the situation where the student feels

punished for finishing early (California Association for the Gifted as cited in Tomlinson, 2001). It especially crucial for elementary school teachers to challenge these advanced learners at a young age. “Challenging them from the start and teaching them good habits gets them through eighth grade and beyond. If they have well-established habit of achievement, even if the bottom falls out, many times those habits will support them” (Cleaver, 2017, para. 17). Educators should provide various opportunities for academic challenge within the classroom. “High ability students need to be given assignments that challenge them intellectually and enable them to use higher order processes and skills. Gifted students often find them most difficult classes are also the most enjoyable” (Berube, 1995, para 8).

Ways to support these students in the classroom include providing open-ended assignments, creating opportunities for collaboration, using tiered assignments, encouraging student pursuit of independent projects, finding appropriate books, considering an accelerated program, aiming for school-wide enrichment (Cleaver, 2017), allowing them to investigate topics outside the curriculum they find stimulating, and setting realistic goals (Berube, 1995). “Although advanced learners are curious and eager to learn, just like all students, they need guidance by educators who value their potential and are willing and able to differentiate instruction to meet their needs” (Manning, Stanford & Reeves, 2010, p. 145). It is the teacher’s job to identify students’ in need of challenge. If these advanced learners are ready for that challenge, but do not receive it, they can become mentally lazy underachievers (Tomlinson, 2008).

Underachievement

"Underachievement is a discrepancy between a child's school performance and some index of his or her actual ability, or the performance in scholastic attainment which is substantially below predicted levels" (George, 2003, p. 4). While any student can be identified as underachieving, it is common in advanced learners, specifically those who were not challenged during their adolescence.

It is estimated that approximately 20 to 50 percent of "gifted" students underachieve academically (National Commission on Excellence in Education as cited in George, 2003). Another study states, "Seventy percent of the kids who are high ability are underachieving, when only 30 percent of high achievers are engaged, the vast majority are sliding through school, unchallenged and unengaged." (Cleaver, 2017, para. 16). Advanced learners are at a high risk for underachievement, both emotionally and psychologically (George, 2003). Because of the students' advanced intellectual and creative abilities, they are extremely vulnerable to pressures, which may initiate underachievement both at school, as well as at home (George, 2003).

When teachers teach to the whole group, they are teaching to the lower third of students. While this is benefiting the lower third of the class, students in the top third are waiting and listening to repeated instructions (Cleaver, 2017, para 16). This constant waiting and repetition may lead to boredom, bad behavior, and disengagement (Cleaver, 2017). These talented students may choose not to excel because the curriculum is neither challenging, nor motivating (Berube, 1995). While a lack of motivation is not the only cause of underachievement, it can place a huge role (Ford, 1996). Many gifted underachievers express a lack of interest in school curricula. They find it uninteresting, meaningless, or irrelevant (Ford, 1996).

What happens to these unchallenged gifted underachievers? Students who are unchallenged during their early years of schooling can develop poor work habits (Berube, 1995). If these high-achieving students are not challenged in elementary school, they become unmotivated when they reach middle or high school (Cleaver, 2017). Underachievers may also resort to anti-social behavior, or develop classroom behavioral problems (Bartokovich & George, 1980). Daydreaming in class may occur, as well as development of an arrogant mindset that contributes to behavioral problems in and out of the classroom (Bartokovich & George, 1980).

These students learn continue to get by in school without putting forth any effort. When they are challenged, they are often unable to succeed (Bartokovich & George, 1980). Cleaver states, "Ignore high-achieving students and they may end up frustrated, disciplined for bad behavior, or even depressed. At best, they're bored; at worst, they won't make it to graduation" (Cleaver, 2017, para. 17).

Failure to challenge these students at a young age, teachers are contributing to the increase in underachievement. This is "an enormous waste of talent for the community and economy as a whole" (George, 2003, p. 1). Cleaver (2017) adds that "[b]y not developing today's high achievers, we're losing tomorrow's scientists, engineers, artists, writers, business leaders, and politicians" (Cleaver, 2017, para 14).

Challenges of Differentiated Instruction for Advanced Learners

Differentiated instruction is a common teaching practice for students who need remediation. Advanced learners, may not get the differentiation they need. Legislation has pressured teachers to focus on students with special needs through the passage of No Child Left Behind Act of 2001 [NCLB, 2001] and the most recent reauthorization Every Student Succeeds

Act of 2015 [ESSA, 2015]. Because these advanced learners are able to successfully pass these standardized tests, many teachers don't feel the need, or feel they have the time to differentiate for these advanced learners. (Manning, Stanford & Reeves, 2010). Radner (2017) stated that because of No Child Left Behind, "Scores did go up, but then they flattened out and along the way we have limited our gifted population, offering fewer programs that enable them to excel. This shows up in the small percentage of students exceeding the standards on tests." (Cleaver, 2017, para 8). While No Child Left Behind, "brought higher standards and more accountability into the classroom" (Cleaver, 2017, para. 8), it forced teachers to focus their attention on getting the low-performing students simply to grade-level, while putting no focus or sense of urgency on challenging and differentiating instruction for those advanced learners.

No Child Left Behind is not the only legal issue educators have to think of when teaching in the classroom. Students with IEPs have legal needs they need to have met in the classroom. One Colorado teacher stated, "In classrooms, IEPs and getting all students to the proficient level on state tests often override high-achieving students' needs… because of legal issues and IEPs, I always looks at my special education kids first" (Cleaver, 2017, para 6). While these laws have been put in place to lower the achievement gap, unfortunately in many cases, it is at the cost of advanced learners not being challenged enough to achieve their full potential.

Teachers have experience with differentiating instruction for students due to No Child Left Behind and IEP's, however, many teachers struggle with differentiating for advanced learners. The teachers lack subject matter knowledge, classroom management skills, available resources, planning time and administrative support. This results in students not being engaged in appropriate challenge and the differentiation they need (VanTassel-Baska & Stambaugh, 2005).

Cognitive Development and Motivation

Piaget believed that children create an understanding of the world around them, and adjust their ideas with what they discover (McLeod, 2015). Piaget's Theory of Cognitive Development also suggests that a child's motivation to learn increases when there is an interest or passion for the topic or subject that is being learned. A study by Danner and Lonky (1981) builds upon Piaget's theory. Their study found that children at a very young age showed a preference for tasks that are just a bit beyond their ability. It discussed the importance of motivation when it comes to students taking on moderately difficult or truly challenging tasks. Once these tasks are attempted and completed successfully students are more likely to feel a sense of pride, competence, determination, satisfaction, persistence and personal control (Danner & Lonky, 1981). In addition, by attempting moderately difficult tasks, a child is able to achieve maximal intellectual development (Fischer, 1980). Moderate risk taking increases performance, persistence, perceived competence, self-knowledge, pride and satisfaction (Deci & Porac, 1978).

Summary

After reviewing the literature the importance of challenging advanced learners at a young age becomes extremely apparent. Young children inherently seek out tasks that are just beyond their ability, yet looking at the number of underachievers it becomes clear they lose this desire for challenge, if that desire is not encourage at a young age. This means that educators of young children have an increasingly important job to ensure all of their students are constantly being challenged in the classroom.

Research shows that providing all students with challenge can be difficult due to many reasons. One of the main reasons found was the affect No Child Left Behind had on educators.

Arguably, the ongoing pressure of getting all students at grade level takes away from teachers' ability to give each student the time they need and deserve. Advanced learners are left bored and unchallenged because they are able to successfully meet grade level expectations without jeopardizing the teacher's time. Research also shows that children are more motivated if they are interested in what they are doing and provided with options when it comes to their education. The research helped influence the strategies that the researcher chose to implement amongst the advanced learners in the classroom being observed. Chapter 3 looks at the research approach and discusses the different strategies that were implemented in order to differentiate in mathematics.

Chapter 3 Method

Research Method

Participatory Action Research or PAR is the qualitative research methodology that fosters collaboration among participants and researchers (MacDonald, 2012), which makes it a useful methodology for this study. It critically analyzes educational situations with the intent of transforming and improving those educational situations for teachers, students, and society. Participatory Action Research looks at how an "individuals feelings, views, and patterns are revealed without control or manipulation from the researcher" (MacDonald, 2012). Qualitative methodology is meant to describe and understand opposed to predicting and controlling data. This type of research aims to integrate "methods and techniques of observing, documenting, analyzing, and interpreting characteristics, patterns, attributes, and meaning of human phenomena under study" (MacDonald, 2012, p. 34). In PAR, participants are actively engaged in learning and further developing their skills, in this case in mathematics. PAR also involves collaboration of "individuals with diverse knowledge, skills, and expertise fosters the sharing of knowledge development" (MacDonald, 2012, p. 40). In this study, collaboration occurred between the researcher, another first grade teacher, and the school's enrichment specialist. The three educators collaborated by observing, planning, teaching and differentiating for the participants.

Research Approach

This study examined the results of differentiated instruction in mathematics on advanced learners' perceived competence, persistence, and intrinsic motivation. This study also examined various strategies teachers can use to implement differentiation in mathematics in both whole

group as well as a small pull-out group. The subgroup was chosen based on the results of Test of Early Mathematics Ability (TEMA). First grade students who scored above a 45 on the test were selected as the participants. Students were provided with differentiated instruction to challenge them in mathematics. Various strategies were used to keep the advanced learners challenged. The researcher observed the students and recorded evidence of their interest in math and approaches to problem solving. At the end of the study, the students were given a survey to measure their level of interest in mathematics, in school itself, and their views on work they found challenge and motivation. Students were re-administered the TEMA after 3 months of experiencing a targeted approach to measure their growth.

Implementation Plan

Pull-out with enrichment specialist

Students were pulled out to work on extension activities that were aligned to the mathematics curriculum used in the classroom. Instructional sessions were intended to strengthen algebraic thinking through representation, proportional reasoning, balance, variable, function, inductive and deductive reasoning.

The first TEMA results reveal that most of the students in the group needed support in the following areas: reading numerals - three-digit numbers; addition facts - sums of 10, teen sums, small & large doubles; number after- one hundred terms; mental number line- two, three and four digit numbers; written addition accuracy- two-digit addends and carrying. These became the focus of the warm-ups, games and activities within the pull-out group.

Enhancement Packets

Enhancement packets were given to all 6 participants as a homework alternative as a choice, not as a requirement. Students were given the option to complete these packets of 6-10 pages at home. They were instructed to take several days to complete the packets. Once students completed one packet and turned it in, they were given another packet with the same guidelines. These packets differed from the general homework in that activities were designed to stretch the thinking of the same concepts taught to the entire class, without introducing new, more advanced concepts. Student results varied (see Table 2 for data).

Warm Up

The researcher began each math class with a warm up activity to get all students talking about numbers in order to build upon the concept of number sense. ‘Dot Cards’, ‘Rekenreks’ and ‘Sets of Addition Problems’ were included during warm up practice.

Dot Cards

Dot cards are index cards with various numbers of dots on them. Students are shown one card for a few seconds and then asked how many dots were on the card. They were then asked to describe how they knew. Some students counted each dot one by one, some counted by twos, and some students created their own strategies. Dot cards allowed students the flexibility to be creative.

Rekenreks

Rekenreks were incorporated into the math warm-up routine. Rekenreks practice number sense while working on "number talks" in which students explain their thinking. Students are asked how many beads are moved to the left side of the Rekenrek, and then ask to explain how they knew. Students the different strategies they used.

Sets of Addition Problems

Warm-ups also consisted of a set of 3 addition sentences, such as 7+7, 7+6, 7+8. All 3 problems were related to each other. Students were asked to solve and explain how they got their answers. Students were also encouraged to use what they already knew to solve for the following problems (Example: If you know 7+7=14, how does that help you solve 7+6?).

Marcy Cook Tiles

By adding Marcy Cook's Quiet Tiles to the "math choices" students are allowed to complete once finished with their work, students practiced activities that involved critical thinking, flexibility, and problem solving strategies. They practiced solving problems with more than one right answer as well as identifying more than one way to solve the problem, building upon students' number sense. The task cards come in various levels and force students to practice persistence.

Consistent Assessment

Constistently assessing all students in the class was important because it allowed the researcher, as the teacher, to identify more students who showed they were ready for additional challenges. Students were tested individually at the end of each math unit in order for the teacher to examine the students' understanding and identify strategies they used to solve math problems. The researcher continued to observe students throughout Math Talk Warm Ups to assess number sense. Throughout the study, 3 additional students in the class were identified and joined the pull-out group. They were also given enrichment packets to complete at their leisure at home. While this was encouraging, the 3 additional students were not included in the study. However, it was noted that constant assessment and flexibility that differentiation offered were important.

Ethical Standards

This paper adheres to the ethical standards for protection of human subjects of the American Psychological Association (2010). Additionally the research proposal was reviewed by the school site principal and the thesis advisor and approved.

Sample and Site

This study was conducted during the spring semester of the 2016-2017 school year on the elementary school campus of a K-12 private, all girls school in California where the researcher taught a 1st grade class. The school is located in an affluent, urban neighborhood in San Francisco. The researcher observed six female 1st graders from an all girls, private elementary school in San Francisco, California. The students were selected based on their performance on a mathematical pretest.

Access and Permissions

The study was conducted by the researcher who served as the teacher of record in her own classroom, providing easy access to all participants. Permission was given from the Head of School acknowledging that she was aware the study and approved the research plan.

Data Gathering Procedures

Data were gathered at the beginning and the end of the study. Students were assessed using Test of Early Mathematics Ability (TEMA) at the beginning of the study to identify participants. The test was given again 3 months later to measure growth after students received differentiated instruction. The TEMA was administered individually by the researcher. Participants were also asked questions, individually at the conclusion of the study. The survey

focused on the participants' views of school, challenge and motivation. The survey used a Likert Scale of *Always*, *Sometimes*, *Rarely,* or *Never.* Students responded to the following prompts:

1. I try my best in school
2. School is easy
3. Math is easy
4. I like it when my teachers challenge me

The last portion of the survey included open-ended questions:

5. What was your favorite subject last year in kindergarten?
6. What is you favorite subject now?
7. What subject are you the best at?

Observations were recorded by the researcher and served as data for the study. Notations were made on student frequency in selecting to complete additional mathematic assignments.

Data Analysis Approach

The pre test was given to identify the students in the classroom who have a strong understanding of mathematical material. The student survey was used to gain insight into the thoughts of the students after participation in the research project. Five of the questions responses were based on the Likert scale with responses including Always, Sometimes, Rarely, and Never. Three questions were open ended to identify the students' perception of themselves in school as well as to document their interests. Results from the survey were used to see how differentiated instruction effected students' viewpoints of school and challenging tasks.

Triangulation

The findings were analyzed using the comparison of data, a triangulation of notes of the observations with the 6 focal students, the results of the pretest and posttest, and the final student survey regarding their views of school and challenge.

Chapter 4 Findings

"Ms. Tricia that was hard, but it was fun!" 1st grade advanced learner

Description of Site, Individuals, Data

The study was conducted at a faith based independent school for girls in kindergarten to eighth grade. The school is located in San Francisco in an affluent, urban neighborhood. There were 344 students enrolled in grades K-8. Approximately 19 percent of the students are students of color. There is a 7 to 1 student-teacher ratio, with 51 teachers total. Approximately 30% of the students receive tuition assistance with awards ranging from $1,000 to $38,000.

Of the 344 students in the school, 42 students are enrolled in 1st grade. The researcher's first grade class included 21 students. The researcher's 21 students were administered the TEMA, and students who scored above a 45 were chosen for the study. Six students scored above a 45. All participants were Caucasian females of a high socio-economic status and were between the ages of 6 and 7. One student, Student A, received math enrichment in kindergarten in which she worked individually with the schools enrichment specialist who provided her with challenging mathematical material. These activities included pull-out once a week with the schools enrichment specialist, enhancement homework, math warm-ups, Marcy Cook Tiles, and constant assessment.

Students received differentiated instruction following the completion of the TEMA in January 2017. Participants completed a survey that was conducted in conversation with the researcher after 3 months of differentiated instruction. Questions 1-4 used a Likert Scale of *Always*, *Sometimes*, *Rarely,* or *Never.* Questions 5-7 were open ended and answers varied. The results are as follows:

Table 1

	Student A	Student B	Student C	Student D	Student E	Student F
I try my best in school	Always	Always	Sometimes	Always	Always	Sometimes
School is easy	Rarely	Sometimes	Sometimes	Sometimes	Sometimes	Always
Math is easy	Sometimes	Always	Sometimes	Always	Sometimes	Always
I like it when my teachers challenge me	Always	Sometimes	Sometimes	Always	Sometimes	Always
Favorite subject in kindergarten?	Math	Art	Math	Math	Science	Art
Favorite subject in first grade?	Math	Math	Math	Math	Writing Workshop	Art
What subject are you the best at?	Math	Math	Math	Math	Reading Workshop	Reading Workshop

Observations

Observations were made during the time of the study. The observations consisted of identifying students who chose to do extra math work. Everyday all students are told if they want to, they are allowed to turn their homework page over and do some extra math on the back. This instruction is extremely open ended and by no means required. The 6 participants work was looked at through the course of 11 math homework that had been sent home to look at how often students were choosing to do extra math. The number of extra math homework done was looked at to measure the students' intrinsic motivation of math.

Table 2

Participants	# extra homework options	# enhancement packets completed
Student A	7	0
Student B	3	6
Student C	2	0
Student D	1	6
Student E	1	0
Student F	1	6

TEMA Results

Test of Early Mathematics Ability (TEMA) was distributed to all 21 students in January 2017. The test was then administered again 3 months later to the 6 participants who had been receiving differentiated instruction. Results are as follows:

Table 3

Participants	Pre-Test Raw Score	Post-Test Raw Score
Student A	54	70
Student B	48	61
Student C	47	60
Student D	48	60
Student E	46	60
Student F	53	67

Average score of Pre-Test: 49.3

Average score of Post Test: 63

Average growth: 27.8%

Themes

After triangulating the data and examining the TEMA scores, student surveys, and the observations of extra math work chosen to complete at home, there were a number of different themes that emerged when reviewing the sources of information. All 6 participants chose to complete extra homework at least once showing they all were at one point or another intrinsically motivated to continue working on developing their math skills. While all 6 students showed an enjoyment of math through additional math work of their choosing, 3 students chose to never complete one enhancement packet while the other 3 completed 6 of the enhancement packets.

The 4 participants who said math was their favorite subject this year also stated it was the subject in which they felt most proficient. This indicates that success and feelings of pride in one subject may increase student enjoyment of the subject. Of the 6 students, the 3 students who did the most extra work on their homework were the same 3 that stated math was their favorite subject. In addition, they felt it was the subject they were the best which supports the theory that success and feelings of pride in one subject increases a student's enjoyment and encourages the pursuit of more challenging material within the subject.

After looking at each survey individually, Student F stated she sometimes tries her best in school. She also stated school and math are always easy. Lastly, this student stated she always likes a challenge. This student's answers show that she is still not being challenged enough and her current feelings that she "sometimes" tries her best in school may be the early signs of an underachiever. Student F will need to be continually challenged in math, as well as other subjects, which she stated came easy. While she is still stating she always likes it 'when her

teachers challenge her', she needs to be continually challenged before any underachievement occurs.

Summary

Six advanced learners participated in differentiated instruction in mathematics and were given the various opportunities to challenge themselves. The researcher noted students' interest and engagement in math varied student to student. While engagement and intrinsic motivation varied from student to student, all students progressed in their math ability. This growth could be seen through the TEMA scores with a 27.8% average growth amongst the 6 participants by the end of the data collection period. Given the short time period in which the test was administered this growth was significant indicating that the differentiated instruction the 6 students participated in improved not only students' understanding of numbers but overall progress in mathematics.

Chapter 5 Discussion /Analysis

Summary of Major Findings

The findings on students' growth in mathematical interest and their intrinsic motivation varied student to student. However, the majority of the students (66%) stated that math was in fact their favorite subject this year. Whether or not this was due to the challenge they had received was inconclusive. Fifty percent of the participants stated math was their favorite prior to the differentiated instruction. Comparison of students' test scores pre and post differentiated instruction indicated significant growth over the short period of the study. The TEMA scores showed a 27.8% average growth over the course of 3 months.

Comparison of Findings to the Literature

The researcher noted that 66% of the students stated math was their favorite subject after participating in challenging differentiated instruction opportunities, confirming the literary research that states, "Gifted students often find the most difficult classes are also the most enjoyable" (Berube, 1995, para 8). Danner and Lonky's (1981) study found that children at a very young age showed a preference for tasks that are just a bit beyond their ability. This statement was further supported by the research done after looking at the survey where 66% of participants stated math was their favorite subject after having received more challenging differentiated instruction in mathematics. Furthermore, 50% of participants continually chose to do enhancement packets proving these 1st graders showed a preference for tasks just a bit beyond their ability.

Tomlinson (2001) noted that anytime it becomes apparent that a student is able to learn more deeply, it is time to begin offering that student differentiated advanced learning opportunities (Tomlinson, 2001), which is why the researcher continued to make observations of all classmates.

The increase in TEMA scores further supports the literature research that found in attempting moderately difficult tasks, a child is able to achieve maximal intellectual development (Fischer, 1980). Lastly, the literature supported moderate risk taking increases performance, persistence, perceived competence, self-knowledge, pride and satisfaction (Deci & Porac, 1978). The participants' performance in mathematics improved when looking at their TEMA scores. Furthermore, the participants' perceived competence could be reflected in the 66% of participants who stated they were best at math after partaking in moderate risk taking through the challenging differentiated instruction.

Limitations/Gaps in the Research

A limitation of this study is the small sample size. The 6 participants provided limited data collected over a short period of time. Only one researcher collected data, and no control group was studied alongside the featured classroom.

Implications for Future Research

Future research is recommended to study the effectiveness of challenging advance learners at a young age and its influence on student worth ethic when they enter middle school and high school. Teachers should consider a longitudinal study over several years in school and collect data to see how being challenged at a young age affects their work ethic. One should note

if students f into the category of the large percentage of advanced learners who become underachievers once they get older because they were not challenged at a young age. Data analysis of students in a large population of students would be valuable, as would data comparing students from year to year, particularly advanced learners receiving differentiated instruction that has been implemented and put in practice for several years.

Overall Significance of the Study

The present study provides additional information demonstrating that differentiating instruction for advance learners is an effective model to improve understanding, intrinsic motivation, perceived competence, and enjoyment in mathematics. Improvement and growth in mathematics was seen through examining and weighing the TEMA scores. Overall enjoyment and interest in math were high as was student perceived competence.

About the Author

Tricia Cawley has been a 1st grade teacher since 2015. She earned her Bachelors Degree in Communication from Loyola Marymount University in 2013. After working in marketing, she realized her true passion was teaching and decided to go back to school. She earned her Multiple Subject Teaching Credential from Dominican University in May 2015. Tricia currently lives in San Francisco where she enjoys teaching 1st grade and rooting for the San Francisco Giants.

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