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Emirati Pre-service Teacher Behaviors in Mathematics Classrooms

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Abstract
The purpose of this study was to investigate the teaching behaviors of Emirati pre-service teachers in mathematics classrooms. Using a validated ecobehavioral assessment tool, the Mainstream Code for Instructional Structure for Instructional Software (MS-CISSAR), the current study examined the teaching behaviors of nine pre-service teachers in general education Cycle 1 (elementary) public schools in Abu Dhabi. Results revealed the pre-service teachers taught mathematics using instructional groupings of whole class for 62% of the time and small group sessions for 22% of the time. Independent work time was assigned for only 8% of the mathematics class. The participants engaged students in discussion for 32% of the time and used other media such as a mathematics video and/or manipulatives for 31% of the time. Worksheets were assigned for only 16% of the time. The pre-service teachers spent 45% of class time talking or asking questions about academics and 15% of the time engaged in talk related to managing the classroom. Implications for teacher education and directions for future research are discussed.
Keywords: Pre-service teachers, Mathematics, Ecobehavioral assessment, MS-CISSAR, Middle East

1. Introduction

The United Arab Emirates (UAE) held the 10th position in the BloombergMarkets' list of fastest-growing economies in 2015 (Robinson, 2015). Phenomenal growth in business in the UAE also means phenomenal growth in education, particularly in the capital city of Abu Dhabi. The Abu Dhabi Education Council (ADEC) was established to develop the educational initiatives in the Emirate and, hence employs thousands of expatriate teachers because teacher training of Emirati individuals has not been able to keep pace with the tremendous need for well-trained classroom teachers to work in the public schools. Like the aggressive plans in growing the economy, there is an equally aggressive plan to employ high numbers of qualified Emirati teachers in the classrooms In March of 2015, 52% of the teachers were Emirati Nationals and 90% of them were female (Zaman, 2016). One of the goals of the UAE is to focus on and maximize the human potential of Emirati citizens by 2021 (Prime Minister's Office, 2021, n.d.). This study examined the teaching behaviors of Emirati pre-service teachers teaching mathematics in Abu Dhabi public schools.

In Abu Dhabi, government schools are directly governed by ADEC. Abu Dhabi schools have undergone significant reform beginning in 2010 when the "New School Model" (NSM) was introduced to students in Kindergarten through Grade 3. The NSM emphasizes a student-centered approach to education that encourages students to become communicators, thinkers, and problem-solvers (ADEC, 2010). Walters et al. (2014) suggest that the term "student-centered" refers to multiple instructional methods that focus on an array of complementary approaches where the student is always at the center of planning, learning and assessment. This model stands in stark contrast to the traditional, teacher-centered, approach that dominated previous models of education in the region (Davidson, 2008; Zellman et al., 2009). Students' coursework in English, mathematics and science are delivered with English as the language of instruction. All other subjects are taught in Arabic. Students in Cycle 1 (Grades 1 through 5) schools should receive a minimum of 3 hours of science, 4.5 hours of English and 3.75 hours of instruction in mathematics each week (ADEC, 2015).

The ADEC Cycle 1 mathematics curriculum requires teachers to cover specific content areas such as numbers, patterns and algebra, measurement and data, and space and geometry (ADEC, 2010). In addition to covering specific content areas, the expectations of the ADEC mathematics curriculum include plans for teachers to engage in instructional practices that facilitate active learning and high levels of student engagement. Examples of such practices include: asking students both closed- and open-ended questions; encouraging students to explain, suggest and opine about mathematics in both written and oral English; using varied assessments; engaging in explicit teaching or modeling; and using hands-on resources (ADEC, 2010).

The shift toward a student-centered curriculum in mathematics has a strong research base. Positive relationships have been found between student-centered mathematics instructional practices and a variety of student outcomes such as engagement levels (Gningue, Peach, & Schroder 2013; Ikhlef & Knight, 2013) and achievement (Bodovsky & Farkas, 2007; Cohen & Hill, 2000; Guarino & Dieterle, 2013; Palardy & Rumberger, 2008; Zellman et al., 2009). Student-centered learning may be of pivotal importance in the early years while learning the content of mathematics. At the elementary school level, the association between specific instructional practices and student mathematics achievement typically varies by grade level. The following

activities are positively correlated with student test scores in mathematics: the use of both independent and small group work in Grade 4 (Cohen & Hill, 2000); student use of worksheets and calendars in Grade 1 (Palardy & Rumberger, 2008); explicitly explaining how problems are solved and a follow-up with supporting students in learning how to solve problems in Grade 1 (Guarino et al., 2013); and incorporating hands-on materials and manipulatives in Grades 3 through 7 (Hamilton et al., 2003).

A student-centered mathematics curriculum relies upon effective teachers to utilize instructional practices that emphasize problem solving and inquiry. Sahan and Adiguzel (2014) describe an effective teacher as "the one who always produces a class of high-achievers, or who generally receives positive evaluations from students, supervisors and administrators" (p. 636). In a student-centered mathematics classroom there are strong teacher/student relationships where students are supported as active learners, and the application of critical thinking skills is promoted. There is a focus on individual learning through scaffolding, differentiation, and choice where students are engaged in meaningful work to understand the "why" and "how" of mathematics. Teachers plan for opportunities for students to collaborate as well as encourage students to explore the use of different tools and technologies (Walters et al., 2014). Students have numerous, focused activities that are designed to apply mathematics to real-world contexts (Hamilton, McCaffrey, Stecher, Klein, & Bugliari, 2003; Le et al., 2006).

In their study of secondary data from the Early Childhood Longitudinal Study, Palardy and Rumberger (2008) found teacher effectiveness in mathematics accounted for 25% of student achievement once they controlled for student input and class composition, which are out of the teacher's control. The average first grade student achievement gain was 0.75 standard deviation. The authors used that figure to then calculate the approximate student learning differentials. They found the student learning differentials could account for an approximate 33% gain in a school year. The point of these statistics is the potential long-term effect of highly effective teachers. The achievement gain of students assigned consistently to highly effective teachers who score two standard deviations above the mean "could easily exceed an entire grade level in a single year" (p. 127). The opposite is also true. Achievement gains of students who have had a series of ineffective teachers may be profoundly and negatively affected. This is an important consideration to teacher training programs. How often are pre-service teachers routinely engaging in research-based, effective teaching strategies?

In another study of 265 classroom observations, Gningue et al. (2013) found that teachers who consistently planned for high levels of student-centered and inquiry-based classroom activities and utilized more student-centered teaching practices tended to be more effective math teachers and have more highly engaged students in their classrooms. The authors measured effectiveness based on ratings of high, medium and low levels of engagement. Levels of high engagement over three semesters were recorded at 40%, 63.5% and 48%. The teacher who makes wise choices regarding classroom design and instructional strategies can optimize student learning (Marzano, Marzano & Pickering, 2003) even in a failing school (Haycock, 1998). As Darling-Hammond (2000) emphasized, teachers are the most important people in the classroom and what they do can make a tremendous difference in student achievement. One quality of an effective teacher is the ability to engage students to become active participants in their learning.

Examining the relationship between observed teaching behaviors and student engagement in middle and high school mathematics classes, Ikhlef and Knight (2013) investigated the relationship between instructional practices and student behaviors in Qatari schools in the early phases of implementation of a K-12 education reform. When the use of teaching behaviors associated with a student-centered approach to education was low, student off-task behavior increased in Grades 3 and 4 in both mathematics and science classrooms. In later phases of the Qatar education reform, Zellman et al. (2009) reported that students in schools whose teachers were more likely to rely upon student-centered instructional practices performed higher on achievement tasks in both mathematics and science. Transforming into an effective teacher is a time-intensive process. Pre-service teachers entering the field are still in the process of developing and honing their skills. Although they could benefit from knowing and practicing the qualities and strategies employed by effective teachers, actual data on what pre-service teachers *do* when teaching mathematics is lacking.

Available research conducted on pre-service teachers' teaching behaviors makes use of: self-report via questionnaires and interviews; analysis of student work, including classroom materials; and classroom observations. Analysis of student work and the specific assignments can reveal strengths or challenges in teacher conceptual understanding as well as an understanding of the teaching role. Self-reporting provides some useful information although the tools used can be biased. Classroom observations by mentor teachers may be more objective but still not data-driven (Brady & Bowd, 2006; Harding & Hbaci, 2015; Lake & Kelly, 2014; Martinez-Rizo, 2012). Examining the specific types of teaching behaviors used by teachers in Cycle 1 mathematics classes is beneficial for preparing pre-service teachers in the UAE.

Given the impact of ecological variables on students' mathematics engagement and achievement, teacher training colleges in the UAE should be ready to provide pre-service teachers with practice using research-based, effective, student-centered teaching strategies. How, then, can pre-service teachers' instructional practice be

evaluated? As measures of self-report are subject to bias, Hamilton et al. (2003) posit that multiple classroom observations, interviews and inspection of materials may serve as a better measure of instructional practice. Gargani and Strong (2014) investigated a more data-driven classroom teacher observation system using the Rapid Assessment of Teacher Effectiveness (RATE). Requiring four hours of training, observers can identify "effective teachers" in less than one hour. They observed teachers in Grades 3 through 8. Although a validated instrument, RATE was not used with children in early grades, nor has it been used as a tool for observation of pre-service teachers. In another study, Goklap (2016) piloted a pre-service teacher observation form for teaching competencies on 202 teacher candidates in Turkey. The data were collected through peer observation over 25 competencies using a Likert scale using terms, "completely adequate, adequate, partially adequate, inadequate and completely inadequate" (p. 505). It was unclear how peers were trained and no information on inter-observer reliability was mentioned in the article. Previous studies have varied in their approach to observation and recording of teacher or pre-service teacher behaviors. For this study, we chose a validated observation tool that has previously been used in observation (Woolsey, Kelly, Tennant & Rashad, 2016) and feedback for pre-service teachers (Roberson, Woolsey, Seabrooks, & Williams, 2004 a, b).

In studying the behaviors of pre-service teachers in mathematics, we collected data using the Mainstream Version–Code for Instructional Structure and Academic Response (MS-CISSAR) which has been used with pre-service teachers (Roberson et al., 2004a) and with students whose first language was not English (Roberson et al., 2004b). The MS-CISSAR tool is a validated ecobehavioral assessment (EBA) tool (Greenwood, Carta, Kamps, Terry & Delquadri, 1994). EBA tools are designed to capture the highly complex interactions of teachers and their students in various instructional environments (Pretti-Fronczak, McGough, Vlardy & Tankersley, 2006). An EBA tool can provide information for teachers and pre-service teachers about how much time they allocate to teaching in general and for teaching specific subjects. It also provides a picture of what teaching behaviors are used most often and when tasks are assigned that typically lead to higher achievement in student performance. This information can support pre-service teachers as they choose instructional strategies and learn to manage time allocated for specific subjects.

As pre-service teachers transition to full-time teachers in the schools, data from an EBA observation can be used to identify teaching behaviors that typically lead to student achievement and teaching behaviors that could be changed to increase the potential for student success. The following research questions guided this study: (1) Which ecological arrangements and classroom tasks are used most often by pre-service teachers in mathematics Cycle 1 classes in Abu Dhabi? and (2) Which teacher behaviors are most frequently exhibited during mathematics classes?

2.Method

2.1Participants

At the time of the study, approximately 50 students were entering their final internship experience (pre-service teaching). The participants were recruited from this pool. Pre-service teachers began their internship experience with a three-week orientation. The first author met with the students during orientation, explained the purpose of the study, answered questions and distributed the information about the study. The information was printed in both English and Arabic. The information included the purpose of the study, how observations would occur, the names of the professors on the research team, and a consent form. Both the information form and the consent form emphasized that the research study would have no effect on their final evaluation or grade. After obtaining signed informed consent, nine pre-service teachers participated in the study and were observed during mathematics instruction. All of the pre-service teachers were fourth year students completing their final pre-service teaching internship.

2.2. Context of the Study

The pre-service teachers were enrolled at a teacher education college to obtain a 4-year Bachelor of Education (B.Ed.) degree. The program of study included courses on educational theories and pedagogies, content knowledge in English, mathematics, science, special education, and classroom management. Pre-service teachers enrolled in the eight semester B.Ed. program in Cycle 1 were required to take specific subject knowledge courses in mathematics such as: number theory and algebra; probability and statistics; geometry; and three pedagogy courses that detailed teaching approaches and assessment in learning. In addition to these courses, they were engaged in intensive practicum experiences. Emirati pre-service teachers are being prepared to teach English, mathematics and science curricula in the medium of English to second language learners. Arabic is their native language. Pre-service teachers who had completed all course work were placed in Cycle 1 (elementary) classrooms for an entire period of twelve weeks during their final semester of their program of study. Planning and teaching a variety of lessons were part of their teaching requirements. Faculty members, who were assigned as college supervisors, conducted the observations of pre-service teachers' teaching performance in Cycle 1 classrooms.

2.3 Description of the Classrooms

The nine pre-service teachers were placed at seven different schools throughout Abu Dhabi with a classroom mentor teacher who was a native speaker of English. All placements were in Cycle 1. Three pre-service teachers taught in Grade 1; three were assigned to Grade 2; and three to Grade 3. Out of the nine classrooms, three were male students-only classrooms, three were mixed gender classrooms, and three were female-student only classrooms**.** Class size ranged from 25 to 30 students. Classrooms were equipped with smart boards, white boards, textbooks, workbooks, reading materials, manipulatives, and flexible learning spaces. Students were UAE nationals. Although English was the medium of instruction in the classroom, students often spoke Arabic among their peers and sometimes with other adults who spoke Arabic. Students interacted with their classroom teacher in English. The students had diverse needs including being at-risk for school failure and identification of special needs.

2.4 Instrument

The data for this study were collected using the Mainstream Version–Code for Instructional Structure and Student Academic Response (MS-CISSAR) computer program. MS-CISSAR is a validated program developed at the Juniper Gardens Children's Project in Kansas, U.S.A. (Greenwood & Terry, 1994). The MS-CISSAR data collection program is one of three similar tools in the Ecobehavioral Assessment System Software (EBASS) package. Researchers employ the MS-CISSAR program when there may be students in the room who have special needs. The MS-CISSAR program runs on a 20-second momentary time sample. Data are collected at the end of each interval. Data collected at the end of the first 20-second interval are composed of ecological arrangements (setting, activity, task, classroom physical arrangement and instructional arrangement). Data collected at the end of the second 20-second interval include the recording of teacher behaviors (teacher definition, focus, approval/ neither/disapproval, teacher focus and where the teacher is located in the room). Data collected at the end of the final 20-second interval focused on student behaviors but in this specific study we could not access student participants. Data were collected on classroom ecology and teaching behaviors.

2.5 Procedure

Observations began in the third week of pre-service teachers' placements and continued through to the end of the twelfth week. Nine pre-service teachers worked with the observers to schedule all observations. When the observer entered the classroom she sat in an unobtrusive area, typically towards the back of the classroom where the pre-service teacher could be seen at all times. Each pre-service teacher was observed for one mathematics class. Data were collected using a Lenovo E10-30 netbook, Model 20424. Data were saved on the Lenovo netbooks and collected and saved on a Toshiba v73600-C 1TB external hard drive. Data were collected by three of the authors. Data coded incorrectly were noted on a record sheet. All incorrect data were re-coded by the first author.

2.6. Reliability

The first author completed and passed a three-day training in use of the MS-CISSAR software provided by a trainer from the Juniper Gardens Children's Project. This is her sixth study using MS-CISSAR software. There are 108 codes used in the MS-CISSAR program. Because we could not observe and record target student behaviors the observers learned and practiced only the codes for classroom ecology and teacher behaviors (73 codes). The categories of teacher verbal behaviors include Academics, Management and Discipline. Sub-categories include Command, Talk and Question. Since the vocal prosody of the pre-service teachers was not native, we combined some of the sub-categories to ensure fidelity of coding, following a similar pattern as Roberson et al. (2004b). Command Academic and Talk Academic were combined and coded as Talk Academic. Command Management and Question Management were combined and coded as Talk Management. Command Discipline and Question Discipline were coded as Talk Discipline. We therefore coded Talk Academic, Talk Management and Talk Discipline.

Observer training consisted of four phases. During phase 1, each observer memorized the codes and practiced with the software independently. When observers felt competent in the definitions for the codes, they met with the first author. In phase 2, the observer used the MS-CISSAR program to record data from classroom scenarios that were described by the first author. Although only four keys and a space bar are required for coding, developing fluency takes time. Scenarios included what was happening in a classroom moment by moment. This phase allowed observers to look at the keyboard for practice, ask questions and stop coding for detailed answers. In the third phase of training, observers watched videos of classroom instruction. The observers were expected to be able to code with more fluency. Coders were also trained to write mistakes in coding on a record sheet and still maintain the timing for coding. The fourth phase of training consisted of in-situ observations of classrooms in a teacher training college in Abu Dhabi. Reliability was confirmed when agreement was reached for 90% or higher across the variables of Classroom Ecology and Teacher Behavior in two ten-minute sessions (range 90-

100%).

3. Results

This study investigated the teaching behaviors of nine pre-service teachers serving in seven different elementary schools in Abu Dhabi in Grades 1-3. Each pre-service teacher was observed teaching mathematics for one session. Mathematics was taught in the general education classroom. Two research questions guided this study.

3.1 Research Question 1

Which ecological arrangements and classroom tasks are used most often by pre-service teachers in mathematics Cycle 1 classes in Abu Dhabi? In the MS-CISSAR program, there are 51 codes for classroom ecology that are divided into five categories: Setting, Activity, Physical Arrangement, Instructional Grouping and Task.

3.1.1 Setting

There are 12 codes for Setting: Regular Class, Special Education, Resource Room, Library, Computer Lab, Music Room, Art Room, Gymnasium, Therapy Room, Hall, Auditorium or Other. In this study the pre-service teachers were observed teaching in general education classrooms, coded Regular Class.

3.1.2 Activity

There are 20 codes for Activity. Categories for Activity Codes specifically include: Reading, Math, Spelling, Handwriting, Language, Social Studies, Pre-vocational, Gross Motor, Daily Living, Self-Care, Arts and Crafts, Free Time, Business Management, Transitions, Music, Time Out, No Activity, Can't Tell, and Other.

In this study we looked at mathematics. Mathematics was the focus for 94% of the time. Transition to or from math class was recorded for 6% of the time. Forty-five minutes is the allocated time for math in Grades 1-3. The pre-service teachers followed the math curriculum outlined by the public school system. The pre-service teachers taught math for a total of 345 minutes (5.75 hours). Time for math instruction ranged from 23-49 minutes. Five classes lasted from 43-49 minutes. Four classes lasted 23, 26, 28 and 33 minutes respectively.

3.1.3 Physical Arrangement

The MS-CISSAR program makes a distinction between the physical arrangement of the classroom and the instructional arrangement. There are three codes for Physical Arrangement: Entire Group, Divided Group and Individual. When Entire Group is coded, students have one option for a place to learn, such as at their desks, in the classroom. The Cycle 1 school classrooms are typically arranged so there are optional places in the room for flexible seating such as a carpet area or stations. This is coded as Divided Group. Individual Group is coded only when the instruction involves tutoring by the teacher or pairs. In all of the classrooms in this study students learned in a divided group for 100% of the time.

3.1.4 Instructional Grouping

Because of the flexible room arrangement, the pre-service teachers could incorporate some variety in grouping students for math instruction. There are six codes for Instructional Grouping: Whole Class, Small Group, One-to-One, Independent, Multi-Media and No Instruction. The pre-service teachers taught using Whole Class instruction for 62% of the time. Students were assigned to small groups for 22% of the time. Independent work was assigned infrequently (8%). For another 8% of the time, no instruction occurred. See Figure 1.

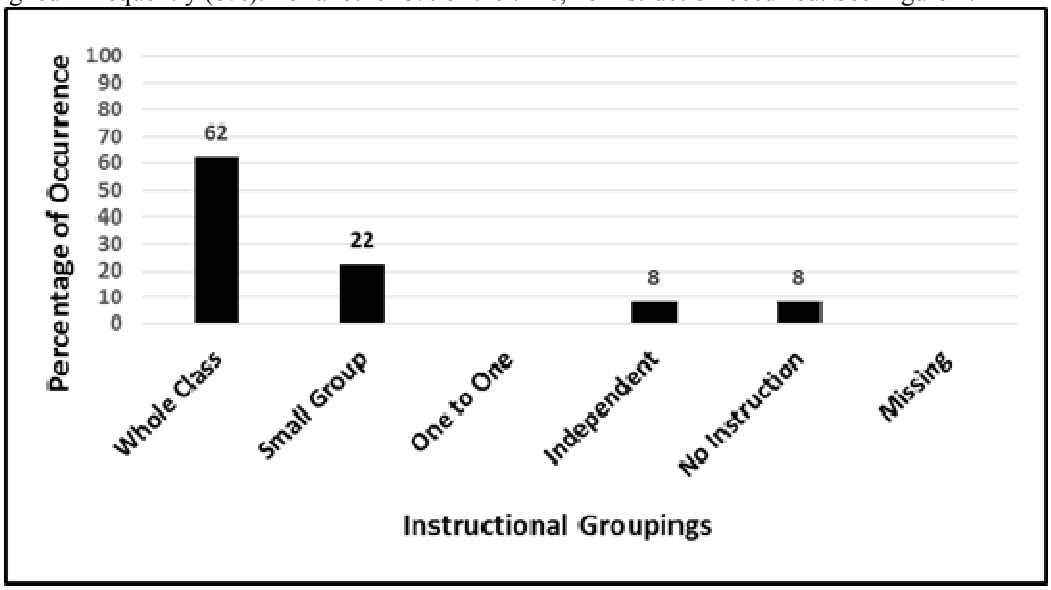

Figure 1: The mean percentage of occurrence of instructional groupings used by Emirati pre-service teachers in the mathematics classroom

3.1.5 Task

Tasks are assigned by the teacher. The tasks include: Readers, Workbooks, Worksheets, Paper & Pen, Listen to Lecture, Discussion, Other Media, Electronic Media, Fetch/Put, No Task and one column for missing data. The pre-service teachers relied on "Discussion" and "Other Media" for 32% and 31% of the time, respectively. Other tasks included Workbooks/Worksheet/Paper and Pen activities. Students engaged in those tasks for 19% of the instructional time. For 12% of the time, there was no task assigned to them. See Figure 2.

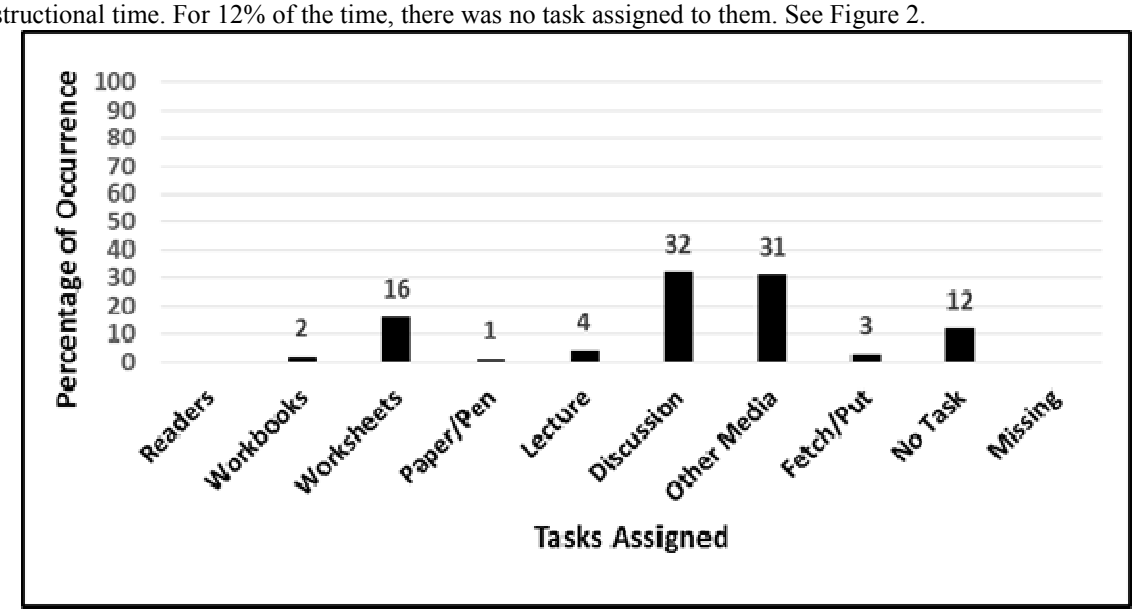

Figure 2: The mean percentage of occurrence of assigned tasks used by Emirati pre-service teachers in the mathematics classroom

3.2 Research Question 2

Which teacher behaviors are most frequently exhibited during mathematics classes?

There are five categories of Teacher Variables: Teacher Definition, Teacher Behavior, Teacher Approval, Teacher Focus and Teacher Position. Because Teacher Approval, Teacher Focus and Teacher Position are tied to student data, we collected data on Teacher Definition and Teacher Behaviors.

Teacher Definition includes nine different descriptions of the adults or peers who lead classroom instruction. In this study Student Teacher was the only code needed during data collection. None of the regular education teachers engaged with students during observations.

The MS-CISSAR program includes 12 categories for Teacher Behaviors and one category for missing data. The categories include: Question Academic, Question Management, Question Discipline, Talk Academic, Talk Management, Talk Discipline, Talk Non-Academic, Non-Verbal Prompt, Attention, Read Aloud, Singing, No Response, and missing data. We combined Question Management and Talk Management, coding it as Talk Management. Similarly, we coded Question Discipline and Talk Discipline as Talk Discipline.

The pre-service teachers talked about academics (i.e., mathematics) for 30% of their instructional time. Questions were asked for 16% of the time. For 15% of the class time, the pre-service teachers engaged in "Talk Management". For example, pre-service teachers told students to come to the carpet, or retrieve their pencils, gather other materials or perform a task that was not directly related to engaged learning. The pre-service teachers paid attention to students for 13% of the time and used non-verbal prompts for 8% of the time. The pre-service teachers had "No Response" for 10% of the time. "No Response" does not reflect negatively on the teachers. It means that at the time of coding, the teacher was not responding to any student. For example, when the students are working in small groups, the teacher walks around the room and remains available to the students. See Figure 3.

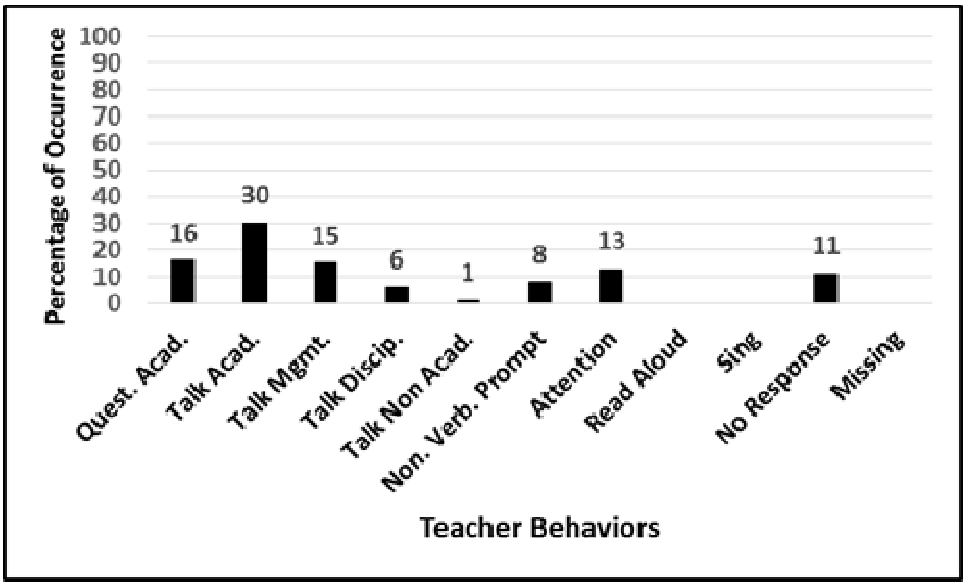

Figure 3: The mean percentage of occurrence of teacher behaviors used by Emirati pre-service teachers in the mathematics classroom

4. Limitations

Participants in this study were a convenience sample of pre-service teachers from a teacher education college in Abu Dhabi, UAE, which limits generalizability. The MS-CISSAR software requires a coder in the room, therefore, there was a possibility of reactivity on the part of the pre-service teacher. The inter-observer agreement sessions were conducted at the college and not in-situ since no student behaviors were recorded for this study.

5. Discussion

This is the first study to conduct an ecobehavioral assessment of pre-service teachers' mathematics instruction in the Middle East. It is part of a larger study where the same authors also investigated the ecological arrangements and teaching behaviors of pre-service teachers during science instruction (Woolsey et al., 2016). Data collected on what preservice teachers actually *do* in the classroom, particularly in the UAE, can be an important contribution to the literature.

These data provide a snapshot of mathematics instruction by pre-service teachers transitioning to working full-time in Abu Dhabi public schools. This is important as it relates to two aspects of the vision for education in the UAE. First, developing human capital by increasing the number of qualified Emirati educators is pivotal to the country's progress. Second, there is an expectation that UAE students will score among the best in the world in international reading, mathematics and science exams (Prime Minister's Office, n.d.). To reach that goal, it is critical that new teachers join the teaching force more than ready to prepare young Emirati Nationals to compete and score among the top countries. They are on their way. In 2012, the Programme for International Student Assessment (PISA) scores for the average 15-year old student in the UAE was 434, which was below the Organization for Economic Co-operation and Development (OECD) average of 490. In the most recent PISA scores, the average 15-year-old student in the UAE scored 437 which ranked the country at 46 out of 70 (OECD, 2014). In order to improve dramatically, students in the UAE need effective teachers who can promote significant gains.

In this study, although pre-service teachers spent nearly half the allocated mathematics instruction time using academic talk and asking questions related to mathematics (30% and 16%, respectively), almost one quarter of instruction time was spent on behaviors that are not likely to be positively related to student achievement. Pre-service teachers in this study spent 15% of time talking about issues related to management of the classroom, and 6% of time talking about discipline. These data may reflect a need to help pre-service teachers "tighten up" their instructional plans and work on procedures that can lead to reductions in the need to discipline students. It may point to gaps in the pre-service teacher training program.

5.1 Ecological Arrangements

The instructional grouping arrangement used most by pre-service teachers in this study did not differ substantially from pre-service teachers in the other studies (Roberson et al., 2004a, b; Woolsey et al., 2016).

Despite differences in number of observations, pre-service teachers relied heavily on whole class instruction. Pre-service teachers in this study spent 62% of the time engaged in whole class instruction. In other studies, pre-service teachers taught the whole class for 59% and 59% respectively in Roberson et al. (2004a, b) and 51% of the time in Woolsey et al. (2016). Less time was spent, however, on student-centered instructional groupings that have been shown to have positive relationships with mathematics achievement (Cohen & Hill, 1998). Pre-service teachers in this study spent only 22% and 8% of class time utilizing small group and independent work, respectively. When the teacher relies on whole class instruction in mathematics, students can be involved, however, the opportunities for engagement in the lesson remain more limited. There are fewer chances to communicate mathematical reasoning. There are fewer chances to solve problems with a partner or alone. There are fewer opportunities to extend the lessons beyond rote application (Walters et al., 2014).

The types of tasks assigned by teachers can positively or negatively student math achievement. Palardy & Rumberger (2008) note a positive relationship between the use of worksheets and elementary student mathematics test scores. Pre-service teachers in this study assigned worksheets/workbooks for 19% of time. Pre-service teachers in the current study spent 32% of class time on discussion, a task which has been shown to facilitate student engagement in mathematics classes (Guarino et al., 2003). The use of other media in this study includes tasks such as manipulatives, interacting with PowerPoint, and the use of videos. While the MS-CISSAR tool was not used to differentiate between each of these categories, it is still notable that pre-service teachers spent 31% of class time assigning tasks involving other media. The use of manipulatives in elementary mathematics classroom is positively related to student mathematics achievement (Hamilton et al., 2003). Finally, students in the classroom spent 12% of their instructional time with no task assigned to them. This is a concern. In Abu Dhabi Schools, 45-minutes per day are allocated for mathematics. A 12% loss of time daily equals approximately 5-minutes per day. Over the course of 180 school days, 5-minutes per day is a loss of 20 math classes per year. Becoming cognizant of planning for full lessons and ensuring the use of allocated time is an important skill for new teachers.

5.2 Teacher Behaviors

In this study, although pre-service teachers spent nearly half the allocated mathematics instruction time using academic talk and asking questions related to mathematics (30% and 16%, respectively), almost one quarter of instruction time was spent on behaviors that are not likely to be positively related to student achievement. Pre-service teachers in this study spent 15% of time talking about issues related to management of the classroom, and 6% of time talking about discipline. These data may reflect a need to help pre-service teachers "tighten up" their instructional plans and work on procedures that can lead to reductions in the need to discipline students. It may point to gaps in the pre-service teacher training program. See Table 1.

Table 1: Comparison of percentage (%) of time spent by pre-service teachers engaged in Talk Academic/Question Academic and Talk Management across four published studies

Items	Roberson et al. (2004a)	Roberson et al (2004b)	Woolsey et al. (2016)	Current Study
Talk Academic/ Question Academic	46%	43%	45%	46%
Talk Management	9%	8%	13%	15%

If student-centered learning requires teachers to focus more on individual learning through scaffolding, choices, differentiation and high levels of engagement (Walters et al., 2014), then teacher trainers may need to help pre-service teachers focus on the important spoken components of a lesson and learn how to allow students to take some of the control of their own learning.

According to Darling-Hammond (2000), the teacher is the most important person in the classroom. In her analysis of the effect of teachers on student achievement, Haycock (1998) found that even when the best teachers are placed in the worst performing schools, students can make achievement gains of more than 50% over one year's time while students entrusted to less effective teachers may make gains of merely 15% over one year. Simply put, what the teacher does in the classroom matters. In this study, although pre-service teachers spent nearly half the allocated mathematics instruction time using academic talk and asking questions related to mathematics (30% and 16%, respectively), almost 25% of instruction time was spent on teaching behaviors that are not likely to be positively related to student achievement. Pre-service teachers in this study spent 15% of time talking about issues related to management of the classroom, and 6% of time talking about discipline. These data may reflect a need to help pre-service teachers "tighten up" their instructional plans and work on procedures that can lead to reductions in the need to discipline students. It may point to gaps in the pre-service teacher training program.

6. Implications for Teacher Education Programs

Incorporating an EBA tool during early practicum and internship opportunities could provide a baseline for first-

time interns and serve as a measure of progress through student teaching. It provides data revealing what interns and student teachers are really "doing" in the classroom. Those data can show individual progress. The data also provide sound evidence for a portfolio.

Meeting with student teachers and comparing their data with the research-based suggestions on what effective teachers do in the classroom (e.g., Haycock, 1998; Parlady & Rumberger, 2008, Sahin & Adiguzel, 2014) can support a deeper understanding of the connections between allocated time, used time, and the long-term effects of unused classroom instructional time. Analysis of the pre-service teacher behaviors suggest that there needs to be a more serious and genuine dialogue between the pre-service teachers and the university college mentors about the ecological aspects as it relates to their teaching behaviors. It is suggested that the MS-CISSAR instrument be included as a tool that provides objective data analysis for their own self- reflection during their student teaching practice.

This study is a starting point for future research on how pre-service teachers who are working with second language learners implement their mathematics topic-specific lesson plans and how they engage their learners in new ways that enhance mathematical thinking and mathematical tasks.

7. Conclusion

The current study investigated the ecological arrangements and the teaching variables of a convenience sample of nine Emirati pre-service teachers during mathematics instruction in Cycle 1 (elementary) schools in Abu Dhabi, UAE. Although this was a small study, it is the first of its kind. As an initial study, it can contribute to the literature on pre-service mathematics teachers in the UAE, what they do, and how an EBA tool might support both pre-service teachers and their teacher trainers.

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