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TRANSFORMATIVE PROFESSIONAL DEVELOPMENT FOR MATHEMATICS TEACHERS

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Abstract

This paper was an attempt to redesign the current professional development training for Mathematics teachers in the Philippines. Mathematics teachers claimed that most training and seminars they attended ignored their local work context; was routinely and was hardly applicable to their classroom milieu. By utilizing the transformative professional development training, the teachers identified the classroom issues that had confronted them; restructured their useful pedagogical ideas and instructional plans and materials; implemented these in their classrooms; and shared their reflections on the new teaching experiences. Qualitative data were gathered from focus group discussions and key informant interviews. University researchers (3), secondary Mathematics teachers (28), and students (250) from four rural public schools in the Hamiguitan Range participated. The teachers and students revealed that their lack of self and environmental understanding were the prevalent issues that led to critical behavior in Mathematical cognition and learning. By applying the transformative education in the classroom, promising results like better teacher performance, improved students' interest, and maximized student participation were evident. This transformative professional development training adequately responded to the teachers' work needs and was recommended to other areas of learning.

Keywords: Pedagogical Ideas, Student Interest, Teacher Professional Development, Transformative Learning, Transformative Mathematics Education.

Abstrak

Artikel ini bertujuan untuk mendesain ulang pelatihan pengembangan profesional yang saat ini ada bagi guru matematika di Filipina. Para guru matematika mengklaim bahwa sebagian besar pelatihan dan seminar yang mereka hadiri mengabaikan konteks pekerjaan lokal mereka, sekadar menjadi kegiatan rutin, dan hampir tidak dapat diterapkan di lingkungan kelas mereka. Dengan memanfaatkan pelatihan pengembangan profesional transformatif, para guru mengidentifikasi masalah kelas yang telah mereka hadapi; merestrukturisasi gagasan pedagogis mereka yang bermanfaat, rencana, serta bahan pengajaran; menerapkannya di kelas; dan membagikan hasil refleksi mereka terhadap pengalaman mengajar yang baru. Data kualitatif dikumpulkan dari diskusi kelompok terpumpun dan wawancara informan kunci. Subjek yang terlibat dalam penelitian ini adalah tiga peneliti universitas, 28 guru matematika sekolah menengah, dan 250 siswa dari empat sekolah negeri di daerah Hamiguitan. Guru dan siswa mengungkapkan bahwa pemahaman terhadap diri dan lingkungan yang rendah menjadi penyebab utama rendahnya perilaku kognitif dalam pembelajaran matematika. Penerapan pendidikan transformatif di kelas menjanjikan hasil seperti kinerja guru yang lebih baik serta peningkatan minat siswa dan partisipasi siswa yang maksimal. Pelatihan pengembangan profesional transformatif ini menjadi jawaban yang memadai untuk kebutuhan pekerjaan guru dan direkomendasikan untuk bidang pembelajaran lainnya.

Kata kunci: Gagasan pedagogis, Minat siswa, Pembelajaran transformatif, Pendidikan matematika transformatif, Pengembangan profesional guru.

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The declining performance of the National Achievement Test (NAT) in mathematics in the Philippines (50.70% in 2005, 47.82% in 2006, and 46.37% in 2012) showed some inadequacy of mathematics education. This phenomenon was also supported with the results in the Trends in International Mathematics and Science Society 2003 (TIMMS) (Mullis, *et al.* 2004), wherein the

Philippines students scored below average in all areas of Mathematics Achievement Test and ranked fifth from the last out of 45 participating countries. This happened in spite of the country's series of large-scale reform efforts (Lomibao, 2016) on curriculum and instruction. These indeed suggest the need to improve mathematics education in the country.

One crucial aspect that needs improvement is the design and delivery of the Teacher Professional Development (Ganzer, 2000; Crowther, *et al.* 2002; Brookfield, 2005; Wenglinsky, 2001; Mizell, 2010; Tahir & Thien, 2013; Ekawati & Lin, 2014; Putri, *et al*. 2015). As teacher competencies are inadequate (Wenglinsky, 2001), there is also a need to restructure the current teacher professional development model in the Philippines and consider an alternative model that is potentially more inclusive and meaningful to teachers and eventually to students. Many teachers said that the training they attended ignored their local work context, and it tends to be merely a routine and hardly applicable to the teachers' classroom milieu. Attributed to such concerns is the traditional model of teacher professional development that is delivered ready-made to a mass of teachers (Putri, *et al*. 2015; Lowrie & Patahuddin, 2015). The model privileges only ‘expert knowledge' that teachers are required to receive during the training, while it ignores their own work needs and the opportunity to reflect and act on their values and beliefs critically. These reduce their role to be empowered, critical, and active recipient of instructions from seemingly authoritative speakers. So the teachers often find the training and workshops routine and irrelevant.

The teachers, together with the researchers as mentors, went through the transformative professional development actions and sought answers to the following objectives. First, to examine/identify the classroom issues that have usually confronted the Mathematics teachers as they examined their values and beliefs relevant to these issues. Second, to restructure pedagogical ideas, developed instructional plans and materials that they perceived would help address the issues. Third, to implement these plans in their classrooms. And fourth, to share reflections on their teaching experience before and after the training as manifested by their students.

METHOD

Research design

This unique transformative educational research utilized the qualitative inquiry by employing both the criticality and the interpretivism as paradigms (Taylor & Medina, 2013; Taylor, *et al*. 2012). This research is a qualitative inquiry because it gives qualitative answers to questions that this research hoped to obtain. The questions given to the teachers were triangulated by the students for verification purposes. For this reason, focus group discussions and key informant interviews were done.

Criticalism is a critical inquiry that was done by elevating the conscious awareness of teachers about established values and beliefs that underpin their seemingly natural teacher-centered classroom roles (Taylor, 2008). Practicing this process helps introduce critical theory (e.g., critical pedagogy,

cultural inclusiveness, social justice). Similarly, it helps stimulate teachers' creative thinking about designing curricula and assessment that are more student-centered, inquiry-oriented, culturally sensitive, community-oriented, and socially responsible (Taylor & Medina, 2013). Also, the interpretive inquiry makes teachers become reflective practitioners in developing and understanding the life-worlds of their students (Palmer, 1998). It involves a broader focal point on the social, political, historical and economic forces influencing the methods of teaching and learning, curriculum rules and schooling structures in which teachers are engrossed (Taylor & Medina, 2013).

The combination of these methods gives new literary genres, modes of thinking, and quality standards and becomes a compelling means for transformative professional development (Taylor, *et al.* 2012). The goal of our narrative inquiry in this research project is to engage others on critical self-awareness and critical understanding for them to develop a sense of urgency to act towards mathematics education hence writing for pedagogical thoughtfulness (Creswell & Garrett, 2008; Van Manen, 1990).

Perspectives and issues that emerged about mathematics teaching and learning, school ethos, and the professional development approach were described in Peter Charles S. Taylor's five ways of knowing in transformative learning: cultural-self knowing, relational knowing, critical knowing, visionary and ethical knowing, and knowing in action. Transformative learning is a theory of adult learning (Baldwin, 1996; Boyd & Meyers, 1998) that utilizes disorienting dilemmas to challenge students' thinking. Students are then encouraged to use critical thinking and questioning to consider if their underlying assumptions and beliefs about the world are accurate.

We focused on how the transformative education can be connected with the training on pedagogical ideas that we had and other relevant learning from workshops we attended before the project. We also theorized that in developing the mathematics education to become more relevant to the students and the teachers, the application of transformative learning and instruction to pedagogical ideas, different classroom activities and other related experiences be considered.

Research participants

We had university researchers (3), secondary mathematics teachers (28), and a good number of students (250) from four rural public schools in the Hamiguitan Range participated in a context-driven, action-oriented, inquiry-based teacher training and classroom-level applications. We had selected the region because of the availability of the environment that transformative learning would want to utilize. Moreover, we hoped to contribute to the preservation of one of the UNESCO Heritage sites utilizing Mathematics learning as a tool. The teachers (16) in the implementation of the program through classroom observations and assessments had volunteered, and they all agreed in the process.

Data collection, analysis, and tools

To ensure the credibility of this research, we spent three – day training workshop and three to six months of immersion in the field (school) by observing classroom instructions, mentoring teachers, and interviewing students in the aspects of transformative education. By using narrative

writing, we provided a rich and detailed account of what the participants did in the classroom. Similarly, the researchers prepared daily data logs to ensure that everything that transpired in the process was documented.

The whole process allowed the participants to learn deeply about their contexts by enabling them to write reflective journals on their past learning activities and their short life histories related to Mathematics learning as a proof of an educative and catalytic endeavor. We employed Key Informant Interviews (KII) by using both the vernacular and English and Focus Group Discussion (FGD) as means in acquiring additional information from the participants. We also utilized classroom observations. Similarly, student interviews were used to triangulate the teachers' responses to the questions given to them.

We also reflected on how their experiences resonate with our experiences as mathematics teachers. This allowed both the researchers and the participating teachers be engaged in understanding subjective realities (Willis, *et al.* 2006). Through following the experiences of our participating teachers, we came up with universal themes as to why mathematics education in the country did not intentionally educate our students towards lifelong learning (knowing in action).

RESULT AND DISCUSSION

Our conduct of the plenary (three days) via leveling the expectation as well as the articulation of aspirations and challenges (a meta-card group activity) led to identifying the teachers' visions/aspirations for their students, school, and for themselves through their stories. The plans of action of teachers were built logically from their own experiences. The participants were empowered to apply the concepts learned inside their classrooms, hoping that the delivery of transformative mathematics education could contribute to educational change.

The classroom issues

The mathematics teachers attested that the most prevalent issue in a mathematics classroom was the students' interest in learning. Teachers said that student interests were manifested in the classroom discussions where most students found difficulty in participating and sharing their ideas or opinions in mathematics. Teachers also connected students' interest with problems in understanding the relevance of mathematics in the real world, so when questions related to the lessons were asked, they found difficulty in answering. Moreover, students' interest arose when their students became lazy in making and submitting their assignments, and other paper works assigned to them. They all agreed that these classroom issues had caused poor learning retention.

The teachers also said that in the new K to 12 curriculum, the topics were difficult to explain and made students afraid even more of Mathematics. Teachers also made mention of their difficulty in establishing good relationships with their students. Finally, the teachers cited some school and environmental set-ups, the lack of facilities and pedagogical materials to help facilitate the discussion in mathematics more effectively and in return may accelerate student interest.

These manifestations of behaviors were verified when the researchers did random interviews with students. A good number of them said that in the classroom discussion, they experienced difficulty in sharing the concepts that they did not understand. In return, they couldn't interact with their teachers and classmates, felt bored, and developed negative feelings about the subject. They also said that when their teachers gave them assignments, they just copied their answers from their classmates. Moreover, they said that they just studied their lessons during examination times and forgot the lessons after.

The students said that their teachers were not making them realize the importance of mathematics in everyday living. They answered that their teachers discussed topics in Mathematics less appealing. However, they cited the role of the teacher in learning regarding attitude and behavior but noted that some mathematics teachers had problems with their personality. They also said that some teachers in mathematics had problems in imparting knowledge to the students. They also said and felt that some teachers couldn't create and develop an excellent critical discourse. The students also said that their teachers tried their best so hard in providing improvised materials and facilities and giving lively discussions. They said that their parents also showed some indifference towards the subject but most importantly, they narrated that poverty also made the subject less-interesting, costly, and difficult.

These classroom issues that had usually confronted the teachers and the students about learning mathematics was on student interest and learning retention – an indication of critical behaviors in mathematical cognition (Azmidar, *et al*. 2017; Khayati & Payan, 2014; Heinze, *et al*. 2005; Nyman, 2017). It had shown that the teachers failed to examine their values and beliefs critically and identifying the very nature of students' abilities attributed to low learning retention. Because of these, the students developed negative feelings on Mathematical cognition like indifference, lack of self-respect, neglect, and inattentiveness (Colomeischi & Colomeischi, 2015; Trezise & Reeve, 2018; Mata, *et al*. 2012). The results also highlighted some of the characteristics of teachers in Mathematics that were fully aware of their roles to their students inside and outside of the classrooms (Azmidar, *et al.* 2017; Khayati & Payan, 2014; Frenzel, *et al.* 2010; Lazarides & Ittel, 2013). Teacher's expectations, styles, and sufficient support may create a positive influence on learning mathematics (Cornelius-White, 2007; Prahmana & Suwasti, 2014). Also, the values and beliefs of the teachers and students to these issues were hoped to be addressed so that the teachers can improve their capabilities in imparting Mathematical knowledge (Brophy, 2000; Wentzel, 2002) as these were essential tools in the delivery of learning. Finally, the results revealed that effective communication was a factor in learning.

In transformative learning, there are two knowing that were essential in this discourse; the critical self-knowing and the relational knowing. The self-knowing or self-realization recognizes the culturally positioned selves, in particular. This is how these premises underpin the worldview – the shared values, beliefs, ideals, emotionality, and spirituality (Taylor, 2008). The researchers believed that the majority of the teachers had failed to identify the nature of their students. This was primarily because of the student to teacher ratio in the public schools and the number of teaching preparations. Relational knowing involves learning to connect empathically and compassionately with the true

(non-selfish) selves, the local community, the culturally different other, and the natural world (Taylor, 2008). The classroom issues confirmed that one of the many factors of student interest in Mathematics includes the social set-up, the family, and the school environments (Khayati & Payan, 2014). Also, the classroom environment helped influence both the emotional and cognitive dimensions of students in Mathematics (Watt, *et al*. 2017; Huetti, 2016). The transformative professional development training is a tool that starts with the assessment of the issues that confront the teachers and students in the academic exercise so that it can directly address the issues and suggest a solution.

Addressing the issues

The training had established an avenue for the participants to develop instructional materials in the classroom. The objective of the exercise was for the Mathematics teachers to enhance these instructional materials without distorting the DepEd K-12 curriculum competencies. The criteria given on the generated instructional materials and other pedagogical inputs were accuracy, appropriateness, identification of learning competency, as well as the alignment of learning competency and the activity. Upon completion, the researchers found out that most of the teachers had difficulty in connecting their teaching materials with the realities inside and outside the classroom, as these are factors that affect students' interest. Thus, the facilitators taught the teachers the transformative processes in making instructional materials through accuracy in drawing and making diagrams, appropriateness in giving definitions about angles and other shapes, aligning the learning competency (ultimate versus enabling) with the lessons presented, and the classroom activities (teaching-learning activity) that connects Mathematics to real-life situations. Then, we introduced transformative teaching strategies.

Most teachers admitted that they also lack new teaching strategies and that their pedagogical ideas inside the classroom were not updated. They found difficulty in applying Mathematics in the environment. The reason why students failed to be interested in Mathematics was that they did not understand its relevance in society. The pedagogical ideas like the "5E's and Metaphors of Learning", "Realistic Mathematics," and "Journaling" were shared, explained and demonstrated by the facilitators so that the teachers can be guided on its utilization inside the classroom. The five E's of learning talks about engaging, exploring, explaining, elaborating, and evaluating. The metaphors of learning by Sfard (2008) focus intensely on learning by acquisition, then learning by participation. It also embraces the commognitive (communication and cognition) framework of learning. Realistic Mathematics education makes the subject applied to the environment while journaling has something to do with communicating the solutions of mathematical problems using journal writing.

Moreover, aspirations and success stories gave flavor to the session. We also shared the "algebra walk," the "recipe Mathematics," and the "Mathematics jingle," which supplied energy to the tiring day. This sharing also addressed and articulated the common issues and concerns in the classroom setting.

Most researchers agreed that standardizing the classroom experience via dominant instructional approach with a tremendous amount of innovation is needed in the conduct of teaching (Garcia-Santillan, *et al.* 2016; Foley & Reveles, 2014; Mumu, *et al*. 2018). Specifically, they said that connecting the pedagogical ideas with the classroom experience is needed to gain student interest in Mathematics and help reduce anxiety in teaching and learning (Garcia-Santillan, *et al.* 2016). As students listen to teachers' aspirations and inspirational stories, it helps improve the Mathematics achievements of the students (Khattab, 2015) and teachers' beliefs, judgments, and a positive outlook in life bring a livelier classroom experience (Biesta, 2015).

In the realms of transformative learning, there is visionary and ethical knowing. Ethical knowing is an approach about views on teaching as a form of service. It goes beyond the understanding of the self and the environment and considers all actions that are deliberate and involve a decision of correct and incorrect (Taylor, 2008). The transformative professional development training is also a tool that when the issues are already addressed, a particular solution is offered and must be implemented.

Classroom implementation of transformative learning

There was a consensus among the Mathematics teachers as to who will try out the process of transformative learning in the classroom. Sixteen teachers accepted the invitation, seven from Compostela Valley, and nine from Davao del Norte. These teachers were teaching Mathematics in Grades 7, 8, and 9 in which the pedagogical ideas were embedded during the fourth grading period. Careful planning was made by the teachers and the researchers to make sure that students would benefit from these exercises. The mathematics classes adopted the transformative teaching and learning pedagogies employing the newly developed Instructional Materials.

We discussed among the volunteer teachers the procedures of classroom implementation, and they accepted the challenging points. We made critiquing about the teaching methodology, the pedagogical inputs, the students' response and reactions to these new inputs. As expected, the volunteer teachers were engaged in several activities in the classrooms that made Mathematics learning even more enjoyable. There was a lively discussion involving the teachers and the students.

Volunteer teachers realized that the application of transformative learning in the pedagogical inputs to the students accelerated, even more, their interest in the subject. The transformative learning incorporated in the discussion was about the teaching of Mathematics integrating the real-life situations and other related experiences. Some teachers had to incorporate dramatics in discussing functions specifically in the aspects of relationships were the millennials are very acquainted with. The teacher had to convert the lecture on direct, inverse and negligible relationships by allowing the students' real – life situations to become part and parcel of the drama. By doing these, the students can involve emotions in the discussion of functions which will become a lifelong learning. Some teachers also had to utilize kite flying while discussing angles and trigonometry. The students, as happier as they were, measured the angles made by the thread and their fingers then discuss in the

classroom the importance of angles to kite flying. The students' eagerness to comprehend the learning out the activity (specifically on slopes) was worth emulating. Some teachers also utilized games while discussing probability. Though the activities distorted time and class schedules, the teachers promised that mastery on the implementation will be studied and applied.

We had seen that the levels of students' interest were harnessed. It was not difficult for both the teachers and students to recall the processes of learning. Though the students' responses to the 'transformations of teachers' were varied. Some said that the classroom now was even enjoyable because of the diverse activities and different application to real-life situations presented by the teacher. The students' noticed that their participation was maximized, and they became empowered to perform the task given to them. Every time the teacher introduced a topic, they became interested in how this topic related to real-life situations. They enjoyed group dynamics and lively discussions. A good number of students said, "Before the discussion in Mathematics was very boring, the classroom was just an ordinary avenue for learning, the students were not so engaged in the activities but today, the learning was fun, and it was memorable and did not deviate from accuracy. The teaching was fun, the learning was fun, and it was just very fantastic." There were two weeks of classroom observations.

In each activity recorded, assessments were done. The students still had difficulty in the mastery of the concepts given but in terms of the narrative evaluation, they were able to explain the learning process without them knowing those. The researchers had to give credit to the metaphors of learning by Sfard (2008). This metaphor suggested that students must be able to first utilize the different senses in learning Mathematics. It is in the utilization of their senses that students developed understanding to certain concepts without their awareness. We had uncovered that several students cannot compute for the values of the unknowns in functions but was able to write the processes on how to solve those. In transformative learning, this is very critical especially on the practice of learning by acquisition. This practice involved those activities presented by the volunteer teachers, where the students tasted (cooking with Math), felt (dramatics in Math), touched (games in Math), smelled (cooking with Math), seen (kite flying) and heard (essay writing in Math) Mathematics. We had seen that when the students became familiar with the concepts presented, they undergo learning by participation. These metaphors of learning helped the students acquire knowledge through the development of skills and dexterities, as well as abilities. The transformative professional development training is also a tool that when solutions are offered, a reflection on the application is made.

Reflections on their teaching experience

Aside from assessing their capability to develop instructional materials and guides, the teacher participants were told to write a reflective journal about their experiences before and after the training. These were assured to become part of the assessment of the training, that is, the realization of the teachers to become critical on their journey of learning and be able to interpret the positive impact of this training to their students. Similarly, their reflective journals was for the Mathematics teachers to

explain the relevance of applying the transformative teaching and learning Mathematics without distorting the competencies featured in the K-12 curriculum.

A good number of teachers wrote, "This was the only training, in which we are actively participating. In many seminars we attended, we merely listened to the speakers. We, the participants, were often instructed immediately to do certain activities. We did not like to participate in those activities. We did not like to speak, either. We never expected that this training turned out to be distinctive. Our voice and expectations were recognized and heard. We are grateful to our trainers for choosing our school and ourselves for the conduct the training." Some teachers also wrote, "If only that we were allowed to participate in this type of training and application before; we would not have encountered difficulty in teaching Mathematics. The students appreciated our efforts, and we became empowered. What happened was an eye opener for us, allowing us to grow more."

Most teachers agreed that the application of transformative education to teaching and learning was one of the relevant lessons that they learned from those exercises. Moreover, they claimed that this training and seminar was within the radius of their local work contexts and was considered relevant in the classroom setting.

The researchers were amazed and fascinated by the responses of both the teachers and the students in the application of transformative learning. According to Sagor's (2005) research framework, the trainers are just "sage on the stage and guide on the side." This was what we wanted this training to give us – to empower teachers to become effective agents of change. We learned that once they were authorized, their creativity and resourcefulness became skills in carrying out their missions. The teachers requested to propagate this training and workshop in other schools, especially to those in the far-flung areas where human resources and facilities are limited. The short closing impressions about the sessions (informal group interview with the teacher-participants) made us aware of the critical points.

The changes that occurred in the implementation did not deviate from the existing K-12 teaching/learning guide of DepEd. The goal to increase the level of interest of students as well as to increase student learning retention was the banner of this paper. Conforming to the words of Mahatma Gandhi, 'we must become the change we want to see in the world,' the trainers believed that empowering Mathematics teachers would lead to producing empowered students to engage in lifelong learning. This training had applied the teachers' local work context in their classroom milieu. In the aspects of transformative education, these exercises knew in action. The transformative professional development training takes out all the positive effects of the solution to issues that affect the academic exercise as part and parcel of the learning process.

CONCLUSION

The most prevalent classroom issue that had usually confronted the Mathematics teachers as they examined their values and beliefs relevant to the issue was about low student interest. This level

of student interest results to difficulty in understanding mathematics, participating in the classroom discussion, making and submitting assignments, teacher and student relationship, environmental set-up as well as sharing their ideas in the classroom. In the long run, the level of retention of students' knowledge of the subject is deteriorating. Self-knowing and environmental knowing are important aspects of the practice of teaching and learning.

The restructuring the pedagogical ideas developed instructional plans and materials that they perceived would help address the issues had to be aligned with transformative learning. This was needed because of the difficulty of the Mathematics teachers to connect their teaching materials with the reality inside the classroom. The teachers admitted that they lack teaching strategies and that their pedagogical ideas inside the classroom are not updated. Thus, Mathematics turned out to be less appealing to the students.

The implementation of transformative learning in Mathematics to their classrooms was very promising. Most volunteer teachers said that the application of transformative learning in the pedagogical inputs to the students accelerated, even more, their interest in the subject. The transformative learning incorporated in the discussion was about the teaching of Mathematics integrating the real-life situations and other related experiences. This helped in addressing the students' interest and retention as it helped harnessed what they wanted to learn and do. It made the classroom learning even more challenging and enjoyable because of the diverse activities presented by the teacher. Student participation is maximized, and they become empowered to perform the task given to them.

The sharing of reflections on their teaching experience before and after the training proved the importance of transformative learning. The Mathematics teachers realized the relevance of the five aspects of knowing in transformative learning. The teachers were empowered, became authorized, creative, and resourceful. They wanted to propagate this training and workshop in other schools, especially to those in the far-flung areas where human resources and facilities are limited. Their willingness to be adaptive to change is the key. The benefits of transformative teacher development are enriching because it captures the systematic growth not only of a teacher but the students as well. Most importantly, it was proven that the five aspects of transformative learning develop and make both the teachers and the students become critical agents.

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