

TEACHERS PROFESSIONAL KNOWLEDGE BASED ON THE SEAMEO REGIONAL STANDARDS FOR MATHEMATICS TEACHERS: THE CASE OF CAGAYAN DE ORO CITY, PHILIPPINES

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ABSTRACT: *The Southeast Asian Ministers of Education Organization (SEAMEO) formulated the regional standards for mathematics teachers in the Southeast Asian region. The Philippines being a member country of this organization has implemented the enhanced basic education curriculum following the 12-year educational journey of Filipino students harmonizing with the educational system of the rest of the member countries in the ASEAN region. However, with this change in the educational landscape in the country, are the mathematics teachers competent based on the standards set by SEAMEO? This study aimed to examine the teaching quality of public secondary mathematics teachers in terms of their level of professional knowledge in Cagayan de Oro City based on the Southeast Asian Regional Standards for Mathematics Teachers (SEARS-MT). The 147 secondary mathematics teachers in the division answered the SEARS-MT professional knowledge dimension qualification checklist and data collected was analyzed using mean and standard deviation. Results revealed that despite these mathematics teachers have strong mathematics content and pedagogy, still, they need to improve this competency to be globally competitive. The researcher recommends that further study of the other dimensions of the SEARS-MT be conducted to assist teachers to become competent with the standards set by SEAMEO. Mutual agreements between SEAMEO member countries also need to be in place so that countries with low performance in mathematics in international comparisons like Program for International Students' Assessments (PISA) are assisted to realize the vision of the ASEAN economic community in 2025.*

Keywords: mathematics teachers' competence, SEAMEO Southeast Asian Regional Standards for Mathematics Teachers (SEARS-MT), professional knowledge, professional teaching and learning process, personal attributes, professional communities

1. INTRODUCTION

In order to promote cooperation in the development and enhancement of education, science and culture in the Southeast Asian region, the Southeast Asian Ministers of Education Organization (SEAMEO) was founded in 1965 and to address the goals of the organization, centers of excellence in every area was established. SEAMEO RECSAM being the center which will provide the needs of SEAMEO member countries in terms of the science and mathematics education, Southeast Asian Regional Standards for Mathematics Teachers was developed.

The Philippines being a member country of the SEAMEO, has made remarkable changes in its educational system with the implementation of the Republic Act No. 10533 otherwise known as the "Enhanced Basic Education Act of 2013". To successfully implement the goals of the government in making our students globally competitive, teachers also need to be very effective and efficient. Teaching competence would entail professional excellence, effective teaching methodologies; possess excellent personal and professional attributes and teacher involvement in the professional community. Various literature suggests that students' performance has a significant relationship with teacher competence in both content and pedagogy [1, 2, 3, 4]. When this is achieved, the goal of the educational system of the country would be very promising and assured student competence in the worldwide arena of work. This research would also be in compliance with the framework for mathematics teacher educators in the country presented by the Science Education Institute of the Department of Science and Technology (DOST) with the help of the Philippine Council for Mathematics Teacher Educators (MATHTED).

This research study would be primary since the implementation of the K to 12 curricula in the Philippines specifically in the Department of Education (DepEd) Division of Cagayan de Oro City. Research shows that teaching competence and teachers' professional development impact students learning, thus it is important to assess teachers' level of competence and preparedness to teach mathematics in the field and through professional development programs, mathematics teachers can be enriched and hone students with the skills needed in the global market. The results of this study would serve as a guide in structuring teacher education programs in in-service mathematics teacher preparation. Furthermore, in line with the university mandate, the Department of Mathematics Education of the College of Science and Technology Education (CSTE) would like to conduct extension activities with the teachers of the Department of Education in the division of CDO is the catch basin of the graduates of the secondary education mathematics program of the college. In order to determine what exactly they need of these mathematics teachers in the division, this research would like to measure teaching competence based on the existing standards used in the Southeast Asian region. This research would also validate if teacher training/workshops held and sponsored by the DepEd have been very effective in improving teaching competence most especially in the field of mathematics.

2. OBJECTIVE OF THE STUDY

This research study sought to determine the status of the quality of mathematics teacher competence as stipulated in the different dimensions in the Southeast Asian Regional Standards for Mathematics Teachers (SEARS-MT) created by the SEAMEO RECSAM. Specifically, mathematics teacher competence will be measured in the following dimensions:

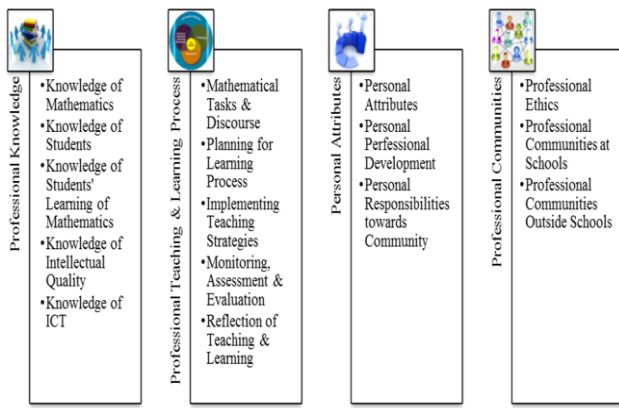


Figure 1: Southeast Asian Regional Standards for Mathematics Teachers Dimensions

3. LITERATURE REVIEW

This study examined the level of competence of secondary school mathematics teachers in Cagayan de Oro City division based on the standards set by SEAMEO. There is no ample amount of literature and studies related to the application SEARS-MT standards, however, there were a number of studies on teaching competencies based on their competence on their pedagogical content knowledge, subject matter knowledge or the technological pedagogical and content knowledge. However, one particular study which explored the SEARS-MT dimensions was the study undertaken to determine the impact of Lesson Study on Bulua National High School mathematics teachers' quality level in terms of SEARS-MT dimensions [5]. According to the study, the efficiency and effectiveness of the learning experience are dependent on the teacher quality, thus, enhancing teacher's quality is vital in improving the students learning the outcome. Moreover, the usual top-down one-shot cascading model practice for teachers' professional development in the Philippines has been observed to have much information dilution, and the Southeast Asian Ministers of Education Organization demanded the need to develop mathematics teachers' quality standards through the Southeast Asia Regional Standards for Mathematics Teachers (SEARS-MT), thus, an intensive, ongoing professional development model should be provided to teachers. She concluded in her study that Lesson Study effectively enhanced mathematics teachers' quality and promoted teachers' professional development. Teachers positively perceived Lesson Study to be beneficial for them to become a better mathematics teacher. The present study would attempt to provide secondary mathematics teachers baseline data on their level of mathematical competence as indicated in the SEARS-MT dimensions. The data that can be studied will be an instrument for the research group on what dimension the teachers perform higher or low so as to provide the appropriate training intervention. This research study would also propose a policy for the DepEd officials concerning the importance of this result and its implications to teacher quality in the division of Cagayan de Oro.

Another study that is directly connected to the present study was the study conducted to determine the mathematics teachers' professional knowledge and showing the discrepancy between the standards and the perception of

teachers. The study found out that teachers agreed on the importance and alignment of professional knowledge as stated in SEARS-MT but there was a discrepancy between the teacher's perception of the use of ICT in the teaching and learning process. They suggested that there should be more exposure for teachers and training to the ICT integration in mathematics teaching which includes the usage of software to assist students in solving mathematical problems [6].

Blömeke & Delaney made a review of studies on assessment of mathematics teacher knowledge across countries and they concluded that mathematics teacher knowledge has a crucial link between mathematics teacher education and student achievement in mathematics. In turn, teacher knowledge represents an important predictor of student achievement because a mathematics teachers' decision making in class is a function, among others, of her mathematical knowledge [7].

Ding & Leung believed that mathematics teachers' pedagogical content knowledge (PCK) and subject matter knowledge (SMK) are two important categories of mathematics teacher's professional knowledge. These two categories of knowledge have been found to interact with effective teaching. SMK is grounded in core teaching activities and influences teachers in making decisions about content-specific instruction, such as designing a task or posing a meaningful question for student exploration. In contrast, PCK is regarded as a tool or vehicle for teachers to deliver the content knowledge in their minds to pupils in a comprehensive manner. In their study, they found out that that teachers insufficient SMK might be one factor for undeveloped PCK. Therefore, more SMK courses are suggested for pre-service teacher education for enhancing their conceptual understanding on basic concepts in mathematics [8].

The result of the above study on PCK supported the result of the study of Kleickmann which concluded that PCK as teacher-specific knowledge about making the subject matter accessible to students is one of the most influential teacher factors for classroom quality and students' learning progress. From the perspective of teacher education, the relevance of PCK for educational practice directly leads to the question of the formation of teachers' PCK [9].

Aclan and Luna determined the subject matter knowledge (SMK) of Grade-V Mathematics teachers and the influence of teachers' Mathematics Pedagogy Content Knowledge (MPCK) training on their pupils' achievement. They found out that the experimental group of teachers has significantly higher MPCK than those without training and pupils' achievement score is significantly higher than pupils under the teacher without training [1].

Tajudin, Saad & Chinnappan examined the interconnectivity among SMK, PCK and professional development (PD) with a view to better understanding the learning needs of a cohort of primary mathematics teachers. Results of their path analysis with SmartPLS indicated that the direct effect of SMK on PD was mediated via PCK. This data provide support for the claim that PD programs for future teachers of primary mathematics should be driven by a more nuanced understanding of the link between SMK and PCK [10].

Danisman & Tanisli explored the probability-related pedagogical content knowledge (PCK) of secondary school

mathematics teachers in terms of content knowledge, curriculum knowledge, student knowledge, and knowledge of teaching methods and strategies. Case study design, a qualitative research model, was used in the study, and the participants were three secondary school, mathematics teachers. Data collected via observations and semi-structured interviews were analyzed using a deductive approach. Their findings indicate that the PCK of these secondary school mathematics teachers about probability is insufficient; furthermore, teachers' beliefs were the most important factors impacting their PCK. In addition, one of the results is that professional experience has a partial effect on PCK [11].

Hine conducted a study which primarily investigated the self-perceptions of pre-service primary and secondary teachers enrolled in a mathematics education unit as they engage with and consolidate their mathematics content. The second aim of the study explored how these pre-service teachers understand and perceive their 'readiness' to undertake such a task, based on their recent tertiary training. Data were collected from participants through the exercise of pre-unit (Phase 1) and post-unit (Phase 2) surveys. Following the completion of Phase 1, participant self-reflections indicated varying degrees of readiness to teach mathematics to Upper Primary and Lower Secondary students. Less than half of the sampled participants asserted that they felt confident in teaching mathematics, and almost all participants stressed the need to strengthen both their content knowledge and pedagogical content knowledge [12].

The above studies explored the importance of SMK and PCK as major components of mathematics teachers' competence. Empirical evidence showed a strong relationship between mathematics teachers SMK and PCK and students' outcomes. This provides a motivation for the present study to study mathematics teachers' competence based on the SEARS-MT dimensions. This present study hoped that when the result of this study will be available, teacher training intervention will be conducted to improve teacher quality as well as students' classroom performance as well as the National Achievement Test (NAT) performance.

4. MATERIALS AND METHODS

This study employed a descriptive survey method. The main direction would be on assessing the mathematics teaches quality based on the standard set by SEAMEO. The mathematics teacher quality would be measured based on the validated SEARS-MT dimensions qualification checklist questionnaire. This survey questionnaire was validated by Lomibao with a reliability coefficient of 0.78 [5]. There are 147 public secondary mathematics teachers in the division of Cagayan de Oro City who acted as respondents of this study. This division is composed of 104 schools both from primary to senior high school. These schools were subdivided into four districts for easy supervision. The researchers secured permission from the Division Superintendent through the Mathematics Education Program Supervisor. In order to ensure 100% retrieval rate of the SEARS-MT survey questionnaire, the research group through the help of the education program supervisor in mathematics requested the division superintendent to issue a memorandum concerning the

conduct of the study. Teachers who would be part of this study would be given informed consent letter to ensure confidentiality of the identity of the respondents and that the results of this research would not in any way discredit the respondents. The survey questionnaire would be answered by the teacher, a peer and the school principal. This is to guarantee triangulation of the feedback or the desired result of this study. The 147 mathematics teachers gathered in one venue in one of the extension programs sponsored by the Department of Mathematics Education of USTP and the research group took the opportunity to gather the data with the permission of the education supervisor and data collected was analyzed using mean and standard deviation.

5. RESULTS AND FINDINGS

The data collected in the survey was analyzed using mean and standard deviation and the analysis was done per dimension of the SEARS-MT. Table 1 below shows the result of the first dimension on teachers' professional knowledge.

Table 1. SEARS-MT Dimension 1 (Professional Knowledge of Teachers)

| Indicators | Mean | SD | Verbal Description |
|--|-------------|--------------|--------------------------|
| Knowledge of Mathematics | 4.07 | 0.578 | Very Satisfactory |
| Knowledge of Students' Learning of Mathematics | 3.88 | 0.610 | Very Satisfactory |
| Knowledge of Intellectual Quality | 3.74 | 0.623 | Very Satisfactory |
| Knowledge of ICT | 3.25 | 0.882 | Satisfactory |
| Overall | 3.73 | 0.673 | VERY SATISFACTORY |

Legend:

| Mean Interval | Verbal Description |
|---------------|--------------------|
| 4.50 – 5.00 | Excellent |
| 3.50 – 4.49 | Very Satisfactory |
| 2.50 – 3.49 | Satisfactory |
| 1.50 – 2.49 | Fair |
| 1.00 – 1.49 | Needs Improvement |

In terms of teachers' professional knowledge, knowledge on ICT was at the bottom which indicates that teachers' need to be trained well in terms of the use of ICT or integrating ICT in the classroom. According to the study of Dotong, De Castro & Dolot, in the Philippines computer resources are greatly overstretched but the use of technology is a burgeoning trend only in all higher education but has limited use in basic education [13]. This is true also in the division of Cagayan de Oro where schools in the hinterland or rural areas had scarcity of computer and internet resources. They further said that many secondary classroom teachers and academic administrators remain uncertain on how to implement new technologies to replace out-dated forms of classroom instruction. By relying on technology that is not completely understood [14], its potential benefits could be attenuated [15]. Some of the probable causes of educational technology integration in most developing countries are: inadequate financial support and infrastructure, human capital, management support, as well as behavioral and environmental aspects. There is electricity [16] and internet connectivity divide between rural and urban areas in some parts of the country.

Therefore, availability of electricity and internet connection in the rural areas are also one of the problems facing by the schools in the ICT use thus becomes a barrier in technology integration. Although, there were problems in the use of ICT tools in mathematics classroom and benefit its transformative potential, DepED is trying its best to develop the teachers as well as the learners to be gain access to quality and inclusive education. The department acknowledged the key role of ICT in improving the quality of education in the country. In fact, in the department order number 35 series of 2016, DepED recognized 21st century skills and ICT integration as a central figure of the K -12 Basic Education Program. Moreover, the Philippine Professional Standards for Teachers noted the ICT competency standard for teachers through the positive use of ICT, includes ICT in curriculum and planning and school-based professional development on ICT through Learning Action Cells (LAC) sessions must be conducted. Concrete examples of these projects which do not require teachers for traditional logistics and multiple materials are the launching of Learning Resource Management and Development System (LRMDS), a portal for online teaching and learning materials created by teachers and education partners, Text2Teach educational media which is a mobile application for teachers and students where science and mathematics lessons are shown through videos and the flipped classroom where students can learn the lesson even without the teacher present. These are evidences that the department is doing his part in fulfilling the vision where both teachers and students learn and through shared connectivity and innovative teaching methods with ICT integration in the classroom; teachers and school leaders can significantly increase the quality of learning in the public sector. As according to Lachica, ICT was viewed as a driver for change, a conduit or channel, a form of modern technology, and an instrument for effective teaching and learning. The divergent understanding of ICTs was due to its very pervasive presence in the society [17]. Public secondary school teachers' concepts of ICTs may hold true as to its use either personally or professionally.

6. CONCLUDING STATEMENTS

Preparedness in the new curriculum requires teachers to be content and pedagogically ready and this was manifested by the level of performance of mathematics teachers in the city of Cagayan de Oro in the SEARS-MT. Although these teachers are proficient in their level of professional knowledge but still they need to improve their level of competence in this area. Through the help of local government and the national government agencies, mathematics teachers would be equipped with skills needed in teaching the 21st century learners where creativity and critical problem solving skills is of prime importance to live in the present generation. Mutual agreements between SEAMEO member countries also needs to be in placed so that countries with low performance in mathematics in international comparisons like Program for International Students' Assessments (PISA) are assisted to realize the vision of the ASEAN economic community in 2025.

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