Ethnomathematics Journal
Volume 1, No. 1, March 2020 (1-12)
Online: http://journal.uny.ac.id/index.php/ethno

Pedagogical content knowledge of mathematics student-teacher in developing ethnomathematics-based lesson plans

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ARTICLE INFO

Article History
Received:
23 October 2019;
Revised:
10 February 2020;
Accepted:
12 February 2020

Keywords
Ethnomathematics;
Pedagogical content knowledge

ABSTRACT

This study aims to describe the pedagogical content knowledge (PCK) of mathematics student-teachers of Yogyakarta State University (YSU). The population is mathematics student-teachers of YSU in their seventh semester of the academic year 2017/2018 who undertook ethnomathematics. A sample of 31 students was established using the cluster random sampling technique. The research instrument is in the form of ethnomathematics lesson plans developed by the students. The result of the study shows that the students' PCK in developing ethnomathematics lesson plans is generally at the level of growing PCK. Viewed from the material and pedagogical aspects, the students' PCK falls at the level of growing PCK. The students' PCK in developing the lesson plans of ethnomathematics of Prambanan Temple is at the level of growing PCK. The students' PCK in developing the lesson plans of ethnomathematics of Yogyakarta Palace is at the level of pre-PCK. The students' PCK in developing the lesson plans of ethnomathematics of Borobudur Temple is at the level of growing PCK.

INTRODUCTION

Teachers not only transfer concept or knowledge directly to students, but also have various competencies and requirements. Act of the Republic of Indonesia Year 2005 on Teachers and Lectures requires that teachers have to: 1.) have the academic qualification of at least beachelor or graduate diploma; 2.) have pedagogic, professional, personal, and social competencies; and 3.) have teaching certificate. The competencies that must be mastered by teachers are described in Government Regulation Number 78 Year 2008, which defines: 1.) Pedagogic competence as the competence related to the understanding of students and teachers who are educating and dialogic. This competence includes the ability to understand students, teaching plan and implementation, evaluation of learning achievement, and student development in the actualization of various abilities they have; 2.) Professional competence is the competence related to the mastery of subject-matter teaching materials extensively and intensively, including the mastery of school curriculum materials and the substance underlying the materials and enriching insights as a teacher; 3.) Personal competence is the personal ability reflecting the personality which is established, stable, mature, wise, and dignified, and which has a noble character; and 4.) Social competence is the competence as a member of the community to communicate and interact effectively with the surrounding community members.

ISSN: 0000-0000

Professional competence according to Shulman (1986. p. 9) is also called content knowledge while teachers' pedagogic competence is also called pedagogical knowledge. Furthermore, Shulman describes that a teacher not only masters CK and PK but also must have PCK ability. PCK is the combination of content knowledge and pedagogical knowledge. In addition to Shulman, De Jong (2009. pp. 3-5) also mentions four kinds of knowledge that must be mastered by a professional teacher: 1.) General pedagogical content; 2.) Subject-matter knowledge; 3.) General contextual knowledge; and 4.) Pedagogical content knowledge. Shulman and De Jong include pedagogical content knowledge (PCK) as an important knowledge that a teacher must have. PCK is teacher ability to combine the ability to understand mathematical content and pedagogy. Loughran, Berry, and Mulhall (2012, p. 7) states that PCK is the knowledge of how to teach certain materials using a certain technique which a teacher needs to develop continually through teaching experience. This means that a teacher not only masters the content or materials but also has the knowledge of how to teach certain materials which he or she must have developed since he or she became a teacher-to-be.

According to Rozenszajn and Yarden (2014, p. 190) PCK is the combination of content knowledge and pedagogical knowledge. Furthermore, Rozenszajn and Yarden (2014) state that content knowledge is concept or theory which a teacher conveys in the teaching process, while pedagogical knowledge is the process of choosing an approach or teaching method, teaching technique, and adapting teaching materials to make the content easy to learn by students. According to Haryanti (2016. p. 90) PCK is divided into three levels: Pre-PCK, Growing PCK, and Maturing PCK levels. At Pre-PCK level, student teachers are at the early stage of interaction between pedagogy and content knowledge and therefore there is no integration of both; at the Growing PCK level student teachers begin to be able to integrate content and pedagogy; whereas at the Maturing PCK level, student teachers are getting mature and able to integrate content and pedagogy flexibly and rationally.

The PCK ability is the ability that a teacher must have. A study by Anwar, Rustaman, and Widodo (2014. p. 138) concluded that pedagogical content knowledge (PCK) is an important ability for developing the professional competence of a teacher and a teacher candidate. A teacher who has a good PCK ability can design teaching that accommodates student diversity and can understand why the design can held students understand the teaching materials (Chordnorck, Yuenyong, & Hume, 2012, p. 5263). A teaching process is a combined interaction among materials, teacher, and students. A classroom interaction highly depends on teacher PCK ability. A good interaction during a teaching process will enhance students' motivation to learn. Therefore, according to Bentram and Loughran, Berry, and Mulhall (2012, p. 1030) a teacher must continually improve his knowledge to support his professionalism. This improvement can help a teacher to be more flexible to adapt to various changes during his teaching process. A teacher who knows his PCK ability can determine his teaching objective and can make decision about the best action to help his students achieve their learning objectives (Rozenszajn & Yarden, 2014. p. 190.)

PCK ability affects a teacher's teaching ability. A teacher who has a low PCK ability makes teaching processes not run smoothly (Widodo, 2017. p. 3). A teacher's low PCK ability results in students' difficulty in understanding his teaching materials, especially mathematics learning materials. The difficulty of the mathematics subject for students is expressed by Haylock (2010. p. 9) who writes that mathematics is perceived by students, parents, even teachers as a difficult subject. The difficulty of mathematics lies on its abstract object of study. According to Muhsetyo, Krisnadi, and Wahyuningrum (2008. p. 12) mathematics has an abstract object of study in the form of facts, concept, operation, and principles. Meanwhile elementary school students according to Piaget's theory are at the concrete operational thinking level, so that they cannot understand abstract concept materials. Therefore, mathematics study objects must be delivered in a concrete way. It is this PCK ability of a teacher that is needed in order to deliver abstract mathematical materials to be concrete using certatain approaches or strategies.

Ethnomathematics is one of the approaches which a teacher can apply in mathematics teaching. Ethnomathematics is a science used to know how mathematics is adapted to a culture (Marsigit, Setiana, & Hardiarti, 2018. p. 23). Ethnomathematics uses the culture surrounding students in mathematics teaching. It is one of the ways which are considered able to make mathematics teaching and learning more contextual so that the students find that mathematics is close to their everyday life. Ethnomathematics gives facilities to students to construct mathematical concepts (Fajriyah, 2018, p. 118). Furthermore, Fajriyah (2018, p. 118) describes that ethnomathematics provides teaching environment which makes learning motivating and better so that students have great interests in learning mathematics. Shirley (2013, p. 4) pus forward that the ethnomathematics which is used and develops in the society and is in accordance with the culture surrounding the students can be used as the center for teaching processes. This opinion is supported by various studies which show that ethnomathematics has positive impacts on mathematics teaching. A study by Laurens (2016, p. 95) shows that the teaching of mathematics applying the Malay culture can be used for improving the quality of mathematics teaching in the concept of number, fraction, and geometry. In addition, the finding of the research by Richardo (2016, p. 124) shows that ethnomathematics presents a new situation; learning mathematics is done not only in the classroom but also outside the classroom by interacting with the local culture.

In relation to the importance of PCK ability as an ability that a teacher must have, there needs to be a study on how student-teachers' PCK ability before they become a teacher. This research aims to describe the PCK ability of the mathematics student-teachers of UNY in developing ethnomathematics lesson plans. PCK in this reseach is the ability of mathematics student-teachers in combining content knowledge and pedagogical knowledge by putting into consideration the culture of Yogyakarta and its surrounding applied in ethnomathematics lesson plans.

METHOD

This research is a descriptive study with the quantitative approach. It was conducted at the Department of Mathematics Education, Universitas Negeri Yogyakarta (UNY) from March to May 2018. The subjects of the sudy are mathematics student-teachers of UNY in their sixth semester who took Ethnomathematics course in the academic year of 2017/2018. The object is the PCK of mathematics student-teachers of UNY.

Table 1. Rubric of PCK Evaluation

Aspect	Indicator	Score		
		1	2	3
Content/ Material	The developed materials are in line with CC/SD Using mathematics notation accurately The developed materials are extensive and intensive The developed questions are in line with material / concept	The content of the developed ethnomathematics lesson plans meets only one indicator or none.	The content of the developed ethnomathematics lesson plans meets 2 or 3 indicators	The content of the developed ethnomathematics lesson plans meets 4 indicators
Pedagogy	The chosen CC/SD is in line with ethnomathematics-based teaching The developed indicators are in line with CC/SC. The developed teaching objectives are in line with CC/SC. The pre-teaching apperception is related to ethnomathematics. The ethnomathematics object used is in line with the material. The developed evaluation instrument can measure CC/SC.	The pedagogy in the developed ethnomathematics lesson plans meets only 1 to 2 indicators or not at all.	The pedagogy in the developed ethnomathematics lesson plans meets 3-4 indicators.	The pedagogy in the developed ethnomathematics lesson plans meets 5-6 indicators.

The research sample is 31 students, established using the cluster random sampling technique out of a polulation of 60 students who developed ethnomathematics lesson plans of Prambanan Temple, 10 students who developed ethnomathematics lesson plans of Yogyakarta Palace, and 11 students who developed ethnomathematics lesson plans of Borobudur Temple. The ethnomathematics lesson plans developed by the students are classified into three categories: ethnomathematics of Yogyakarta Palace, ethnomathematics of Prambanan Temple, and ethnomathematics of Borobudur Temple. The data were collected through the observation of the ethnomathematics lesson plans that the students developed, and they were analyzed descriptive-quantitatively by counting the score of RPP l based on the level of the rubric in Table 1.

The quantitative data in the form of PCK mean scores of each student were then converted to determine the level of the PCK of mathematics student-teachers with reference to Table 2 which is adapted from Arikunto (2013).

Table 2. PCK Level

Score	Level
5-6	Maturing PCK
3-4	Growing PCK
1-2	Pre PCK

Furthermore, the number of mathematics student-teachers with the Pre-PCK, Growing PCK, and Maturing PCK levels was converted based on the percentage calculation using the formula:

$$\boldsymbol{P} = \frac{\sum \boldsymbol{B}}{\sum \boldsymbol{T}} \times 100\%$$

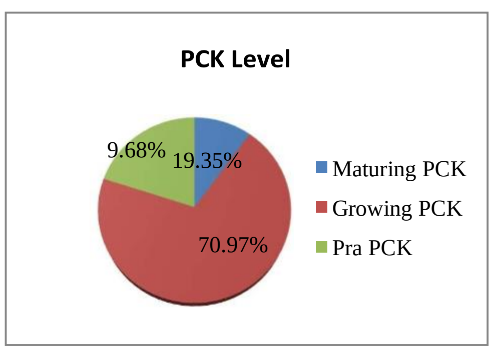
where $\boldsymbol{P}$ is the percentage of students, $\sum \boldsymbol{B}$ is the number of the students at PCK level, and $\sum \boldsymbol{T}$ is the total number of students.

FINDINGS AND DISCUSSION

The over-all result of the analysis of mathematics student-teachers' ethnomathematics lesson plans can be seen in Table 3 and pie-chart in Picture 1.

Table 3. Percentage of mathematics student-teachers' PCK Level in developing ethnomathematics lesson plans

PCK Level		
Pre PCK	Growing PCK	Maturing PCK
19.35 %	70.97%	9.68%



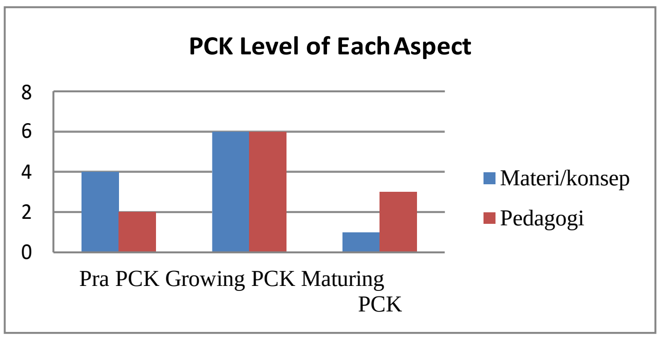
Picture 1. Precentage of PCK Level

Table 3 and Picture 1 show that in all aspects, the PCK ability of mathematics student-teachers is dominant (70.96%) lying at the growing PCK level. This shows that the students has been able to integrate ethnomathematics in the teaching of mathematics, but not very flexibly. Their PCK ability must be improved continually in order to be flexible. According to Damawati (2015. p. 3) teachers' flexibility in adapting to the changes during teaching processes is a teacher's main provision for making decision in dealing with problems and changes during teaching processes.

The data distribution based on each aspect of PCK can be seen in Table 4 and tree diagram in Picture 2.

Table 4. PCK Level of Each Aspect

Aspect	Level PCK Pre PCK	Growing PCK	Maturing PCK
Material/concept	16.13%	64.52%	19.35%
Pedagogi	16.13%	67.74%	16.13%

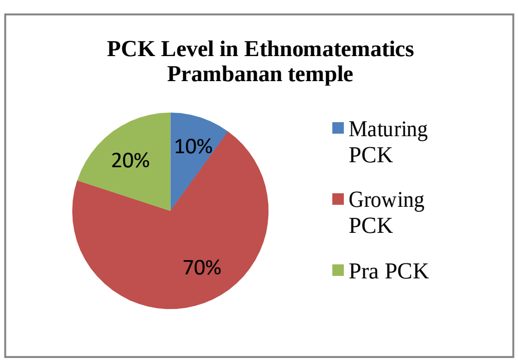


Picture 2. Tree Diagram of Each Aspect of PCK Level

pedagogy lies at the growing PCK level. This means that mathematics student-teachers have been able to develop mathematics teaching materials and to apply appropriate strategy or approach in their teaching plans. The result of the analysis of the ethnomathematics lesson plans of Prambanan Temple developed by the mathematics student-teachers of UNY is presented in Table 5 and Picture 3.

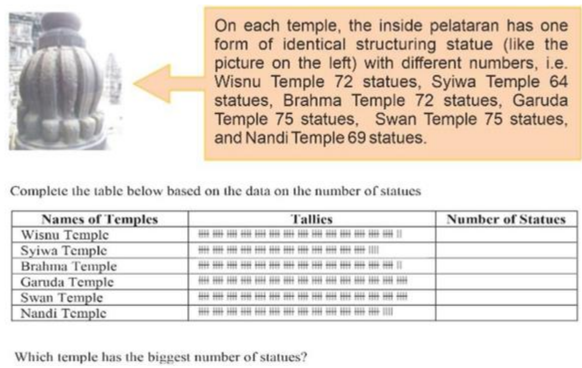
Table 5. Percentage of Mathematics Student-teachers' PCK Level in Developing Ethnomathematics Lesson Plans of Prambanan Temple

Pre PCK	Level PCK Growing PCK	Maturing PCK
20 %	70%	10%



Picture 3. Percentage of PCK Level of Ethnomathematics of Prambanan Temple

Table 5 and Picture 3 show that 20 % of the mathematics student-teachers who developed ethnomathematics lesson plans of Prambanan Temple lies at the pre-PCK level, 70% at growing PCK level, and 10% at maturing PCK level. This means that most students have been able to use the context of Prambanan Temple in teaching mathematics materials. An example of the ethnomathematics of Borobudur Temple in the lesson plan of mathematics student-teachers of Universitas Negeri Yogyakarta can be seen in Picture 4.

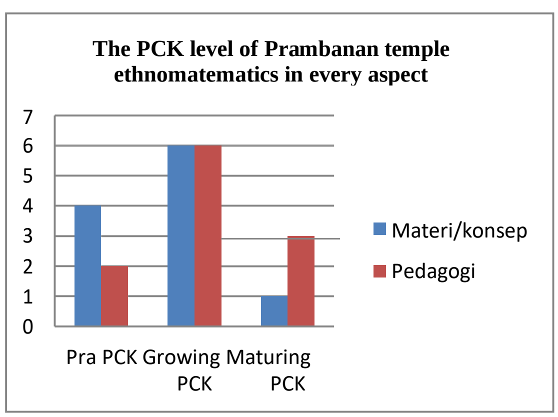


Picture 4. Example of the Ethnomathematics of Prambanan Temple Developed in Lesson Plan

The distribution of the data based on each aspect of PCK can be seen in Table 6 and tree diagram in Picture 5. Table 6 and Picture 5 show that 30% of the mathematics student-teachers who developed ethnomathematics lesson plans of Prambanan Temple master the material aspect lying at pre-PCK level, 70% at growing PCK level, and 10% at maturing PCK level. This means that most of the students have been able to develop materials extensively and intensively in line with CC/SC, to use mathematics notations accurately, and to develop test items according to concepts.

Table 6. PCK Level of Each Aspect in Ethnomathematics Lesson Plans of Prambanan Temple

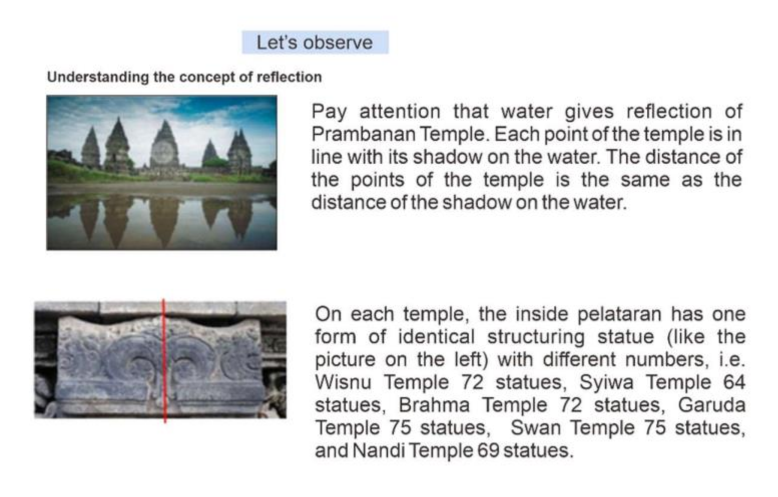
Aspect	Level PCK		
	Pre PCK	Growing PCK	Maturing PCK
Material/concept	20%	70%	10%
Pedagogi	10%	80%	20%



Picture 5. Tree diagram of PCK Level of ethnomathematics of Prambanan Temple

Table 6 and Picture 5 also show that in terms of the pedagogical aspect, 10% of mathematics student-teachers are at pre-PCK level, 80% at growing PCK level, and 20% at maturing PCK level. This means that most of the students have been able to determine CC/SC used in the teaching of mathematics based on the ethnomathematics of Prambanan Temple, to develop teaching objectives and indicators in line with CC/SC, of the object of Prambanan Temple used is suitable with the developed mathematics concept/material, the developed evaluation instrument can measure CC/SC.

The mathematics materials the students chose for the ethnomathematics of Prambanan Temple are quite varied, including statistics, reflection, translation, dilatation, exponential numbers, and the most chosen material is curved solid figure material. An example of the ethnomathematics of Prambanan Temple in the reflection material can be seen in Picture 6.

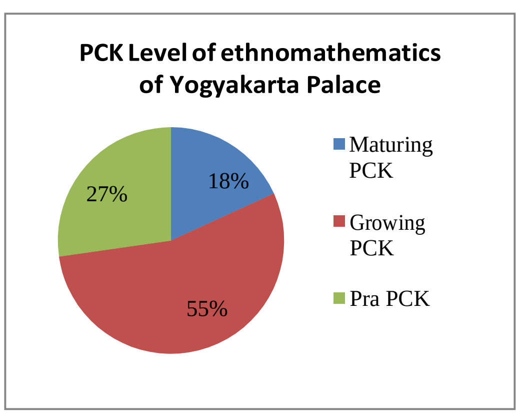


Picture 6. Ethnomathematics of Prambanan Temple in Reflection Material

The result of the lesson plan of the ethnomathematics of Yogyakarta Palace developed by mathematics student-teachres of UNY is presented in Table 7 and pie chart in Picture 7.

Table 7. Percentage of Mathematics Student-teachers' PCK Level in Developing Ethnomathematics Lesson Plans of Yogyakarta Palace

	Level PCK	
Pre PCK	Growing PCK	Maturing PCK
50 %	40%	10%



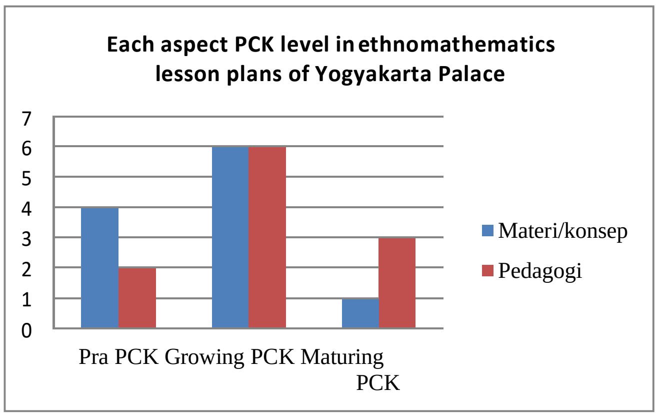
Picture 7. Pie chart of PCK Level of ethnomathematics of Yogyakarta Palace

Table 7 and Picture 7 show that 50 % of the mathematics student-teachers who developed the lesson plans of the ethnomathematics of Yogyakarta Palace lie at the pre-PCK level, 40% at growing PCK level, da 10% at maturing PCK level. This shows that most of the students are at the stage of interaction between pedagogy and content knowledge, so that there is no integration of both. The materials the students chose in their ethnomathematics lesson plans lacks variation, only the geometry material of plane figure.

The data distribution based on each aspect of PCK can be seen in Table 8 and tree diagram in Picture 8

Table 8. Each Aspect PCK Level in Ethnomathematics Lesson Plans of Yogyakarta Palace

	Level PCK		
Aspect	Pre PCK	Growing PCK	Maturing PCK
Material/concept	40%	50%	10%
Pedagogi	50%	40%	10%



Picture 8. Tree Diagram of PCK Level of Ethnomathematics of Yogyakarta Palace

Table 8 and Picture 8 show that 40% of the mathematics student-teachers who developed the lesson plans of the ethnomathematics of Yogyakarta Palace have the mastery of the material aspect at the pre-PCK level, 50% at the growing PCK level, and 10% at the maturing PCK level. This means that most of the students have been able to develop the materials in line with the stated CC/SC, to use accurate mathematical symbols, and to develop test items according to the concept, but there are still 40% of the students who have not been able to master the material well. The students' ability in mastering the materials which are taught must always be developed, because a teacher can deliver teaching materials well to his students if he really masters the characteristics of the materials (Agustina, 2015. p.300). An example of the ethnomathematics lesson plan of Yogyakarta Palace which is developed by the students can be seen in Picture 9.

From Table 8 and Picture 8, it is known that in terms of the pedagogical aspect, 50% of mathematics student-teachers are at the pre-PCK level, 40% at the growing PCK level, and 10% at the maturing PCK level. This means that 40% of the mathematics student-teachers of UNY who developed the lesson plan of the ethnomathematics of Yogyakarta Palace can determine the CC/SC suitable for the teaching of mathematics based on the ethnomathematics of Prambanan Temple, and the object of Prambanan Temple which is used is in accordance with the developed mathematics concept/materials. However, most of the students still find it difficult to develop indicators from the stated CC/SC. The students' mistake in developing indicators is that they develop only one indicator for one standard competence and that the developed indicator still cannot be used to measure the mastery of standard competence. An example of the indicators developed by the students can bee seen in Picture 10.

Picture 9. Example of Ethnomathematics of Yogyakarta Palace

B. Basic Competencies

No.	Basic Competencies	Indicators
1	3.11. Relating the formulas of circumference and area of varieties of quadrilaterals (square, parallelogram, belah ketupat, jajar genjang, trapezoid, kite) and triangle.	3.11.1. Finding the concept of trapezoid area
2	4.11. Solving a contextual problem related to the area and circumference of varieties of quadrilaterals (square, parallelogram, belah ketupat, jajar genjang, trapezoid, kite) and triangle.	4.11.1. Solving a problem related to the area of a trapezoid

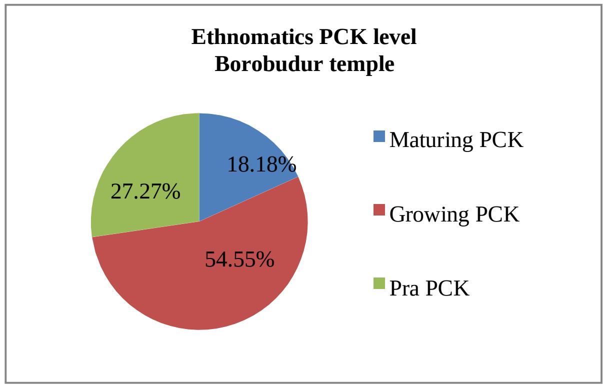
Picture 10. Example of Inaccurate Indicators and Learning Objectives Developed

The analysis of the PCK result showing the pre-PCK level must be the reason for mathematics student-teachers of UNY to keep on improving their PCK ability. PCK ability can be improved through professional development programs, which cover the introduction to instruments and teaching materials development. The result of the analysis of the ethnomathematics lesson plans of Borobudur Temple developed by the students is presented in Table 9 and pie chart in Picture 11.

Table 9. Percentage of Mathematics Student-teachers' PCK Level in Developing Ethnomathematics Lesson Plans of Borobudur Temple

	Level PCK	
Pre PCK	Growing PCK	Maturing PCK
27.27 %	54.55%	18.18%

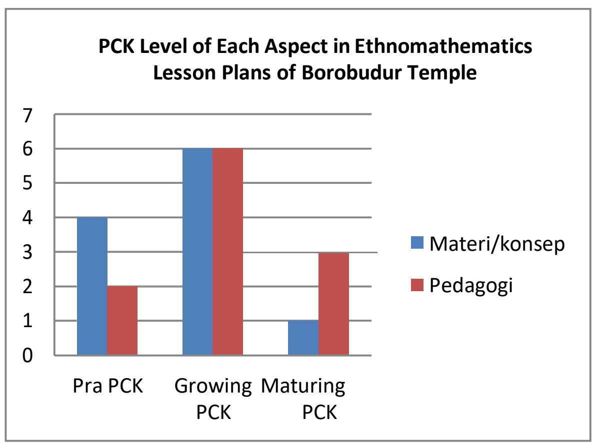
Table 9 and Picture 11 show that 27 % of the mathematics student-teachers who developed the ethnomathematics lesson plans of Borobudur Temple are at the pre-PCK level, 54.55% at the growing PCK level, and 18.18% at the *maturing* PCK level. This shows that majority of the mathematics student-teachers have been able to integrate their pedagogical ability, in this case the ethnomathematics of Borobudur Temple, into the teaching of mathematics.



Picture 11. Pie Chart of PCK Level of Ethnomathematics of Borobudur Temple

Table 10. PCK Level of Each Aspect in Ethnomathematics Lesson Plans of Borobudur Temple

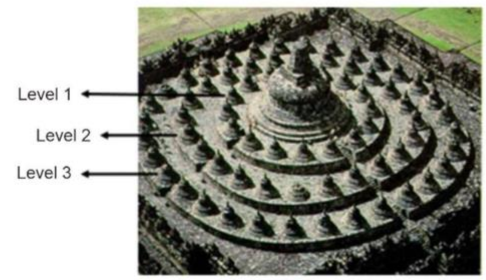
Aspect	Level PCK		
	Pre PCK	Growing PCK	Maturing PCK
Material/concept	36.36%	54.55%	9.09%
Pedagogy	18.18%	54.55%	27.27%



Picture 12. Tree diagram of PCK Level of Ethnomathematics of Yogyakarta Palace

Table 10 and Picture 12 show that in material aspect, 36.36% of the mathematics student-teachers who developed the ethnomathematics lesson plans of Borobudur Temple are at the pre-PCK level, 54.55% at the growing PCK level, and 9.09% at the maturing PCK level. This means that most of the students have been able to develop mathematics teaching materials well. The mathematics teaching materials developed by the mathematics student-teachers in the ethnomathematics of Borobudur Temple include solid figure, plane figure, Pythagoras theorema, and lines and rows. An example of the ethnomathematics in the materials of lines and rows can be seen in Picture 13.

Table 10 also shows that in terms of the pedagogical aspect, 18.18% of the mathematics student-teachers are at the pre-PCK level, 54.54% at the growing PCK level, and 27.27% at the maturing PCK level. This means that most of the students can determine the CC/SC used in the teaching of mathematics based on the ethnomathematics of Borobudur Temple, they can also develop the teaching objectives and indicators of success in line with CC/SC, and that the object of Prambanan Temple used is suitable with the developed mathematics concept/material.



Picture 13. Examples of Borobudur Temple Ethnomathematics in Row and Series Material

CONCLUSION

Based on the result of the data analysis, it can be concluded that the PCK ability of student-teachers of UNY in developing the ethnomathematics lesson plans lies at the growing PCK level. Viewed from the materials/content aspect and pedagogical aspect, the PCK ability of mathematics student-teachers of UNY is at the growing PCK level. Their PCK ability in developing the ethnomathematics lesson plans of Prambanan Temple and Borobudur Temple lies at the growing PCK level, while that in developing the ethnomathematics lesson plans of Yogyakarta Palace lies at the Pre-PCK level. In order that the PCK ability of mathematics student-teachers get better, they should practice making lesson plans continually using ethnomathematics and other approaches. They should also master the mathematics content or materials well. In addition, this research can be continued with the analysis of students' PCK not only in terms of developing lesson plans but also practice teaching of mathematics.

DAFTAR PUSTAKA

Agustiani, R. (2015). Profil pengetahuan pedagogik konten mahasiswa calon guru matematika dalam melaksanakan pembelajaran dengan pendekatan PMRI. *Jurnal Pendidikan Matematika RAFA*, *1*(2), 288-305.

Anwar, Y., Rustaman, Y., & Widodo, A. (2014). Hypothetical model to developing pedagogical content knowledge (PCK) prospective biology teachers in consecutive approach. *International Journal of Science and Research (IJSR)*, *3*(12), 138-143.

Arikunto, S. (2013). *Prosedur penelitian: Suatu pendekatan praktik*. Jakarta: Rineka Cipta.

Bentram, A., & Lougran, J. (2012). Sciences teachers views on cores and pap-ers as a framework for articulating and developing pedagogical content knowledge. *Research in Science Education*, *42*(6), 1027-1047.

Chordnorck, B., Yuenyong, C., & Hume, A. (2012). Exploring of experienced science teacher's pedagogical content knowledge: the case of teaching global warming. *Journal of Applied Sciences Research*, *18*(11), 5258-5265.

Damawati, N. A. C. (2015). Pemahaman terhadap PCK untuk meningkatkan profesionalisme guru. *Seminar Nasional ALFA IV*, 1-5.

De Jong, O. (2009). *Teachers' professional knowledge in science and mathematics education: Views from Malaysia and abroad*. Selangor: Faculty of Education University Kebangsaan Malaysia.

Fajriyah, E. (2018). Peran ethnomathematics terkait concept matematika dalam mendukung literasi. *PRISMA: Prosiding Seminar Nasional Matematika*, *1*(1), 114-119. Retrieved from https://journal.unnes.ac.id/sju/index.php/prisma/article/view/19589

Haryanti, E. H. W. (2016). Profil Pedagogical Content Knowledge mahapeserta didik calon guru biologi. *Bioma: Jurnal Ilmiah Biologi*, *5*(1), 87-96.

Haylock, D. (2010). *Mathematics explained for primary teachers*. London: SAGE.

Laurens, T. (2016). Analisis ethnomathematics dan penerapannya dalam meningkatkan kualitas pembelajaran. *LEMMA*, *3*(1), 86-96.

Loughran, J., Berry, A., & Mulhall, P. (2012). *Understanding and developing science teachers' pedagogical content knowledge (Vol. 12)*. Springer Science & Business Media.

Marsigit, M., Setiana, D. S., & Hardiarti, S. (2018). *Pengembangan pembelajaran matematika berbasis ethnomathematics*. Paper presented at the Seminar Nasional Pendidikan Matematika Etnomasia.

Muhsetyo, G., Krisnadi, E., & Wahyuningrum, E. (2008). *Pembelajaran matematika SD*. Jakarta: Universitas Terbuka.

Presiden Republik Indonesia. (2005). Undang-undang Republik Indonesia Nomor 14 tahun 2005 tentang Guru dan Dosen.

Presiden Republik Indonesia. (2008). Peraturan Pemerintah Republik Indonesia Nomor 74 Tahun 2008 Tentang Guru.

Richardo, R. (2017). Peran ethnomatematika dalam penerapan pembelajaran matematika pada kurikulum 2013. *LITERASI (Jurnal Ilmu Pendidikan)*, *7*(2), 118-125. Doi: http://dx.doi.org/10.21927/literasi.2016.7(2).118-125

Rozenszajn, R., & Yarden. A. (2014). Expansion of biology teacher's Pedagogical Content Knowledge (PCK) during a long-term professional development program. *Research In Science Education*, *1*(44), 189-213. Doi: https://doi.org/10.1007/s11165-013-9378-6

Shirley, P. & Palhares, P. (2013). The role of ethnomathematics in mathematics education. *Revista Latinoamericana de Etnomatemática*, *6*(3), 4-6.

Shulman, L. S. (1986). Those who understand: knowledge growth in teaching. Educational research, 15(2), 4-14. Doi: https://doi.org/10.3102/0013189X015002004

Widodo, A. (2017). Teacher pedagogical content knowledge (PCK) and student's reasoning and wellbeing. *Journal of Physics: Conference Series*. 812 012119. 1-7.