

## Improving Mathematics Learning Outcomes through Learning Cycle Development

Belman Mangapul R. Horbo<sup>1</sup>, Arif Rahman<sup>2</sup>, Yumiati<sup>3</sup>

<sup>1</sup> Universitas Terbuka, Indonesia; belman.rumahorbo462@gmail.com

<sup>2</sup> Universitas Negeri Medan, Indonesia; arifr81@gmail.com

<sup>3</sup> Universitas Terbuka, Indonesia; yumi@ecampus.ut.ac.id

---

### ARTICLE INFO

#### Keywords:

Mathematics;  
Learning Cycle;  
Development

---

#### Article history:

Received 2023-10-30

Revised 2024-01-02

Accepted 2024-02-01

---

### ABSTRACT

This study aims to describe about: (1) development of valid learning cycle teaching materials for improving student mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, (2) development of practical learning cycle teaching materials for improving student mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, (3) development of effective learning cycle teaching materials for improving student mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, and (4) improving students' mathematics learning outcomes using teaching materials based on the learning cycle method developed in grade VIII of SMP North Tapanuli Regency. The object of this research is mathematics teaching materials developed based on learning cycle learning methods to improve mathematics learning outcomes of Pythagorean Theorem material. Research using the Plomp development model consists of investigation, design, realization/construction, test, evaluation and revision, and implementation phases. The product test consists of Teaching Material Validity Data Analysis consisting of three linguists, three material experts and three design experts, as well as data analysis of learning outcomes by calculating N-gain. The results of the study stated that (1) teaching materials based on the learning cycle method developed are valid, used to improve students' mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, (2) teaching materials based on the learning cycle method developed practically, used to improve student mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, (3) teaching materials based on the learning cycle method developed effectively, used to improve student mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, (4) teaching materials based on the learning cycle method developed can improve student learning outcomes in grade VIII SMP North Tapanuli Regency. The acquisition of calculated results or N-Gain value of 0.64 with the category of sufficient or good learning improvement results.

*This is an open access article under the [CC BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/) license.*



---

### Corresponding Author:

Belman Mangapul R. Horbo

Universitas Terbuka, Indonesia; belman.rumahorbo462@gmail.com

---

## 1. INTRODUCTION

Learning mathematics must be able to be a means to improve students' reasoning power and can improve the ability to face the challenges of daily life. That is why, learners need to have the ability to think clearly and logically, a means of solving problems of everyday life, a means of recognizing patterns of relationships and the generation of experiences, a means of increasing awareness of cultural development.

Someone who is good in mathematics will tend to be good at thinking and someone who is trained in learning math, will then be a good thinker. In this connection, the process of the emergence of mathematical ideas or concepts arises because of a mindset related to ideas, processes, and reasoning. When viewed from the point of view of student learning activities, mathematics learning carried out by students during learning activities is certainly related to mathematics activities that have the potential to further increase attitudes of responsibility, freedom of thought which is an indicator of improving student learning outcomes. Learning mathematics for students becomes an arena to be able to solve a problem and gain confidence that the correct solution is not because of the teacher's words, but because of their clear logical reasoning. However, the results of pre-research observations showed that only 45% of students did Student Worksheets out of 50 grade VIII students, many students still considered mathematics difficult and boring.

The school needs to prepare a learning program that will be implemented to achieve the planned educational goals. The government made changes to the learning system in schools, especially in SMP Negeri 2 Parmonangan, because it was in accordance with natural conditions of internet difficulties and parents' lack of economic ability, where according to "Dapodik" data reports that 65% of students who have the means to go online. The school and teachers make plans that are in accordance with the circumstances of students in learning with the implementation of learning by providing independent assignments for students.

The teacher does not act as a giver of knowledge, but rather acts as a facilitator who allows students to activate all dynamic elements in the learning process that lead students to the construction of knowledge. Some characteristics of learning that need to be considered by teachers according to Ratumanan (2004: 4) are: (1) activating motivation, (2) informing learning objectives, (3) designing learning activities and devices that allow students to be actively involved, especially mentally, (4) asking questions that can stimulate student thinking (provoking questions), (5) providing limited assistance to students without giving a final answer, (6) appreciating student work and provide feedback, and (7) provide activities and conditions that enable knowledge construction.

The learning needed must be able to foster the desire to learn students by activating all the potential of students both visually, auditorially and kinetically. Therefore, teaching materials become one of the parts used by students as a guide to facilitate the learning process of students and train learning independence. Teaching materials need to be designed using learning approaches or methods including learning cycle-based. Learning cycle learning is a form of learning that can improve student characteristics and is able to empower all student potential in achieving learning goals. This study aims to explain the development of learning cycle-based teaching materials in order to improve the learning outcomes of grade VIII students of SMP North Tapanuli Regency.

The implementation of learning stages arranged is one of the most important and useful tools in the learning process, as well as in supporting the development of mathematics learning. Artama, Amin, and Siswono (2021) emphasized that mathematics learning is one of the tools to develop logical, creative, critical, systematic ways of thinking, skilled at solving problems in everyday life, and communicating systematically. Kusuma, Jampel, and Bayu (2019) assert that someone who is good in mathematics will tend to be good in thinking and someone who is trained in learning mathematics, will become a good thinker. In this connection, the process of the emergence of mathematical ideas or concepts arises because of a mindset related to ideas, processes, and reasoning. This study aims to describe about: (1) development of valid learning cycle teaching materials for improving student

mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, (2) development of practical learning cycle teaching materials for improving student mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, (3) development of effective learning cycle teaching materials for improving student mathematics learning outcomes in grade VIII SMP North Tapanuli Regency, and (4) improving students' mathematics learning outcomes using teaching materials based on the learning cycle method developed in grade VIII of SMP North Tapanuli Regency.

## 2. METHOD

This development research refers to the development of the general education development model proposed by Tjeerd Plomp (2010). Plomp development design has stages or phases, namely preliminary investigation, design, realization / construction, test, evaluation and revision, and implementation. The subjects in this study are grade VIII students of SMP Negeri 2 Parmonangan for the 2021/2022 academic year. The object of this research is mathematics teaching materials developed based on learning cycle learning methods to improve mathematics learning outcomes of Pythagorean Theorem material.

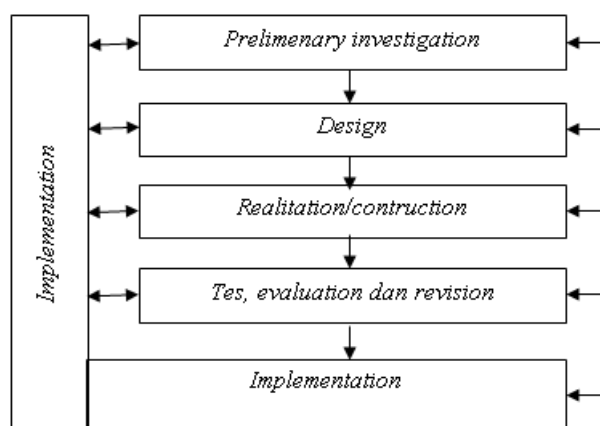


Fig 1. Plomp Development Model (2010) With Modifications

Data obtained from observations, as well as assessments need to be processed to draw research conclusions. To guarantee that the data obtained is not doubtful, the data needs to be tested to see its validation. Based on this validation, it will be concluded whether the teaching materials are suitable for use or need to be revised.

## 3. RESULT AND DISCUSSION

### Result

Development of Pythagorean teaching materials based on learning cycle learning methods in the final stage, namely testing effectiveness through the dissemination stage, where after the expert validation stage, feasibility, student responses and teacher responses then the effectiveness test stage through dissemination as evidence to test the effectiveness of the use of teaching materials developed by looking at the results of post-test ability to improve student learning outcomes in mathematics lessons.

The results of testing carried out with pre-tests and post-test of student mathematics learning outcomes related to teaching materials Pythagorean material based on the learning cycle learning method can be stated 0,64. Furthermore, the acquisition of such an N-Gain value of 0.64 is included in the medium category based on scoring provisions. Based on the results of research and discussion, it can be stated that learning tools in the form of teaching materials developed based on the learning cycle learning method on the Pythagorean Theorem material turned out to be valid in its use. The

validity of the teaching materials developed is based on expert assessment and several revisions that have been made before.

Based on the results of the study, it was concluded that teaching materials based on practical learning cycle learning methods were used in improving students' mathematics learning outcomes. The teaching materials made are certainly directed at the purpose of activating students when learning activities and written activities in learning devices can be carried out properly during the learning process. This is because the lesson has the aim of increasing student understanding and mastery to be better so as to support the improvement of student mathematics learning outcomes. The teaching materials developed certainly aim to support the implementation of the learning process carried out by teachers in the classroom. Learning tools are also intended to help students to be better able to improve their understanding of the subject matter, including improving learning outcomes. Thus it can be concluded that teaching materials are developed and used effectively in learning so as to improve student learning outcomes. The ability of teachers to develop that teaching must certainly go through various stages of the process so that the teaching materials used support the effectiveness of learning. With the realization of the effectiveness of the learning process carried out, it will certainly support the success of the implementation of learning so as to improve student learning outcomes.

## Discussion

Learning is seen as a relatively steady effort for behavior change thanks to practice and experience. Learning in this case can change the behavior of students because of repeated exercises that are carried out to achieve the expected results. Learning carried out by students is part of their life experience, lasts a lifetime, carried out both at school and outside school, and in the surrounding environment for an unlimited time. Learning is an activity that can provide change in each individual. The change is shown in various forms such as changes in knowledge, attitudes and behavior, abilities, skills and others. Each individual's environment is a learning vehicle that can influence behavior change to achieve the desired results. Thus, the result of learning is a change in behavior and will show consciously, without being influenced from outside himself.

Learning outcomes can be classified into five, namely: 1. Intellectual skills, aimed at by students about intellectual operations that can be performed; 2. Cognitive strategy, is a process of control; 3. Verbal information, knowledge presented in the form of propositions (ideas) and is static; 4. Motor skills, abilities that include physical activities, merging motor with intellectual skills; 5. Attitude, is an attitude that can be learned and can influence one's behavior towards objects, events, or other living things. In short, student learning outcomes can be shown from two dimensions, namely content type and performance level. This classification is only applied in the learning cognitive realm. The classification of content types is: intellectual skills, cognitive strategies and verbal information. The level of performance is: motor skills and attitudes. To achieve objective student learning outcomes, a teacher keeps a daily assessment of each learning process.

On the other hand, Mathematics is a scientific discipline that can improve the ability to think, argue and even contribute to helping solve problems in everyday life, as well as providing support in the development of science and technology. Thus mathematics learning can be interpreted as one of the subjects that is very important to master from an early age because in everyday life what humans do cannot be separated from Mathematics activities. Learning Mathematics is learning about the concept of Mathematical structure contained in the material when looking for relationships between Mathematical concepts and structures. Exercises and tests for students are not to measure mechanical abilities in counting, but to express children's intelligence abilities in understanding numbers and dealing with arithmetic situations with perfect understanding both in terms of mathematics and practical.

#### 4. CONCLUSION

After carrying out the process or stages of development of learning cycle-based teaching materials, it can be stated as follows: 1. The results of statistical calculations found a validity score of 3.66, so it can be concluded that teaching materials based on the learning cycle method developed are valid, used to improve students' mathematics learning outcomes in grade VIII SMP North Tapanuli Regency; 2. The results of statistical calculations found a practicality score of 0.89, so it can be concluded that teaching materials based on the learning cycle method developed practically, are used to improve students' mathematics learning outcomes in grade VIII of SMP North Tapanuli Regency; 3. The results of statistical calculations found an effectiveness score of 0.64, it can be concluded that teaching materials based on the learning cycle method developed are effective, used to improve students' mathematics learning outcomes in grade VIII SMP North Tapanuli Regency; 4. Teaching materials based on the learning cycle method developed can improve student learning outcomes in grade VIII of SMP North Tapanuli Regency. The acquisition of calculated results or N-Gain value of 0.64 with the category of sufficient or good learning improvement results.

#### REFERENCES

- Abdurrahman, M. 2003. *Pendidikan Bagi Anak Berkesulitan Belajar*. Jakarta: Rineka Cipta
- Amri, S. dan Ahmadi K. I. (2010). *Proses Pembelajaran Kreatif dan Inovatif Dalam Kelas*. Jakarta : Prestasi Pustaka Raya
- Arends, R. I. (2008). *Belajar untuk mengajar*. New York: McGraw Hills.
- Ariawan, Sandy, Eko Sukanca, dan Maya Trisia Wardani. 2023. *Administrasi Pendidikan*. Disunting oleh M.Pd. Dr. An An Andari. Cetakan I. Yogyakarta: Sultur Pustaka.
- Arikunto, S. 2003, *Dasar-Dasar Evaluasi Pendidikan*, edisi revisi, Bumi Aksara, Yogyakarta
- Armanto, D. 2004. *Aspek Perubahan Pendidikan Dasar Matematika Melalui Pendidikan Matematika Realistik artama(PMR)*. Makalah disampaikan pada seminar nasional sehari Penerapan Pendidikan Matematika Realistik pada Sekolah dan Madrasah, tanggal 5 Nopember 2001, Medan. *Tesis*. Tidak diterbitkan
- B. Weil, J. and Calhoun. 2000. *Models Of Teaching*. Newyork: A Person Education Company.
- Baharuddin, 2009, *Pendidikan dan Psikologi Perkembangan*, Yogyakarta: Ar-Ruzz Media
- Belawati, T. 2003. *Pengembangan bahan Ajar*. Jakarta: Pusat Penerbitan UT
- Creswell, J. W. (2010). *Research design: pendekatan kualitatif, kuantitatif, dan mixed*. Yogyakarta: Pustaka Pelajar.
- Dahar, RW.. (2011). *Teori-Teori Belajar dan Pembelajaran*. Jakarta: Erlangga.
- Degeng, I. 2000. *Ilmu Pengajaran Taksonomi Variabel*. Jakarta: Depdikbud, Dikti, P2LPTK.
- Dimiyati, M. (2006). *Belajar dan Pembelajaran*. Jakarta: Rineka Cipta.
- Fitriana, dkk. 2019. "Pengembangan Modul Matematika Berbasis *Learning Cycle 5E* untuk Memfasilitasi Kemampuan Pemecahan Masalah Matematis Siswa Sekolah Menengah Pertama (SMP)". *Jurnal for Research in Mathematics Learning*. 2 (1) : 21-31
- Gagne, R. M. 2000. *Kondisi Belajar dan Teori Pembelajaran*. Terjemahan Munandir. Jakarta: Depdikbud Dirjen Pendidikan Tinggi.
- Gazali, Rahmita Yuliana. (2016). Pengembangan Bahan Ajar Matematika untuk Siswa SMP Berdasarkan Teori Belajar Ausubel. *Jurnal Pendidikan Matematika*. 11 (1). 182 - 192
- Hamalik, O. 2010. *Kurikulum dan Pembelajaran*. Jakarta; Bumi Aksara.
- Hamdayana, J. 2016: *Metodologi Pengajaran*. Jakarta: Bumi Aksara.
- Haryonik, Y & Bhakti, Y.B. 2018. "Pengembangan Bahan Ajar Lembar Kerja Siswa Dengan Pendekatan Matematika Realistik". *Jurnal Matematika dan Pembelajaran Vol 6*
- Hudojo, 2016. *Pengembangan Kurikulum dan Pembelajaran Matematika*. Malang: Universitas Negeri Malang.

- Jarnawi. 2007. Implementasi Pembelajaran Matematika Melalui Pendekatan Open Ended dalam Meningkatkan Kemampuan Penalaran Dan Pemahaman Matematika Siswa Sekolah Menengah Pertama (Studi Eksperimen pada SMP Negeri di Kota Bandung). *Jurnal Mimbar Pendidikan*. 1 (1)
- Jauhar, M. 2011. *Implementasi Paikem dari Behavioristik sampai konstruktivistik*. Jakarta: Prestasi Pustakaraya.
- Khabibah. 2006. *Pengembangan Model Pembelajaran Matematika dengan Soal Terbuka untuk Meningkatkan Kreativitas Siswa Sekolah Dasar*. Disertasi. Surabaya: Program Pascasarjana Unesa
- Lestari, Indri. 2018. Pengembangan Bahan Ajar Matematika dengan Memanfaatkan Geogebra Untuk Meningkatkan Pemahaman Konsep. *Jurnal Pendidikan Matematika*. 1(1), 26 – 36.
- Maryana, Suaedi, Nurdin. 2019. Pengembangan Media Pembelajaran Matematika Menggunakan Powerpoint dan Ispring Quizmaker pada Materi Teorema Pythagoras. *Jurnal Penelitian Matematika dan Pendidikan Matematika*. 2 (2), 53-61.
- Maswatu, S. (2013). Penerapan Model Learning Cycle (Siklus Belajar) Untuk Meningkatkan Pemahaman Siswa Terhadap Konsep Pembelajaran Akuntansi.(online): <http://suardimaswatu.blogspot.co.id/2013/03/skripsimodel-pembelajaran-learning.html>
- Mustofa, Romy Faisal . 2018. Pengaruh Pembelajaran Learning Cycle 5E terhadap Kemampuan Berpikir Kritis dan Hasil Belajar. *Bioedusiana*. 3(2) , 51-59.
- Ngalimun. 2016. *Strategi dan Model Pembelajaran*. Yogyakarta : Aswaja Pressindo
- Nieveen, N. 1999. *Prototyping to Reach Product Quality*. Jan Van den Akker, Robert Maribe Branch, Kent Gustafson, and Tjeerd Plomp (Ed), London : Kluwer Academic Publisher.
- Nismalasari, dkk. 2016. Penerapan Model Pembelajaran *Learning Cycle* terhadap Keterampilan Proses Sains dan Hasil Belajar Siswa pada Pokok Bahasan Getaran Harmonis. *Edusains*.4 (2) : 74-94.
- Nurhidayati, S., Tayeb, T., & Baharuddin. (2017). pengembangan bahan ajar matematika berbasis masalah untuk memfasilitasi pencapaian kemampuan penalaran pada pokok bahasan perbandingan kelas vii mtsn model makassar Siti. *Jurnal Matematika Dan Pembelajaran*, 5(2), 236–250.
- Prastowo, Andi. (2013). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: Diva Press.
- Ramadhana, Rizky., Hadi, Abdul. 2018. Pengembangan Modul Pembelajaran Matematik Berbasis *Learning Cycle 7E* dengan Pendekatan Saintifik. *Jurnal Ilmiah Pendidikan Matematika*. 1(1) : 45-52.
- Ratumanan, T.W. (2004). *Belajar dan Pembelajaran*. Surabaya : UNESA University Press
- Retnowato, Endah dan Pangesti, Pangesti, Fitrianing Tyas Puji. 2017. Pengembangan Bahan Ajar Geometri SMP Berbasis *Cognitive Load Theory* Berorientasi pada Prestasi Belajar Siswa. *Jurnal Pendidikan Matematika*. 12(1), 33-46
- Rochmad. 2012. Desain Model Pengembangan Perangkat Pembelajaran. *Jurnal Kreano*. 3 (1): 59-72.
- Romiszowski. 2000. *Designing Instructional System*. New York: Nicholas Publishing.
- Sanjaya. W. 2008. *Strategi Pembelajaran “ Berorientasi Standart Proses”*. Jakarta: Prenada Media Group.
- Slameto. (2013). *Belajar dan Faktor-faktor yang Mempengaruhinya*. Jakarta: Rineka Cipta.
- Slavin, R.E. (1983) *Using Student Team Learning ( 3 rd. ed )*. Baltimore: Johns Hopkins University, Centre For Research On Elementary And Middle Schools.
- Sriyanto. 2007. *Strategi Sukses Menguasai Matematika*. Yogyakarta: Indonesia Cerdas.
- Sudijono, Anas. 2011. *Evaluasi Pendidikan*. Jakarta; Raja Grafindo Persada
- Sugiyono. (2009). *Metode Penelitian Bisnis (Pendekatan Kuantitatif, Kualitatif, dan R&D)*. Bandung: Alfabeta.
- Suherman, A. 2009. *Dasar-dasar Penjaskes*. Jakarta : Depdikbud.
- Sujarwo, dkk. 2019. Pengembangan Bahan Ajar Untuk Pembelajaran Matematika Bagi Siswa Tunarungu. *Suska Journal of Mathematics Education*. 5(2), 87-94.

- Susanto, A. 2014. *Teori Belajar dan Pembelajaran di Sekolah Dasar*. Jakarta: Kencana Prenada Media Group.
- Tegeh., Sudatha. 2015. *Desain Multimedia Pembelajaran*. Yogyakarta. Media Akademi.
- Thiagarajan, Sivasailan, dkk. (1974). *Instructional Development for Training Teacher of Exceptional Children: A Source Book*. Washington D.C.: National Center for Improvement of Educational System.
- Trianto. 2009. *Mendesain Model Pembelajaran Inovatif Progresif*. Surabaya: Kencana.
- Trianto. 2011. *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta : Kencana
- Triyono. 2009. *Metodologi Penelitian Pendidikan*. Yogyakarta: Ombak.
- Wena made. 2009. *Strategi pembelajaran inovatif kontemporer*. Jakarta : Bumi aksara.
- Windiarti, Z. (2014). Perbedaan Kemampuan Penalaran Adaptif Siswa yang Diajar Menggunakan Model Pembelajaran Learning Cycle 7e dengan Model Pembelajaran Konvensional pada Materi Luas Permukaan Balok Kelas VIII SMP Negeri 17 Tesis. Surabaya.

