

## **Teaching Math to Young Children— What is Behind the Profession?**

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### **Introduction**

Some may view it as unusual for pre-service educators not to like math. It is not. In order to understand why this feeling exists, the article will take you on a journey of the pre-service teacher. Initially, the foundations of math acquisition will be explored. In this section, encouragement, learning and effective instruction will be discussed. Next, difficulties and factors of learning will be investigated. Then, the pre-service educator will be deconstructed. A closer look at how their self-efficacy and mathematical knowledge impact their role as future educators will be employed. Finally, many of the above elements will be applied to a community college's methods course assignment in summative arrangement.

### **Foundations of Math Acquisition**

The journey of the pre-service teacher begins with their own acquisition of the subject. In order for the expedition to come full circle, the initial stage should be reviewed. The foundations of acquisition incorporate encouragement, learning and effective instruction.

### *Encouragement*

Encouragement is the initial opportunity for mathematical acquisition. Parents play an important role in shaping the mindset of students. Carol Dweck believes that an optimistic attitude is what encourages some students to be persistent when others feel defeated. The child with a set state of mind feels there are a certain set of talents they were born with and stop trying when they embark on challenges. They do this because they believe they have reached their limit based on their natural abilities. Then there are students who have a growing mindset who do not apply limits to their potential. These students see challenges as an opportunity to improve. They have an inherent belief that experience and persistent can build their intelligence and rise to the challenge (Dweck, 2007). Modern research demonstrates inbred mathematical talent may not be as significant as we think, hard work is what is essential. Colvin (2008) supports this theory by stating focus and effort can improve skills. It is the hard work that impacts the success of a student in math. Parents are an essential aspect of the development of a child's attitude towards math. Children come to believe in their potential to conquer challenges with focused effort. If a student is placed in a math class, encouraged and supported in working hard, both authors claim the accomplishments are limitless (Colvin, 2008; Dweck, 2007). Without individuals who are encouraging, children can surrender to the notion that if something is difficult it is not valuable (Colvin, 2008).

When young children are in primary school, they state math is their preferred subject. During these years, teachers adhere to assembling students in groups according to their abilities. Then when in middle school, they come to believe that success is inherent and those who can compute examples at an accelerated rate are successful. Finally, these negative dispositions are prolonged throughout high school and continue in college. These beliefs about academic performance are learned and maintained in environments where no one tells or demonstrates otherwise to this group of students. Teachers are essential in providing support and strategies that engage students in rich mathematical thinking. When students are engaged in these types of environments, they come to believe that success comes from working hard to comprehend math (Colvin, 2008). Encouragement and motivation are important elements of math acquisition. Five chief factors which influence motivation were found during a 20-year summary of motivation research. These elements are motivation is learned and pivots on students' beliefs of their capacity to succeed or fail. Additionally, inherent motivation is better than a tangible incentive, inequities are impacted how groups receive instruction, and teachers are an important element (Huetinck & Munshin, 2008).

### *Learning*

Experience is the most significant resource in self-efficacy. Students should not only be inspired by positive experiences, but those where they persist through challenges. Positive facilitators structure activities for triumph and persuade students to employ in self-evaluation. Evaluation is not only derived from the instructor, nor should it include only positive feedback. There should be an opportunity for growth and recognition of the process. Informal knowledge is knowledge children acquire in regular environments before attending school. Students have a sense of counting and numbers essential for formal math learning. This informal knowledge exists in older children and is developed through their experiences. These are the very same occurrences that can be utilized in developing official math knowledge. Teachers evaluate children's prior knowledge to connect to new math learning (Gurganus, 2007).

Teaching concepts within a framework has the advantages of gaining interests and imaginations of students and providing mathematical knowledge in applicable relatable situations. The ultimate strategy is an awareness of students' interests and how to challenge and support them. When students are able to apply math to everyday life, they are more receptive because they find value in learning concepts. They often ask, "When are we going to use this?" Therefore, including circumstances from students' personal experiences incorporates interest to the topic being studied. Passionate teachers who display an adoration and knowledge of math, anticipate student success, and utilize wide-ranging problem-solving techniques are those who motivate students to ascertain academic merit (Huetinck & Munshin, 2008).

A report on primary education references the need for students to develop responsibility for what and how they learn. They should be aware that knowledge is not only transferred, but negotiated and re-created. The activities presented to young students should provide chance to take control of their learning and be empowered in that ownership (Sangster, 2012). A student's belief in their capabilities can impact how they think, their motivation, actions, level of attempts, insistence, and level of achievement. Elevated self-efficacy and improved performance result when they set undersized goals, relate precise learning strategies, and receive performance-dependent rewards. Being able to assure themselves as a result of their beliefs are essential components to handling challenging tasks. However, when students encounter failure and see it as being out of their power to manage, learned helplessness can decline their performance (Swars, 2005).

Huetinck & Munshin (2008) describe an elementary research study where children were not told if their answers were correct. This purpose of this was to foster independent thinkers. Some of the children declined additional supposedly because he was not conducting himself as a teacher and disclosing or verifying responses. Over time these children became accustomed and began to verify their own work. They did not rely

on the instructor. As a result of this research some ideas emerged—math requires proof and computation. They realized math problems do not always contain information necessary for solutions, sometimes they had to use prior knowledge to obtain solutions. In addition they found math to be useful and integrated with other topics (Huetinck & Munshin, 2008).

### Effective Instruction

Integration is also seen in previously-learned skills. Moreover, progress in math extends greatly on this incorporation. Therefore, it is essential for instruction to be clear and methodical with essential prerequisite skills taught at the forefront. For example, expectations of memorization of addition facts should not exist when students have not understood the basic notion of addition or associated symbols. Adequate practice while students acquire skills is helpful. This practice should match the needs of each child. Some students require manipulative, whereas others may not. It is totally dependent on each student and their needs. As students progress into the upper grades, they are generally tracked based on their abilities. Intensive remediation of basic math skills is essential and usually provided to those who require the services. It helps those students ascertain these skills which are needed to function in everyday life, many occupations and is a gateway for higher education (Gurganus, 2007).

Active learning is cornerstone in assisting a larger number of individuals learn math successfully and providing venues for them to study the subject at a deeper level. This is accurate within the higher education sector. This type of learning can assist educators in higher education respond to the agendas of learning, teaching and increasing effectiveness. It can also assist with some problems ensued in the transition to higher education. Additional outcomes of incorporating active learning is motivation, enthusiasm, excitement and a maintained admiration of math for students and educators (Kahn, Kyle & Institute for Learning and Teaching in Higher Education, 2002).

Very little research about effective components of math instruction is known when compared to that of reading instruction. Nevertheless, information can be deduced from the excellent research that is in existence in conjunction with the standard grade-level expectations in this subject. There is no single approach that works best for math as can be said about reading. Instead, the focus is on essential skills associated with learning math which should be concentrated on during math instruction. The significance of these skills vary across elementary and secondary grades (Gurganus, 2007).

### Challenges in Math Acquisition

The journey of the pre-service teacher continues with obstacles that could be encountered during acquisition of the subject. For some acquisition comes naturally, whereas others have more difficulty. These are the challenges that prevent individuals from building on

motivation and positive experiences. Although all pre-service instructors may have not personally encountered these challenges, they may in fact have students who will experience them. Some challenges of acquisition include environmental and individualized factors.

The subject of Math has been classified as the porter of triumph or failure for high school graduation and occupation victory. It is important that this subject become a force as opposed to a strainer in American education. A deficiency in mathematical skill and understanding affect an individual's aptitude to make significant life, career and academic decisions (Richardson, Sherman & Yard, 2008). Students fall below their projected level of math attainment for many reasons. Some students have expressed that they had no comprehension of the subject matter or it was not a relatable subject. This expression is the basis for two factorial categories—environmental and individualized factors (Richardson, Sherman & Yard, 2008).

#### Environmental Factors

Instruction should be taught through integration where there are concept-building opportunities, real-world applications and a spiraling curriculum. When math is relatable and concepts are repetitive, they have an opportunity to understand. Isolated facts are foundation for disconnection. In addition, the learner's ability should be considered. Modifications should exist for those who are not able to grasp content initially. Then when the curriculum repeats itself, they can try to understand it again with the encouragement of the teacher and in earlier years, their parents (Gurganus, 2007).

#### Individualized Factors

Some students feel that because they are lucky, they succeed in math. These external beliefs are not based on their general comprehension or effort. In addition, they may not feel that they were born with mathematical strengths. These views stifle their ability to persist. Some students lack well-developed mental strategies relative for procedures, organization or recall of facts. Also focus, ability to deal with long-term projects and isolated facts also create interference. Meaningless memorizing terms without association is not helpful. Insufficient concept development can be evidenced in older students. Sometimes educators assume mastery and the foundational concepts and experiences are missing. Thus presenting challenges in learning new concepts that originate from the eliminated concepts (Gurganus, 2007).

#### **Pre-Service Teachers—The Journey Continues**

The journey of the pre-service teacher continues with their actual experiences in the classroom. Through challenges and foundations in acquiring mathematical concepts, future educators are provided opportunities that enable them to function as successful educators. They gain experience that can be utilized in their interaction with young

students. Many thoughts fill their head as to the adequacy of their own mathematical knowledge, self-efficacy and disposition toward the subject based on their experience with the subject thus far.

### ***Teacher Efficacy***

Mathematical instructional strategies, past math experiences, teacher implementation of significant academic strategies and pre-service educators' influences on notions of teaching effectiveness were associated with math teacher efficacy. Highly efficacious educators were stronger math teachers than those with a lower sense of efficacy. There are two factors in a teacher's self-efficacy. One of which is personal teacher efficacy—their belief in their effectiveness as an educator. The second is a positive outcome they anticipate in their students' learning despite external elements. Teacher efficacy also has been linked to notable variables like classroom instructional strategies and readiness to embrace modernizations. Educators with a high sense of efficacy are more likely to utilize student-centered, try innovative strategies, and inquiry approaches, whereas educators from the other side of the spectrum would rely more on traditional methods like lecture and direct instruction. In the limited amount of studies on math teacher efficacy of elementary pre-service teachers, significant increases in math efficacy were correlated to pre-service teachers' participation in math methods courses (Swars, 2005).

### ***Teacher's Mathematical Knowledge***

Pre-service elementary teachers stated feelings of anxiety and felt the desire to utilize similar strategies to those they experienced during their education. Yet, education of these individuals is meant to decrease the level of trepidation as other instructional strategies instructional approaches are introduced during their academic career in higher education (Levine, 1998). During methods courses, there is a concentrated focus on specific mathematical concepts. Research indicates that there was a significant improvement in pre-service teachers' understandings. However, there continues to be deficiency of accord in the literature as to information educators should know about math to disseminate it well (Kajander, 2010). During teacher education programs, there are opportunities which support elementary pre-service teacher development.

Scholars dispute successful teachers must comprehend more than the act of instruction. Some propose that student teaching placements can be considered learning laboratories where student interns become familiar with higher education and the school. However, some say that this is not a positive environment for pre-service teachers to picture a successful educator. (Mewborn, 1999).

Nevertheless, research demonstrates that college students might become more engaged in their pre-service coursework if they perceived that these assignments were

instrumental for their upcoming classroom instructors. Therefore, they must first have a detailed awareness of what their future as educators will be like (Moyer & Husman, 2006). When students have meaningful experiences, that which they can recall later, they become more engaged in methods courses (Moyer & Husman, 2006).

### **Pre-Service Educators at Hostos**

Lesson plans flood the traditional environment of our community college method courses. The philosophy behind such practice stems from that of a constructivist view. Participants should build their knowledge in order for it to be most meaningful. Sometimes students try their lessons on children that they know or formally during their field work class. For the purpose of this assignment, I will focus solely on a Math and Science course. This is a methods course designed to prepare future teachers to teach math and science to young children. In the course, they become aware of theory and are able to connect it to practice in front of their peers. Hybrid classes are opportunities to balance the in-person lecture of a traditional setting and independent online atmosphere. Originally, I thought in a hybrid setting, it would be a bit challenging to provide an equivalent experience. However, I found that the online setting lent itself to a much richer experience in lesson planning.

The following assignment was designed for teacher-education students to put theory into practice. For several weeks, elements of the lesson plan were being taught through the traditional lecture. Resources are provided for lesson-plan development. Within a handbook, students can review sample lesson plans, explanation of lesson-plan elements and a rubric. This information is not presented all at once. Perhaps two elements are taught at a time in conjunction with practice. So the lesson plans that they create only incorporate the elements that were reviewed. As new elements are introduced during the lecture, they are included in the students' lesson plans. A wealth of resources and opportunities are provided. They are considered tools. Yet, ultimately it is up to the student to utilize those tools. The assignment is entitled "Lesson Plan Transcription and Addition". The guidelines are as follows:

Locate and examine a YouTube instructional video in the area of Math. As you watch the video write down each part of the lesson plan that you viewed (i.e. motivation, grade level, evaluation...etc.). Then write which elements (if any) were missing from the video. Finally, write a follow up for the lesson. What would you teach this group of students next? This is based on their response to the instructional session. Do you feel anything needs to be re-taught? Do you feel they are ready for the next aspect of that topic? What would that be?

Students are asked to produce their findings in a typed report which includes the transcribed lesson, justification of the follow-up activity and citation of the YouTube video. An option (not a requirement) for the more technologically-adventurous students is

to present that information in a mind-map format. There are several free software packages available. On the day the assignment is due, students give a brief presentation of their lesson plan to the entire group. Yet, in cooperative learning groups, neighboring students can offer alternative strategies for follow-up activities. This is a more intimate way of sharing, respecting the feedback of others and feeling empowered to plan and interpret lesson plans. In addition, they are able to observe actual children learning, witness how they respond and strategize ways to support their learning. As a result of this assignment, students are able to utilize both the online and traditional environment. This is a task that will be required in their future and they can begin now.

### **Context, Preparation, and Objectives**

A fundamental learning objective is for students to experience meaningful learning that they will present to their students. Students scrutinize the lesson of an educator in the field. In doing so, they demonstrate higher-level thinking. Students are able to analyze, synthesize and evaluate a lesson. When eliminating themselves from the picture, they maintain a more objective view as opposed to that of a biased nature. They tend to see more errors from an external examination. This is one lesson of many required for a larger assignment—the lesson plan portfolio. This is a collection of lesson plans written during the semester. Initially, the lessons are simplistic as they incorporate few lesson plan elements. Then they include all elements. They begin to exchange their created lessons with classmates and provide feedback. Next this assignment allows them to view the lesson of an educator in the field, analyze and extend their lesson. This assessment is a direct result of their lesson development and exchanges. The feedback has a different tone when it comes from the professor as opposed to a peer. At the beginning of the process, some students question the authority of a peer revising their work. However, I reassure them that revising the lesson plans of others is essential to the process. Practice makes perfect. In addition, the resources assist in the process—especially the checklist. Therefore, their colleague is centrally ensuring certain elements are present and they understand the lesson and the practicality. Choosing a video that lends itself to many elements of the lesson is essential. The option to transcribe the lesson via mind map software or typed is another helpful element. The hybrid course is a transition for many into an asynchronous course. Therefore, baby steps and gradual immersion into technology is helpful to those who may not be ready. In addition, I review how to create the mind map during face-to-face lectures weeks prior to the due date. Some students are willing to attempt the mind map. Others are not there and I realize that. The primary objective of the course is that they are able to create lessons that are appropriate for young students in the area of math and science.

### **Summary**

The initial mathematical acquisition which occurs in the earlier years of instruction is paramount in later years. This includes encouragement, learning and effective instruction.



Students may encounter challenges during acquisition; those can be mastered whether they be environmental or individualized. The experience as a pre-service educator provides an opportunity for success with several elements mentioned during their overall journey. Efficacy and their mathematical knowledge are considered. Below review these elements as we consider the college method course assignment:

Foundation	<ul style="list-style-type: none"> <li>• Encouragement</li> <li>• Learning</li> <li>• Effective Instruction</li> </ul>	<ul style="list-style-type: none"> <li>• Peers and lead instructor provide commentary. This is not only positive, but constructive to provide an opportunity for growth and assessment.</li> <li>• Independence and accountability</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Factors (environmental &amp; individualized)</li> </ul>	<ul style="list-style-type: none"> <li>• Concept building</li> <li>• Cyclical lessons</li> <li>• Videos are relatable</li> <li>• Integration</li> <li>• Meaningful learning</li> <li>• Opportunity for application and higher-order thinking</li> </ul>
Pre-Service	<ul style="list-style-type: none"> <li>• Teacher Efficacy</li> <li>• Teacher's Mathematical Knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Reinforced efficacy through presentation and feedback</li> <li>• Immersion in lesson plans throughout course and additional methods courses</li> </ul>

### Bibliography

Colvin, G. (2008). *Talent Is Overrated: What Really Separates World-Class Performers from Everybody Else*. NY, NY: Penguin Group.

Dweck, C. (2007). *Mindset: The New Psychology of Success*. NY, NY: Ballantine Books.

- Fuchs, L., & Fuchs, D. (2001). Principles for the prevention and intervention of math difficulties. *Learning Disabilities Research & Practice, 16*, 85-95.
- Huetinck, L & Munshin, S.N. (2008). Teaching Math in the 21st Century: Methods and Activities for Grades 6-12. (3<sup>rd</sup>. edition). NY, NY: Allyn & Bacon. p. 49-51.
- Gurganus, S.P. (2007). Math Instruction for Students with Learning Problems. NY, NY: Pearson. p. 34-36.
- Kahn, P., Kyle, J., & Institute for Learning and Teaching in Higher Education (Great Britain). (2002). *Effective learning & teaching in math & its applications*. London: Kogan Page.
- Kajander, A. (2010). Elementary Math Teacher Preparation in an Era of Reform : The Development and Assessment of Math for Teaching. *Canadian Journal of Education, 33*(1), 228-255.
- Levine, G. (1998). Changing Anticipated Math Teaching Style and Reducing Anxiety for Teaching Math among Pre-service Elementary School Teachers *Educational Research Quarterly, 21*(4), 43-76.
- Moyer, P. & Husman, J. (2006). Integrating Coursework and Field Placements: The Impact of Preservice Elementary Math Teachers' Connections to Teaching. *Teacher Education Quarterly. 33*(1),37-56.
- Richardson, L., Sherman, H., & Yard, G. (2008). Teaching Learners Who Struggle with Math: Systematic Intervention and Remediation. (2nd edition). NY, NY: Pearson.
- Sangster, M. "[An Investigative Approach to Teaching Primary Math.](#)" Math Teaching. Association of Teachers of Math. 2012. *HighBeam Research*.
- Swars, S. (2005). " Examining Perceptions of Math Teaching Effectiveness among Elementary Preservice Teachers with Differing Levels of Math Teacher Efficacy." *Journal of Instructional Psychology, 32*(2), 139-147.