UJME 8 (2) 2019: 128-134
UNNES JOURNAL OF MATHEMATICS EDUCATION
https://journal.unnes.ac.id/sju/index.php/ujme/
ISSN: 2252-6927 (print); 2460-5840 (online)

The mathematics connection ability of 8th grade students' in terms of cultural capital in brain-based learning

Maulina Dhyan Nugraheni*, Iwan Junaedi

Universitas Negeri Semarang, Sekaran Gunungpati, Semarang 50229, Indonesia

** E-mail address: dhyanugraheni@gmail.com*

ARTICLE INFO

Article history:
Received 20 April 2019
Received in revised form 20 July 2019
Accepted 20 August 2019

Keywords:
Mathematics connection ability;
cultural capital;
brain-based learning.

Abstract

The main purpose of the study is to determine the pattern of students' mathematics connection ability as a result from the implementation of Brain-Based Learning and conventional learning in experiment and control class respectively. This research was held in one of junior high school in Semarang. The Research design is mixed method sequential explanatory design. The results are 1) Brain-Based Learning is effective for 8th grade students' mathematics connection ability; and 2) description of mathematical connection ability in terms of cultural capital, namely: (1) category I, 50% of students reached the indicator of understanding the relationship between topics in mathematics, 90% of students reached the indicator of being able to understand and use mathematics in daily life, and other indicators reached by all students ; (2) category II, 50% of students reach the indicator of understanding the relationship between topics in mathematics, and are reached by all students on other indicators; (3) category III subcategory 1. students are able to achieve all indicators of mathematical connections, subcategory 2 the students are not able to reached indicators of relationships between topics in mathematics but are able to reached other indicators, subcategory 3 the students are unable to reached all indicators of mathematical connections, and subcategory 4 with one of two students unable to reached the indicator of understanding the relationship between topics in mathematics but other indicators reached by all students on other indicators; (4) category IV, subcategory 1 indicators understand the relationship between topics in mathematics reached by one student but other indicators can be reached by three out of four students, and subcategory 2 students are able to achieve all indicators of mathematical connections; and (5) category V, one of two students reaches an indicator of understanding and being able to use mathematics in other disciplines, and another indicator is reached by both. Based on the categories obtained with each student's mathematics connection ability, it is recommended to optimize learning in order to obtain better mathematics connection ability.

1. Introduction

One of the effort to improve the quality of human resources is to improve the quality of education in Indonesia. Therefore, education is one issue that continues to be one of the development focus in Indonesia. Indonesian education which is contained in Law number 20 of 2003 article 37 (1) mentioned that mathematics is one that must be contained in the curriculum of primary and secondary education. According to the National Council of Teachers of Mathematics (NCTM) in the Principles and Standards for School Mathematics, there are five process standards described through examples that are demonstrated as each standards and the teachers' role obtain it. The five standard processes include: problem solving, reasoning & proving, communication, connection, and representation.

Mathematics connection ability is one of mathematics' ability which students are expected to be able to master since it may broaden the students thinking ability in mathematics. Indicators of mathematics connection ability according to NCTM include: recognizing and using connections between concepts in mathematics, understanding how mathematics concepts are interconnected and connect on one another to produce a coherent

To cite this article:
Nugraheni, M. D. & Junaedi, I. (2019). The mathematics connection ability of 8th grade students' in terms of cultural capital in brain-based learning. *Unnes Journal of Mathematics Education*, *8*(2), 128-134. doi: 10.15294/ujme.v8i2.32480

whole, and recognizing and applying mathematics outside mathematics contexts.

According to Junaedi & Asikin (2012: 116), mathematics connection as the one of mathematics skill is an activity there are: finding the connection between various concepts representation and procedure, understanding connection between mathematics topics, use mathematics in daily life, understanding the same equivalent concepts representation, find the connection of another procedure in equivalent representations; using connections between mathematics topics; and between mathematics topics to another mathematics topics. Another definition of mathematics connection was the connection between mathematics topics, connection of mathematics with another field, and mathematics connections to real life or daily life (Maisyara & Surya, 2017).

The ability can easier students to recall given material and remember different materials because mathematics has many principles (Siregar & Surya, 2017). Rohendi & Dulpaja (2013) explain mathematics connection indicators, include: (1) finding relationships of various mathematics concepts and procedures; (2) understanding the relationship between topics in mathematics; (3) using mathematics in solving problems in everyday life; (4) understanding the equivalent concept representation; (5) finding an equal relationship between one procedure and another; and (6) using the connection between mathematics and mathematics itself and with other sciences.

Mousley (within Prasetyo, et al., 2004: 192) describe the indicators of mathematics connection ability there are: (1) build connetion between new information and science directly; (2) build connection between mathematics concept; and (3) build connection with daily experiences.

The students' mathematics connection ability adapted in this study is the students' ability to connect mathematics topics, connect mathematics with mathematics itself and with other sciences, and connect mathematics with the real life or daily life.

From various studies that have been done, it is known that students' mathematics connection ability is still not well developed yet, so that students forget the materials that have been learned before (Aini, et al., 2016; Siregar & Surya, 2017; Handayani, et al., 2016). Based on an interview with a mathematics teacher grade VIII at a junior high school in the city of Semarang, the students' mathematics connection ability is not good. In order to develop mathematics connection skills, students need a student-oriented learning process.

Based on interviews with teachers at the school, it is known that the learning used to conventional learning model, it is named direct instruction learning model. According to Lestari (2015: 37), direct instruction learning model is a learning with teacher centered approach so that the activity of presenting material / transferring information directly and structured is carried out by the teacher by lecturing, expository, question and answer, or presentation / demonstration methods.

It was revealed in various studies that Brain-Based Learning can improve mathematics connection ability (Dewi & Masrukan, 2018; Lestari, 2014; Handayani, et al., 2016). Syafa'at (within Lestari, 2014: 38) argues that Brain-Based Learning refers to the creation of learning by empowering students' brains as an orientation.

Brain-Based Learning (BBL) is a comprehensive model to teach based on what fundamental questions are good for the brain (Jensen, 2008: 4). Stages of Brain-based learning according to Jensen (2008) include: pre-exposure, preparation, initiation and acquisition, elaboration, incubation and memory entry, verification and checking of beliefs, integration and celebration.

This study will investigate how is the on students' mathematics connection abilities in terms of cultural capital. The teacher at the junior high school revealed that cultural capital, especially in the aspects of reading climate, participation in extracurricular activities, cultural resources at home, and parents' expectations of children's education in each student varied, so it felt necessary to be analyzed in more detail. This review of cultural capital is based on several studies which reveal that cultural capital influences student academic achievement (Jaeger, 2010; Huang & Liang, 2015; Eryanto & Rika, 2013).

The initial concept of cultural capital is outlined in Bourdieu's research which try to use this concept in explaining the function of the education system on social mobility in social division into social classes (Huang & Liang, 2013: 5). The core hypothesis in Bourdieu's cultural reproduction theory is that cultural capital, transferred from generation to generation and owned by each family and individual, is an important source that contributes to the educational success of each individual (Jaeger, 2010: 1). According to Eryanto & Rika, (2013) cultural capital is an understanding form of the dominant

conceptual and normative codes written in a culture that includes knowledge, expertise and family.

Jaeger (2010: 1) shows that cultural capital affected educational success. Various studies on the impact of cultural capital on academic achievement or educational success, have each indicator. Jaeger (2010: 8) describes the types of cultural capital into indicators as follows: (1) cultural participation; (2) reading climate; and (3) extracurricular activities.

Another research by Tan (2015) examined the contribution of cultural capital to students' mathematics achievement on medium and high socioeconomic gradients. The cultural capital of the study is objectified and tangible type of cultural capital, with indicators are the source of education at home and expectations of parental education towards children. Tan's research results state that the two indicators are more significantly influential on students' academic achievement at higher socioeconomic gradients than others.

Aspects of cultural capital in Tan's research (2015) the effect of each socioeconomic gradient was examined. The cultural capital studied included: (1) home education resources; and (2) educational expectations of parents towards children. The aspects of cultural capital that will be examined refer to the results of Jaeger's (2010) research on aspects that have been stated to affect student academic achievement and aspects of cultural capital studied by Tan (2015), including: (1) reading climate; (2) participation in extracurricular activities; (3) home education resources; and (4) parents' expectations for children's education. The results of this cultural capital review will then be described by each students' mathematics connection abilitiy.

Research on students 'mathematics connection ability is examined with a focus of research in the form of achieving indicators of students' mathematics connection ability that include connections between mathematics topics, connections with other disciplines, and mathematics connections with everyday life. Cultural capital is focused on the form of understanding of the dominant conceptual and normative codes written in a culture that includes knowledge, expertise, and family (Eryanto & Rika, 2013: 46) with a research focus on categorizing cultural capital.

In connection with research into mathematics connection skills with Brain Based Learning, refer to Lestari (2014) found that the ability of mathematics connections and critical thinking skills in students who were subjected to Brain-Based Learning increased better than students who were subjected to direct learning; and Dewi & Masrukan (2018) revealed that the mathematics connection ability of students subjected to the web-assisted Brain-Based Learning model was higher than the students who were not subjected to such treatment.

Related to cultural capital, researcher refers to Jæger (2010) who found that cultural capital had an influence on students' academic achievement. One of the results of this study is that cultural capital (with indicators of participation in cultural activities, reading climate, and extracurricular activities) has a positive impact on students' reading and math test scores.

The objectives in this study include: (1) testing the effectiveness of Brain-Based Learning on the mathematics connection abilities of Grade VIII students; and (2) describe the ability of mathematics connection of class VIII students in terms of cultural capital in mathematics learning with Brain-Based Learning.

2. Method

This study used mixed method and sequential explanatory design. The design used in quantitative research is an experimental research design Posttest-Only Control Design as in Table 1 below.

Table 1. Posttest-Only Control Research Design

Class	Treatment	Measurement
Experiment	*X*	*T+M*
Control		*T*

Information:

X : Brain-Based Learning model

T : Students' mathematics connection ability test (same question)

M : Students' cultural capital.

The population of this experimental study were all students of class VIII in one of junior high school in Semarang. This research use simple random sampling technique. Two classes were taken by purposive sampling, there are class VIII I and class VIII H, where class VIII I as an experimental class and class VIII H as a control class. The experimental class will given a treatment in the form of mathematics learning with a Brain-Based Learning model while the control

class will given a treatment in the form of mathematics learning with a conventional learning model.

The subjects in this study were determined using purposive sampling techniques with consideration coming from each category of cultural capital namely category I (has four indicators of cultural capital), category II (has three indicators of cultural capital), category III (has two indicators of cultural capital), category IV (having one indicator of cultural capital), category V (not having a single indicator of cultural capital) which then each observed score of each indicator of its mathematics connection ability based on the tests of mathematics connection ability. But as a case to be elaborated in this study, the researcher chose all students from the experimental class in each category of cultural capital.

The research variable used in this study is the mathematics connection ability of students who are given a Brain-Based Learning model and the conventional learning model refers to learning that applies in school as a comparison in the control class. The independent variable in this study is mathematics learning with Brain-Based Learning. The dependent variable in this study is the ability of students' mathematics connections in terms of cultural capital. In this study, the data used is primary data, where the data in this study are the results of student work on mathematics connection ability test and data on the results of cultural capital questionnaires by students. The data source of this research is 8th grade students in one of the junior high schools in Semarang City in the academic year 2018/2019. There are two classes as the subject to tests of mathematics connection ability and student's cultural capital on experimental class only, while the case that will be elaborated in the study is all experimental class students.

In this study, data collection techniques that used includes observation, tests, interviews, and questionnaires. Observations were made with teacher observation sheet activity on mathematics learning with a Brain-Based Learning model. The technique used is a test in the form of description. The interview method used in this study is unstructured interviews. The questionnaire in this study, researchers used a questionnaire that was adapted from two studies of previous cultural capital (Pavic & Dukic, 2016; Pishghadam, et al., 2011).

3. Results and Discussion

Based on preliminary data on mathematics connection ability, it is found that the subjects of the experimental class and the control class are normally distributed and homogeneous which means that both samples come from populations with the same conditions.

3.1. The Effectiveness of Brain-Based Learning Model

The data of the mathematics connection ability test results of the experimental class and control class students are normally distributed and have a homogeneous variance, then the hypothesis test is performed to find out effectiveness the Brain-Based Learning learning model is towards the students' mathematics connection ability. The effectiveness of one of them is tested by completeness. Completeness according to Masrukan (2014: 17) is complete learning involving the mastery of practice questions and tests by students.

Hypothesis 1 is the student learning outcomes of mathematics connection ability in mathematics learning with the Brain-Based Learning model achieving classical completeness criteria. The criteria for completeness of student learning are based on the minimum completeness criteria (KKM) of mathematics in one of the junior high schools in the city of Semarang, which is 60 with the percentage of students achieving KKM at least 75%.

Based on the results of the one-sided test on the similarity test, two proportions were obtained $z_{count} = 1{,}925 > z_{table} = 1{,}645$, which means the learning outcomes of students in the experimental class have reached classical completeness.

Hypothesis 2, which is the proportion of students 'mastery learning outcomes to the ability of mathematics connections in mathematics learning with the Brain-Based Learning model in the experimental class is more than the proportion of students' mastery learning outcomes to the ability of mathematics connections in the control class.

Based on the results of the one-sided test on the similarity of two proportion test were obtained $z_{count} = 1{,}657 > z_{table} = 1{,}645$, which means the proportion of completeness of student learning outcomes to the ability of mathematics

connections in the experimental class is more than the proportion of completeness in the control class.

Hypothesis 3 is the average student learning outcomes on mathematics connection abilities in mathematics learning with the Brain-Based Learning model in the experimental class more than the average student learning outcomes on mathematics connection abilities in the control class.

Based on the results of one sided similarity of two proportion test were obtained $t_{count} = 2{,}687 > t_{table} = 1{,}995$, which means the average student learning outcomes of mathematics connection skills in the experimental class are more than the average student learning outcomes of mathematics connection abilities in the control class.

3.2. Description of Students Mathematics Connection Ability in terms of Cultural Capital

The category of cultural capital used in this study is the acquisition of each student's cultural capital score. Aspects or indicators of cultural capital, namely (1) reading climate; (2) participation in extracurricular activities; (3) home education resources; and (4) educational expectations of parents towards their children.

The categories of cultural capital used in this study include: (1) category I, namely students who have 4 indicators of cultural capital; (2) category II, namely students who have 3 indicators of cultural capital; (3) category III namely students who have 2 indicators of cultural capital; (4) category IV namely students who have 1 indicator of cultural capital; and (5) category V namely students who does not have any indicator of cultural capital. The five categories of cultural capital will be juxtaposed with the acquisition of mathematics connection ability scores from each indicator of students 'mathematics connection abilities to determine students' mathematics connection abilities in terms of cultural capital.

Indicators that having by the students on category I are reading climate, participation in extracurricular activities, home education resources, and educational expectations of parents towards their children. Category II that contains students who have 3 indicators of cultural capital, the indicators are reading climate, home education resources, and educational expectations of parents towards their children.

The category of cultural capital is further broken down into subcategories in the discussion to make it more comprehensive because in categories III and IV there are slices of aspects of cultural capital owned by students. Category III is broken down into four subcategories. Subcategory 1 is students who have aspects of reading climate and participation in extracurricular activities. Subcategory 2 is students who have aspects of reading climate and parents' expectations for children's education. Subcategory 3 is students who have aspects of participation in extracurricular activities and parents' expectations for children's education. Subcategory 4 is students who have aspects of the source of education at home and parents' expectations for children's education. Category IV is broken down into two subcategories. Subcategory 1 is students who have aspects of participation in extracurricular activities and subcategory 2 is students who have aspects of parent expectations of children's education.

Referring to the achievement of mathematics connection indicators in terms of cultural capital, in this case students are considered able to achieve certain indicators if the score obtained is more than half the maximum score of each indicator that is 12. There are 20 students who have all four indicators of cultural capital in category I, 10 able students understanding the relationships between topics in mathematics, 20 students are able to understand and use mathematics in other disciplines, and 18 students are able to understand and use mathematics in daily life. Students who have cultural capital indicators namely reading climate, home education resources, and parents' expectations for children's education in category II consist of four students with two students able to understand the relationship between topics in mathematics, four students are able to understand and use mathematics in scientific disciplines another, as well as four students able to understand and use mathematics in everyday life.

Students who have indicators of reading climate and participation in extracurricular activities in category III subcategory 1, have one student able to understand the relationships between topics in mathematics, able to understand and use mathematics in other disciplines, and are able to understand and use mathematics in everyday life. Unlike the case with students in category III subcategory 2 which have indicators of reading climate and parents' expectations for children's education, students are not able to understand the relationships between topics in mathematics, but are able to understand and use mathematics in other disciplines, and are able to

understand and use mathematics in everyday life. While students in category III subcategory 3, namely one student who has indicators of participation in extracurricular activities and parents' expectations for children's education is not able to understand the relationship between topics in mathematics, unable to understand and use mathematics in other disciplines, or unable to understand and use mathematics in everyday life. Then two students who have indicators of the source of education at home and parents' expectations for children's education in category III subcategory 4, only one student is able to understand the relationship between topics in mathematics, but the indicators are able to understand and use mathematics in other disciplines, and are able understand and use mathematics in daily life, both students are able to reached it.

In the category of cultural capital IV subcategory 1: students who have indicators of participation in extracurricular activities, from four students only one student is able to understand the relationship between topics in mathematics, three students are able to understand and use mathematics in other disciplines, and as many as three students are able to understand and use mathematics in everyday life. In category IV subcategory 2, namely one student who has an indicator of parent expectations of children's education, is able to understand the relationship between topics in mathematics, is able to understand and use mathematics in other disciplines, and is able to understand and use mathematics in daily life.

In the cultural capital category V, two students in this category are able to understand the relationships between topics in mathematics, are able to understand and use mathematics in everyday life, and are able to understand and use mathematics in other disciplines, only one student is able to reached indicators.

4. Conclusion

Based on the results of the study, it can be concluded that: (1) the Brain-Based Learning learning model is effective on the mathematics connection ability of Grade VIII students; and (2) the description of the mathematics connection skills of Grade VIII students in terms of cultural capital in mathematics learning with Brain-Based Learning. In terms of the description of students' mathematics connection abilities based on the category of cultural capital, students who tend to be able to reached mathematics connection indicators are students in a category that has 4 aspects of cultural capital such as reading climate, participation in extracurricular activities, home education resources, and educational expectations of parents towards their children; 3 aspects of cultural capital such as reading climate, home education resources, and educational expectations of parents towards their children; a category with aspects of reading climate and participation in extracurricular activities; a category with aspects sources of education at home and parents' expectations for children's education; a category with aspects of parents' expectations for children's education; and students in categories that do not have aspects of cultural capital. Students who tend to be unable to reached indicators of relationship between topics in mathematics are students in the category with aspects of reading climate and parents' expectations for children's education, as well as categories with aspects of participation in extracurricular activities. While students in the category that have aspects of participation in extracurricular activities and parents' expectations for children's education are not able to reached all indicators of mathematics connections.

References

Aini, K.N., Purwonto, & Sa'dijah, C. (2016). Proses Koneksi Matematika Siswa Berkemampuan Tinggi dan Rendah dalam Memecahkan Masalah Bangun Datar. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*, 1(3), 377-388.

Dewi, N. R., & Masrukan. (2018). Kemampuan Koneksi Matematis Mahasiswa Calon Guru pada Brain-Based Learning Berbantuan Web. *Jurnal Matematika Kreatif-Inovatif*, 9(2), 204-214. . Tersedia di http://journal.unnes.ac.id/nju-/index.php/kreano [diakses 27-12-2018].

Eryanto, H., & Darma, R.S. (2013). Pengaruh Modal Budaya, Tingkat Pendidikan Orang Tua Dan Tingkat Pendapatan Orang Tua Terhadap Prestasi Akademik Pada Mahasiswa Fakultas Ekonomi Universitas Negeri Jakarta. *Jurnal Pendidikan Ekonomi Dan Bisnis*, 1(1), 39 – 61. Tersedia di http://jpeb.net [diakses 21-5-2018].

Handayani, W.Y., Sugiman, & Susilo, B.E. (2016). Kemampuan Koneksi Matematis Siswa dalam Pembelajaran Model Arias melalui Pendekatan Brain-Based Learning. *Unnes Journal of*

Mathematics Education, 1(3), 1-9. Tersedia di http://journal.unnes.ac.id/sju/index.php/ujme [diakses 29-11-2018].

Huang, H., & Liang, G. (2015). Parental Cultural Capital and Student School Performance in Mathematics and Science across Nations. *The Journal of Educational Research*. Tersedia di https://researchgate.net/publication/275465817 [diakses 11-12-2018].

Jaeger, M.M. (2010). Does Cultural Capital Really Affect Academic Achievement?. *Centre for Strategic Research In Education*, 1.

Jensen, E. (2008). Pembelajaran Berbasis-Otak. Translated by Molan, B. 2011. Jakarta: Indeks.

Junaedi, I., & Asikin, M. (2012). Pengembangan Pembelajaran Matematika Humanistik untuk Meningkatkan Kemahiran Matematis. *Unnes Journal of Mathematics Education Research*. Tersedia di http://journal.unnes.ac.id/-sju/index.php/ujmer [diakses 28-4-2018].

Lestari, K.E. (2014). Implementasi Brain-Based Learning untuk Meningkatkan Kemampuan Koneksi dan Kemampuan Berpikir Kritis serta Motivasi Belajar Siswa SMP. *Jurnal Pendidikan Unsika*, 2 (10), 38 – 39.

_____. (2015). *Penelitian Pendidikan Matematika*. Bandung: PT Refika Aditama.

Masrukan. (2014). Asesmen Otentik Pembelajaran Matematika, Mencakup Asesmen Afektif dan Karakter. Semarang: FMIPA Unnes.

Maisyara, R., & Surya, E. (2017). Kemampuan Koneksi Matematis (Connecting Mathematics Ability) Siswa dalam Menyelesaikan Masalah Matematika. *ResearchGate*, (December). Tersedia di https://researchgate.net/publication/321803645 [diakses 20-4-2018].

NCTM. (2000). *Principles and Standards for School Mathematics*.

Pavic, Z., & Dukic, M. (2016). Cultural Capital and Educational Outcomes in Croatia: A Contextual Approach. *Sociologia*, 48(16), 601-621.

Prasetyo, A., Dwidayanti, N.K., Junaedi, I. (2017). Students's Mathematical Connection Ability and Disposition Reviewed by Keirsey Personality Type through Eliciting Activities Mathematics Learning Model. *Unnes Journal of Mathematics Education*, 6(2), 190-197. Tersedia di https://journal.unnes.ac.id/-sju/index.php/ujme/article/view/14301/8694 [diakses 12-8-2019]

Pishghadam, R., Noghani, M., & Zabihi, R. (2011). The Construct Validation of a Questionnaire of Social and Cultural Capital. *Canadian Center of Science and Education*, 4(4), 195-203. Tersedia di https://www.-researchgate.net/publication/265262348 [diakses 28-2-2019].

Rohendi, D., & Dulpaja, J. (2013). Connected Mathematics Project (CMP) Model Based on Presentation Media to the Mathematics Connection Ability of Junior High School Student. *Journal of Education and Practicetice*, 4 (4), 17–22. Tersedia di http://iiste.org [diakses 20-4-2018].

Siregar, N.D., & Surya, E. (2017). Analysis of Students ' Junior High School Mathematics Connection Ability. *International Journal of Sciences*: *Basic and Applied Research (IJSBAR)*, 3(2), 309–320. Tersedia di https://www.researchgate.net/publication/318560987 [diakses 18-4-2018].

Tan, CY. (2015). The Contribution of Cultural Capital to Students' Mathematics Achievement in Medium and High Socioeconomic Gradient Economies. *British Educational Research Journal*, 41(6), 1050–1067. Tersedia di http://hdl.handle.net/10722/212012 [diakses 9-2-2019].