Mathematics Teachers' Pedagogical Beliefs and Practices: Does being '*Conventional or Constructivist* matter?'

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Abstract This study explored the pedagogical beliefs and classroom practices of mathematics teachers and determined whether their beliefs system and practices lean towards the conventional or constructivist pedagogy. It employed the mixed method design and stratified-purposive sampling procedure to identify the 20 participating schools that provided the 96 mathematics teacher-participants. Overall, math teachers held beliefs system and teaching practices that are combinations of both conventional and constructivist perspectives. However, when grouped accordingly, high school math teachers demonstrated classroom practices that leaned more to conventional approaches and are inconsistent with their pedagogical beliefs. Result suggests that math teachers' preparation for K to12 implementation through training seemed not enough to shift their pedagogical perspective to lean more towards constructivism view. Such would likely strain if not impede the effective implementation of K to12 program. Hence, continuous and periodic teacher trainings on how to design a constructivist learning environment are deemed essential.

Keywords: constructivism, mathematics, pedagogy, teachers' beliefs and practices, teaching and learning

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Introduction

Success of every educational reform depends largely on teachers' effective implementation of such reform in the classrooms. Teachers are the main agents in transforming the underpinning theories in each curricular reform into actual classroom practices. Classroom practices, correspondingly, are influenced by teachers' beliefs system (Mansour, 2009). The latter is considered in the literature as the mediating factor between theory and practice. Teachers' beliefs system then could either facilitate or hinder the effectiveness of any curricular reforms (Minarni, et al., 2018; Zakaria & Maat, 2012).

In the context of Philippine mathematics education mathematics teachers' beliefs are critical in the implementation of mathematics curricular reforms under the K to12 Enhanced Basic Education Curriculum. The country's new educational paradigm is grounded on the principle of *Constructivism* which posits that man learns by constructing knowledge and meaning from their experiences (Bada, 2015). But an emerging question remains, 'Are mathematics teachers in the Philippines adequately equipped with necessary knowledge, understanding, and pedagogical skills of the new educational framework so as to shift teachers' belief from being *conventional* (or traditional) to, *constructivist* perspective and influence classroom practices?

This study presupposed that pedagogical beliefs and classroom teaching practices of math teachers, whether they lean towards a conventional or constructivist view of mathematics education, could somehow impact the implementation of the proposed innovation in mathematics curriculum.

Conventional and Constructivist view of Mathematics Education

Conventional mathematics teaching and learning is associated with *traditional* mathematics instruction described by Guffin (2008) and *School Math Tradition* by Bernardo and Limjap (2012). It characterizes conventional mathematics as a learning process that emphasizes learners' rote-memorization of mathematical formulas, mastery of rules and procedures in solving problems, and hard drill-and–practice exercises, which are disconnected from the learners' culture and 'real-world' experiences. It mainly utilizes the board-lecture learning approach in a classroom that is very structured and teacher-controlled. The learners are considered as passive recipients of information that is content-based with exam-driven promotion.

In contrast, *constructivist* pedagogy can be associated with what Bernardo and Limjap (2012) described in their study as *Inquiry Math Tradition.* Constructivist teaching and learning employs democratic and inquiry approach allowing the learners to explore their own ways of solving problems, discuss, explain, argue, collaborate, and negotiate among their peers and teacher. Learners are encouraged to actively participate in knowledge construction and understanding of mathematical concepts based on their socio-cultural experiences (Bada, 2015; Komulainen & Natsheh, 2008). Constructivist learning environment is learner-centered with math teachers taking a different role of facilitating the learning process, and adopts an outcome-based promotion.

In this study, math teachers' beliefs system is said to lean towards conventional if one's pedagogical perspective about the goals of mathematics education and about the nature of effective teaching and learning activities are consistent with the traditional or the conventional view. That is, they are those who believe that rote-memorization of mathematical formulas and solving problems, which follow a step by step procedure are more effective than allowing the learners to generate their own solutions to the problem through inquiry approach. The use of lecture-board, pen and paper approaches are more evident in their classroom practices rather than learners engaging in collaborative and exploratory activities. Otherwise, math teachers' beliefs and practices are said to lean towards constructivist mathematics education.

To create a constructivist learning environment in the classroom, math teachers need to employ different teaching strategies that include inquiry approach, problem-solving and collaborative learning, reflective processes, exploratory and situated learning (Bada, 2015). The country's new educational framework largely relies on the ability of teachers to translate these learning theories into practice in their math classes. However, such requires the shift of their pedagogical views from being conventional to a constructivist perspective. This phenomenon poses a challenge among mathematics teachers in the field.

Challenges and Shifts in Mathematics Education

Among the reported primary reasons of students' *failures and difficulty* in mathematics include: (1) mathematics teachers' inappropriate and ineffective teaching approaches (Anchor, et al., 2009), and (2) mathematics curricula, which overemphasize rote-learning, memorization rather than the understanding of concepts (Saritas & Akdemir, 2009; UNESCO, 2012). In fact, Dagar and Yadav (2016) supported this report when they pointed out that "the most important challenges to pedagogy are developing curricula and teaching methods…"(p. 4). The present curricular reform in the country calls for a pedagogical shift of teachers' conventional teaching approaches to be coherent to constructivism principle of teaching and learning.

Relatively, literature reviews provide extensive discussions stressing the positive gains of pedagogical shift to constructivism as the present educational philosophy

(Bada, 2015; Minarni, et al., 2018). These were upheld by empirical studies showing the advantages of constructivist over the traditional or conventional approach in enhancing the learners' understanding and classroom achievement (Fernando & Marikar, 2017; Samsudin, et al., 2016). Despite these evidences, teachers still find difficulty concretizing the abstract constructivism principle into classroom practice. Some mediating factors seem to inhibit teachers' pedagogical shift from conventional to constructivist. Mansour (2009) emphasizes that one of these mediating factors is the teachers' beliefs system. He pointed out 'that beliefs of many teachers may need to be changed to achieve broader implementation of strategies that are coherent with constructivist philosophy.'

Mathematics Teachers' Beliefs and Practices

Teachers hold varied beliefs system about the nature of mathematics, beliefs in how mathematics can be effectively taught in classrooms, and beliefs in learning mathematics. Sometimes teachers' beliefs system does not agree with the theories underpinning educational reform. Internal and external factors are seen to have contributed to the contradictions. In fact, Mansour (2009) identified the internal factors to include teachers' life experiences of being a student of board-lecture teaching approach or an apprentice who is exposed to the same structured instruction. He considered life experience as the strongest factor in shaping teachers' beliefs. Association with a person who served as teacher model and attendance to seminars could shape mathematics teachers' belief system as well. External factors influencing teachers' pedagogical beliefs include school's management, instructional policies, school's culture, school resources, family and the learners themselves (p. 43). Maxion (1996, in Mansour, 2009) argues that when these internal and external factors complement with teachers' beliefs, classroom practices and beliefs become consistent. But when these factors interfere, teachers' beliefs become inconsistent with their classroom practices. Additionally if teachers' beliefs are not aligned with their classroom practice, they inhibit student-centered learning and correspondingly, student achievement.

Many empirical studies (Minarni et al., 2018; Zakaria & Maat, 2012) showed the coherence between teachers' beliefs and instructional practices. These teachers' beliefs and practices correspondingly influenced learners' achievement. This is well established in the studies of Bernardo and Limjap (2012) who explored the beliefs and practices of mathematics teachers in some low-performing, average, and high-performing schools in Luzon. They found that beliefs of mathematics teachers in low-performing schools tend to lean towards the traditional or conventional perspective while those of math teachers in high-performing schools lean towards inquiry approach that is associated with constructivist pedagogy. These findings are not necessarily true among math teachers in Mindanao, particularly in Cabadbaran City, Agusan del Norte. The study site was purposively identified since the researcher has been teaching high school mathematics in the area for more than two decades. So far, there are no studies conducted exploring the pedagogical beliefs and practices of math teachers in Mindanao. With the implementation of RA 10533 otherwise known as Enhanced Basic Education Act of 2013, alignment of teachers' pedagogical beliefs and teaching practices to the constructivism framework of the new curriculum is deemed necessary.

Purpose of the Research

The study primarily aimed to explore mathematics teachers' beliefs system with respect to goals of mathematics education, about the nature of effective mathematics teaching and effective learning activities. It tried to examine if the math teachers' beliefs system complements with their classroom practices and whether their beliefs system and practices lean towards conventional or constructivist perspectives of teaching and learning. Moreover, the study tried to look into the coherence between teachers' professed teaching practice and the observed classroom practices. It also attempted to gain understanding of the nature of their beliefs system and its implications in the implementation of the new education framework. Results of this study are deemed beneficial to the people in the academe-teachers, administrators, national leaders and indirectly to students and stakeholders. Education leaders may use the result of this study to forge decision-making initiatives, policies and programs necessary to specifically address the training needs of mathematics teachers in the field with respect to pedagogy consistent to the underpinning theories of the present educational paradigm.

Methodology

Research Design

The study adopted a mixed method research design and the triangulation method to verify the data. A stratified-purposive sampling design identified the participating schools all over Schools Division of Cabadbaran City, Agusan del Norte. Considering the topographical challenge, schools were grouped into: *upland, lowland, along highway, coastal, and city proper or Poblacion.* The researcher considered at least two schools from each group based on student population and number of math teachers who are really math majors.

Participants

Thirteen (13) out of the total 23 public elementary schools and seven out of the total 10 high schools (including private schools) participated in the survey. One hundred one (101) teachers from the participating schools provided information on math teachers' pedagogical beliefs and professed classroom practices. However, only 96 of these teachers provided complete data that were useful in the analysis. Thirty-four of these teacher-participants gave their consent to be observed in their math class and be interviewed thereafter. Previous negative experiences of some mathematics teachers on classroom observation, mostly with their supervisors, made them reluctant to participate and become the subject of classroom observation in this study.

About 63% of the sample has an age range from 30 to 49 years old and generally were experienced mathematics teachers (Figure 1). Participants in the study were grouped according to clusters: *primary* or *Cluster 1* were math teachers in Kindergarten to grade 2 (K-Gr2); *elementary* or *Cluster 2* were those handling grades 3 to 6 (Gr3-Gr6); and, math teachers in junior *high school* were grouped as *Cluster 3*. When grouped accordingly (Figure 2), Cluster 2 or math teachers in Grades 3 to 6 comprised the majority of the participants (45.8%).

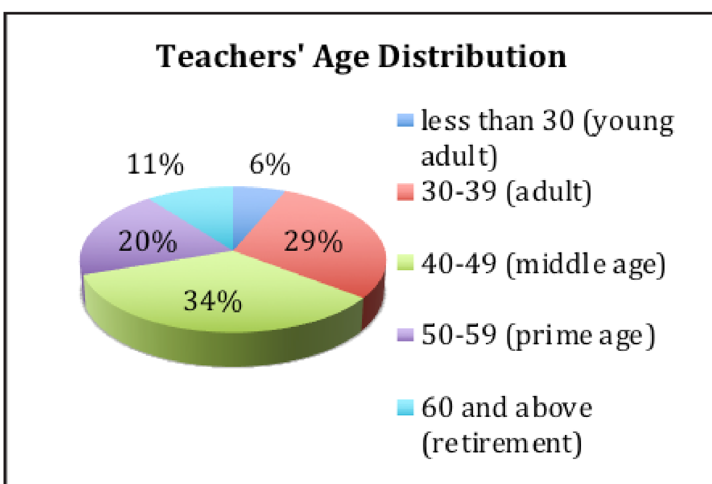


Figure 1. Distribution of Cabadbaran math teachers according to age.

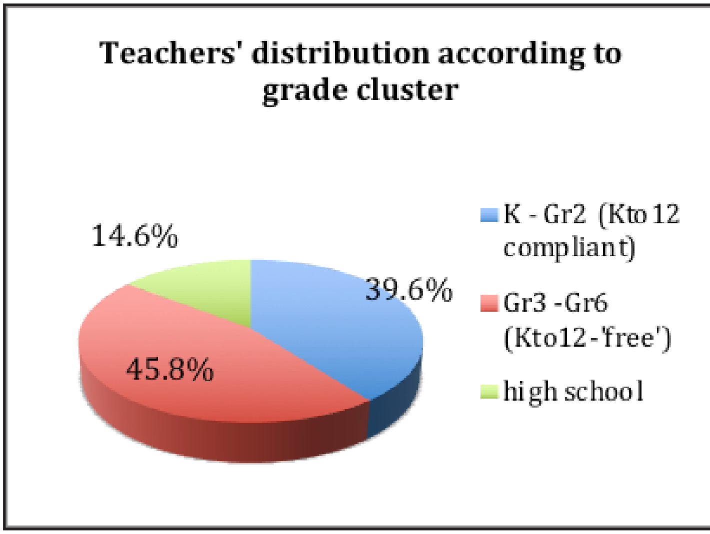


Figure 2. Distribution of math teachers according to grade cluster.

Participants who agreed as subjects during class observation included 13 math teachers in cluster 1; 13 math teachers in cluster 2; and, 8 high school math teachers in cluster 3. The reason for viewing the data by grade clusters was the fact that during the data gathering process, the Kto12 program of the Department of Education or DepEd was in full implementation for grades 1 and 2, as well as, in grades 7 and 8. Given the fact, Cabadbaran teachers handling Math in these grade levels, presumably, would likely lean to a constructivist view of mathematics teaching and learning rather than being conventional. These teachers, in the above-mentioned grade levels, presumably had attended seminars launched by DedEd prior to the implementation of the program. Hence, teachers assigned to teach math in these levels must have gained enough background on constructivism principle of learning. Educational leaders expected them to be implementing constructivism teaching and learning approaches in their math classes.

Instruments

Mathematics teachers' pedagogical beliefs and preferred teaching practices were established using the instrument, ***Cabadbaran Mathematics Teachers Pedagogical Beliefs and Practices Survey*** (***CMT-PBPS)***, that was adapted from 'Revised Teaching Beliefs Questionnaire' of Villena (2004). This instrument includes 42 items, (five-point) Likert scale-questionnaire. It consisted of four major components that aimed to extract information on teachers' (a) beliefs about goals of mathematics education (10 items); (b) beliefs on the nature of effective mathematics teaching (12 items); (c) beliefs on effective learning activities in mathematics (12 items); and, (d) self-professed teaching practices in the field (8 items). Half of the items in each dimension indicated the *conventional beliefs of mathematics education* and the other half indicated the *constructivist view of mathematics teaching and learning*. Experts in the field validated the instrument as to content, construct, readability, and structure. The conduct of pilot testing further established the validity of the survey tool. Using Cronbach's alpha coefficient (α), reliability analysis of the instrument by subscales yielded values ranging from .75 to .91

Guide for Classroom Observation (GCO) established the ratings of math teachers' teaching practice. The researcher adopted the instrument from Villena's (2004) GCO is a two-column checklist such that each column consists 30 observable activities and items that math teachers in basic education usually do from the time their math class begins until it ends. The first column indicates the practices of conventional teachers and the second column indicates those in a constructivist learning environment. GCO adopts the following rating scale: 1- if the practice leans towards conventional, that is, conventional approaches of teaching mathematics are clearly observed and dominant in the whole class duration; 3- if constructivist teaching strategies are largely observed in the classroom;

and 2- if the teaching practice is a clear combination of both conventional and constructivist approaches. Experts' correction and pilot testing established the validity of the tool. Reliability test using Cronbach's Alpha indicated an adequate (α=.96) internal consistency of the scale.

Data Collection and Analysis

The researcher sought permission from the office of the division superintendent. School principals/heads of the identified participating schools also received a similar request with attached copy of the approval from the division superintendent to administer the questionnaire. The researcher personally handed in the letters requesting permission to undertake the survey, observe math classes and subsequently interview those who consented as subjects. The school principals/heads determined who and how many teacher-participants would be involved in the survey. They also identified the date when to conduct the survey and the classroom observation. During the initial meeting, the researcher briefed the respondents as to the nature, scope, and purpose of the survey. Such provided the participants the opportunity to clarify some points in the instrument and the extent of information required. Likewise, it gave the researcher the chance to specifically address their queries that helped in minimizing their hesitation to be part in the study. The researcher left copies of the questionnaire equivalent to the number of math teacher-participants with the principal or with the school's trusted personnel. The filled copies of the survey tool were retrieved after a week or two from the initial meeting.

Prior to class observation, a preliminary meeting oriented the math teachers who consented to be observed on the purpose of the observation, its extent, and the mechanics of the observation. The meeting highlighted the importance of the teacher-participant to use his/her most common approach in teaching mathematics. It also provided the teacher-participants the opportunity to raise their concerns and apprehensions. Addressing their issues prior to the conduct of classroom observation seemed to lessen their hesitations to participate in the study. Math teacher-participant determined the time and the math class to be observed. Topics for class observation followed those reflected in the third quarter of K to12 curriculum guide. Math teachers in elementary discussed topics on measurement while Junior High School math teachers discussed topics in Geometry.

The researcher conducted the observation by herself. After the class observation period, a brief interview with the teacher-participant subsequently followed. This is to clarify and validate some gray points in the observed data. With the permission of the teacher-participant, an audio-video recording captured the entire proceedings in addition to the field notes taken during the actual class observation. Both were used in reviewing the whole teaching and learning process and to verify the appropriateness of the observation rating given in each parameter before the data finalization and encoding in excel data sheet. Time constraints and conflict in work schedules rendered non- implementation of the follow up class observations not possible.

The study employed descriptive statistical tools and nonparametric tests (Kruskal –Wallis Test, Mann-Whitney U Test) to analyze the quantitative data obtained from surveys and classroom observations. It utilized nonparametric tests in the analysis of data based on the fact that the researcher purposively choose the participating schools based on their population. Correspondingly, the principals/heads of these participating schools purposely identified the teacher-participants based on their availability and willingness to be involved in the study. The study analyzed qualitative data obtained from interviews using qualitative data analysis techniques such as sorting, organizing and categorizing the data.

Results and Discussion

Results of data analysis and discussions are presented in this section according to the sequence of the objectives in the study.

Teachers' Pedagogical Beliefs

As shown in Figure 3, overall, Cabadbaran math teachers hold beliefs system as combination of both conventional and constructivist perspectives. Most of them agree that mathematics is best taught when teachers allow students to explore tasks and solutions to problems on their own. But at the same time, they also believe, that they need to demonstrate a detailed, step-by-step procedure on how students would go about every learning task. They generally agree that an effective learning process involves students engaging in a wide variety of tasks to discover their own solution to math problems. But at the same time, they also believe that effective math classes involve students engaging in constant and repeated practice to master important mathematical skills.

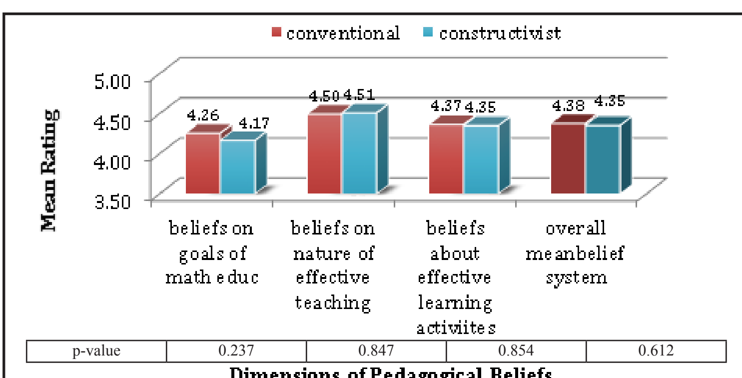


Figure 3. Extent of Cabadbaran math teachers' pedagogical beliefs across different dimensions.

Across the different dimensions of pedagogical beliefs, math teachers express a seemingly conventional perspective. For example, under the *goals of mathematics education,* math teachers rated the statement - '*students should be able to master mathematical facts, principles and algorithms'* – slightly higher, compared to the statement, '*students should be able to generate their own solution at the end of the class*'. Mann-Whitney U test (overall, $p=.612>.05$), however, indicates that there is no significant difference in teachers' pedagogical beliefs in mathematics education implying that mathematics teachers did gain some understanding of the constructivist pedagogical view. Yet, they still hold on to some of their conventional beliefs of how mathematics should be taught in the classroom. Math teachers are not fully convinced then that the constructivist approach of teaching mathematics is better in promoting students' understanding of mathematical concepts over the conventional approach.

During the interviews, math teachers expressed that educational leaders should not expect them to fully grasp the underlying concepts of constructivism philosophy after attending trainings in few occasions. They explicitly conveyed that they need periodic trainings focused on how to enact the constructivist learning strategies in classroom.

Apparently, the results in this study could be accounted to what Bernardo and Limjap (2012) emphasized as teachers' superficial, vague, and incomplete understanding of the progressive view or constructivist philosophy of teaching and learning. Some math teachers, though they had attended trainings and seminars for Kto12 implementation, may not have the full grasp of its constructivism framework. As a result, math teachers' vague and incomplete understanding of the constructivist philosophy may constrain them to effectively apply the appropriate teaching approaches consistent with the present educational framework. Worse, math teachers may tend to go back to conventional approaches, which they find more familiar and convenient to use. Such scenario will most likely impede the successful implementation of Kto12 program

(Minarni et al., 2018).

Professed Teaching Practice vs. Beliefs

In contrast to the result of teachers' pedagogical beliefs, Cabadbaran math teachers distinctly claim that they practice more of constructivist than conventional teaching and learning approaches in their math classes. Analysis (p=.027<.05) indicates a significant difference in their views as reflected in Figure 4.

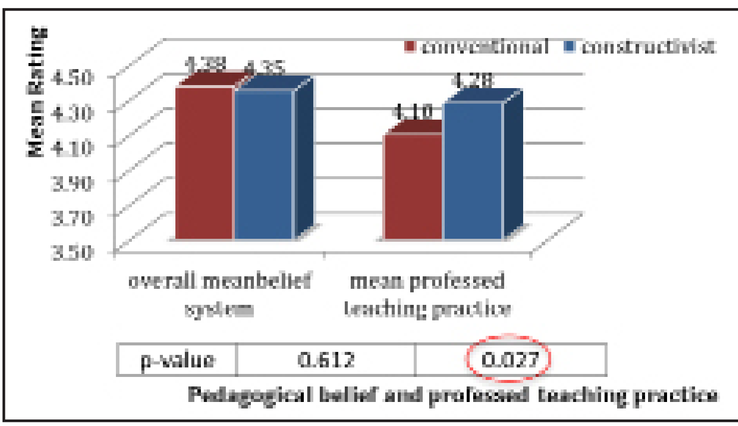


Figure 4. Math teachers' overall mean beliefs against mean professed teaching practice.

Cabadbaran math teachers rated the items indicating constructivist mathematics teaching practices significantly higher than those items indicating conventional teaching practices. For example the statement, '*I consider students' interests and preferences in planning my lessons*', was rated higher compared to the statement, " *I depend on textbooks and curriculum guide in preparing lessons, drills, and exercises in math*'. Teachers seem to have distinctly identified their teaching practices to lean more towards constructivist mathematics teaching rather than conventional. They seem to be convinced that the constructivist approach is better in promoting students' understanding of the concepts and far more effective than the conventional teaching practice.

Comparing math teachers' pedagogical beliefs overall mean against their mean *professed* teaching practice, Wilcoxon signed rank test (p=.00<.05) indicates enough evidence to suggest that the pedagogical beliefs of Cabadbaran math teachers significantly differ from their professed teaching practices in teaching mathematics. Professed teaching practice, in the study, refers to what the teachers claimed as their usual practices in their math classes. The result means that generally, the beliefs of math teachers about effective mathematics teaching and learning are significantly inconsistent with their professed classroom teaching practices. This finding concurs with that of Mansour (2009). Mean pedagogical beliefs of math teachers lies in-between conventional and constructivist while their claimed or professed teaching practice clearly lean towards constructivist perspective. Analysis by cluster further elaborates this finding.

Grouping the data accordingly, Figure 5 shows that, math teachers across clusters claim that they practice more of the constructivist teaching approach than conventional in their math classes.

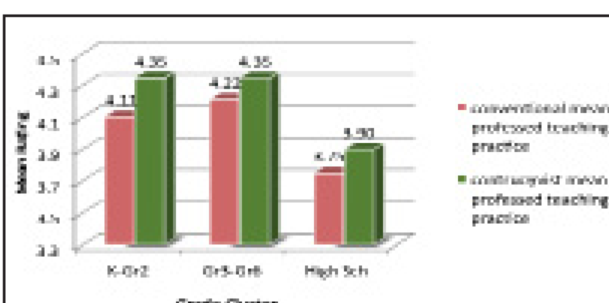


Figure 5. Mean ratings of math teachers' professed teaching practice according to grade cluster.

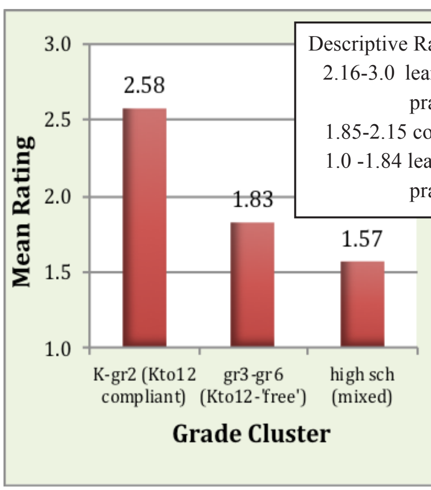
Data suggest that math teachers (in all clusters) can clearly distinguish the conventional math teaching practice from that of a constructivist. Teachers seem convinced that mathematics is learned best in a constructivist learning environment. That is, when they allow their learners to explore what they already know and what more they need to know. This result, however, is yet to be verified with the data drawn from actual classroom observations.

Teaching Practices Based on Classroom Observation

Analysis of data gathered during class observations suggest that, overall, math teachers demonstrate a combination of conventional and constructivist teaching practices with the mean rating of 2.09. When grouped accordingly, Figure 6 shows a more comprehensive view of the extent of variability in the teaching practices among math teachers in Cabadbaran City.

Mathematics teachers in Cluster 1 (Kindergarten to Gr2), generally practice the constructivist teaching approach. This result aligns with the math teachers' pedagogical beliefs and professed classroom practices. This finding is consistent with Zakaria and Maat's (2012) assertion. They reported that there exists a significant, moderate positive correlation between math teachers' teaching practice and pedagogical beliefs. Result implies that math teachers in Kindergarten through grade two are capable to translate their pedagogical beliefs into classroom practice that supports the K to 12 educational framework.

On the other hand, observed classroom practices of math teachers in Cluster 2 (grade 3 to grade 6) show seemingly a combination of both conventional and constructivist teaching approaches. Math teachers allow the students to work collaboratively in groups to solve math problems and let them explain their work. Such approach is associated with constructivist pedagogy. However, this comes only after the teacher has illustrated solving similar problems in detail following the step by step process. This means that the teaching practices of math teachers in Cluster 2 are consistent with their pedagogical beliefs but are inconsistent with their professed teaching practice. It is noted that some teachers in Cluster 2 (Grades 3 to Grade 6) have yet to undergo trainings in K to12 during the conduct of the study. Some teachers in Cluster 2 who had trainings in K to 12 are also made to teach mathematics in primary grade levels which may have caused teachers having pedagogical beliefs and classroom practices that are a combination of both conventional and constructivist approaches.



Descriptive Rating Scale:
2.16-3.0 leans towards constructivist teaching practice
1.85-2.15 combination of practices
1.0 -1.84 leans towards conventional teaching practice

Test Statistics[a,b]

	average
Chi-Square	13.861
df	1
Asymp. Sig.	.000

a. Kruskal Wallis Test
b. Grouping Variable: grade cluster

Figure 6. Mean ratings of teachers' teaching practices according to grade clusters based on Class Observations and interviews.

During the interview, some teachers stated that other assignments and in extra-curricular activities, such as being a coach in journalism, sports activities, scouting, and other administrative functions, took some of their time from their classes and pushed them to resort to conventional board-chalk approach and teacher-controlled learning environment. Such cases constraint them to perform activities with their math classes that may be more aligned to constructivist teaching and learning. For them, the former are easier means to cover the topics and competencies that they missed during their absence. This revelation quite explains the slight inconsistency of the professed teaching practices from the observed teaching practices of math teachers in Cluster 2. Result concurs with Kelly and Berthelsen (1995, in Mansour, 2009) who identified time pressures and non-teaching tasks among the constraints for teaching practices.

Disparity between observed and professed teaching practices was more evident among high school math teachers in Cluster 3. Observed teaching practice of high school math teachers lean more towards the conventional approach that is inconsistent with their professed teaching practice and pedagogical beliefs. Observed math classes were dominated largely by teachers' lectures who used only the board-chalk, paper and pen approaches. This was so despite the fact that most of them have already undergone trainings in Kto12. Math teachers in this group presumably had gained some understanding of the constructivist philosophy as evidenced by their professed teaching practice that leans distinctively towards constructivist pedagogy. However, they seemed to find difficulty to enact what they professed as their teaching practices in their math classes. Data gathered during interviews provided some explanation of this phenomenon. Teachers revealed that the trainings they had, provided them inadequate understanding of the teaching strategies espoused by constructivism philosophy. They wished to be exposed to periodic trainings for them to learn how to design a constructivist learning environment using those different teaching strategies. They added that their problem was made worse by the absence of K to12 compliant mathematics textbooks in grades 7 and 8 that would somehow guide them on how to translate the constructivism philosophy into classroom teaching practice.

Examining the graph, Figure 6 shows a declining trend of constructivist teaching practices. That is, as the grade level gets higher, the more likely that math teachers return to their conventional way of mathematics teaching, which is basically characterized by board-chalk approach and teacher-centered learning environment. Kruskall-Wallis test ($p=.00<.05$) indicates that this contrast across clusters is highly significant. This phenomenon can be attributed to the fact that teachers in primary grade levels employ varied activities such as games, role-playing and story-telling that relates to real life experiences in order to hold the learners' attention. These activities keep the learners more motivated and engaged in the discussion. Such activities are aligned to constructivism principle of learning as pointed out by Vintere (2018). However, these were not clearly evident among the observed high school math classes.

Another thing that may have factored in is the fact that math teachers in Kinder to grade 2 (K-Gr2) have access to K to12-compliant textbooks. Their training and the availability of math textbooks guided them on how lessons that are built on constructivism principle can be carried out in mathematics classroom. Those teachers with vague understanding of the principle still are able to enact the constructivist teaching and learning and gain clearer understanding of the learning principle through the process. The situation is different among high school math teachers. Though math teachers in grades 7 and 8 attended trainings for K to12 implementation, gained understanding and seemed open to the new educational philosophy, such understanding, as what Berndardo and Limjap (2012) emphasized, are vague, superficial and incomplete. Hence, they need something to guide them in the implementation in which, in this particular case, K to12 compliant textbooks are not made available (during the conduct of the study). Old math modules, with a completely conventional approach, were given, instead. Unfortunately, six out of eight high school math teachers who were observed used the conventional math modules that emphasized only drills and mastery of computational skills. This phenomenon seems to explain the declining trend in math teachers' observed teaching practices. Results highlight the significance of textbooks that are compliant to the new educational framework as teacher aid in enacting the mathematics curricula. A clearer view of what do mathematics teachers need in the field, accordingly, is bared. The information may guide educational leaders in crafting appropriate training designs.

Conclusion and Recommendations

The study explored the pedagogical beliefs and practices of mathematics teachers in Cabadbaran City, Agusan del Norte. It aimed to determine if math teachers' pedagogical beliefs and practices lean towards the conventional or constructivist view of teaching and learning. It also tried to look into the implication of teachers' pedagogical beliefs and practices on the implementation of K to12 Curriculum.

Generally, Cabadbaran mathematics teachers held pedagogical beliefs that were combinations of conventional and constructivist perspectives of mathematics teaching and learning. Mean pedagogical beliefs of math teachers are found inconsistent to their mean professed teaching practices. Across grade clusters, math teachers claim distinctly that their teaching practices lean towards the constructivist approach. However, math teachers in grades three through high school (Cluster 2 and 3) failed to actualize what they believed in and profess in their math classes. A declining trend of constructivist teaching practice is evident in the data gathered from actual classroom observation. That is, as the grade level increases, mathematics teaching practices tend to become more conventional. The use of board-lecture method, memorization of formulas and mastery of procedures in solving problems are more prevalent in high school math classes.

Inadequate knowledge of constructivism principle and its pedagogical approaches, time and tasks pressures, as well as, unavailability of K to12 compliant textbooks are seen as some barriers in shifting math teachers' beliefs system and practices towards the constructivist view of mathematics teaching and learning. With mathematics teachers' beliefs system that holds both the conventional and constructivist pedagogical view, translation of the constructivist learning theories into classroom practices seems unclear. Consequently, implementation of K to 12 curriculum, that is anchored on constructivism framework, is undermined and will less likely become successful. So that, being conventional or constructivist really matter in the implementation of the new basic education program.

Proper and periodic trainings (i.e., to increase teachers' competence in creating a constructivist learning environment), reduced teaching pressure, and increased capacity of math teachers in developing learning materials that are K to 12 compliant (i.e., contextualized, localized and culture-relevant) can address the problem. Given these conditions will eventually reorient teachers' pedagogical beliefs and classroom practices to be coherent with the constructivist educational paradigm. Durban and Catalan (2012) in fact described this as the process of pedagogical transformation.

One limitation considered in the study is the observation data that was obtained in one setting only due time constraint. For future research undertaking, averaged data from 2 or 3 rounds of classroom observations will help establish the classroom practices of math teachers being observed more reliably.

Math teachers' life's experiences can influence their beliefs system and the latter correspondingly influences teaching practices. Since teachers' daily experiences vary which may change their beliefs system hence, examining the nature of such change is imperative (Mansour, 2009, p. 42)..

References

Anchor, E., Imoko, B., & Uloko, E. (2009). Effect of ethnomathematics teaching approach on senior secondary students' achievement and retention in locus. *Educational Research and Review, 4*(8), 385-390.

Bada, S.O. (2015). Constructivism Learning Theory: A Paradigm for Teaching and Learning. *Journal of Research & Method in Education, 5,* 66-70. DOI: 10.9790/7388-05616670.

Bernardo, A., & Limjap, A. (2012). Investigating the influence of teachers' pedagogical beliefs and reported practices on student achievement in basic mathematics. Presented in 12th International Congress on Mathematical Education, COEX, Seoul, Korea. Retrieved from http://www.icme12.org/upload/submission/1975_F.pdf.

Dagar, V., & Yadav, A. (2016). Constructivism: A paradigm for teaching and learning. *Arts Social Science Journal, 7*, 200. doi: 10.4172/2151-6200.1000200.

Durban, J., & Catalan, R. (2012). Issues and concerns of Philippine education through the years. *Asian Journal of Social Sciences & Humanities, 1*, 2. Retrieved from http://www.ajssh.leena-luna.co.jp/AJSSHPDFs/Vol.1(2)/AJSSH2012(1.2-08).pdf.

Fernando, S., & Marikar, F. (2017). Constructivist teaching/learning theory and participatory teaching methods. *Journal of Curriculum and Teaching, 6*, (1). Retrieved from https://doi.org/10.5430/jct.v6n1p110.

Komulainen, R., & Natsheh, A.A. (2008). Constructivism theory based learning: A total quality approach. Retrieved from HYPERLINK "http://www.theseus.fi/bitstream/"https://www.theseus.fi/bitstream/

handle/10024/20402/jamk_1232716749_1.pdf?sequence=1.

Mansour, N. (2009). Science teachers' beliefs and practices: issues, implications and research agenda. *International Journal of Environmental & Science Education, 4,* 25-48. Retrieved from https://files.eric.ed.gov/fulltext/EJ884384.pdf.

Minarni, B. W., Retnawati, H., & Nugraheni, T.V.T. (2018). Mathematics teachers' beliefs and its contribution toward teaching practice and student achievement. *Journal of Physics*. DOI: 10.1088/1742-6596/1097/1/012143.

Samsudin, S.S, Ujang, S., & Sahlan, N.F. (2016). Effectiveness of constructivist approach on students achievement in mathematics: A case study at primary school in Kuantan, Pahang. AIP Conference Proceedings 1739, 020031. https://doi.org/10.1063/1.4952511.

Saritas, T., & Akdemir, O. (2009). Identifying Factors Affecting the Mathematics Achievement of Students for Better Instructional Design. Retrieved from HYPERLINK "http://www/"http://www. itdl.org/Journal/Dec_09/article03.htm.

UNESCO (2012). Challenges in Basic Mathematics Education, 7, place de Fontenoy, 75352 Paris 07 SP, France.

Vintere, A. (2018). A constructivist approach to the teaching of mathematics to boost competences needed for sustainable development. *Rural Sustainability Research, 39*(334), 1-7 doi:10.2478/plua-2018-0001.

Villena, R. (2004). Exploratory Investigation of the Beliefs and Practices of Mathematics Teachers in High and Low Performing Schools in Metro Manila. PNU, Philippines.

Zakaria, E., & Maat, S. M. (2012). Mathematics teachers' beliefs and teaching practices. *Journal of Mathematics and Statistics, 8*(2), 191-194. Retrieved from: https://doi.org/10.3844/ jmssp.2012.191.194.