Using Mathematics Journals to Enrich the Methods Course Experiences of Prospective Mathematics Teachers

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Abstract

This paper illustrates ways to employ Mathematics Teacher Journals to improve the quality of methods course experiences for prospective mathematics teachers. Based upon research conducted in an undergraduate teacher preparation program, this study describes how the author used Mathematics Teacher Journals to mentor prospective teachers in new ways. The study describes the author's experiences through this educational activity, but did so in ways that highlighted strategies for change to the methods course. The main topics of methods of teaching mathematics course were: Problem solving and posing, Teaching fractal geometry, Using dynamic geometry software (Cabri 3D, Geometric Sketchpad) in teaching, Using Graphing Calculator (Casio cfx9850+) in teaching functions, and teaching mathematical proof. Selected articles were chosen from Mathematics Teacher Journal focused on these topics. Student-teachers were asked to develop new ideas based on the articles context for their teaching practices. By providing a detailed account of the feedback process that led to this result, this paper illustrates how mathematics student-teacher can use Mathematics Teacher Journals activities to enrich the quality of their methods courses.

Introduction

Most teacher education programs in mathematics teachers' preparation institutes include a combination of mathematical content courses, or content knowledge, and a course centered on pedagogy, also commonly referred to as math methods. Education programs, a perusal of the literature (Strawheaker 2005, Burton 2008,and Clarke 2009) suggests there are common characteristics for each individual entity: mathematics content courses, mathematics methods instruction, and an early field experience. The overlying goal of a methods course is to understand how students learn various mathematical concepts and skills and how to teach particular mathematical ideas to them. When and how field experiences occur varies greatly from program to program. Despite the separation of three such experiences in traditional teacher. Pedagogical content knowledge links with subject-matter knowledge to guide the sequence of concept presentation and with general pedagogical knowledge to draw on global techniques of teaching (Marks, 1990).

" Aspiring elementary teachers must begin to acquire a deep conceptual knowledge of the mathematics that they will one day need to teach, moving well beyond mere procedural understanding" (National Council on Teacher Quality, 2008). In addition, they must be prepared to address the different learning styles and the different developmental levels of a diverse student population. Teacher development programs should ensure that mathematics teachers are fluent in the language of mathematics and have broad and deep knowledge of mathematical content, processes, and contexts.

(Martin, 2007; 119): All teachers can improve their teaching of mathematics; they have self learning experiences, searching for new trends in mathematics teaching, and professional development programs involvement.

These elements affect the choices a student teacher makes about what to teach, how to teach it, how to organize the classroom, and what techniques to use, how to individualize instruction, and what modifications will be made. All of these decisions are guided by a teacher's pedagogical content knowledge in concert with subject-matter understandings, perceptions of pedagogical practices, student difficulties, and expected roles of the teacher and student as well as the role of the subject matter.

This study focuses on the use of reading research articles to engender changes in prospective teacher's subject-matter knowledge and pedagogical content knowledge regarding situations involving secondary mathematics content**.**

Objectives:

Objectives of this study were to:

1. Develop a framework of the uses of Mathematics Education Journal articles to enrich Methods of Teaching Mathematics for prospective secondary mathematics course.
2. Investigate the enrichment of the uses of Mathematics Teacher Journal to improve mathematics learning literature of prospective mathematics teachers.

Theoretical background

Mathematics Teacher Education Preparation:

Teacher candidates and experienced teachers alike tend to see course as 'theoretical' by which they generally mean 'vague and impractical' (Darch, Carnine & Gersten 1988, p. 35). Mathematics teacher education program still persists their own conservative methods that developed in 19th century to decorate 21st novice teacher. Therefore, we need a progress for teacher education program. We need a solution for the issue that cultivates competency teachers. Brown and Borko (1992) also pointed that improvements are needed in teacher education.

In mathematics education. Polya advocated radical changes in preparing teachers since the early 1960's, however, his ideas are only now being reflected in reform efforts (Kilpatrick 1987). The reform imbedded into the efforts of the National Council of Teachers of Mathematics (NCTM). NCTM has developed guides for the content and pedagogy of teachers through the Curriculum and Evaluation Standards for School Mathematics (NCTM 1989), the Professional Standards for Teaching Mathematics (NCTM 1990) and Principles and Standards for School Mathematics (NCTM 1999). Below are five principles concerning the mathematical preparation of teachers of all grade levels:

1. Mathematics courses for future teachers should develop "deep understanding" of mathematics, particularly of the mathematics taught in schools at their chosen grade level.
2. Tools for teaching and learning, such as calculators, computers, and physical objects, including manipulative commonly found in schools, should be available for problem solving in mathematics courses taken by prospective teachers.
3. Mathematics courses for future teachers should provide opportunities for students to learn mathematics using a variety of instructional methods, including many we would like them to use in their teaching.

4. Faculty involved in the preparation of teachers of mathematics should engage in study and discussion of how people learn mathematics.
5. Greater communication and cooperation is necessary among all stakeholders in the mathematics(CBMS, 2001).

Instruction in college mathematics classes should involve more than lecture. Instructors should include various techniques for engaging students actively in solving problems. This could include, whenever appropriate, having students solve problems or discuss strategies with a partner or small group, and engaging the whole class in discussion. Instructors and students should be encouraged to solve problems in more than one way, to explain their reasoning, and to describe how the mathematics they are doing today is related to mathematics done earlier. Deep understanding of school mathematics should be a goal of all mathematics courses taken by future teachers, whether they are courses satisfying general requirements for graduation or specialized courses for teachers.

Universities Methods of Teaching Course Design:

Teacher education programs must provide experiences that will prepare their graduates for these increased demands. Teacher education programs must make pedagogical content knowledge a priority (Brown & Borko, 1992).

Teachers of mathematics at secondary school level are facing increasing demands in the classroom. Secondary school mathematics has become much more challenging.

Today's mathematics curricula require students to demonstrate understanding and competence far beyond mathematics skills. Secondary school teachers of mathematics must have greater content knowledge (Ball, 1990).

There is a gab between what mathematics should be presented to pre-service teachers from both mathematics departments, and mathematics education department, the mathematics faculty member may be unaware of how the content courses fit into the overall teacher preparation program and the education faculty may not have a complete understanding about the mathematical content their teachers have before entering their program.

The math journal ***Mathematics Teacher*** is to be used for specific selected topics in Methods of Teaching Mathematics II course. Each student has to translate a specific article chosen by both student and instructor into Arabic language, summarize the main idea of the article, Explain how you as a teacher, could use the information found in this article effectively in a classroom. What modifications, based on the new reform of mathematics education that focuses on problem solving, conceptual understanding, Mathematical proof, and mathematical thinking need to be made for successful implementation in his classroom? Explain. How can this idea are used in a classroom. Mathematics Teacher journal provide opportunities for students to develop mathematical problems, explore student responses, and connect these with the content they have learned. Journals are a means for pre-service teachers to develop strategies for teaching mathematics. They allow pre-service teachers to explore mathematical concepts and thinking both receptively and initiatively, which addresses most of the points in Methods of teaching mathematics course.

Methods of Teaching Mathematics course:

The purposes of this course for preserves secondary mathematics teachers are (1) to take an in-depth look at the fundamental ideas and applications of secondary school

mathematics; (2) to provide methods for teaching secondary school mathematics; (3) to provide techniques for assessing the learning of mathematics; (4) to present issues related to current reform in secondary school mathematics; and (5) to become familiar with professional journals.
The content and teaching methods for secondary school mathematics should be learned together. I have found integration to provide a deeper, more meaningful understanding of teaching and of mathematics. In this course we “do” quite a bit of mathematics in order to set the context for learning about teaching mathematics.

One of the important factors of understanding mathematics is the ability to provide meaningful examples and illustrations of mathematical concepts. Over the past few years, I have found that being able to explain concepts with everyday life experiences is particularly useful

The pre-service teachers in the mathematics methods course spend two hours of the course time each week in theoretical lectures, and another two hours working in microteaching situations in the area of teaching secondary mathematics. During microteaching times, students are involved in observing how experienced math teachers approach problem solving and how they address their mathematical thinking.

The course consists of three main components; teaching methods with the mathematics topics, addressing core content (number, geometry & measurement, probability & statistics, algebraic ideas, mathematical concepts, mathematical skills, mathematical relationships, problem solving, communication, connections, representation), major teaching methods (use of problem solving, cooperative group work, use of technology, use of physical models), and forms of assessment (tests and quizzes, performance tasks, portfolios, journals). We focused on how to incorporate the core concepts in course content and how to enrich traditional instruction with the teaching and Mathematics Teacher articles.

The main topics of Methods of teaching mathematics course were: Problem solving and posing, Teaching Fractal Geometry, Using dynamic geometry software (Cabri 3D, Geometric Sketchpad) in teaching, Using Graphing Calculator (Casio cfx9850+) in teaching Functions, and teaching mathematical proof. Selected articles related to these topics from Mathematics Teacher Journal were chosen based on:

- Article related to course topics.
- Article contains a practical ideas and be able to use it in our math curriculum.
- Article contains a creative and attractive ideas and be able to encourage our students to do the same.

Methodology

Participants

A total of 34 mathematics student teachers participated in the study; they enrolled on "methods of teaching mathematics II" course during fall semester 2010. All of them were asked to do the following: each two students have to choose an article from "Mathematics Teacher" Journal, and then prepare a report about the content of that article, report should contain:

- Translation of the main idea to Arabic language;
- How to implement this idea to our mathematics curriculum?

- Could you develop this idea to be much more effective in mathematics teaching?

There was a presentation by all students to all reports during the course time. Class discussions and connections to readings follow each session with the students. all the articles collected and analyzed according to: the quality of presenting the idea; the abilities of implementing the idea in our local mathematics curriculum; and the creative development of the idea.

Teaching materials

The resources needed for the course was available to all students: mathematical manipulative, multiple types of technology, curricula materials used by schools, books, journals, and articles that discuss research in mathematics education and applications of mathematical content. Mathematics Teacher Journal is available for all students in the main SQU library in addition to access to website of Mathematics Teacher Journal were available to all students. Each two students were asked to choose suitable article under supervision of the author, they also asked to prepare all required materials to present the idea in class. Seventeen articles were developed and presented (Appendix II).

Instrument

A suitable questionnaire designed by the author to find out how are the uses of Mathematics Education Journal articles were effective in developing student-teachers ideas of Teaching Mathematics for prospective secondary mathematics course. A list of 18 statements; statements were written so that participants could respond to each statement using a Likert-type five-part scale of Strongly agree (4), Agree (3), disagree (2), Strongly disagree (1), or uncertain (0).

Data collection

Questionnaire was administered to the participants at the end of teaching "*Methods of Teaching Mathematics II*" course; where students analyzed and present the requested work for "*Mathematics Teacher Journal*" articles.

Survey results were analyzed, descriptive statistics and frequency statistics were conducted to determine the most benefits of using mathematics teacher articles by participants.

Results and Discussion

Results of questionnaire in table (1) showed that students agreed and willing to see a similar specialist journal in Arabic language, item 1(3.97, 0.171), articles developed students mathematical thinking 2 (3.56, 0.561), items 3(3.56, .561), 4 (3.53, .563), 5(3.50, .615), 6 (3.44, .660), and 7 (3.38, .604) showed that articles contain valuable ideas, There was enrichment of the cognitive level of mathematics, and they showed a confidence of implement articles ideas on my teaching style. While items 16 (2.35, 1.228), 17 (2.15, .925), and 18 (1.62, 1.129) showed that students disagree of that articles ideas are hard to use it in some different circumstances because of the learning environment differences. The results also showed that students were so exited of new ideas and the way presented through the articles, and they use some of these ideas in there teaching practices in some classes.

Table (1): Means and Std. Deviations of Questionnaire
Mathematics Teacher articles in developing student-teachers ideas about mathematics teaching

Item#	Statements	N	Mean	Std. Deviation
1	I wish to find a similar specialist journal in Arabic language.	34	3.97	.171
2	Articles developed my mathematical thinking.	34	3.56	.561
3	Articles ideas were excellent	34	3.56	.561
4	M.T. articles contain valuable ideas.	34	3.53	.563
5	It is easy for me to implement articles ideas on my teaching style.	34	3.50	.615
6	In the future, I'll try to present my work for my teacher's colleague.	34	3.44	.660
7	There was enrichment of the cognitive level of mathematics.	34	3.38	.604
8	I need a suitable learning environment to apply articles idea.	34	3.35	.734
9	This work developed my confidence to be a mathematics teacher.	34	3.24	.741
10	Developing the article idea part helped me in developing mathematical thinking	34	3.21	.880
11	I need much time to read additional articles.	34	3.18	.936
12	Articles content was a new experience for me.	34	3.15	.702
13	I'm thinking of writing a similar article in the future.	34	2.91	.965
14	The chosen articles were so closed to the course topics.	34	2.88	.844
15	The articles were chosen according a subjective criteria's.	34	2.68	.806
16	The most difficulties I faced were the articles language.	34	2.35	1.228
17	I did suffer of preparing my presentation to be systematic with the article.	34	2.15	.925
18	It is hard for me to apply articles ideas.	34	1.62	1.129
	Valid N	34		

This connection of mathematics teacher articles with the course lessons creates an atmosphere of professional collaboration during the course and creates a model for professional collaboration in the future. The most important results were the content parts of the developed paper; implementation of the idea to our mathematics curriculum, and the development of the idea to be much more effective in mathematics teaching. Students showed that articles ideas were important enrichment activities in Omani mathematics curriculum, and they developed and extend some of articles ideas to be implemented in other mathematical situations.

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Appendix I

Questioner

Mathematics Teacher articles in developing student-teachers ideas about mathematics teaching

Student-teacher name/ ……

N	Statements	Acceptance degree				
		4	3	2	1	0
1	Articles ideas were excellent.					
2	There was enrichment of the cognitive level of mathematics.					
3	M.T. articles contain valuable ideas.					
4	Articles developed my mathematical thinking.					
5	It is hard for me to apply articles ideas.					
6	The chosen articles were so closed to the course topics.					
7	The articles were chosen according a subjective criteria's.					
8	It is easy for me to implement articles ideas on my teaching style.					
9	The most difficulties I faced were the articles language.					
10	Developing the article idea part helped me in developing mathematical thinking					
11	Articles content was a new experience for me.					
12	I'm thinking of writing a similar article in the future.					
13	I need much time to read additional articles.					
14	I did suffer of preparing my presentation to be systematic with the article.					
15	I need a suitable learning environment to apply articles idea.					
16	This work developed my confidence to be a mathematics teacher.					
17	In the future, I'll try to present my work for my teacher's colleague.					
18	I wish to find a similar specialist journal in Arabic language.					