A MATH TEACHER'S PLIGHT ON CONSTRUCTING INSTRUCTIONAL MATERIALS: A CASE STUDY

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Abstract- The development and application of appropriate instructional materials is necessary. The gap in the availability and utilization of appropriate instructional materials adhering to Bruner's Constructivism, Dale's Cone of Experience, and Experiential Learning Theory makes a misalignment in the K to 12 Curriculum, thus fails in achieving learning competencies and assessment procedures. This research is a qualitative interpretative single-case study focused on the experiences of a math teacher on a low performing school as identified by the Department of Education, Division of Tacloban City, Philippines in the production and utilization of instructional materials. Research data were gathered through an intensive interview and analyzed by having three cycles of coding. Findings of the study revealed that there are plenty of factors affecting teacher, production and utilization of instructional materials, and students' academic performance. It is an eye-opener on the challenges and difficulties teachers face in everyday teaching.

Keywords- Instructional Materials, Interpretative Single-Case Study, K to 12 Curriculum, Mathematics.

I. INTRODUCTION

Designing instructional materials is one on the principles of effective instruction (Astleitner, 2005). According to Saad and Ibrahim (2017), instructional materials should be made available to schools, adequately supervised by principals, and efficiently utilized by the teacher for effective teaching and learning. Hoogyeld, Paas, and Jochems (2005) argue that teachers should undergo training to apply better an instructional systems design methodology. Teachers' use of instructional materials maybe influenced with their professional development. It has been observed that common practices are still evident, rarely the existence of dramatic change in instructional materials (Collopy, 2003). But Obara and Sloan (2010) found out that change in practice of teachers with regard to new standards would be difficult to achieve. Even if there is awareness and desire, teachers find it hard to embrace such changes. However, Harsono (2015) emphasized that teachers should develop his or her own teaching materials. Teachers should modify textbooks to suit activities for the target learners. Furthermore, the use of multiple materials in teaching mathematics is not evident. Teachers rely on single textbook and program. Thus, exposure to various activities is hindered (Banilower et al., 2013). Some teachers tend to use manipulatives to enhance previous knowledge and disregard the idea of using it to accommodate new learning (Banilower et al., 2013). It is important to take note that construction of instructional materials should be influenced by the learning outcomes (Khalil and Elkhider, 2016).

The implementation of curricular tasks is influenced by the teacher. Factors like content and pedagogical content knowledge, years of experience, and years of implementing a certain curriculum program would mediate the guidance offered to teachers in instructional materials (Styliandes, 2008). Also, mathematical knowledge for teaching and instructional materials are mediators for instructional quality. Instructional materials can reinforce learning that is engaging students in mathematical thinking and reasoning. Also, it could help low performing teachers in delivering high-quality instruction (Hill and Charalambous, 2012).

Teachers are bombarded with different things to consider for classroom activities and addressing students' needs and interest. It is then necessary to improve content and pedagogy by studying textbooks and teacher's guide and consulting peers for improvement that is following the curriculum design. However, students' ideas are being neglected if teachers will be following the chains in the teacher's guides in their work (Hemmi et al., 2013).

1.1. Issues and Concerns

Different uses of the resource led to different opportunities for student and teacher learning (Remillard and Bryans, 2004). Instructional materials can help teachers predict and analyze learners' interpretation to instructional activities. Curriculum materials could (1) support teachers' learning of subject matter, (2) help teachers consider ways to relate units during the year, (3) make a visual representation on the developers' pedagogical judgments, and (4) help teacher's technological pedagogical content knowledge to achieve productive instructional ends (Davis and Krajcik, 2005; Awolaju, 2016). Indeed, classes utilizing standard-based intructional materials perform better than with traditional programs (Harris et al., 2001). Use of research-based instructional materials and curriculum-professional development leads to better students' performance. These findings are supported by other researches (August et al., 2014; Domitrovich et al., 2009 cited by Taylor et al., 2015).

It is expected that these instructional materials are aligned to the new standards. Studies found out that there is curriculum misalignment in substantial areas

like the textbooks (Polikoff, 2015). Contextualized textbooks are important in solving context-based tasks however there is a need in improving the activities that promotes real life contexts (Wjjaya, van den Heuvel-Panhuizan, and Doorman, 2015). They provide aid and support to students' learning. But there is insufficient evidence of the effectiveness of textbooks due to limitations on contextualized experiences students can have (Elsaleh, 2010). Furthermore, inadequate instructional materials and resources available across subject areas is evident (Okobia, 2011).

Taylor et al. (2015) found out that research-based instructional materials improves teaching practice. Teaching practice is associated with the inherent features of instructional materials for students. Matarazzo, Durik, and Delaney (2010) found out that visually-stimulating instructional materials give greater task interest to students with low individual interest in math. Students who are highly motivated to think deeply about the lecture perform better than less motivated counterparts (Bolkan, Goodboy, and Kelsey, 2016). With regard to achieving learning outcomes with the use of sophisticated calculators, schools have a difficulty in providing such authentic experience. Students are expected to bring their own calculators (Banilower et al., 2013).

The K to 12 conceptual framework emphasized the use of appropriate tools such as manipulative objects, measuring devices, calculators and computers, smartphones and tablet PCs, and the Internet. According to Cayton-Hodges, Feng, and Pan (2015), there are four areas to review in using Mathematics apps designed for tablets, namely, the quality of mathematical content, feedback and scaffolding, richness of interactions, and adaptability of applications.

Teaching is now confronted in designing instructional materials with the use of technology to enhance learning (Kali, McKenney, and Sagy, 2015). Digital educational materials can provide activities in achieving better learning outcomes. It also helps teachers in designing learning content and choosing effective materials (Chiu and Churchill, 2015). Computer-assisted instruction programs are also effective in achieving learning outcomes. Schools using computer-assisted instruction programs have better educational attainments than those that frequently use it (De Witte, Haelermans, and Rogge, 2015). Electronic educational resources improve competitiveness of students (Anisimova and Krasnova, 2015). Computer technology allowing the use of sensory-motor perceptions help achieve numerical and arithmetical competencies (Moeller et al., 2015). Study shows that publisher-generated educational resources with instructor-generated video lectures improve students' performance (Hegeman, 2015). Video presentations are more effective than the print-based instructional materials in learning practical skills and craftsmanship among distant learners (Donkor, 2010). Arbain and Shukor (2015) found out that the use of GeoGebra software on Mathematics learning is effective. It provides positive perception towards learning. Furthermore, students show better learning achievement. And, there is higher motivational effect of Iphone games than classroom lessons. With regards to motivational outcomes, children found Iphone games more satisfying than classroom lessons. With this, digital games could be a tool to reinforce student's learning (Furió et al.,2015).

1.2. The Research Problem

With the new standards set for educational programs, teachers are challenged to cope up with the 21st century skills, Philippines Professional Standards for Teachers, K to 12 Enhanced Basic Education Program, and the Department of Education Vision, Mission, Goals, and Objectives. Furthermore, it is expected that teaching-learning process should provide varied meaningful learning experiences to learners. And one of the things to look at is the production and utilization of appropriate instructional materials. However, it has been observed that the use of instructional materials are limited only to board works, that is the use of chalkboards, books, notebooks, and paper. It is a monotonous cycle of teaching that restricts learners' experiences. It is necessary that the development and utilization of instructional materials should be aligned with the conceptual framework of the curriculum. It should carter the twin goals of mathematics education-critical thinking and problem-solving. Thus, the researchers would like to answer the question "What are the issues and concerns of a math teacher in a low performing school with regard to the production and utilization instructional materials?"

1.3. Theoretical Framework

According to Jerome Bruner's Constructivism, learning is an active process. Learners create new ideas or concepts based on their current or previous knowledge (Bruner, 1985). This paved way to the three learning modes- enactive, iconic, and symbolic (Bruner, 1966). This learning theory in education emphasizes that learners have different cognitive representations. Dale (1969) adapted Bruner's (1946) classification system for modes of learning with his own categories (Molenda, 2003). Dale's cone of experience brought significant impact on how instructional materials are designed for learners (Dwyer, 2010). Concept development of learners can be represented by a cone of progression starting from concrete to abstract (Dale, 1946). It is then necessary to use variety of materials and medium in order to maximize the learning experience. Higher order thinking skills are necessary to develop that is with the aid of appropriate instructional materials. Teachers should attain balance, concrete and abstract, in facilitating effective and meaningful learning.

Experiential learning theory emphasized that concrete experience and abstract conceptualization are two

ways of grasping experience and reflective observation and active experimentation are ways to transform it (Kolb, 2012). By providing varied appropriate instructional materials, learning experience could be improved.

II. METHODOLOGY

1.4. Research Design

This research is a qualitative interpretative single-case study. This research aims to interpret the data by developing conceptual categories to support and challenge the assumptions regarding about the production and utilization of instructional materials. An empirical enquiry was conducted by interviewing the teacher that investigates a contemporary phenomenon on the development and use of instructional materials in the class in depth and within its real-life context. The researchers would like to describe the experiences, the real life contexts, of the teacher in developing and utilizing instructional materials in educative processes. This research followed three cycles of coding as suggested by Saldana (2009).

1.5. Data Collection

The researchers went to a secondary school, pre-identified as a low performing school, as suggested by the Department of Education, Division Office of Tacloban City. A math teacher was interviewed regarding about the issues and concerns in the production and utilization of instructional materials. The researchers have guide questions but interesting topics were entertained during the interview (Drever, 1995; Van Teijlingen, 2014). The researchers used a recorder as approved by the interviewee. Also, the researchers conducted field observation with regard to the classrooms. The teacher showed the existing instructional materials used in instruction and for other educative purposes to the researchers.

1.6. Data Analysis

To help explore the data in real-life environment and explain the complexities of the real life situation of the math teacher, the researcher used interpretative single-case study. Three cycles of coding were done using the interview transcript to develop conceptual categories (Saldana, 2009). The first cycle of coding includes initial coding, descriptive coding, In Vivo coding, process coding, and themeing the data. And the second cycle coding technique used is theoretical coding. Then it was followed by post-coding and pre-writing. For consistency of the coding manual and rules, analytic memos and an inter-coder agreement among researchers was conducted. This is to establish the truthfulness and trustworthiness as a requirement of an interpretative work. Improvements such as revisions on the codes, categories, and themes were evident to improve the consistency and meaningfulness of the result.

1.7. Ethical Considerations

The interview was not offensive and stressful to the participant. As much as possible the researchers ensured that the participant was satisfied and comfortable with the interview experience such that the participant would not feel distressed if asked to have an interview again. The researchers did not coerce the participant into answering the questions. The participant was informed prior to the interview with the informed consent approved by the principal, concurred by the supervisor, and noted by the superintendent of the Department of Education, Division of Tacloban City. Furthermore, the researchers protects the confidentiality or anonymity of the participant and the school. Identifiable information are safeguarded by the researchers.

1.8. Triangulation

To establish the validity of the data, aside from the teacher the peers were also asked regarding about the issues and concerns in developing and utilizing instructional materials. Furthermore, the teacher's classroom was checked and the existing instructional materials were shown. The researchers also looked at the background of the participant.

1.9. Reflexivity

Qualitative data analysis is dependent on the skills of the researchers. Thus, it is affected by the professional background and experiences of the researchers. The researchers are faculty members of Leyte Normal University, Tacloban City. It is mandated to provide higher professional and special instructions for special purposes and to promote research and extension services, advanced studies and progressive leadership in education and other related fields. Since the flagship of the institution is in education, the researchers finds it very critical, informative, and intriguing to conduct this study for a future extension program. Thus, as much as possible the researchers followed a systematic process in conducting this research to avoid biases and inconsistencies.

III. RESULT

The central/core category of this study is: Teacher as Organizer of Curriculum. It was found out that the production and utilization of instructional materials greatly rely on the teacher. Also, this supports the idea that teachers are the implementers of the curriculum.

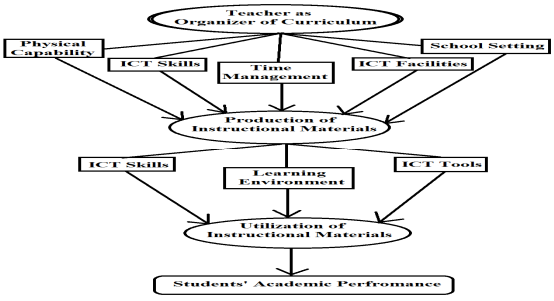

Figure 1. The diagram for the central/core category, Teacher as Organizer of the Curriculum, and its major processes.

Bombarded with different factors- physical capability, ICT skills, time management, ICT facilities, and school setting, the teacher struggles in the production of instructional materials.

"…that's it…we don't have rest…supposedly we can make better instructional materials."(P1, L14, P12)

"Dear! If just know...Statistics is my undergrad. I had supplemental teaching. I do not know about SPSS…"(P1, L13, P11)

"…time availability is the problem…" (P1, L14, P12)

"There are only two projectors. It should be one-is-to-one so that we will not be sharing. Me, I would stay away with that."(P1, L1, P10)

"…the principal provided printers…we will go to his office. But if it's raining. Sus! It's tiring especially if you don't have umbrella…there are three printers…that is, one printer for nineteen teachers…"(P1, L4, P4)

The challenge doesn't stop on the production but continues in the utilization of instructional materials. The researchers found out that the ICT skills of the teacher, the learning environment, and the ICT tools available makes it hard for the teacher to utilized varied instructional materials.

"Is it Geogebra you use in making a test? Basta! In making test.."(P1, L21, P11)

"…each student should have one computer so that they will be solving there…" (P1, L6, P8)

"Computer? We provide our own. I have my own."(P1, L15, P4)

The use of varied instructional materials is not evident. According to Oakes and Saunders (2004), this could lead to low performance of students. This is supported by the teacher.

"I have failed students. But what can I do? I only use manila papers with decorations…"(P1, L16, P5)

Also, the teacher is restricted with lecture-discussion. This only implies students are constrained. The learning experience of students can be greatly enhanced by introducing varied methods that complement learning materials and students' participation (Badenhorst, 2006).

"I use lecture-discussion most of the time…"(P1, L8, P8)

"…if I will not discuss, I will be wasting my time. Right?..."(P1, L24, P10)

"I have failed students. But what can I do? I only use manila papers with decorations…"(P1, L16, P5)

DISCUSSION AND CONCLUSION

Teachers should create varied instructional materials aligned with the conceptual framework of the curriculum. Thus, appropriate tools should be used. Research findings showed that the use of instructional materials support learning. It is then necessary to take this matter seriously for the betterment of the educational system.

As shown in the diagram, the factors concerning on the production of instructional materials makes it hard for the teacher to be efficient. Teachers that are overworked, sickly, primitive in terms of technology, unsupported, and in unsuitable condition would fail in producing varied instructional materials. However, the path shows that either some or all of the factors would be the flow of the struggle of the teacher. Likewise in the utilization of instructional materials, these factors would hinder the effectiveness of instruction thus affects students' academic performance.

It is evident that the factors greatly distress the production and utilization of instructional materials. Teachers should be given enough time in preparing instructional materials for their classes. This should be reflected in their teaching load. It's obvious to say that without an allotted time, production and utilization of varied instructional materials will be hard to achieve. And it is important to take note that without such materials, learning experiences will be restricted. Furthermore, teachers that are physically fatigue, emotionally overwhelmed, and not updated with the new trend would likely be unable to develop instructional materials that are consistent with the new demands and the learning outcomes. Teachers that are eager and motivated would likely find a way to develop varied instructional materials to support meaningful learning. But with the scarcity of resources, it's a problem to develop instructional materials. Also, it would be a burden for less creative teachers.

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