How Field Experiences Prepare Pre-service Teachers in Teaching Elementary Mathematics

Marvin S. Daguplo, Stella Marie D. Consul and Nonilon B. Consul

Journal of Educational and Human Resource Development Vol. 3,No. 1:82-95(2015)

Abstract

Field experience is a foundation among teacher education programs in which student-teachers are provided with excellent role models willing to engage in a reflective practice of the teaching profession. This descriptive-narrative-phenomenological study is anchored on the theory that field experiences contributes to the mathematical pedagogical content knowledge of pre-service teachers. Responses from 60 elementary education pre-service teachers revealed that field experiences significantly affect their preparation for teaching elementary mathematics not only in the areas of content and pedagogy but also in management and social relationship. The study thus concludes that field experiences materialized the desire of every teacher education institution to model teacher candidates in all aspects of pedagogical content knowledge though intense exposure that enrich and enhance their capability in teaching elementary mathematics.

Keywords: *teaching mathematics, field experience, pedagogical content knowledge, narrative, phenomenological*

1.0 Introduction

Field experience is a foundation in pre-service teacher education programs today. In fact, early teacher educators have found the value of field experience in the "learning by doing" approach since as early as the mid-nineteenth century (Cruickshank & Armaline, 1986). Consistent with John Dewey's emphasis on experiential education, field experiences today are focused on providing examples of best practices and pairing students with teachers who are not only excellent teachers, but also excellent role models willing to engage in reflective practice with student-teachers (Posner, 2005).

Numerous benefits of field experiences in teacher preparation programs have been documented in the literature. They include helping students decide if teaching is the right career choice, providing an opportunity for students to practice skills prior to student teaching, helping student-teachers start viewing themselves as teachers, and improving pre-service teachers' attitudes toward teaching (McIntyre, 1983). Field experiences are also typically offered in conjunction with a course as a way of helping students better understand the

Southern Leyte State University, Tomas Oppus, Southern Leyte

conceptual and theoretical knowledge being presented (Hopkins, 1995).

Outcomes of field experiences are clearly desirable and have emphasize the importance of field experiences in teacher education. These findings, however, are results of the evaluation of the general program of pre-service teachers' field experiences. Less evidence was established on how field experiences of pre-service teachers provide an impact on the specific field of study in education particularly that of mathematics education.

Literature revealed that mathematics teacher preparation programs expect their student-teachers to develop both a depth and breadth in the content knowledge in mathematics. This initial content knowledge assumes basic skills and broad general knowledge of the subject along with knowledge of inquiry in the specific discipline. Increased research attention to teachers' subject matter knowledge has focused attention to how student teachers organize and inter-relate these subject matter facts, concepts, and principles (Niess, 2005). However, student-teachers develop their understanding of mathematics through classes aimed at the accumulation of knowledge. Whether these pieces of knowledge are interconnected in a manner that supports them in translating the knowledge and understanding into a 21st century curriculum in a form accessible to learners is unknown as they begin their study of learning to teach their subject.

Being in the teacher education institution mentoring future teachers in the field of mathematics, it is the belief of the researchers that making an assessment on the impact of field experiences among pre-service teachers, especially on the teaching elementary mathematics, is of great importance. Emphasis is put on mathematics considering the fact that prospective elementary teachers may not be cognitively prepared for teaching mathematics compared to mathematics majors (Aiken & Day, 1999) especially to basic education students. Other factor to consider is their general beliefs and understanding on the very nature of mathematics derived from their own experiences as students (Holt-Reynolds, 1992; Knowles & Holt-Reynolds, 1991) which might have a great impact in their way of teaching mathematics (Ball, 1990; McDiarmid, 1990).

This study, therefore, attempts to document the impact of field experiences, including their

responses to challenges, among pre-service teachers in teaching elementary mathematics. Information from this study is of great importance as an input to curricular improvement of the university, more particularly, among mathematics professors. Moreover, this will provide information to the student teaching supervisors on how prepared student-teachers are in teaching elementary mathematics.

2.0 Framework of the Study

This study is anchored on the theory of Strawhecker (2005) who points out that field experiences has a great impact on the mathematical pedagogical content knowledge of pre-service teachers. She added that the impact of the mathematics field experience, combined with methods or content, perhaps, shows the greatest promise in preparing elementary teachers to teach mathematics.

The theory explains that in teaching preparation, field experiences will help pre-service students to improve pedagogical content knowledge of their coursework. Pedagogical content knowledge is categorized into two parts: the pedagogy and content.

Pedagogy means the art or profession of teaching. On the other hand, content is the main thought or the subject matter dealt with in a field of study.

Moreover, the theory implies that pre-service teachers' consideration of content knowledge in the subject specifies methods which allows for the reorganization of knowledge by classifying how the content should be taught. The blending of content and pedagogy will represent the pedagogical content knowledge in which has become the key word in teacher preparation and assessment. This theory credited that pre-service teachers will possess these pedagogical content knowledge if they will be exposed in the field which is crucial for an education student for them to be ready in the field of teaching.

3.0 Methodology

The Locale and Respondents of the Study

This descriptive-narrative-phenomenological study participated by 60 elementary education pre-service teachers was conducted at Southern Leyte State University-Tomas Oppus from school year 2013 -14 to 2014-15.

The Research Design and Procedure

Descriptive-narrative-phenomenological study is a form of qualitative investigation which focused on how individuals experience the world (Moustakas, n.d.). It's a synthetic and systematic narration of experiences of individuals engaged into a phenomenon taking place in the society. It emphasized on the idiosyncratic meaning individuals gave to their experiences. In the process, the researchers are trying to bracket self out and enter into the other person's perspective and experience.

As stated above, phenomenological study investigates the qualitatively different ways in which people experience or think about various phenomena. This implies that phenomenology is not concerned solely with the phenomena that are experienced and thought about, or with the human beings who are experiencing or thinking about the phenomena. Nor is phenomenology concerned with perception and thought as abstract phenomena, wholly separate from the subject matter of thought and perception. Phenomenology is concerned with the relations that exist between human beings and the world around them (Sherman & Webb, 2005).

In this study, analysis of working portfolio and interview were used as the primary method of data collection. Working portfolio is a narration or a written expression of personal-evaluation on how student-teachers experience the real world of teaching. The coding and analysis of data were conducted based on three analytic techniques: open coding, axial coding, and selective coding (Strauss, 1987; Strauss and Corbin, 1990).

Open coding is the analytic process through which concepts are identified and their properties and dimensions are discovered in data; Axial Coding is the process of relating categories to their subcategories, termed "axial" because coding occurs around the axis of a category, linking categories at the level of properties and dimensions; and Selective Coding is the process of integrating and refining the theory, the point in category development at which no new properties, dimensions, or relationships emerge during analysis (Strauss & Corbin, 1998).

Coding method, as used in this study, was based on the premise that no one is smart enough or intuitive enough to read a series of transcripts and immediately see the

patterns within them. In order to overcome this imitation, the coding method is a procedure for organizing the text of the transcripts, and discovering patterns within that organizational structure. By using the coding method, researchers able to discover patterns that one cannot see directly in the massive amount of text when one begin to analyse transcripts (Auerbach & Silverstein, 2003).

Researchers, therefore, moved from relevant text (guided by the research question in mind) through repeating ideas which shed lights on research concerns in order to formulate themes - groups of repeating ideas that respondents had something in common. This was conducted as part of the general process of conducting constant comparative technique (Strauss and Corbin, 1990) and narrative analysis (Soanes & Stevenson, 2004) to formulate themes.

Data Triangulation

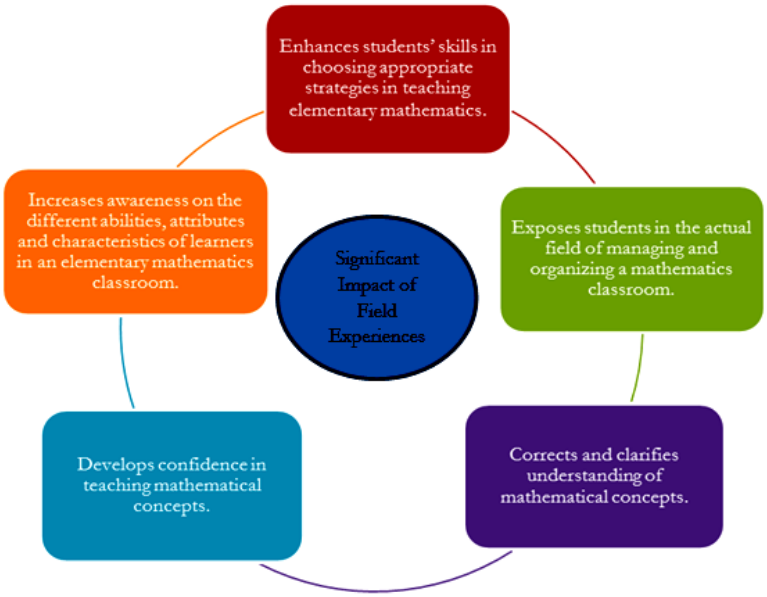
The use of different kinds of methodologies strengthened the validity of the findings since this allowed for the triangulation of results (Candelaria & Abao, 2012). This study utilized data triangulation through the use of Focus Group Discussion (FGD).

A series of Focus Group Discussion (6 batches) with five randomly chosen participants for each batch were conducted to check and verify researchers' thematic analysis of the data collected from portfolio and interview. In this process, validating and re-validating of the researchers' interpretation of the narratives and the responses during the interview were made intensively (Myers, 2009). After the FGD process, five out of nine formulated themes were finalized. These themes were now labelled as the significant impacts of filed experience in the student-teachers' preparation in teaching elementary mathematics.

4.0 Results and Discussion

Impact of Field Experience among pre-service teachers' preparation in Teaching Elementary Mathematics

Field experiences provide various impacts to pre-service teachers. This unique influence from field experience for each student, however, did not negate the possibility of sharing common importance derived from the experience. Below were themes developed and formulated and considered as significant impacts of



field experiences to elementary pre-service teachers in their preparation to teach elementary mathematics.

Significant Impact # 1: Field experience enhances pre-service teachers' skills in choosing appropriate strategies in teaching elementary mathematics.

Field experience provided pre-service teachers the opportunity to identify, choose and select appropriate strategies and techniques to be used in teaching various concepts in elementary mathematics. It also gave them the idea on how to facilitate and guide the learners specifically on the subject mathematics in which they felt difficult.

Participants said:

> "*My student-teaching performance enriches my knowledge on the application of the different teaching strategies*".
>
> "*I have used different techniques to cater the level of understanding of my pupils in mathematics.*"

This response reflected pre-service teachers' realization on the importance of the appropriateness of strategies in the effectiveness in teaching elementary mathematics. The nature and complexity of mathematics requires effective teaching which is brought about by

understanding and utilizing various strategies that will enable pre-service teachers to continually evaluate and improve teaching-learning activities (Develа, *et al*., 2000).

Pre-service teachers, moreover, narrated that the combination of the traditional but effective strategies and the modern pedagogical techniques increased their confidence to demonstrate various topics in mathematics despite their unpreparedness of the subject matter. Sometimes, pre-service teachers' art of building confidence were rooted in their exposure to traditional and modern pedagogical techniques which provided them with a strong foundation on how to deal with daily challenges of demonstrating mathematical concepts. This experience supported the claim of Vega (2008) who stressed that there is no single standard strategy to teaching. Instead, every teacher/ student-teacher should strive to adopt various strategies valuable in the classroom setting.

Atienza, Garibay, and Ramos (2007) pointed out that the primary objective of student teaching is to provide the opportunity for acquisition and demonstration of instruction competence with beginning professional educators. This involved the rightful choice of true and tried teaching strategies and methods fit to the teaching-learning process of the learner's nature and needs. They added that the ability of student teachers to interpret correctly and apply appropriate strategies makes teaching a science.

Significant Impact # 2: Field experience exposes Pre-service teachers in the actual field of managing and organizing a mathematics classroom.

Pre-service teachers' field experience provides them a gain of understanding on how to relate and apply concepts that have learned in school into the real scenario of teaching. Student-teaching helps students to become more aware on the role of a teacher as a classroom manager. In fact, one of the objectives of student-teaching is for the students to be exposed to current issues and trends in classroom management and organization which will help them gain valuable insights on classroom practices (Vega, 2008).

A study of Stepaneck (2000) recognizes the importance of good classroom management to ensure that all students have equal opportunities to learn rigorous mathematics. She added that pre-service teachers must see to it that mathematics classrooms must

become places where students are not ashamed of making mistakes. Instead, errors and misconceptions are recognized as an important and often necessary aspect of achieving deep conceptual mathematical understanding. This type of classroom management increases students' achievement and creates in them a positive attitude towards the subject (Borich, 2013).

The underlying philosophy of field experiences is to provide a link between theory and practice. The transfer of learning becomes more meaningful when students put to use what they learned on campus to real life situations. Below were some quotations of students' statements in the portfolio:

> "*Student-teaching gives me the opportunity to handle and organize classroom properly. It removes my fear to manage a big crowd, instead, it strengthens my capacity to lead and manage a class*".
>
> *"Majority of my students don't like math. I have to do a lot of motivational activities, games or plays, to informally relay to them the concepts of mathematics."*

The response above was an actual expression of how field experiences provide students an active participatory role of internship in management and instruction (Vega, 2008). Fundamentally, student-teaching aim not only the development of teaching skills among students. It likewise intends to provide them the necessary skills needed to become a manager or a leader in the classroom. There is, therefore, a felt necessity that pre-service teachers must also acquire the fundamentals of management especially in the subject that students do not like the most.

Management in a mathematics classroom requires student-teachers the patience in handling various types of student behaviours. Included in this aspect is the ability of the student-teachers to organize the class to cater students that are mathematically unmotivated or less motivated. It is the task of pre-service teachers to plan and organize their classroom environment and activities to cater students who love mathematics and those who do not. Star and Strickland (2008) revealed in their study that pre-service teachers are astute in their observation and implementation of classroom management. They revealed that classroom environment continued to be a strong category for the pre-service teachers.

Significant Impact # 3: Field experience corrects and clarifies understanding of mathematical

concepts.

Prior knowledge or schema has been rooted down in the minds of students from the moment they learned it, sometimes, without knowing that some of them are erroneous. This erroneous understanding of the concepts sometimes caused some of the students' difficulty in understanding mathematics (da Ponte & Chapman, 2008) which continues to influence unless corrected. Respondents said that field study corrected some of their misinterpretations in so many mathematical concepts. Ideas that they thought are right ones have been changed or perfected and amended because of their intense exposure to the various interrelated concepts in mathematics during their field experiences. There were many things that they thought were right, nevertheless, because of field study, have been perfected or corrected.

Field study connects knowledge that students gain in the classroom with real world situations, allowing students to make new discoveries and understand their world on a whole new level (Wahsega 4-H Center, *n.d.*). It exposes and familiarizes students to various mathematical concepts and principles providing them higher chance to detect and identify erroneous concepts they have in mind. When achieved, students will have early opportunity to correct these misunderstood concepts before they can be professionals in their field. This experience articulated the real experience of constructivism where students construct and develop new knowledge from their experiences. Constructivist said that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. An encounter with new ideas will create an opportunity to reconcile with previous ideas and experiences, maybe changing what we believe, or maybe discard the new information as irrelevant. In any case, students as learners are active creators of new knowledge.

By field study, pre-service teachers were able to learn authentically the real complexity of mathematical problems and their possible solutions using various strategies like role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice (Lombardi, 2007). Obviously, the development of these skills does not occur overnight. However, these various opportunities provided during field studies help students to become increasingly skillful at collecting and

studying related concepts and using it to correct misunderstandings and clarify issues or doubts on certain topics (Kazemi & Franke, 2004). All these field exposure activities and programs result to the refinement and improvement of students' understanding to various mathematical concepts.

Significant Impact # 4: Field experience develops confidence in teaching mathematical concepts.

One of the explanations for the gap between what teachers knowledge and what they do relate to their confidence, or self-efficacy, for performing the task successfully. As noted earlier, the most powerful source of efficacy information is personal mastery, followed by vicarious experiences (Bandura, 1997). Both of these provide useful strategies for building confidence among pre-service teachers especially in teaching elementary mathematics.

Although we might expect our current pre-service teachers to be more prepared to teach elementary mathematical concepts than their in-service counterparts due to a responsive and specialized elementary curriculum, this does not seem to be the case (Russell *et al*., 2003). Pre-service teachers still need opportunities to develop various methodological and pedagogical skills in teaching mathematical concepts (Russell *et al*., 2003). This can be accomplished both within the college classroom (microteaching, simulated lessons) and through field experiences (practical, student teaching). The more experiences students have, the more likely they will be comfortable and confident to facilitate learning mathematical concepts in their future classrooms (Ertmer & Ottenbreit-Leftwich, 2010). Furthermore, they need to be able to experience the entire process of facilitating a mathematics classroom; including handling the technical and management issues that commonly occur (Hew & Brush, 2007). These experiences will help students overcome their fear of making mistakes and will illustrate the importance of persistence (Ertmer & Ottenbreit-Leftwich, 2010).

Access to a variety of mathematical models and techniques builds knowledge and confidence in organizing meaningful mathematical discussion. Additionally, experiences in the field provide an opportunity for student-teachers to observe successful others which can possibly build confidence in the observers who tend to believe "if he/ she can do it, then I can too." The

more examples student-teachers observe, the more likely they will gain both the knowledge and confidence they need in their own classrooms (Ertmer, 2005).

Significant Impact # 5: Field study increases awareness on the different abilities, attributes and characteristics of learners in an elementary mathematics classroom.

Field experiences provide pre -service teachers a real view on the different abilities, attributes and characteristics of learners in a mathematics classroom. This in effect developed their emotional maturity especially when caught in a situation when they have to respond to students' individual differences. Meyer (1997) defined this challenge as a complex construct that requires meta-cognitive, motivational, volitional and affective processes which support student-teachers' cognitive engagement and persistence in difficult work.

An increase in awareness to students' manifestations of various behaviours in the classroom is a proof that pre-service teachers, indeed, are reflective in their daily tasks. They become more sensitive on small yet significant aspects of behavioural attributes which might intervene or facilitates learning of mathematical concepts. Here, emotional maturity is central to understanding the motives and hidden abilities or characteristics of every student in a mathematics classroom (Meyer & Turner, 2002). Being affective connects pre-service teachers to every student and strengthens the opportunity to understand deeply the learning desire and goals they have in mind.

In addition, involvement is another key term that defines pre-service teachers effort to connect to their students in the hope of understanding better the latters' mathematical abilities. For many pre -service teachers, field experiences is the suitable scholastic period where they have to engage themselves in the real world of teaching as explained and framed by various theoretical perspectives which tries to explain the real world of teaching. Particularly, in a mathematics classroom where most of the students either hate the subject or the teacher, pre-service teachers are expected to respond positively, in whatever means, all the negative feedback and reactions thrown by students. Pre-service teachers revealed how they refine every moment of dullness when they tried to introduce mathematics concepts to students. They clearly said, "Every

student seems to hate mathematics".

5.0 Conclusion

Field experiences materialized the desire of every teacher education institution to model teacher candidates in all aspects of pedagogical content knowledge though intense exposure that enrich and enhance their capability in teaching elementary mathematics. The value of field experience, however, was dependent on the degree to which student-teachers motivationally involved themselves in the process of redefining their understanding towards teaching elementary mathematics, finding a more personal connection and value to the significance it brings to every student they encounter.

6.0 References Cited

Aiken, I. P., & Day, B. D. (1999). Early field experiences in pre-service teacher education: Research and student perspectives. *Action in Teacher Education*,*21*(3), 7-12.

Ball, D. L. (1990). Breaking with experience in learning to teach mathematics: The role of a pre-service methods course. *For the Learning of Mathematics*, 10-16.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. Macmillan.

Borich, G. D. (2013). *Effective teaching methods: Research-based practice*. Pearson Higher Ed.

Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative sociology*, *13*(1), 3-21.

Cruickshank, D. R., & Armaline, W. D. (1986). Field experiences in teacher education: Considerations and recommendations. *Journal of Teacher Education*, *37*(3), 34-40.

da Ponte, J. P., & Chapman, O. (2008). 11 Pre-service mathematics teachers' knowledge and development. *Handbook of*

International Research in Mathematics Education, 223.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration?. *Educational Technology Research and Development*,*53*(4), 25-39.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, *42*(3), 255-284.

Hew, K. F., & Brush, T. (2007). Integrating technology into K -12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development*, *55*(3), 223-252.

Holt-Reynolds, D. (1992). Personal history-based beliefs as relevant prior knowledge in course work. *American educational research journal*, *29*(2), 325-349.

Hopkins, S. (1995). Using the past; guiding the future. In G. A. Slick (Ed.). *Emerging trends in teacher preparation: The future of field experiences*. Thousand Oaks, CA: Corwin Press, 1–9.

Kazemi, E., & Franke, M. L. (2004). Teacher learning in mathematics: Using student work to promote collective inquiry. *Journal of Mathematics Teacher Education*, *7*(3), 203-235.

Knowles, G., & Holt-Reynolds, D. (1991). Shaping pedagogies through personal histories in pre-service teacher education. *The Teachers College Record*, *93*(1), 87-113.

Lombardi, M. M. (2007). Authentic learning for the 21st century: An overview. *Educause Learning Initiative*, *1*(2007), 1-12.

McDiarmid, G. W. (1990). Challenging prospective teachers' beliefs during early field experience: A quixotic undertaking?. *Journal of teacher education*, *41*(3), 12-20.

McIntyre, D. J. (1983). *Field Experiences in Teacher Education: From Student to Teacher*. Foundation for Excellence in Teacher Education, One Dupont Circle, NW, Suite 610, Washington, DC 20036.

Niess, M. L. (2005). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. *Teaching and teacher education*, *21*(5), 509-523.

Posner, G. J. (2005). Field experience: a guide to reflective teaching (6th Ed.), White Plains, NY: Allyn and Bacon.

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003). Examing teacher technology use: Implications for preservice and inservice teacher preparation. Journal of Teacher Education, 54(4), 297–310.

Soanes, C. & Stevenson, A. (2004) *Concise Oxford dictionary*. Oxford University Press, New York.

Star, J. R., & Strickland, S. K. (2008). Learning to observe: Using video to improve pres-ervice mathematics teachers' ability to notice. *Journal of Mathematics Teacher Education*, *11*(2), 107-125.

Stepanek, J. (2000). *Mathematics and science classrooms: Building a community of learners*. It's Just Good Teaching.

Strawhecker, J. (2005). Preparing elementary teachers to teach mathematics: How field experiences impact pedagogical content knowledge. *Issues in the Undergraduate Mathematics Preparation of School Teachers*, *4*.