Ethnomathematics Journal
Volume 4, No. 2, September 2023 (120-131)
Online: http://journal.uny.ac.id/index.php/ethnomath

MODIFICATION OF *POCUNG* SONG IN ETHNOMATHEMATICS-BASED LEARNING FOR THE TOPICS OF LENGTH MEASUREMENTS

Lilis Risma Putri*, Universitas Negeri Yogyakarta, Indonesia
Hanifah Mar'atush Shalihah, Universitas Negeri Yogyakarta, Indonesia
Asma' Khoirunnisa', Universitas Negeri Yogyakarta, Indonesia
Heru Sukoco, Universitas Negeri Yogyakarta, Indonesia
*e-mail: lilisrismaputri@gmail.com (corresponding author)

Abstract: Learning in measuring units of length is basically inseparable from familiar objects in the society, one of which is traditional songs. This study was aimed at finding whether using the tune of a traditional song in Yogyakarta, namely *Pocung* song, and modifying the lyrics with mathematical contents can facilitate students to think mathematically. This study used the pre-experimental design method with the one-group pre-test-posttest design model. The research subjects were 10 3rd grade students of a cultural elementary school in Gunungkidul. The results showed that the modification of the *Pocung* song in ethnomathematics-based mathematics learning in the length-unit competencies was developed in an audio-visual form which could be accessed via the YouTube and the implementation ofthe *Pocung* song modification in ethnomatematics-based learning in the length-unit competencies had a positive influence on students' learning achievements.

Keywords: unit of length, macapat song, ethnomathematics.

How to cite:

Putri, L. R., Shalihah, H. M., Khoirunnisa', A., & Sukoco, H. (2023). Modification of *Pocung* song in ethnomathematics-based learning for the topics of length measurements. *Ethnomathematics Journal*, *4*(2), 120-131. https://doi.org/10.21831/ej.v4i2.59965

INTRODUCTION

Learning processes are strongly associated with education. Any fundamental process conducted by any individual in order to achieve improvement in behaviours, broadening in perspectives, and modification in positive thinking can be identified as a learning activity. A learning process between a teacher and the learner is certainly expected to be able to improve the learning process and outcome so that changes can be achieved in behaviours, knowledge, thinking, skills, habits, and other competencies (Saragih & Ain, 2022).

All levels of education receive learning in the field of mathematics which is a universal scientific knowledge. This makes mathematics so needed in order to understand other scientific fields (Rahmadani, 2019). Although mathematics is taught in all levels of education, many students still find it difficult and unattractive which makes mathematics learning not optimal. Learning about measurement of length units in the mathematics class is still regarded as difficult by the majority of students for the reason that they find it hard to memorize and convert length units, as stated in a study by Riyani et al. (2022). In response to this case, a learning medium is needed that is interesting for students so that it can stimulate the students to memorize the conversion concepts of length units. In other words, the application of a learning medium in the learning-teaching process will increase the effectiveness and accuracy of the learning course.

Ethnomathematics can become an effective learning medium in the learning-teaching processes. Ethnomathematics is mathematics learning which involves cultural elements in embedding mathematical concepts (Fajriyah, 2018). Ethnomathematics is an interesting entity because it can help students to understand mathematical concepts by relating learning to daily-life phenomena, such as cultures. In South Korea, mathematics learning is tied to the traditional game *Yut* and *Ddakji* which use the shape patterns triangles, squares, rectangles, and circles (Permana, 2019).

Cultural treasure of Yogyakarta can also be used as media in mathematics learning. One of the Yogyakarta's cultural objects that can be modified as an ethnomathematics-based learning medium is the *tembang macapat* (old traditional Javanese song). It is one of the traditional Javanese folk ballads. Anto & Anita (2019) explain that the *macapat* is a traditional Javanese song lyric which is sung in various rules. Each verse in the *macapat* song consists of a definite number of lines (called *gatra*); each *gatra* has a definite number of syllables (called *wilangan*); and each *wilangan* ends in a definite vowel sound (called *lagu*) which is an end rhyme. Each verse is a song unit sung in a definite melody. Through the *macapat*, students learn rhythms, patterns, and other properties that demand students to think mathematically.

Application of the *macapat* as an ethnomathematics-based learning medium is inseparable from the unique Javanese cultures owned by the Javanese people such as the Yogyakarta *macapat*. Presently, the existence of the *macapat* is fading away among the young generation because of the massive impact of globalization. Be as it may, the *macapat* can be used as a medium in mathematics learning in the topic of length unit conversion.

It is in this spirit that the present study is aimed at analyzing the implication of modifying the *Pocung* song as an ethnomathematics-based learning medium in the learning of length units in the 3rd grade of the elementary school. It is expected that an ethnomathematics-based modification of the *Pocung* song is developed for the competency of converting length units and for the evaluation of the implementation of the medium as well.

METHOD

The study was pre-experimental research with the one-group pretest-posttest design model. In this design, the researcher assigned an experimental treatment to the research subjects and observed the impacts of the results of the treatment (Sugiyono, 2020). In this case, the study gave a research treatment in the form of using the *Pocung* song in the mathematics class and then analyzed how the use of the *Pocung* song had an impact on students' understanding competencies of the length unit conversion.

The one-group pretest-posttest design was selected as the research method with the reason that, with the adminitering of the pretest before the treatment, results could be compared to the condition after the administering of the post test. This way would make it possible for the researcher to gain accurate information about the impacts of the conduct of the experimental treatment. The research subjects were 3rd grade students of one of the culture-based elementary schools in Gunungkidul, Yogyakarta. The choice of the culture-based school was motivated by the suitability between the subjects and objects of the study so that practical research applicability can be reached in that the modification of the *Pocung* song can be practiced as a learning medium in class.

The main focus of the study was the use of the modification of the *Pocung* song as a learning medium in the mathematics class. The study was conducted in the region of the Special Province of Yogyakarta in the duration of 2 months, i.e. within the months of June and July, 2022. The instructional lessons were conducted in two meeting sessions (4 class hours). The independent research variable was the *Pocung* song in the mathematics class and the dependent variable was the students' learning achievement as indicated by their understanding of length units.

The tools used in the study were white-board markers, white-board eraser, rulers, and students' work books/sheets. The research materials were students' ompetencies in length units, validation sheets for media and material, test item validation for the pre-test and post test, and student questionnaires.

Steps of the study was initialized by the construction of the learning medium by tracing the ADDIE phases (analysis, design, development, implementation, and evaluation), and continued with the data collection (the mathematics learning class activities using the treatment learning medium), and ended with the data analysis and conclusion. The learning phase was initiliazed by the administering of the pre-test to measure the students' initial competencies, continued with the learning process using the *Pocung* song as the medium, and ended with the giving af the post test to be compared with the pre-test.

The data analyses consisted of three tests, namely for the statistical pre-requisites, validity, and hypotheses. The tests for the analytical pre-requisites consisted of the validity of the research instruments, normality, and homogeneity. The test validation consisted of medium validity and medium feasibility. The drawing of the conclusion was conducted after the hypothesis testing. The pre-requisites for the data analyses were tested by using the Shaphiro Wilk's and Fligner Killeen's tests and the hypothesis testing was done by using the non-parametric one-sample sign test with a level of significance of 5%.

The research instruments are explained in the following:

Pre-test

The pre-test was administered to know the students' initial knowledge about length units before the *Pocung*-song was given. The *pre-test* consisted of 15 multiple-choice test items with simple length unit conversions as the indicators completed with one essay-type test item.

After the administering of the pre-test, student analyses were done on the results of the pre-test. It was found that the material and examples for length units in the learning textbooks was considered limited in amount. The inadequacy of the material and examples caused a discrepancy of materials in the textbook. Therefore, additional material needed to be designed to produce an interesting material which would not only help the students in their thinking processes, but also assist them in developing motor skills.

Treatment

The next phase consisted in delivering to the students the research treatment which consisted of the mathematics learning with the modification of the *Pocung*-song in the topic of length units. The learning activities included the students listening, sing, and internalizing the *Pocung*-song verses. For implementing this activity, the following preparational stages were conducted to develop the audio contents and digital video visualization:

Design

In this phase, the researcher prepared the design for the learning medium layout. The design was developed by considering the students' characteristics such as the ease in understanding the material, attractiveness of the audio-visual contents in a vector game interface, and bright font and background which characterized the medium as an attractive and innovative ethnomathematics-based material for mathematics learning. By integrating all these properties involving the *Pocung* song, it was expected that students would obtain fun learning experience that was more interactive and attractive in studying the concepts in length units.

Development

The learning medium which was in the video-visual format was uploaded into the YouTube channel. In this way, it was expected that students would be able to download and use it as a learning medium through listening and watching so that it could give them motor acceleration. Results of the validation analyses on the visual, audio, readibility, linguistic, and ethnomathematic indicators concluded that the medium was feasible to be used with minor revision. Suggestion for improvement included writing which should be more aligned with the KBBI [Indonesian Grand Dictionary], consistence in the use of local vocabulary, and use of the term mathematics in the medium. The lyric of the *Pocung* song that has been validated is presented below.

	Translation
Satuan Panjang	*Length Units*
(Nada lagu Tembang Pocung)	*(Rhythm: Pocung Song)*
Kilometer, hektometer, dekameter	*Kilometre, hectometre, decametre*
Meter, desimeter, centimeter, milimeter	*Metre, decymetre, centimetre, milimetre*
Tangga turun 1	*Declining scale 1*
Bilangan dikali 10	*Number multipled by 10*
Kilometer, hektometer, dekameter	*Kilometre, hectometre, decametre*
Meter, desimeter, centimeter, milimeter	*Metre, decymetre, centimetre, milimetre*
Tangga naik 1	*Inclining scale 1*
Bilangan dibagi 10	*Number divided by 10*
Km, hm, dam, m, dm, cm	*Km, hm, dam, m, dm, cm*
mm, yang terkecil	*mm, the smallest*
Itulah satuan panjang	*That's length units*
Antar satuan selisihnya 0 satu	*Among the units the difference 0 one*

Implementation of the mathematics learning using the modification of the *Pocung* song was conducted in two meeting sessions consisting of four lesson hours. The instructional procedure used the Bruner phases which consisted of enactivating, iconic, and symbolic. In the enactivating phase, students sang the modified *Pocung* song. In the iconic phase, students transformed the lyric of the *Pocung* song into the picture of the conversion scale of the length units. This was meant to make it easy for students to memorize the order of the length units. In the symbolic phase, students presented their understanding of the song lyric of the length-unit scale concerning the competencies of length units.

Post test

At the end of the treatment class, students were subjected to the post test. This was meant to measure how far students understood the concepts of length units after taking the treatment of the mathematics learning using the modified *Pocung* song as a learning medium. The post test was constructed using the same specification and indicators as the pre-test.

RESULTS AND DISCUSSION

Implementation

Implementation consists in the conduct and results of the use of the *Pocung* song in the learning activities. In this phase, the medium *Pocung* song is used and treated in accordance with the conditions of the real class. From this implementation, results can be shown concerning the effectiveness of the modified *Pocung* song as a learning medium in the mathematics class.

Explanation of the material used as the research treatment was given by presenting the audio-visual modification of the *Pocung* song in the competencies of length units. The following shows the song lyric and its accompaniment background pictures. The complete audio-visual *Pocung* song mathematics learning medium on the competencies of length units can be seen in Figure 1 and accessed on the link https://bit.ly/TembangPocungSatuanPanjang.

Evaluation

After the administering of the post test, it was found that the average scores of the control class (pre-test) and the experiment class (post test) were 31.33 dan 43.33. There was an increase in the students' learning results after the implimentation of the treatment using the *Pocung*-song learning medium.

Analyses were initialized by the pre-requisite test and followed by the hypothesis test of the research treatment. The pre-requisite test consisted of test of normality and test of homogeneity with the *p*-values of 0.1729 and 0.4767 respectively. The following presents the pre-requisite tests of normality and homogeneity.

Hypothesis Testing of Normality

H_0: Data have a normal distribution
H_α: Data are not normally distributed

Hypothesis Testing of Homogeneity

H_0: Data have the same distribution as the population
H_α: Data do not have the same distribution as the population

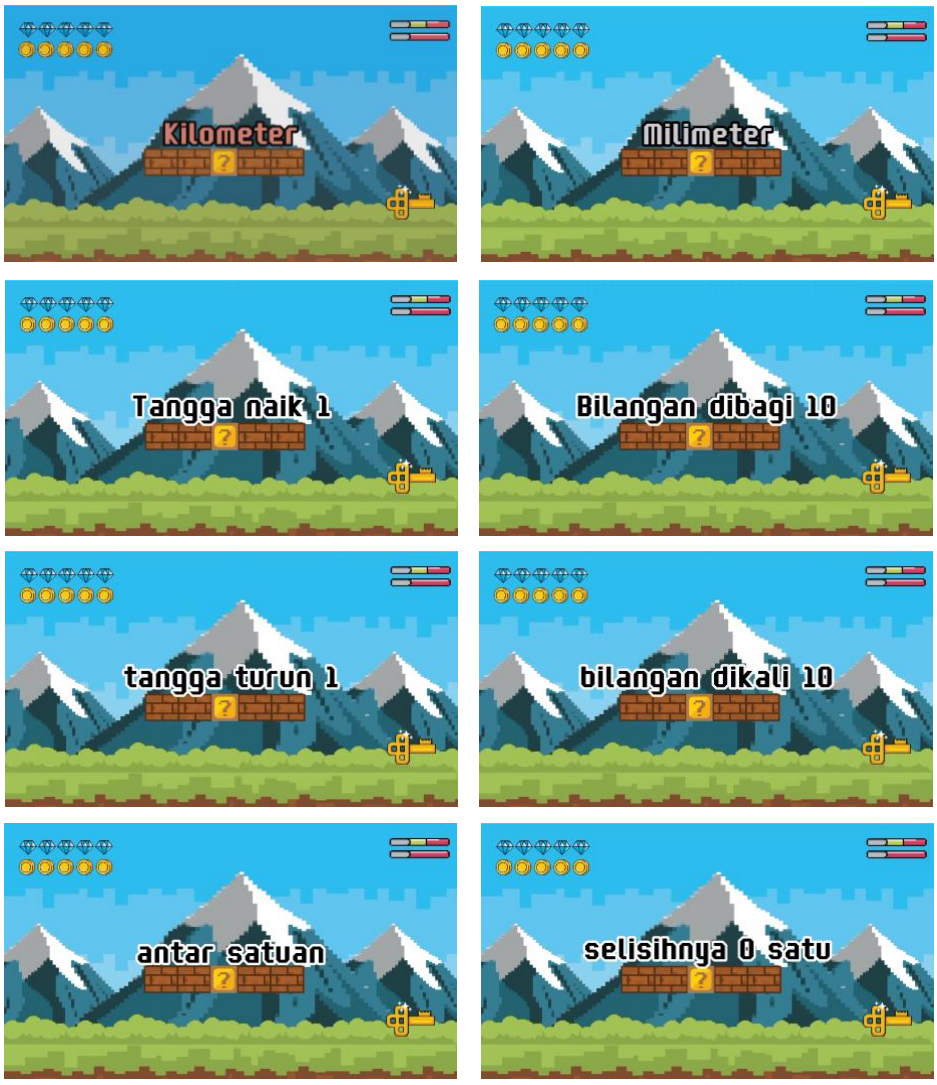

Figure 1. Learning medium of the *Pocung* song on the competencies of length units

Both tests reject the H_0. This means that, for the first pre-requisite test, data gained in the study is normally distributed. For the second pre-requisite test, all the variables in the data are homogenenous; all input samples are from a population with equal variances.

The next step was conducting the non-parametric statistical test using the one-sample sign test to see whether there is a significant difference between the two mean scores after the implementation of the research treatment. The use of the non-parametric statitistic was based on the reason that the data collected were not more than 30. The results of the one-sample sign test with a significance level of 5% produced a *p* value of 0.039. Meanwhile, the results of the pre-requisite tests were as follows.

Hypothesis for the One-Sample Sign Test

H_0: $\eta = 0$ (There is no significant difference in students' competencies in length units.)
H_α: $\eta \neq 0$ (There is a significant difference in students' competencies in length units.)

This means that H_0 is rejected. Results of the hypothesis testing with the pre-determined *p-value* show that the innovative learnimg media *Pocung* song in the topic of length units gives a signicant influence on on the improvement of students' learning achievements. This shows that the use of the medium was effective in increasing the students' knowledge and skills in understanding the material of length units.

Mathematical Concepts as Subjects of Ethnomathematics

One of the ways of improving students' formal mathematical knowledge through realistic approaches is use of the ethnomathematics-based learning medium using the *Pocung* song in mathematics learning. This is in line with Danoebroto (2020), who stated that one of the choices in developing ethnomathematics-based formal mathematical knowledge is by using a realistic approach in learning. In addition, D'Ambrosio in Danoebroto (2020) stated that the construction of ethnomathematics does not only include elements of cultures and mathematics, but also methods and techniques in learning mathematics.

In another article, it is stated that ethnomathematics introduces a mathematics learning approach that is based on the cultures and habits of a local community. In this case, learning can help the learners understand mathematical concepts better and increase their motivation in learning. In line with Zeichner (1996), teachers should apply the principles of the people's cultures in learning as an appreciation to the cultural traditions and language used by the learners in everyday life.

***Pocung* Song Learning Medium in Mathematical Concepts**

It is true that mathematics is a subject that is given in every level of education in Indonesia; but it is equally true that many students find mathematics difficult and unattractive so that mathematics learning is not optimal. In it, there are many formulas and unit concepts that should be memorized, which become one of the reasons for

mathematics to be unattractive or, even, threatening for students. It therefore becomes a great challenge for teachers to make mathematics fun for students to learn. This can be realized by packaging the instructional materials in such a way that it will be easy for students to learn. When students find it easy to understand, they will automatically feel enlightened from their apathy to mathematics.

From the results of the implementation of the *Pocung* song medium, it can be seen that the students' soft skills improve quite well. It is also statistically supported that the treatment produces significant improvement in the students' competencies understanding length units. Subsequently, it can be clearly understood that creativities of teachers are needed to develop learning activities using mediums from other *macapat* songs. Besides being able to promote local wisdoms, use of the *Pocung* song learning medium can become a tool to improve students' motivation and enthusiasm in learning. For students, culture-based instructional media can serve as a bridge in improving their learning achievement, making instruction more interesting and humanistic, and become a process in the internalization of local wisdoms, which assists in learning retention and touches the students' affective and esthetic feelings.

Through the foregoing understanding, it can be seen that emotional relations are built between students and the instructional materials, as stated in the theories by Massarwe et al. (2010). In addition, this more socio-cultural approach to learning carries in positive impacts in making the learning processes more effective and meaningful because learners are familiar with the materials, as stated by Matang (2006). Furthermore, as stated by Bonner (2010), students come to appreciate cultures, both their own and others'. It is therefore conclusive that the modification of the *Pocung* song can be used as a learning medium for mathematics instruction in the competency of length units.

This learning medium in the form of a modification of the *Pocung* song is one of the products of ethnomathematics in school learning. In line with results of a study by Rafiepour & Moradalizadeh (2022), mathematics which is hidden within culture groups (ethnomathematics) must be done in a curriculum that facilitates knowledge, understanding, and integration of learning methods. This is so in the expectation that, when learning in the perspectives of ethnomathematics, learners can gain wider knowledge about life, cultures, environments, and their selves through learning materials that make them successful in mastering the mathematics learning given at school (Rosa & Orey, 2011). In this situation, ethnomathematics is used by teachers and students to work with informal mathematics and compare it with formal mathematics

(Putra, 2018). Dahlan & Permatasari (2018), meanwhile, state that using culture-based approaches in learning can give advantages, one of which building a bridge batween learners' backgrounds and formal mathematics instruction.

CONCLUSION

From the findings of the study, conclusion can be drawn as follows. *First*, the *Pocung* song has been developed into an audio-visual learning medium that can be accessed on the YouTube on the link https://bit.ly/TembangPocungSatuanPanjang. *Second*, the implementation of the modified *Pocung* song as a mathematics learning medium is carried out using the audio visual learning method. Students make use of the medium for gaining knowledge by way of listening and watching in order to develop motor acceleration.

Bases on the results of the treatment learning, the modification of the *Pocung* song as a learning medium in the topic of length units gives advantageous and significant implications in improving students' learning achievements. This is because the use of the modified *Pocung* song as a learning medium has made the learning processes more fun and humanistic. It can also become a process of the internalization of local wisdoms to build learning retention and touch the students' affective and esthetic feelings. In the future, teachers' creativities are needed to develop mathematics learning activities that use other *macapat* songs as one of the efforts in revitalizing local wisdoms (strengthening the Indonesian identities).

ACKNOWLEDGEMENTS

Acknowledgements of gratitude are conferred to Faculty of Mathematics and Natural Sciences (FMIPA) UNY for funding this study by the 100 Title Student Creativity Program Year 2021.

REFERENCES

Anto, P., & Anita, T. (2019). Tembang *Macapat* sebagai penunjang pendidikan karakter [*Macapat* songs as supporters of character education]. *Deiksis*, *11*(01), 77-85. http://dx.doi.org/10.30998/deiksis.v11i01.3221

Bonner, E. P. (2010). Promoting culturally responsive teaching through action research in a mathematics methods course. *Journal of Mathematics and Culture*, 5(2), 16-30.

Dahlan, J. A., Permatasari, R. (2018). Development of instructional materials based on ethnomathematic in mathematics learning in Junior High School. *JNPM (Jurnal Nasional Pendidikan Matematika*, *2*(1), 133-150. http://dx.doi.org/10.33603/jnpm.v2i1.987

Danoebroto, S. (2020). Kaitan antara etnomatematika dan matematika sekolah: Sebuah kajian konseptual [Relation between ethnomathematics and school mathematics: A conceptual study]. *Idealmathedu: Indonesian Digital Journal of Mathematics and Education*, *7*(1), 37-48. https://doi.org/10.53717/idealmathedu.v7i1.171

Fajriyah, E. (2018, February). *Peran etnomatematika terkait konsep matematika dalam mendukung literasi* [Roles of ethnomathematics in relation to mathematical concepts in supprting literacy] [Paper presentation]. In PRISMA, Prosiding Seminar Nasional Matematika. https://journal.unnes.ac.id/sju/index.php/prisma/article/view/19589

Matang, R. A. (2006, February). Linking ethnomathematics, situated cognition, social constructivism and mathematics education: An example from Papua New Guinea. In *ICME-3 Conference Paper* (pp. 135-150).

Massarwe, K., Verner, I., & Bshouty, D. (2010). An ethnomathematics exercise in analyzing and constructing ornaments in geometry class. *Journal of Mathematics and Culture, 5*(1), 1–20.

Permana, W. H. (2019). Etnomatematika: Aplikasi bangun datar dan peluang pada permainan tradisional kebudayaan Korea Selatan [Ethnomathematics: application of flat shape and its probibility in the South Korean traditional cultural games]. *Jurnal Pendidikan dan Pembelajaran Terpadu (JPPT)*, *1*(2), 138-150. https://doi.org/10.32696/pgsd.v1i2.360

Putra, M. (2018). How ethnomathematics can bridge informal and formal mathematics in mathematics learning process at school: A framework. *For the Learning of Mathematics*, *38*(3), 11–14.

Rafiepour, A., & Moradalizadeh, A. (2022). Using mathematical ideas from carpet and carpet-weavers as a context for designing mathematics tasks. *Journal on Mathematics Education*, *13*(3), 383–392. https://doi.org/10.22342/jme.v13i3.pp383-392

Rahmadani, A. (2019). Keefektifan model pembelajaran kooperatif tipe TGT (Team Games Tournament) type on the topic simple fraction for 3rd grade of Tanjungsari 1 State Elementary School, Sidoarjo]. *Trapsila: Jurnal Pendidikan Dasar*, *1*(01), 55–71. https://doi.org/10.30742/TPD.V1I01.724

Riyani, B. M., Fuadiah, N. F., & Murjainah. (2022). Desain didaktis materi pengukuran satuan panjang kelas IV Sekolah Dasar [Didactic design for measurements of length units for grade IV of Elementary School]. *INNOVATIVE: Journal of Social Science Research*, *2*(1), 252–261. https://doi.org/10.31004/INNOVATIVE.V2I1.3388

Rosa, M., & Orey, D. (2011). Ethnomathematics: The cultural aspects of mathematics. *Revista Latinoamericana de Etnomatemática: Perspectivas Socioculturales de La Educación Matemática*, *4*(2), 32-54.

Saragih, H. A., & Ain, S. Q. (2022). Analisis kesulitan belajar matematika pada materi KPK dan FPB siswa kelas IV SD Negeri 48 Pekanbaru [Analyses of difficulties in mathematics learning in the KPK and FPB materials of students of class IV of State Elementary School 48, Pekanbaru]. *IJoIS: Indonesian Journal of Islamic Studies*, *3*(1), 27–35. https://doi.org/10.5281/ZENODO.6461719

Sugiyono. (2020). *Metode penelitian kuantitatif, kualitatif, dan R&D* [Methods for quantitative, qualitative, and R & D research]. Edisi ke-2 [2nd Edition]. Alfabeta. Bandung.

Zeichner, K. (1996). Educating teachers to close the achievement gap: Issues of pedagogy, knowledge, and teacher preparation. In Williams, B. (Ed.), *Closing the achievement gap: A vision to guide change in beliefs and practice (pp.55-77)*. Alexandria, VA: Association for Supervision and Curriculum Development.