

A Study of Pre-Service Teachers Teaching Experience of Mathematics

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Abstract

Are pre-service teachers able to notice their strengths and challenges in teaching? This paper reports on a study of pre-service teachers' teaching performance being simultaneously evaluated by themselves and their professor. Thirty-two pre-service teachers created and planned mathematics lessons approved by their professor to be taught in elementary classrooms. The teaching experience of those teachers was videotaped and evaluated by the professor using the Field Assessment Observation Form in the areas of content knowledge, instruction, assessment, classroom management, and affective skills. Furthermore, the pre-service teachers completed a Self-Reflection answering their professors' questions regarding their teaching experience. Mixed methods research analyzed the data. The findings of the quantitative data indicate pre-service teachers evaluated themselves higher than what their professor did in assessment and time management. Moreover, the findings of the qualitative data indicated there were similarities in student engagement, inquiry teaching, and scaffolding identified through the teaching performance between pre-service teachers and their professor.

Keywords: *Pre-Service Teachers, Mathematics, Classroom Management, Elementary, Assessment, Scaffolding Instruction, Inquiry Teaching, Students' Engagement, Professor.*

1. INTRODUCTION

Teacher educators are in demand to provide pre-service teachers cohesive courses and guiding principles enabling those teachers to apply what they have learned in university based-course work to the field-based portion of their future profession. However, many studies have concluded pre-service teachers reveal concerns applying theories into actual teaching [4]. This transition from being students who were supported by cooperative teachers and/or university supervisors to new teachers who are fully responsible for learning process and managing classrooms stresses pre-service teachers. Pre-service teachers concerns vary in themes from one study to another; however, pre-service teachers are preoccupied with applying theories in their actual teaching. Because their image of themselves as students does not change once they get in the field experience, this concern transforms to some issues related to time management, classroom management, lesson planning, providing clear instructions, and assessing without using rubrics. Many studies have been conducted in the past few years to examine pre-service teachers teaching barriers. These barriers are directly related to their experience including: behavior management, time management, lack of ability to work with students with different needs, and lack of communication skills. Pre-services teachers' strengths include propensity for inquiry, attention to children, and awareness of school/society relationships. Since our aim was to explore strengths and areas of improvements of pre-service teachers, we reviewed literature that focused on pre-service teachers teaching experience and several of the mentioned barriers and the teaching strengths identified through our research. The following literature review reinforces the themes found through this research: classroom management, assessment, scaffolding, inquiry teaching, and student engagement.

2. MANAGEMENT

All management types identified through this research such as classroom management, time management, instructional management, and behavior management play significant roles to establish an educational atmosphere

for both teachers and their students. Emmer & Stough define classroom management as teachers' activities that "order, engage students, or elicit their cooperation" (p. 103), even though some literature defines classroom management and behavior management interchangeably. Shin & Koh posit a difference between the two. They state student behavior management focuses on modifying students' behavior. Pre-service teachers should be aware of the behavior management strategies to confirm the learning process cannot be interrupted by misbehaving students causing other students to lose their chances to learn. Time management is one of the barriers pre-services teachers reveal. It is crucial because new teachers have to organize their time between teaching, preparing, and reflecting. Teacher educators should impart time management strategies for teaching content allowing pre-service teachers to experience these strategies in actual teaching environments [4]. Shin & Koh summarized the Attitudes and Beliefs on Classroom Control Inventory and measured instructional management by items including: students transition from one learning activity to another, monitoring students learning behavior, assigning students to specific seats in the classroom, providing feedback regarding students' performance, teachers decision as to what topics and tasks students need to study, teacher allocation of classroom materials and supplies, implementing the structure of students daily routine, providing homework for drill and practice of skills learned at school, setting time for each learning activity, and trying to stay within schedules. Classroom management is the biggest area of concern for pre-service teachers during field experience. For instance, Beeth and Adnan [4] have conducted a study with forty two pre-service teachers who reflected on their barriers and strengths through field experience. The researchers concluded classroom management was the highest area pre-service teachers expressed as a weakness during their teaching experience.

3. ASSESSMENT

Assessment is one of pre-service teachers' concerns. Formative assessment is a tool teacher educators use to improve pre-service mathematics teachers' conceptual understanding. Pre-service teachers should be knowledgeable of assessment approaches because it is their instrument to document student content understanding, reflects on their own teaching, and collaboration with others [2]. Self-assessment is an approach to conduct formative assessment and it assists pre-service teachers evaluate their teaching quality and student learning in the classroom specifying their strengths and areas of improvement [1]. Informal assessment is also a formative assessment denoting some techniques not restricted by the instructional time. It helps teachers identify the strengths and weakness of students who are not able to prove their understanding in formal/ standard exams without stressing them with grades [24]. Informal assessments include items such as homework, logs or journals, debates, games, brainstorming, teacher observation, and story retelling. How pre-service teachers are able to assess their students' learning is also a concern pre-service teachers struggle with while teaching elementary children. In their study, Beeth and Adnan [4] found pre-service teacher have difficulties in developing assessment items and how to grade their students, but this concern was not as immediate as the management issue.

4. SCAFFOLDING

Scaffolding refers to all types of classroom activities supporting student learning [5]. These activities relate scaffolding to the sociocultural theory because they occur through the interaction either verbally or using body language between learners and teachers. Scaffolding includes activities such as bridging, reasoning, prediction, collaboration, modeling [26], and simulation where "the learner interacts with objects or characters of realistic situations to achieve a specific goal" [31]. Scaffolding is not considered a challenge from pre-service teachers' point of view. For instance, although Beeth and Adnan [4] study showed pre-service teachers did not count working with IEP students and interaction with all students as an issue in their teaching experience, they reveal cooperative or collaboration is one of the their concerns.

5. INQUIRY TEACHING

Inquiry teaching refers to teachers' ability to assist their student in being equipped with analytical skills so as to grasp what underlies scientific aspects [28]. Through this type of teaching, learners would be able to engage with a scientific question, participate in designing procedures, give priority to evidence, formulate explanations, connect explanations to scientific knowledge, and communicate and justify explanations; furthermore, teachers should have deep and full understanding and knowledge of their discipline concepts, in the National Research Council. Although pre-service teachers have propensity for inquiry as strengths, it has been and is still a barrier for many classroom teachers. The study of Beeth and Adnan reveals inquiry teaching was one of the highest concerns of the forty two

pre-service teachers in their field experience. Inquiry teaching is a challenge for teachers because it requires the use of discussion or discourse for inquiry learning. Discourse is an essential item of inquiry teaching especially for mathematic since it encourages mathematical thinking. Inquiry learning allows teachers to provide feedback after the learning experience to extend students' ideas and help them connect the concept to their experience.

6. STUDENT ENGAGEMENT

Bloom [3] specified that students can be cognitively engaged when they accept challenges and accomplish more than they require. Pre-service teachers should be prepared to engage in their learning by challenging themselves to learn, interact, and reflect in order to obtain the highest benefit from their university courses [8]. Moreover, to maximize the opportunities of verifying their students are engaged, pre-service teachers have to develop engagement techniques tailored to their students' needs and background [14]. Focusing on classroom activities is the key to make students engaged. For example, pre-service teachers of Beeth and Adnan expressed their students were not engaged and motivated because the activities they created did not match their students' interest. The research literature available examines pre-service teachers concerns about teaching students in the classroom through classroom management, assessment, scaffolding, inquiry teaching, and student engagement. To the best of our knowledge, an important missing portion in the literature is the professor's point of view. This study explores pre-service teachers' perceptions by using reflection writing. They revealed their strengths and areas of improvement during their field experience for one of their university-based mathematics coursework. Simultaneously, a professor evaluated these teachers performance using observation through videotaped classroom teaching of the pre-service teachers [35]. This comparative study investigates whether there is a difference between the professor and pre-service teachers in terms of what they notice about mathematics instruction to children in order to better prepare pre-service teachers.

7. CHILDREN ENGAGED WHILE LEARNING MATHEMATICS

These prospective teachers engaged children during mathematics instruction. The professor observed this engagement through math activities, prediction, sentence stems, manipulatives, explicit modeling, involvement with numbers, vocabulary journals, pair/group work with specific student jobs, math games, children's mathematics literature, experiments, opportunities for students to think about problems in multiple ways, students creating their own math problems, and songs/raps about math topics. Engaged children during math learning was confirmed with the students' Self Reflections through the following examples: creating fun activities, students had a good time learning math concepts, student discussions were passionate, students enjoyed the lesson, excited/enthusiastic about math topic, videos, songs/raps, math children's literature, and hands-on activities. The quantitative data confirms the finding of the qualitative results with mean of 3.68 (73.6 %) representing the highest ability of pre-service teachers reported by the professor.

8. SCAFFOLDING OF MATHEMATICS CONTENT

These pre-service teachers were successful in scaffolding content with children during mathematics instruction. The professor observed this scaffolding through differentiation, guided questions, real life mathematics connections, multiple problems at different math levels, concept maps, creating small groups of students to work with the teacher during independent practice time, multiple entry points as access to math problems, supporting individual students, and sentence stems. Scaffolding content during math learning was confirmed with the students' Self Reflections through the following examples: challenge problems for gifted students, three-column chart, building on background knowledge, vocabulary in multiple languages, different representations of concepts, pictures/visuals/drawings, gestures, think/pair/share, manipulatives, shelter instruction, children's literature, different centers for different students (high, medium, and low math groups), and cooperative learning. However, the scaffolding of culture was an area identified as a weakness. Some of our pre-service teachers showed that they had difficulties when interacting with ESL students, students with learning disabilities, and gifted students. The quantitative data confirms the finding of the qualitative results with mean of 3.15 (63 %) which represents the second highest pre-service teachers' abilities reported by the professor.

9. EFFECTIVE INQUIRY TEACHING

These pre-service elementary teachers planned and implemented effective inquiry mathematics lessons. The professor observed effective inquiry math learning taking place within the lessons. Some examples of effective

inquiry math learning found in the observation data are probability exploration where shapes and double shapes were tossed determining if it lands on its face or side, arrays with coins gaining conceptual understanding of multiplication, measuring objects around the room to find their perimeter, acting out the book to solve mathematical problems, matching written numerals with counter manipulatives, number cards to create larger and smaller numbers, coins connection to decimals, colored sticks pattern creations, measuring centers, and asking higher level questions. Effective inquiry math learning was confirmed with the students' Self Reflections through the following examples: hands-on math activities, explicit vocabulary instruction, effective math strategies used while teaching, guided instruction, manipulative use, asking guiding questions, multiple representations of concepts, building on background and prior knowledge, discovering math, and exploring math concepts. The quantitative data confirms the finding of the qualitative results with mean of 3.12 (62.4%) representing the third highest pre-service teachers' teaching ability reported by the professor.

10. CLASSROOM MANAGEMENT

Classroom management is the area needing the largest improvement for these pre-service elementary teachers in terms of behavior management, time management, transitions from one activity to another, and wrapping up the lesson. The professor observed a lack of classroom management through the following examples: back towards the students while teaching, students making distracting noises with papers/materials during directions, materials/manipulatives not ready or organized prior to teaching, lack of time management, lack of classroom control, students not physically close to the pre-service teacher were off task and it was not noticed during instruction, and not having something for students to do when they finish an activity early. A lack of classroom management was confirmed with the students' Self Reflections through the following examples: backs towards students, not sure how to transition from one activity to another, did not have enough materials, students were not listening while giving directions, not knowing how to respond to students, there was too much downtime, calling on all students, and unarticulated expectations. However, pre-service teachers did not mention time management issues. There were eight occurrences observed by the professor including having materials and technology ready, creating seamless transitions, allowing enough time for lesson closure, and using appropriate lesson pacing. The quantitative data confirms the finding of the qualitative results with mean of 2.73 (54.6 %) which represents the lowest pre-service teachers' abilities reported by the professor.

11. SCAFFOLDING

Both pre-service teachers and their professor unanimously evaluated the area of scaffolding as one of pre-service teacher's strengths, there is still a gap in the cultural scaffolding. As we mentioned above, pre-service teachers learn teaching methods in an isolated environment different than the real classroom. This might be a reason why pre-service teachers had difficulties in applying cultural scaffolding when they interacted with students. Therefore, they need guides to develop their confidence while they interact with learners in real situations [16] such as providing pre-service teachers with multiple opportunities to teach real classes and increase their connection with students. The following quote from reflective writing supports the claim our pre-service teachers struggled with this part of scaffolding: The ESL aspect was a little shaky. I made a chart labelling all the parts of division problem in both English and Spanish, I got a little nervous to read each part in Spanish. I would add more ESL aspects in my lessons. (Pre-service #4) For this lesson, it was harder to be creative when coming up with a cultural background for students, and relating it to their culture. (Pre-service #19) However, I did not include enough differentiation because I did not think of accommodating students with special needs or advanced learners. Dar [10] asserted in her study that there is a need to equip pre-service teachers with social skills in their classrooms in order to assist their students having not only academic skills but also effective skills. Both skills will enable pre-service teachers to be good communicators in the community at large. Kea, Campbell-Whatley, Richards confirmed our findings regarding pre-service teacher's lack of experience and skills to teach different linguistic and ethical students. Considering the solutions of cultural scaffolding, teacher educators are in demand in preparing pre-service teachers to be culturally responsive agents. Kea and his colleges [15] suggest pre-service teachers should examine and confront negative attitudes that might impact negatively different students learning process. Pre-service teachers also should be prepared to know their students in and out of classrooms. They should be capable to know their students past experience, language, culture, and the like. Furthermore, pre-services teachers should be able to create activities such as direct teaching, large group discussion, small group activities, reading assignments, simulations, and performance activities reflecting care and respecting their students' different culture. Otherwise, the non-included groups will be unintentionally prevented from learning math content.

12. CONCLUSIONS

The findings of this study demonstrate pre-service teachers during their math teaching performance rate themselves higher than their professor did on the five themes: engagement, scaffolding of instruction, inquiry teaching, assessment, and classroom management. Inquiry teaching and students' engagement were areas of strengths identified through both pre-service teachers and their professor. Scaffolding of instruction was effectively implemented during teaching, but the cultural scaffolding was missing. Assessment was an area positively rated by the pre-service teachers, but not observed by their professor. Classroom management was the area evaluated for improvement from both pre-service teachers and their professor. Classroom management, assessment, and cultural scaffolding continue to be areas where pre-service teachers need additional classroom experiences and practice with children in order to change these challenges into strengths.

13. REFERENCES

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