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Growth through Reflection in Mathematics Education

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Reflecting on Action: Implications from the Child Mathematics Inquiry Portfolio

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ABSTRACT This article examines how the Child Mathematics Inquiry Portfolio (CMIP), a semester-long field experience project attached to an elementary mathematics methods course, can impact preservice teachers' understanding about teaching and learning mathematics and set them on more positive mathematics teaching journeys as they prepare to enter the field. This action research study, grounded in reflective practice, was contextualized in undergraduate and graduate elementary mathematics methods courses with 92 participants over two academic years. Data came from preservice teachers' written reflections on the child mathematics inquiry process. Findings reveal that the CMIP impacted the preservice teachers' mathematics teaching and learning in four major areas: bridge between mathematics methods course, textbook, and actual classroom experience; mathematical confidence; greater understanding of how teachers shape students' mathematics dispositions; and personal. Implications for mathematics teacher education are discussed.

KEYWORDS *preservice elementary teachers, mathematics inquiry, action research, reflective practice, field experiences*

Mathematics scores from students in the United States are regularly compared to those in other countries whose mathematics achievement is greater on international assessments such as Trends in International Mathematics and Science Study (TIMSS) and Program for International Student Assessment (PISA). The results have shone a spotlight on areas for mathematics improvement. Consequently, there has been a great push toward increasing student mathematics achievement in the United States (NCTM, 2014). Beginning with the mathematics standards set forth by the National Council of Teachers of Mathematics (NCTM, 1989; 2000) and continuing with the Common Core State Standards (CCSSO, 2010), there has been a focus on what students need to learn in order to be successful in college and careers in the 21st century. With increased emphasis on these standards comes increased responsibility and accountability for teachers to meet them. Competency in both content

and pedagogical content knowledge is essential for teachers to effectively teach their students (Shulman, 1987) and meet those standards. However, mathematics is a content area that can be challenging for early childhood and elementary teachers (Buss, 2010; Phillip, 2007) since they may not feel as confident in teaching it as other areas (Gujarati, 2013). In an extensive examination of the Teacher Preparation Programs of approximately 100 institutions in the northeast region of the United States leading to initial teacher licensure in either early childhood or elementary education, Pimentel (2018) found that most preservice elementary teachers are only expected to take one mathematics methods course, which covers all K-6 content in one semester, to prepare them for all their mathematics teaching responsibilities that lay ahead. In some instances, that one methods course is integrated with science methods, and relies on prior undergraduate preparation in mathematics which

varies widely. Mathematics educators, therefore, need to maximize time with preservice teachers in their one semester to ensure that they are prepared with appropriate content and pedagogical content knowledge. This preparation should also entail reflective practice since the degree to which preservice teachers' practice improves depends on how well and how frequently they reflect on their practices (Artzt, Armour-Thomas, Curcio, & Gurl, 2015). Reflection is a meaning-making process that can move preservice teachers to the next level of understanding so they can become more effective teachers and decision makers (Rieger, Radcliffe, & Doepker, 2013). Intentional and structured reflection needs to be built into preservice teachers' experiences more, as research indicates this is currently lacking (Rieger, Radcliffe, & Doepker, 2013).

This article presents an action research study which examines the impact of the Child Mathematics Inquiry Portfolio (CMIP), a semester-long field experience project attached to an elementary mathematics methods course which preservice elementary teachers can engage in to maximize learning how to teach mathematics and learning more about themselves as teachers, within the parameters of only one semester. For the CMIP, preservice elementary teacher candidates are required to observe one child (and teacher/classroom) in grades 1-6 during mathematics lessons/activities, collect and analyze several work samples (artifacts) from that child, document what they learned about that child relative to mathematics, and reflect on how this semester-long project benefits their learning to teach mathematics. The research questions which inform this study are: (1) What can preservice elementary teachers learn through engaging with the CMIP to aid with their mathematics teaching and learning? and (2) How can that information be used to inform how I structure my mathematics methods course to use the time most effectively? The voices of preservice teachers are prominent in this study because it is the teachers and their practices which impact student achievement and dispositions in the discipline.

Frameworks

Action Research

This study is grounded in teacher action research which is a systematic, intentional study of one's professional practice (Cochran-Smith & Lytle, 2009). At the heart of teacher action research is teachers seeking change by reflecting on their practice (Dana, 2013; Foulger, 2010); it

is change research (Pine, 2009). Action research assumes that teachers are the agents and sources of educational reform and not the objects of it (Pine, 2009). The cyclical nature of action research involves identifying an area of focus, collecting data, analyzing and interpreting data, and developing an action plan (Mills, 2014). Action researchers engage in multiple cycles of inquiry as they reflect on each phase.

Reflective Practice

Since action research incorporates a reflective stance into daily routines and a willingness to critically examine one's teaching in order to improve or enhance it (Mills, 2014), this study is also grounded in reflective practice (Dewey, 1933; Schön, 1983). Teacher reflection is a vehicle for knowledge growth. While thinking is automatic and unregulated, reflective thinking has a purpose, a goal. "[Reflective thought] emancipates us from merely impulsive and merely routine activity...It enables us to know what we are about when we act. It converts action that is merely appetitive, blind, and impulsive into intelligent action" (Dewey, 1933, p. 17).

According to Dewey (1933), there are two phases of reflective thinking: (1) State of doubt, hesitation, perplexity, mental difficulty, in which thinking originates and (2) Act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity. By thinking reflectively, a person can "transform a situation in which there is experienced obscurity, doubt, conflict, disturbance of some sort, into a situation that is clear, coherent, settled, harmonious" (Dewey, 1933, pp. 100-101). One can think reflectively only when one is willing undergo the trouble of searching which is an active process that involves open-mindedness, wholeheartedness, and responsibility (Dewey, 1933).

Schön (1983) posits the notions of reflection-in-action and reflection-on-action. The former is sometimes described as "thinking on [one's] feet." It entails building new understandings to inform one's actions in the midst of the situation that is unfolding. The latter is done after the encounter. It enables one to spend time exploring why one acted as one did. In doing so, one develops sets of questions and ideas about one's activities and practices to propel one forward. The power of these processes is when reflection-in and on-action are taken together since action is an integral component of reflective practice as reflection is not a singular retrospective act but an ongoing process to prepare teachers to take action. If reflection does not translate into taking action, it cannot be considered reflective (Reynolds, 2011).

Methodology

Sites and Participants

The site purposefully selected for this study was Greenville College (pseudonym), a small liberal arts college located in the northeast region of the United States. The study was contextualized in two undergraduate and four graduate elementary mathematics methods courses (six sections of the same course) which I taught, with 92 preservice teachers ranging in age from 20 through mid-50s and who were working toward their initial teaching licensure in childhood education (grades 1-6) during the 2011-2012 and 2012-2013 academic years. So that I had a sense of who these teachers were relative to mathematics, their initial course assignment was to write a mathematics autobiography in which they detailed their beliefs about what mathematics is, the evolution of those beliefs, and their relationship to this content area.

As part of the semester-long elementary mathematics methods course, teacher candidates at Greenville College were expected to complete eight hours of a field experience since the state in which they were enrolled required observation hours prior to student teaching. As the action researcher/professor of the mathematics methods course, I was particularly interested to know if the way I structured the observation hours was beneficial. Unlike many of my colleagues who chose to have eight short disparate assignments to fulfill the requisite observation hours, I chose to assign one comprehensive integrated project, which spanned the semester. I designed the CMIP to accompany and extend what I was teaching in the methods course. Teacher candidates selected an elementary school of their choice, observed a child (and teacher) in one elementary classroom (grades 1-6) during mathematics lessons/activities during the semester, collected and analyzed student work samples (artifacts), and reflected on the process of this child's mathematics inquiry regarding their current and future teaching practices (see Appendix for the CMIP's guidelines). The major difference between the expectation of the undergraduate and graduate teacher candidates was the collection of the number of artifacts, with graduate teacher candidates collecting and analyzing two additional artifacts.

For the CMIP, teacher candidates chose a school setting and grade level they were interested in teaching in the future. They could choose a child according to an area of interest (e.g., special education, English language learners, gifted and talented). There did not have to be a particular reason for the selection of the focal child, but I encouraged them to select a child based on an area within mathematics they were genuinely interested in studying.

School sites included suburban, urban, public, private, inclusive, and self-contained settings, with the majority being public, inclusive, suburban classrooms. Table 1 shows the breakdown of grade levels which teacher candidates chose as the sites for their child mathematics inquiry.

Table 1
Breakdown of Grade Levels for CMIP Sites

Grade Level	Number of Teacher Candidates
First	23
Second	11
Third	19
Fourth	17
Fifth	14
Sixth	8

Data Sources and Analysis

The CMIP was comprised of four parts: (I) Introduction; (II) Artifacts; (III) Integration and Interpretive Analysis; and (IV) Reflection on the Process (See Appendix for the CMIP's detailed guidelines). The data collected for this study primarily came from Part IV, Reflection on the Process, in which teacher candidates had to reflect on how the CMIP informed their understanding and teaching of mathematics, the usefulness of it when they assume their own classrooms, and any questions which remained.

Using qualitative research design (Creswell, 2013; Guba & Lincoln, 1989), analysis of data began as soon as it was collected. Data were manually analyzed within and across cases utilizing Grounded Theory (Strauss, 1987; Strauss & Corbin, 1998) where theorizing grows from the data rather than from a pre-existing framework used to confirm or disconfirm a theory. Analytic memos (Saldaña, 2016) were utilized in this process. The CMIP reflections were analyzed by reading and re-reading them, paying close attention to what was learned from the process of reflection on the experience to understand what preservice teachers learned/took away from it to assist them on their teaching journeys, and what questions still remained after this experience. Inductive coding methods were primarily utilized during the first and second cycles of the coding process. To ensure trustworthiness of the data, member-checking (Guba & Lincoln, 1989) was utilized. I asked participants any clarifying questions, as needed, to ensure that I understood the intention behind their quotes in the reflections.

Findings

Analysis of data reveals that the Child Mathematics Inquiry Portfolio (CMIP) impacted the preservice teachers' mathematics teaching and learning in four major areas: Bridge between Mathematics Methods Course, Textbook, and Actual Classroom Experience; Mathematical Confidence; Greater Understanding of How Teachers Shape Students' Mathematics Dispositions; and Personal.

Bridge between Mathematics Methods Course, Textbook, and Actual Classroom Experience

The preservice teachers overwhelmingly felt that the CMIP brought what they were learning in our mathematics methods course to life. The strategies which were shown and discussed in our methods course and read about in the Van de Walle, Karp, and Bay-Williams (2010) textbook were being implemented in actual classrooms. Noted one preservice teacher observing in a second grade classroom, "When reading about certain strategies in a textbook, they may seem productive and useful, but you cannot know that until you apply them to your students." The area that most preservice teachers saw in practice was differentiated instruction. At the heart of differentiated instruction is tailoring instruction to meet diverse student needs. Nearly all of the teacher candidates felt that the process of engaging in a child mathematics inquiry over the course of an entire semester was such a valuable experience because they witnessed the importance of differentiated instruction first-hand. In their portfolios, they emphasized that it was a start to hear about differentiated instruction in the mathematics methods course, but it was a vastly different experience witnessing and experiencing it in their field experience classrooms.

The preservice teachers had a greater sense of what it means to differentiate instruction for particular learning styles to really get to know who a student is on a deeper level. Here are two reflections about learning styles on different parts of the spectrum; the first on a first grade child who struggled with mathematics and the second on a fifth grade child classified as gifted and talented:

Being able to observe mathematics lessons being taught in both a general education classroom setting and a resource room setting was eye opening. I was amazed at what a different child Sara (pseudonym) was once placed in a small group setting. She went from struggling in math to being able to

shine in the resource room setting. This made me realize that sometimes academic issues are not always what they seem. I first believed that Sara did not have the cognitive ability to complete the grade level work she was given. I went on to later find that Sara just needed a different type of instruction than what she was being given.

Often, gifted and talented students are forgotten or ignored in the classroom. When teachers need to turn their attention to struggling students, the gifted and talented students receive less one-on-one attention. By focusing on Caitie's (pseudonym) growth and development, I have thought more about students who require less remedial work and more challenges. This case study has also helped me to realize that challenging gifted and talented students does not have to take much time. Instead, it requires extra thoughtfulness about a specific student's interests and needs. This project will help me design appropriate instruction so that I can support my students' mathematics development at their own *zone of proximal development* (Vygotsky, 1978) no matter which zone that is.

From this experience of engaging in the CMIP, the preservice teachers became much more aware of the range of student abilities within each classroom. These teacher candidates now realized just how critical it is to observe students, their behaviors, and learning processes to inform their own instruction. They further learned how important it is to know each individual student and check in with each student regularly. This concept, echoed by nearly all teacher candidates, was nicely summarized by one teacher candidate observing in a fifth grade classroom:

This project will definitely serve as a reminder throughout the upcoming years, especially when first beginning my teaching career, to make sure I pay attention to every student in my class and to get to know them and their learning styles—learning their weaknesses in order to counterbalance it with their learning strengths. It will also serve as a great reminder to never be the teacher that I encountered on so many occasions growing up who could not be bothered to pay attention to the students who did not understand the material, and who expected everyone to work at a set pace in order to get through the curriculum in an efficient manner.

Mathematical Confidence

From reading their mathematics autobiographies at the onset of the semester, at least three-fourths of the preservice teachers said they had a negative relationship or self-image with mathematics based on experiences in their formative years which left them feeling not as confident to teach it as other areas. However, the majority of the teacher candidates felt that the CMIP helped them gain much needed mathematical confidence. By the end of the semester, mathematics was not such “a foreign and scary subject” because it was taught in a “more real-world and comprehensive way” both in the methods course and in the field experience classrooms. As one preservice teacher observing in a fifth grade classroom noted:

This project has allowed me to change my prior negative view of teaching math into a positive one. The knowledge I have gained on techniques and strategies of teaching mathematics has shown me how to teach mathematics in an exciting and effective way.

Stated by another teacher candidate observing in a fourth grade classroom:

I have always been hesitant to teach math because I know that in order to teach a subject one has to have an understanding of the subject itself. This project, while allowing me to focus on how one student comes to learn and deeply understand a topic, gave me incredible insight into the necessity of providing students with a few strategies to utilize when solving a problem; giving them the ability to make math a creative subject rather than one based on strict and structured rules.

These teacher candidates gained a greater appreciation for mathematics, a new perspective on the subject, and confidence to teach students a variety of strategies using more manipulatives. As another teacher candidate mentioned “I will take away the confidence that there is a way to reach every student; you may just have to think about and present the concept another way.” Overall, the CMIP deepened teacher candidates’ understanding of current practices for teaching mathematics which led to greater confidence when they assume their own classrooms.

Greater Understanding of How Teachers Shape Students’ Mathematics Dispositions

Many preservice teachers came away with a heightened understanding of the role they play in shaping students’ mathematics dispositions for life. Since many candidates had expressed in their autobiographies that they had negative experiences with their own elementary mathematics teachers and that they perceived as ineffectiveness of some of their teachers, the CMIP allowed for more positive experiences and more positive role models than they experienced growing up. It hit home for many that they have a large role in shaping student dispositions, and that this role is important in not perpetuating a negative cycle of mathematics affect. Reflected one teacher candidate observing in a third grade classroom:

I discovered that the role of the math teacher is very different from the role that many of my elementary math teachers assumed. Teaching math is not simply about memorizing formulas and solving problems; it is about its application to the real world and its use in critical thinking development... Overall, I learned new strategies for teaching math as an integral life process rather than as a set of facts and problems. Math is often a subject that many people struggle in but if it is taught in a hands-on way that makes connections to students’ real worlds, it can make a huge difference in how students think about and approach math. As a math teacher, I will now assume a larger responsibility of teaching math for life.

Reflected another teacher observing in a fourth grade classroom:

Math is a subject that is very difficult, confusing, frustrating and disliked by many students. I believe that many of these negative feelings toward math have developed because students are often not taught mathematical concepts using their strengths or through strategies which meet their individual learning styles and needs. After this experience, I now intend to incorporate as many different teaching strategies and activities as possible in every math lesson I teach. By assessing my students and their learning styles, I will plan my lessons to include different elements which will appeal to all different types of learners.

Personal

For many teacher candidates, the CMIP impacted them in highly personal ways. One teacher candidate found a new colleague (and role model) in her field experience teacher and plans to keep in touch. Another teacher candidate came away from the experience inspired to emulate some interactive PowerPoints in her future sixth grade classroom as a result of what she successfully saw enacted in the observed class. Yet another felt confident that she chose the right career as a result of her experience. For others, it solidified their interest in teaching a particular grade level. Still others learned more about specific learning styles such as gifted and talented and language based disabilities. Each candidate had something personal to take away but as one teacher candidate observing in a fifth grade classroom said, engaging in the CMIP helps to develop a personal teaching philosophy:

It is my belief that the purpose for projects and assignments such as these, coupled with field experience and observation, is to help teacher candidates to develop our own philosophy in teaching, and that each methods course helps us to further investigate our philosophies in specific subjects, such as math.

Teacher candidates felt more invested in this project than in ones for other courses where they may have just observed more generally, as one teacher candidate observing in a sixth grade classroom asserted:

This project forced me to take on the teacher's role of tracking a student's progress and being able to identify their individual strengths and weaknesses. This was the first time I felt involved in a student's development and it changed my whole perception on observations; I was more invested in the process... As a teacher you can make such a difference in a child's life and seeing this first hand is so remarkable; it's a feeling I hope to carry with me as I begin to teach in my own classroom... The CMIP has let me look at how I can be a better teacher; how I can change the ways that I teach children to better benefit the ones who need more help than others.

Enduring Questions

Even with the tremendous learning experience the CMIP afforded them, these preservice teachers had questions to ponder as they begin to enter the teaching profession, as a result of their observations and experience with the

child inquiry process. Most of the questions fell into three areas: differentiation; parental involvement; and mathematics methods in the current educational climate. A question representative of each area follows:

How does one teacher provide the students with extra support or enrichment? How does a teacher, without additional assistance, effectively differentiate within a classroom to provide all students with the most beneficial and positive learning experience?

How can teachers educate parents on the new methods being used for math in the classroom? What is being done in schools to help solve this issue and what is the best method to help parents become more involved in the curriculum provided at their children's school?

After being introduced to all the exciting and motivating ways to teach children math through inquiry and exploration, I wonder how realistic it is to think I will be able to teach this way out in the real world. As a result of NCLB and standardized testing, this seems to be the age of prepackaged curriculum that leaves very little to the teacher's imagination. Therefore, is it realistic to believe a teacher (especially a new one) is going to be given the freedom to use her own teaching philosophy and present math through inquiry ideas in a classroom? Although we all like to think that we are willing to do whatever it takes to do what is best for our students, how realistic is it to think that a new teacher can venture away from the package of curriculum, lesson plans and activities she will most likely be handed when she starts teaching?

Discussion

The Child Mathematics Inquiry Portfolio (CMIP) not only encouraged preservice teacher candidates to observe, it also caused them to reflect on their own practices. As mentioned earlier, reflection is purposeful; it has a goal. In this case, the goal was to gain a heightened awareness of mathematics teaching and learning in today's classrooms through this formative assessment project. With continuous and sustained reflection resulting from this semester-long project, preservice teacher candidates learned more about teaching mathematics in elementary classrooms and more about themselves in relation to mathematics in their authentic field experience settings and appeared to begin to move from phase one

to phase two of reflective thinking (Dewey, 1933). In short, they began to move from a state of doubt to search for ways to resolve the doubt, specifically pertaining to mathematics teaching and learning.

Prior to this child mathematics inquiry project, from reading the portfolios and earlier mathematics autobiographies, it appeared that the preservice teachers had many doubts about their teaching responsibilities, particularly in their confidence to teach mathematics. However, by the end of the project/semester, they all reported being more confident to teach as a result of learning about differentiated instruction, the role of the teacher in shaping students' mathematics dispositions, and strategies in authentic classrooms. They better understood mathematics teaching as they had sustained time in authentic contexts. These preservice teachers were asked to reflect predominantly "on action" (Schön, 1983) by reflecting on each individual artifact (Part II), across the collection of artifacts (Part III), and on the inquiry process as a whole (Part IV). The multiple opportunities for reflection enabled them to understand the ways this project was beneficial to their future teaching careers. It is unlikely that this would have happened if they had not been asked to engage in this project and instead only relegated to learning through a textbook and an on-campus mathematics methods course. However, although the teacher candidates appeared to move toward phase two of reflective thinking, questions about teaching and learning mathematics still remained, as described earlier. This is natural for a novice teacher just beginning the teaching journey. As one preservice teacher noted, "many questions can really only be answered through experience over time."

For myself as the action researcher and mathematics methods professor, the enduring questions provide potential directions for future coursework. Having completed several cycles of inquiry over two years, patterns of questions emerged which are now incorporated into the methods courses I teach.

Educational Significance

Teachers are at the forefront of this study because it is necessary to look beyond simple curriculum reform efforts. Instead, we must focus on the actual practices of teaching mathematics in order to help identify the additional support systems needed to bring about the desired changes. We must also look at challenges which can hinder change or high-quality mathematics teaching. It is important to listen to preservice teachers' voices and

hear what they have to say in their own words because they represent the future of the profession. Often teachers' voices become muted in larger educational conversations, but this study puts their voices front and center.

As the action researcher, this study had personal significance for my methods courses in that it validated how I used the requisite observation hours. I could have had eight separate short assignments as many of my colleagues did, but chose one comprehensive, sustained project and the preservice teachers found value in the way the project was structured—namely that they were more invested in it since it represents what teachers are expected to do around formative assessments. The CMIP has allowed me to restructure my coursework to tap some of the enduring questions especially surrounding differentiated instruction.

As Pimentel (2018) found, most preservice elementary teachers only have one mathematics methods course to prepare them for all their mathematics teaching responsibilities in grades K-6. Looking beyond my courses, teacher educators can maximize their time by engaging in the CMIP and framing the work of the semester within real world mathematical contexts. Furthermore, they can learn valuable information about their students and what is learned from this experience in conjunction with the methods course; these can give preservice teacher candidates valuable glimpses into what they will do as teachers even before they begin their student teaching practicum. In today's educational climate, data-driven instruction to inform teaching practices is a major classroom responsibility. This project provides teacher candidates an experience with data-driven instruction as they analyze and interpret students' mathematics work samples (artifacts). Several preservice teacher candidates' reflections noted that they were then able to extrapolate their experience with one student to a larger scale with the whole class.

Reflective practice is critical in preservice teacher education. The CMIP underscores how much preservice teachers can learn about teaching mathematics by engaging in and reflecting on real world/authentic experiences, and not just busy work to fulfill a degree requirement. The beauty of the CMIP is that it can be done anywhere in the world; it is easily transferrable because it is not country-specific. Teacher candidates just need a classroom to conduct observations, a child to observe, and a purpose for the observations, which can vary according to specific needs a professor may see and want to explore further. Overall, the CMIP is a valuable project to prepare teachers for authentic, real world,

teaching experiences and set them on more positive mathematics teaching journeys in which they can positively impact student achievement and mathematics dispositions.

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Appendix

Guidelines for the Child Mathematics Inquiry Portfolio

Field Experience Assignment: Child Mathematics Inquiry Portfolio

Teacher candidates are required to complete **8 hours** of fieldwork for this course.

Each teacher candidate is required to fill out ONE field experience log documenting their hours. The major assignment for this fieldwork experience is a Child Mathematics Inquiry Portfolio.

This semester-long project provides an opportunity to develop close observational and authentic assessment skills, document a child's growth and development over time, and carefully interpret observational data to inform your teaching.

Create a portfolio for one child in your field experience setting (grades 1-6). Observe and record this child's mathematics behavior, document activities, and systematically collect and analyze artifacts that demonstrate his/her individual strengths, needs, interests, and achievements.

Artifacts may include: student work samples, checklists, journal writings, informal interviews, curricular materials, anecdotal records, conference notes, end of unit tests, etc.

This semester-long project will be regularly discussed during class sessions so that ongoing feedback and suggestions can be incorporated.

Please note: No real names of children, teachers, or school settings should be written. Please create pseudonyms for all names used.

Outline for the Child Mathematics Inquiry Portfolio

I. Introduction [Approximately 2 pages]

- Context/background information which includes:
 - The type of educational setting (e.g., urban, suburban, public, private, grade level, school demographics)
 - Classroom environment (e.g., number of students, physical layout, mathematics décor)
 - Mathematics curriculum used (include title and publisher) and mathematics approach in the classroom (e.g., teacher's philosophy)
 - A brief description of the child
 - Rationale for choosing the particular child

II. Artifacts [Approximately 2 pages *per artifact*]

- Approximately 4 or 5 pieces of student work (artifacts) and descriptive analysis
- Each artifact should contain the following information **clearly labeled**:
 - Artifact # and a brief title (e.g., Artifact #1: Subtraction Fun)
 - Date and time artifact was observed/collected (e.g., October 13, 2011 from 9:30–10:15am)
 - A description of the activity/lesson observed
 - Give a brief summary of the lesson/activity
 - What were the directions given? Student expectations?

- Child participation in the activity/lesson
 - Give an *objective* description of how the child approached the lesson/activity
- Reflections of the child's response to the activity/lesson
 - These are *subjective* interpretations. For example, why do you feel the child may have approached the activity/lesson as he/she did? What are your impressions of the child's participation in the activity/lesson?

III. Integration and Interpretative Analysis [Approximately 3 pages]

- In analyzing the artifacts, what have you learned about this child and his/her mathematics thinking/skills/behavior? For example, is this child particularly strong or weak in a certain content strand? What type of mathematics learner is this child? (e.g., auditory, visual, kinesthetic, spatial). Please cite specific evidence.
- As a teacher candidate, if this were a child in your class, what might you have done the same/different to accommodate this child's mathematics needs?

IV. Reflection on the Process [Approximately 2-3 pages]

- A reflection on the child mathematics inquiry process. Consider the following questions:
 - How has the child mathematics inquiry project informed your understanding and teaching of mathematics?
 - How might this project be helpful when you assume your own classroom? In other words, what will you take away from this experience?
 - What questions still may remain?