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SYSTEMATIC LITERATURE REVIEW: MATHEMATICAL CONNECTIONS THROUGH PROBLEM-BASED LEARNING IN TERMS OF ADVERSITY QUOTIENT

Lilik Supono*[1], Arief Agoestanto[2]
[1,2] Universitas Negeri Semarang

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ABSTRACT

Mathematical connection is a skill needed to understand mathematical concepts and relate them to formulas taught, once taught, applied in other subjects, and applied to the real world. Every student has differences in terms of mathematical connection ability. This is known as the Adversity Quotient (AQ). AQ is divided into three groups: Climbers, Campers, and Quitters. Apart from the AQ review, an appropriate learning model to improve students' mathematical connections is the Problem-Based Learning (PBL) model. PBL is a learning model related to everyday problems. This study aims to (1) determine the effect of AQ on mathematical connection skills in the PBL learning model and (2) determine the influence of AQ on mathematical connection skills. The discussion in this article uses the SLR (System Literature review) method searched from Google Scholar, Scimago Journal Rank, and Publish or Perish from 2013 to 2023. The results of this study get 22 relevant articles. Of the 24 articles studied, 14 concluded that mathematical connections are appropriate for PBL learning models, and eight concluded that AQ's effect on students' mathematical connections is proportional or directly proportional. Students with a good AQ will have good math connections.

Corresponding Author:

Lilik Supono,
Departement of Mathematics Education,
Pascasarjana Universitas Negeri Semarang, Indonesia
Email: liliksupono@students.unnes.ac.id
Phone Number: 081328588068

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1. INTRODUCTION

In the preamble of the 1945 Constitution, one of the objectives of the Indonesian state was to educate the nation's life. According to Law No. 20 of 2013, the national education system is a planned effort to create a learning process for students to develop their potential and provide religious knowledge, personality, wisdom, noble morals, and also the skills needed for themselves, society, and the country. Mathematics is a science that can help in problem-solving. With mathematics, humans are accustomed to thinking systematically,

scientifically, logically, and critically.

Mathematical connections are a compulsory skill to build. With good mathematical connection skills, it can help students connect mathematics with everyday life, can feel the benefits of learning mathematics, and can also prolong the way students understand mathematics. According to Siagian (2016) in the mathematics curriculum in schools, mathematical connections are basic mathematical abilities that must be mastered by students at the secondary school level. The ability to make mathematical connections needs to be developed through learning models. The selection of learning models used must be of high quality(Syaiful et al., 2021). The learning model has a profound effect on the learning process and outcomes(Brinus et al., 2019; Cahyaningrum et al., 2019; Hanifah et al., 2019).

Problem based learning (PBL) is a problem-based learning method, encouraging students to learn to get a solution to a problem both individually and in groups, to think critically, and to be able to determine and use appropriate sources of subject matter. PBL is a learning model that can help students improve their skills(Hotimah, 2020).

In fact, many studies have found that students are still relatively weak in their math connection ability. One of them is research by Kenedi et al. (2019) Hanarafa (2021), Ningsih et al., (2020), and Hati et al., (2022) which indicates that students have a relatively low level of mathematical connection ability. In addition to the selection of learning models that must be appropriate, the ability to tolerate adversity is an important aspect of a person's quality of life known as the Adversity Quotient (AQ). According to Suryaningrum et al., (2020) showed that people with high AQ perform better than people with low AQ. AQ provides strong motivation for people to solve the problems they face so that AQ can support someone to succeed. Stoltz divided individuals into three groups of AQ: quitters, campers, and climbers. Quitter is a term for those who like to give up, Campers is a term for people satisfied with certain achievements, and Climbers is a term for people who continue to want to achieve success.

Based on the description above, it is hoped that this research can conclude that there is an appropriate learning model to be able to improve students' mathematical connection skills. Through the review of the Adversity Quotient, it is expected to be able to determine the effect of students' mathematical connection abilities based on their AQ level.

2. METHOD

This study used the Systematic Literature Review (SLR) method. According to Triandini et al., (2019) the SLR method is used to identify, evaluate, then interpret all research in a particular field with relevant research questions. According to Novitasari et al., (2019)the purpose of this Systematic Literature Review research is to help overcome the problems faced and identify different points of view on the problem being studied and show theories that are in accordance with the problems in the research.

In the initial data collection, many relevant articles were obtained from Google Scholar, Scimago Journal Rank, or Publish or Perish from 2013 to 2023. This search is done with with the keywords *koneksi matematika, model PBL, adversity quotient (AQ), koneksi matematika dan PBL, koneksi matematika dan AQ,* mathematical connections, problem-based learning, and adversity quotient (AQ), mathematical connections and PBL, mathematical connection and AQ. Further articles are selected based on the suitability of the content. After being reviewed based on the content, 22 articles relevant to the content were taken and used as literature in this SLR method. The articles used are then summarized and presented in the form of tables based on the name of the journal, author, and research results.

Research questions:

1. What learning model is appropriate to use to measure mathematical connections?
2. How does the mathematical connection affect AQ?

3. RESULTS AND DISCUSSION

3.1. Results

From several articles taken, the results of this study obtained 22 articles that are relevant to the research question. The 22 articles were detailed into 14 research articles on mathematical connections in PBL learning models and 8 research articles on mathematical communication in terms of adversity quotient.

1. **Research on mathematical connections in PBL learning models**
   The table below contains some research articles on mathematical connections that are suitable to be applied to PBL models

Table 1. List of articles regarding the connection of mathematics to PBL

Journal	Written	Research Results
PRISMA Tahun 2022, Volume 5, Hal 612-618	Nur et al., (2022)	PBL with a STEM approach is effective for students' mathematical connection skills.
Jurnal Pembelajaran Matematika Inovatif Vol. 1, No. 4, Juli 2018	Rohmah & Mahardika (2018)	Students' mathematical connections can improve with the PBL approach. They are able to understand and relate concepts when solving problems in everyday life
AKSIOMA: *Jurnal Program Studi Pendidikan Matematika* Vol. 11, No. 2, 2022	Aisyah et al., (2022)	The application of the PBL model has a good influence on the development of students' mathematical connections.
SIGMA: Jurnal Pendidikan Matematika Vol.13 Nomor 1,	Salim & Pitriani (2021)	There is a good influence between PBL and students' mathematical connection skills
JP3M *Jurnal Penelitian Pendidikan dan Pengajaran Matematika* vol. 3 no. 1, pp. 39–44, Maret 2017	Herawati (2017)	Improving students' mathematical connections with geogebra app-assisted PBL is no better or the same as non-geogebra app-assisted ones.
Seminar Nasional Pendidikan Matematika (SENPIKA)	Trisnawati et al., (2019)	The student's mathematical connection with PBL is

4 Agustus 2018		classified as a high qualification.
Jurnal Dedikasi Pendidikan Volume 6, No. 2, Juli 2022 : 503-514	Muliana et al. (2022)	The mathematical connection of students with PBL models is superior to through a scientific approach to linear system material.
Indonesian Digital Journal of Mathematics and Education Vol. 6 No. 2 2019	Diana (2019)	A student's mathematical connection with PBL is better than with a hands-on learning model.
Jurnal Pendidikan Matematika Vol. 3, No. 3, 2014	Sugiarti & Basuki (2014)	Students' math connections with PBL are better than conventional learning
Jurnal Pena Ilmiah Vol. 2, No. 1 2017	Afifah & Irawati (2017)	PBL math learning can improve students' math connections
Formosa Journal of Sustainable Research Vol.1, No.2, 2022	Fefri Wahida & Andriyani (2022)	PBL models are effective for measuring students' mathematical connections to probability mathematics.
Seminar Nasional Matematika Dan Pendidikan Matematika (6thsenatik) 2021	Anggraini (2021)	There is a good influence on students' mathematical connections to the PBL learning model.
Prosiding Seminar Nasional Matematika dan Pendidikan Matematika (Sesiomadika) 2018	Nuraeni & Effendi (2019)	A student's mathematical connection with PBL is better than with regular learning.
Journal of Medives Vol. 2, Nomor 1, 2018	Atiningsih (2018)	Students' math responsibilities and connections can increase with PBL

Based on Table 1 which contains a collection of articles from the last 10 years, it can be concluded that PBL is suitable for improving students' mathematical connections.

In the description of 14 articles taken from the last 10 years, 14 articles concluded that the PBL learning model is very appropriate to be used to measure mathematical connections. PBL is a learning model that is able to relate mathematical connections to everyday problems

2. Research on mathematical connections reviewed from AQ

The table below contains some research articles on mathematical connections in PBL learning models reviewed from AQ .

Table 2. List of articles regarding the connection of mathematics to AQ

Journal	Written	Research Results
Jurnal Pendidikan Indonesia. Volume 1, Nomor 3, 2020	Azizah (2022)	A student's mathematical connection ability can be affected from a student's AQ.
Mathedunesia Jurnal Ilmiah Pendidikan Matematika Vol. 9 No. 1 2020	Mafulah & Amin (2020)	The math connection of students in the quitters group in solving math problems was lower than that of the campers and climbers group.
International Journal of Research in Education Vol. 2, No. 1, 2022	Viyani et al. (2022)	Mathematic communication skills on the subject of AQ meet all indicators of mathematical communication skills is climbers
Unnes Journal of Mathematics Education Research 2022) 8-13	Konita et al. (2020)	Evaluation of mathematical connection based on AQ shows that different AQ students will have different mathematical connection ability
ICE 2019, Purwokerto, Indonesia EAI DOI 10.4108/eai.28-9-2019.2291035	Purwaningsih et al., (2020)	Mathematical Aspects of Communication Emerging from Students of Quitters in Solving a Problem of a System of Two-Variable Linear Equations
Juring (Journal for Research in Mathematics Learning) Volume 3, Nomor 2, 2020	Dalti & Kurniati (2020)	The difference in mathematical connections in students who have high, medium and low fighting power is very noticeable.

JP3 Vol. 17, Nomor 7, 2022	Adiningsih et al. (2022)	The mathematical connection capability indicator on AQ Climbers is met so that it has good mathematical connection ability
Journal of Physics: Conference Series IOP Publishing ICCGANT 2020	Yuniarti & Putra (2021)	Almost all the indicators of the quittes group can not be met, several indicators of the camper group can be achieved, and all the indicators of mathematics and communication of the climber group can be achieved.

Based on Table 2, in the last 10 years, articles on the ability of mathematical connections reviewed through adversity quotient have been widely examined. The results of his research referring to the the reviewed articles showed such as Mafulah & Amin (2020), Konita et al. (2020), Adiningsih et al. (2022), and Yuniarti & Putra (2021) that AQ is directly proportional to the ability of students' mathematical connections. At the AQ level, it is divided into 3 parts, namely from the highest Climbers, Campers, and the lowest is Quitters and students who have the level of climber have high mathematical connections as well. Student climbers are able to connect, associate, and solve math problems.

4. CONCLUSION

Looking at the results and discussion, the conclusions of this study are: (1) The PBL learning model is appropriate to improve students' mathematical connections. (2) The effect of AQ on mathematical connection ability is proportional or directly proportional. The AQ level is divided into 3 sections, the highest is Climbers, then Campers, and the lowest is Quitters. Students with the AQ Climber level have higher mathematical connection skills compared to the other 2 levels. A good AQ in this case is the position of Climbers.

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