

Topic Study Group 51

Mathematics Education for Ethnic Minorities

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ABSTRACT Ten papers were presented in TSG-51, involving nineteen contributors from five countries. Four themes were discussed in these presentations: (1) mathematics teaching practices and strategies in classrooms with ethnic minority students, (2) mathematics teacher professional development practices intended to improve the quality of mathematics teachers in ethnic minority regions, (3) ethnic minority students' performances in mathematics learning, and (4) research methodology in mathematics education for ethnic minority students.

Keywords: Ethnic minority; Teaching strategies; Teacher professional development; Learning results; Research methodology.

1. Introduction

All over the world, members of ethnic minorities (EM) face difficulties with the type of education that is offered to them, particularly in mathematics education. Difficulties are very diverse, including low achievement, dismissal of endogenous mathematical knowledge, mismatch of expectations with school goals, methods, and procedures, and even threats to the cultural and material existence of the minorities. Several educational models and strategies have been proposed to address these difficulties, varying broadly according to the historical, political, and cultural context in which each ethnic minority is immersed.

TSG-51 aims to gather researchers and practitioners from different countries who are interested in share their own experiences, reflections, and concerns about mathematics education for Ethnic Minorities. The TSG is envisioned as an open agora to discuss theoretical or empirical issues of diverse nature, adopting a strengths-based approach that goes beyond deficit perspectives, and is sensitive and respectful of the singularity of the contexts, constraints, and stances of each ethnic minority.

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² Organizing Team of TSG-51:

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Ten papers were presented in the three sessions of TSG-51. These presentations were given by nineteen contributors from five countries, namely Brazil, China, Colombia, New Zealand, and U.S.A.

2. Main Ideas and Discussions in TSG-51

Four themes emerged in the ten papers (Tab. 1): (1) mathematics teaching practices and strategies in classrooms with ethnic minority students, (2) mathematics teacher professional development practices intended to improve the quality of mathematics teachers in ethnic minority regions, (3) ethnic minority students' performances in mathematics learning, and (4) research methodology in mathematics education for ethnic minority students.

Tab. 1. The list of papers presented

Paper and author(s)
<i>Mathematics teaching practices and strategies in classrooms with ethnic minority students</i>
[1] How does a teacher sustain collective mathematizing among non-dominant students? John Griffith Tupouniua and Jodie Hunter (New Zealand).
[2] The implementation of culturally responsive teaching practices into the mathematics course. Hsueh-Yun Yu, Huey-Lien Kao, and Kuo-Hua Wang (Chinese Taipei).
[3] A case study on the application of "situational problems" teaching model in the mathematics education of ethnic primary school students. Chang-Jun Zhou (China).
<i>Mathematics teacher professional development practices intended to improve the quality of mathematics teachers in ethnic minority regions</i>
[4] Investigation on teacher professional development in minority areas: taking Yao autonomous county of Liannan, Qingyuan as an example. Mudan Chen and Ida A.C. Mok (Hong Kong SAR, China).
[5] Renegotiating recruitment and retention efforts: promoting teacher diversity in mathematics and science classrooms. Christine Darling Thomas and Natalie Simone King (USA).
[6] Investigation and research on mathematical culture accomplishment of primary school mathematics teachers in ethnic minority areas. Jun Wu and Jing Ting (China).
[7] Preparing the next generation of STEM innovators. Daniela Cabrera, Jose David Fonseca, and Gerardo Lopez (USA).
<i>Ethnic minority students' performances in mathematics learning</i>
[8] Chinese ethnic minorities students' performance in mathematical problem posing. Lianchun Dong and Wei He (China).
[9] Study on influencing factors of math achievements of ethnic minority senior high school students in Mainland China. Aoxue Su (China).
<i>Research methodology in mathematics education for ethnic minority students</i>
[10] Rethinking ethnography in mathematics education of ethnic minorities. Carolina Tamayo (Brazil) and Aldo Parra (Colombia).

2.1. Mathematics teaching practices for minority students

Tupouniua and Hunter^[1] presented their investigation of a teacher's attempt to sustain collective mathematizing among non-dominant students in a classroom that emphasizes collective success. Taking a collectivist stance, they conceptualized the featured classroom as one in which the students function as a single learning organism. They analyzed three roles that the teacher played within a lesson focused on students' engagement with repeating patterns. They also discussed the affordances of the three

roles with respect to sustaining three characteristics of a classroom that functions as a single learning organism.

Yu et al.^[2] investigated how culturally responsive teaching influenced students' motivations to engage in mathematics learning. They used the approach of action research and the participants are grade eight Bunun students in secondary schools in Taiwan, China. Following the culturally responsive pedagogy, researchers designed mathematics learning materials for the participating students. It is found that: (a) students learning motivation had become more positive after experiencing culturally responsive pedagogy of mathematics teaching; (b) culturally responsive pedagogy enhanced students' mathematics capabilities and scores efficiently.

Zhou^[3] selected mathematics classrooms from 12 primary schools in Longchuan County, Dehong Dai and Jingpo Autonomous Prefecture in west of Yunnan Province in China, aiming to explore the effects and existing problems of the teaching model of mathematics "situational problems". This three-year study ran from 2014 to 2016, showing that teachers who are culturally sensitive and good at using modern educational methods can use this model to help ethnic students learn mathematics more efficiently and achieve better results. In order to fulfill the effects of this teaching model, attention needs to be paid to we pay attention to the cultivation of teachers' cultural sensitivity and to the improvement of teachers' ability to use modern education techniques.

2.2. Mathematics teacher professional development practices in ethnic minority regions

Chen and Mok^[4] adopted the perspective of Mathematics Pedagogical Content Knowledge (MPCK), examining mathematics teachers' professional development in Yao Autonomous County of Liannan, Qingyuan in Guangdong Province. They employed the questionnaire survey and in-depth interview to investigate the current status and teachers' MPCK, and the degree of contribution of different sources to the development of three dimensions of MPCK. They also explored whether characteristic variables have a significant impact on the MPCK development. It is found that hearing the voices of teachers in different contexts and putting forwards schemes for related departments are efficient patterns for accelerating the teacher education development. The implications for education researchers and policy makers were also discussed.

Thomas and King^[5] reported evidence-based strategies on how to recruit and retain diverse mathematics and science teachers. Previous studies suggest that many teachers often underestimate the potential of students of color to excel in the STEM disciplines (Brickhouse, Lowery, and Schultz, 2000). These negative perceptions have a tendency to discourage students from realizing their true potentials and perceiving themselves as STEM talent. Although researchers have analyzed various challenges and strategies to decrease the impact of resisting factors, increasing teachers' capacity to create equitable mathematics and science learning spaces within urban settings continues to remain a challenge (Fraser-Abder, Atwater, and Lee, 2006; Kokka, 2016). These

realities reify the need to explore innovative ways to prepare and develop culturally competent STEM teachers who can thrive even in the most challenging working conditions. Therefore, Thomas and King attempted to provide potential approaches and solutions so that the relatively homogeneous and static demographic of the teaching workforce (particularly in mathematics and science) can begin to adequately reflect the dynamism and racial and ethnic diversity of U.S. students.

Wu and Ting^[6] conducted questionnaire and interview survey of 760 primary school mathematics teachers in ethnic minority areas of Yunnan Province, China. It is reported that mathematics culture accomplishment of primary school mathematics teachers in ethnic minority areas are generally at a medium level. In addition, teachers' mathematics culture accomplishment showed significant ethnicity, gender and urban-rural differences. Based on these findings, Wu and Ting recommended to set up a "primary school mathematics culture" course, establish a primary school mathematics culture teacher community and integrate the national mathematics culture into primary school mathematics teaching.

Cabrera et al.^[7] presented a project aimed to address issues of social justice, and the environment in the educational pipeline. To do this, the project incorporated environmental science, math, and cultural elements into hands-on project-based learning activities for 6–12 students in predominantly American Indian and Hispanic communities. Professional development (PD) workshops for the development of a culturally relevant STEM greenhouse project-based learning curriculum was provided for teachers.

2.3. Ethnic minority students' performances in mathematics learning

Dong and He^[8] investigated Chinese ethnic minorities students' performance in problem posing tasks. A set of mathematics problem posing tasks in three different situations (respectively free, semi-structured and structured situations) was developed to examine students' performance in mathematics posing. 105 students in year 5 from Xinjiang Province, China participated in this study. It is reported in this study that the number of problems posed by Chinese ethnic minorities students in all three situations is fewer than those by Chinese Han students, but the complexity of the problems posed by Chinese ethnic minorities students in semi-structured and structured situations is not lower than their Chinese Han counterparts.

Su^[9] conducted a questionnaire survey of 932 teachers and 1873 senior high students in ethnic minority regions to examine the school factors that impact students' math achievement with the two levels HLM. The results showed: (1) boys' math achievement was significantly higher than girls; (2) students with expectations of learning in mixed classes had a significantly higher math achievements than those who expected to be enrolled in non-mixed classes; (3) SES had no significant influence on math achievement; (4) students' learning strategies and learning self-efficacy had a significant positive impact on their math achievement and learning self-efficacy was

the primary factor; (5) teacher job satisfaction had significant positive effects on student math achievement; (6) school location mediated the relationship among the expected mode of class and academic performance.

2.4. Research methodology in mathematics education for ethnic minority students

Tamayo and Parra's presentation^[10] aimed to problematize ethnography in research conducted on ethnic minorities. They provoked a movement of deconstruction of the certainties caused by the uses of the method of ethnography, tracing lines of escape to understand that ethnography carries with it a series of assumptions that create limitations of political and epistemological nature for mathematics education research. They argued that some of those limitations end up undermining the possibility of reaching a new understanding of mathematics as a sociocultural practice.

References

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