UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA
FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN
Kampus B : Jl. Tanah Merdeka No.20, RT.11/RW.2, Rambutan, Kecamatan Ciracas, Kota Jakarta Timur,
Daerah Khusus Ibukota Jakarta 13830 Telp. (021) 8400341, 8403683, Fax. (021) 8411531
Website : www.fkip.uhamka.ac.id Home page : www.uhamka.ac.id

**SURAT KEPUTUSAN**
**DEKAN FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN**
**UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA**
**Nomor: 1735 / A.30.02/ 2022**

**T e n t a n g**

**PENGANGKATAN DOSEN PEMBIMBING DAN REVIEWER SEMINAR PROPOSAL**
**FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN**
**UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA**
**TAHUN AKADEMIK 2022/2023**

Bismillahirrahmanirrahim,

DEKAN FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA:

Menimbang :

a. Bahwa penulisan skripsi bagi mahasiswa adalah salah satu syarat dalam menyelesaikan studi di Fakultas Keguruan dan Ilmu Pendidikan UHAMKA sesuai dengan ketentuan yang berlaku.

b. Bahwa sebagaimana konsideran (1), dan dalam rangka penulisan dan bimbingan proposal skripsi bagi mahasiswa di lingkungan Fakultas Keguruan dan Ilmu Pendidikan UHAMKA dipandang perlu mengangkat tim dosen pembimbing dan reviewer Seminar Proposal bagi mahasiswa yang telah memenuhi persyaratan dengan Keputusan Dekan.

Mengingat :

1. Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tanggal 8 Juli 2003, tentang Sistem Pendidikan Nasional.
2. Undang-Undang Republik Indonesia Nomor 12 Tahun 2012 tentang Pendidikan Tinggi;
3. Peraturan Pemerintah Republik Indonesia Nomor 4 Tahun 2014, tanggal 30 Januari 2014, tentang Penyelenggaraan Perguruan Tinggi dan Pengelolaan Perguruan Tinggi ;
4. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 3 Tahun 2020 Tanggal 24 Januari 2020 tentang Standar Nasional Pendidikan Tinggi;
5. Keputusan Dirjen Dikti Depdikbud Republik Indonesia Nomor 138/DIKTI/Kep.1997 tanggal 31 Mei 1997, tentang Perubahan Bentuk Institut Keguruan dan Ilmu Pendidikan (IKIP) Muhammadiyah Jakarta menjadi Universitas Muhammmadiyah Prof. DR. HAMKA;
6. Pedoman Pimpinan Pusat Muhammadiyah Nomor 02/PED/I.01.13/2012 tanggal 24 Jumadil Awal 1433 H/16 April 2012 M, tentang Perguruan Tinggi Muhammadiyah;
7. Keputusan Rektor UHAMKA Nomor 681/A.01.01/2020 tanggal 13 Muharram 1442 H/1 September 2020 M tentang pengangkatan Dekan FKIP Universitas Muhammadiyah Prof. DR. HAMKA masa jabatan 2020 – 2024;
8. Statuta Universitas Muhammadiyah Prof. DR. HAMKA Tahun 2013;
9. Keputusan Rektor Universitas Muhammadiyah Prof. DR. HAMKA

Nomor 133/ G. 18. 03/ 2011 tanggal 22 Safar 1432 H., tentang peraturan Pokok Kepegawaian Universitas Muhammadiyah Prof. DR. HAMKA;

10. Keputusan Rektor Universitas Muhammadiyah Prof. DR. HAMKA Nomor 016/G.18.03/1997 tanggal 26 Rabiul Awal 1418 H/31 Juli 1997 M, tentang Pemberlakuan Ketentuan dan Peraturan – Peraturan IKIP Muhammadiyah Jakarta pada Universitas Muhammadiyah Prof. DR. HAMKA;

M E M U T U S K A N :

Menetapkan :

Pertama : Mengangkat Dosen Pembimbing dan Reviewer Seminar proposal di lingkungan Fakultas Keguruan dan Ilmu Pendidikan Universitas Muhammadiyah Prof. DR. HAMKA.

Kedua : Dosen pembimbing mengarahkan mahasiswa yang akan melaksanakan pengambilan data dan penelitian ke lapangan harus mengajukan surat permohonan penelitian terlebih dahulu dengan ketentuan yang bersangkutan telah memenuhi persyaratan administrasi akademik.

Ketiga : Reviewer atau penguji seminar proposal memberikan saran kepada mahasiswa atas rancangan atau usulan penelitian yang akan dilakukan.

Keempat : Seluruh biaya bimbingan dibebankan sepenuhnya kepada mahasiswa yang dialokasikan untuk itu.

Kelima : Surat keputusan ini disampaikan kepada pihak-pihak yang terkait untuk dilaksanakan sebagaimana mestinya.

Keenam : Apabila dalam keputusan ini terdapat kekliruan, maka akan diperbaiki sebagaimana mestinya.

Ditetapkan di : Jakarta
Pada tanggal : 20 Shafar 1444 H
16 September 2022 M

Dekan,

**Dr. Desvian Bandarsyah, M.Pd.**

Surat Keputusan ini disampaikan kepada:
1. Wakil Dekan I, II, III, dan IV;
2. Ketua dan Sekretaris Program Studi
3. Dosen Pembimbing dan Reviewer Seminar Proposal FKIP UHAMKA.

Lampiran SK Nomor: 1735/ A.30.02/ 2022

DATA SEMINAR PROPOSAL
SEMESTER GASAL TAHUN AKADEMIK 2022/ 2023
FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN
UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA

| No | NIM | Nama | Dosen Pembimbing |
|---|---|---|---|
| 1 | 1901105022 | Devi Yuliana | Asih Miatun, M.Pd. |
| 2 | 1901105053 | Cinthia Venita Putri | Asih Miatun, M.Pd. |
| 3 | 1901105061 | Humaira | Asih Miatun, M.Pd. |
| 4 | 1901105076 | Habibah Nurhani Zulfah | Asih Miatun, M.Pd. |
| 5 | 1901105005 | Ahmad Iswanto | Ayu Faradillah, M.Pd. |
| 6 | 1901105010 | Rika Khairunnisa | Ayu Faradillah, M.Pd. |
| 7 | 1901105100 | Putri Awalia Rizkia | Ayu Faradillah, M.Pd. |
| 8 | 1901105110 | Andika Ghabira Sena | Ayu Faradillah, M.Pd. |
| 9 | 1901105115 | Axl Ferrari Fatahillah | Ayu Faradillah, M.Pd. |
| 10 | 1901105016 | Andira Rahmawati | Ayu Tsurayya, M.Si. |
| 11 | 1901105033 | Vivied Eka Pratiwi | Ayu Tsurayya, M.Si. |
| 12 | 1901105069 | Tri Septiani | Ayu Tsurayya, M.Si. |
| 13 | 1901105107 | Dina Khoirunnisa | Benny Hendriana, M. Pd. |
| 14 | 1901105116 | Annisa Aulia Aziz | Benny Hendriana, M.Pd |
| 15 | 1901105070 | Febbyana Ilwan Kajori | Benny Hendriana, M.Pd |
| 16 | 1901105083 | Rayhan Muhammad Akbar | Benny Hendriana, M.Pd |
| 17 | 1901105119 | Jihan Rofifah | Benny Hendriana, M.Pd |
| 18 | 1901105001 | Kiki Amalia | Dr. Ishaq Nuriadin, M.Pd. |
| 19 | 1901105066 | Soma Wijaya Rawi | Dr. Ishaq Nuriadin, M.Pd. |
| 20 | 1901105111 | Ihsan Ramdani Nasihin | Dr. Ishaq Nuriadin, M.Pd. |
| 21 | 1901105029 | Alifah Noer | Dr. Joko Soebagyo, M.Pd. |
| 22 | 1901105031 | Sarah Aida Salsabila | Dr. Joko Soebagyo, M.Pd. |
| 23 | 1901105065 | Wildan Nugraha | Dr. Khoerul Umam, M.Pd. |
| 24 | 1901105105 | Adjie Muhamad Ilham | Dr. Khoerul Umam, M.Pd. |
| 25 | 1901105030 | Muhammad Rizky Pradana | Dr. Khoerul Umam, M.Pd. |
| 26 | 1901105085 | Ade Aswar | Dr. Samsul Maarif |
| 27 | 1901105038 | Ayu Budi Cahayani | Dr. Samsul Maarif |
| 28 | 2201109002 | Widy Zaina Yumna | Dr. Samsul Maarif, M.Pd. |

| No | NIM | Nama | Dosen Pembimbing |
|---|---|---|---|
| 29 | 1901105006 | Muhammad Ilham Fikri Fathoni | Dr. Sigid Edy Purwanto, M.Pd. |
| 30 | 1901105055 | Diah Ayu Rifitasari | Dr. Sigid Edy Purwanto, M.Pd. |
| 31 | 1901105097 | Endah Luqyana | Dr. Sigid Edy Purwanto, M.Pd. |
| 32 | 1901105048 | Riska Wahyu Ananda | Drs. Slamet Soro, M.Pd. |
| 33 | 1901105078 | Nurul Fathonah Najla | Drs. Slamet Soro, M.Pd. |
| 34 | 1901105079 | Safaqa Ahmar | Drs. Slamet Soro, M.Pd. |
| 35 | 1901105060 | Nur Kurniyasih | Esti Ambar Nugraheni, M.Pd. |
| 36 | 1901105096 | Nikita Dewi | Esti Ambar Nugraheni, M.Pd. |
| 37 | 1901105046 | Afiful Haidar | Fitri Alyani, M.Si |
| 38 | 1901105091 | Adinda Oktavia | Fitri Alyani, M.Si |
| 39 | 1901105094 | Dima Vadya | Fitri Alyani, M.Si |
| 40 | 1901105125 | Silvia Ismi Widyarini | Fitri Alyani, M.Si |
| 41 | 1901105009 | Intan Puspita Sari | Hella Jusra, M.Pd. |
| 42 | 1901105018 | Varadina Nurulita | Hella Jusra, M.Pd. |
| 43 | 1901105068 | Fitriani | Hella Jusra, M.Pd. |
| 44 | 1901105093 | Dita Nuranggraeni | Hella Jusra, M.Pd. |
| 45 | 1901105003 | Fika Rahmah | Hikmatul Khusna, M.Pd. |
| 46 | 1901105041 | Adjeng Nabila Saskiya | Hikmatul Khusna, M.Pd. |
| 47 | 1901105050 | Salaamah Nur Mujahidah | Hikmatul Khusna, M.Pd. |
| 48 | 1901105081 | Diah Sofiana Eka Putri S | Hikmatul Khusna, M.Pd. |
| 49 | 1901105084 | Sekar Rani Candraningtyas | Hikmatul Khusna, M.Pd. |
| 50 | 1901105015 | Kristianti | Isnaini Handayani, M.Pd. |
| 51 | 1901105023 | Syifa Fauzia | Isnaini Handayani, M.Pd. |
| 52 | 1901105058 | Zahra Maya Syamsyiah | Isnaini Handayani, M.Pd. |
| 53 | 1901105101 | Naufal Fadhilah | Isnaini Handayani, M.Pd. |
| 54 | 1901105102 | Mayda Ayu Ningsih | Isnaini Handayani, M.Pd. |
| 55 | 1901105063 | Riska Fitriani | Leni Marlena, M.Si |
| 56 | 1901105012 | Sitta Agustiani | Leni Marlena, M.Si |
| 57 | 1901105056 | Nasywa Qothrunnada | Leni Marlena, M.Si |
| 58 | 1901105108 | Isma Putri Kamila | Leni Marlena, M.Si |
| 59 | 1901105021 | Asma Ul Husna | Meyta Dwi Kurniasih, M.Pd. |
| 60 | 1901105024 | Anggie Risma Dwiyanto | Meyta Dwi Kurniasih, M.Pd. |

| No | NIM | Nama | Dosen Pembimbing |
|---|---|---|---|
| 61 | 1901105054 | Sri Amelia | Meyta Dwi Kurniasih, M.Pd. |
| 62 | 1901105080 | Gisni Anjarrani | Meyta Dwi Kurniasih, M.Pd. |
| 63 | 1901105104 | Vina Anggraeni | Meyta Dwi Kurniasih, M.Pd. |
| 64 | 1901105051 | Dyah Ayu Wulandari | Muntazimah, M.Pd. |
| 65 | 1901105064 | Hena Rosita Dewi | Muntazimah, M.Pd. |
| 66 | 1901105071 | Nurul Suci Wardana | Muntazimah, M.Pd. |
| 67 | 1901105106 | Indah Putri Diani | Muntazimah, M.Pd. |
| 68 | 2201109001 | Laras Damayanti | Subhan Ajiz Awalludin, M.Sc |
| 69 | 1901105004 | Hafiz Alfarisy | Subhan Ajiz Awalludin, M.Sc |
| 70 | 1901105025 | Lazuardi Sastra Al-Ashri | Subhan Ajiz Awalludin, M.Sc |
| 71 | 1901105028 | Devina Yulianti | Subhan Ajiz Awalludin, M.Sc |
| 72 | 1901105011 | Shiska Putri Astuti | Supiat, M.Pd |
| 73 | 1901105044 | Salsabilla Indah Alfiani | Supiat, M.Pd |
| 74 | 1901105046 | Dzulhijjah Atdina Putri | Supiat, M.Pd |
| 75 | 1901105008 | Eka Sari Widiastuti | Syafika Ulfah, M.Sc. |
| 76 | 1901105033 | Salma Nadhira | Syafika Ulfah, M.Sc. |
| 77 | 1901105075 | Rizqa Alysya Rafianida | Syafika Ulfah, M.Sc. |
| 78 | 1901105114 | Ummi Kulsum Alaydrus | Syafika Ulfah, M.Sc. |
| 79 | 1901105035 | Ajeng Sucitra Haryanza | Trisna Roy Pradipta, M.Pmat |
| 80 | 1901105017 | Lusiana Nur Maghfiroh | Trisna Roy Pradipta, M.Pmat |
| 81 | 1901105045 | Alifia Nur Cholifah | Trisna Roy Pradipta, M.Pmat |
| 82 | 1901105020 | Laili Gita Syahharani | Wahidin, M.Pd. |
| 83 | 1901105052 | Niken Fijayanti | Wahidin, M.Pd. |
| 84 | 1901105062 | Devie Nursaidah Putri | Wahidin, M.Pd. |
| 85 | 1901105092 | Widya Saviraningrum | Wahidin, M.Pd. |
| 86 | 1901105109 | Alya Zulkhoirunnisa | Windia Hadi, M.Pd. |
| 87 | 1901105013 | Adella Irma Wiyanti | Windia Hadi, M.Pd. |
| 88 | 1901105040 | Destianti Sulistyawati | Windia Hadi, M.Pd. |
| 89 | 1901105090 | Raras Cahyaningrum | Windia Hadi, M.Pd. |
| 90 | 1901105113 | Adryani Br Ginting | Windia Hadi, M.Pd. |

UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA
FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN
Kampus B : Jl. Tanah Merdeka No.20, RT.11/RW.2, Rambutan, Kecamatan Ciracas, Kota Jakarta Timur, Daerah Khusus Ibukota Jakarta 13830 Telp. (021) 8400341, 8403683, Fax. (021) 8411531
Website : www.fkip.uhamka.ac.id Home page : www.uhamka.ac.id

**KEPUTUSAN DEKAN**
**UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA**
**Nomor : 1745/ A.30.02/ 2022**

**T e n t a n g**

**PENGANGKATAN DOSEN PEMBIMBING SKRIPSI**
**PROGRAM STUDI PENDIDIKAN MATEMATIKA**
**FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN**
**UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA**
**TAHUN AKADEMIK 2022/2023**

***Bismillahirrahmanirrahim,***

DEKAN FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA :

Menimbang :

a. Bahwa Kegiatan Penulisan skripsi bagi mahasiswa adalah salah satu syarat dalam menyelesaikan studi di Fakultas Keguruan dan Ilmu Pendidikan UHAMKA sesuai dengan ketentuan yang berlaku.

b. Bahwa sebagaimana konsideran (a), dan dalam rangka penulisan dan Bimbingan skripsi bagi mahasiswa Program Studi Pendidikan Matematika Fakultas Keguruan dan Ilmu Pendidikan UHAMKA dipandang perlu mengangkat Dosen Pembimbing Skripsi bagi mahasiswa yang telah memenuhi persyaratan dengan Keputusan Dekan.

Mengingat :

1. Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tanggal 8 Juli 2003, tentang Sistem Pendidikan Nasional.
2. Undang-Undang Republik Indonesia Nomor 14 Tahun 2005 tanggal 20 Desember 2005 tentang Guru dan Dosen;
3. Peraturan Pemerintah Republik Indonesia Nomer 17 Tahun 2010, tentang Pengelolaan dan Penyelenggaraan Pendidikan;
4. Keputusan Dirjen Dikti Depdikbud Republik Indonesia Nomor 138/DIKTI/Kep.1997 tanggal 31 Mei 1997, tentang Perubahan Bentuk Institut Keguruan dan Ilmu Pendidikan (IKIP) Muhammadiyah Jakarta menjadi Universitas Muhammmadiyah Prof. DR. HAMKA;
5. Pedoman Pimpinan Pusat Muhammadiyah Nomor 02/PED/I.01.13/2012 tanggal 24 Jumadil Awal 1433 H/16 April 2012 M, tentang Perguruan Tinggi Muhammadiyah;
6. Keputusan Rektor UHAMKA Nomor 860/A.01.01/2016 tanggal 15 Zulhijjah 1437 H/17 September 2016 M tentang pengangkatan Dekan FKIP Universitas Muhammadiyah Prof. DR. HAMKA masa jabatan 2016 – 2020;
7. Statuta Universitas Muhammadiyah Prof. DR. HAMKA Tahun 2013;
8. Keputusan Rektor Universitas Muhammadiyah Prof. DR. HAMKA Nomor 133/G.18.04/2011 tanggal 22 Safar 1432 H., tentang Peraturan Pokok Kepegawaian Universitas Muhammadiyah Prof. DR. HAMKA;
9. keputusan Rektor Universitas Muhammadiyah Prof. DR. HAMKA Nomor 016/G.18.03/1997 tanggal 26 Rabiul Awal 1418 H / 31 juli 1997 M, tentang Pemberlakuan Ketentuan dan Peraturan-Peraturan IKIP Muhammadiyah Jakarta pada Universitas Muhammadiyah prof. DR. HAMKA.

M E M U T U S K A N

Menetapkan :

Pertama : Mengangkat Dosen Pembimbing Skripsi mahasiswa Program Studi Pendidikan Matematika FKIP UHAMKA sebagaimana tercantum dalam daftar lampiran.

Kedua : Tugas Dosen Pembimbing Skripsi:
1. Membimbing dan mengarahkan kegiatan penelitian yang telah disetujui;
2. Memberikan masukan, arahan dan saran kepada mahasiswa yang berkaitan dengan penulisan dan penyelesaian skripsi;
3. Menandatangani skripsi yang telah selesai bimbingan untuk segera diadakan ujian siding skripsi.

Ketiga : Bagi mahasiswa yang akan melaksanakan pengnambilan dan penelitian ke lapangan harus mengajukan surat permohonan penelitian terlebih dahulu dengan ketentuan yang bersangkutan telah memenuhi persyaratan administrasi akademik.

Keempat : Seluruh biaya bimbingan dibebankan sepenuhnya kepada mahasiswa yang dialokasikan untuk itu.

Kelima : Keputusan ini berlaku selama 6 (enam) semester sejak tanggal ditetapkan, jika sampai batas waktu yang telah ditentukan masih ada mahasiswa yang belum melaksanakan bimbingan, maka mahasiswa yang bersangkutan mengulang dengan pembimbing yang baru.

Keenam : Surat keputusan ini disampaikan kepasa pihak-pihak yang terkait untuk dilaksanakan sebagaimana mestinya.

Ketujuh : Apabila dalam keputusan ini terdapat kekeliruan, maka akan diperbaiki sebagaimana mestinya.

Ditetapkan di : Jakarta
Pada tanggal : 20 Shafar 1444 H
16 September 2022 M

Dekan,

FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN

**Dr. Desvian Bandarsyah, M.Pd.**

Salinan Keputusan ini disampaikan kepada :
1. Wakil Dekan I, II, III & IV;
2. Ketua dan Sekretaris Program Studi Pendidikan Matematika;
3. Dosen Pembimbing Prodi Pendidikan Matematika;
   FKIP UHAMKA

Journal of Tadris Mathematics (JTMT)
Volume 4 No. 2, 2023, P-ISSN (2745-956X), E-ISSN (2745-9551)
Website: https://journal.uiad.ac.id/index.php/Jtm

# Application of ADDIE Learning Model Assisted by Desmos Application to Improve Ability to Understand Mathematical Concepts

**Jihan Rofifah[1], Benny Hendriana[2]**
[1,2] *Muhammadiyah University Prof. Dr. Hamka, Indonesia*
*E-mail correspondence: rofifahjihan31@gmail.com*
DOI: 10.47435/jtmt.v4i02.2043

**Submission Track:**
||Received: June 18, 2023||Approved: July 07, 2023||Published: December 24, 2023


***Abstract***

*This study aims to improve students' understanding of mathematical concepts using the application of the ADDIE learning model assisted by the desmos application. This research is a Classroom Action Research. The research subjects consisted of 36 students of class X-D SMAN 83 Jakarta. Data collection techniques used description test instruments, observation sheets, and documentation. Data analysis used quantitative and qualitative descriptive analysis. Researchers conducted initial observations (pre-cycle) and two learning cycles. An observer assessed the activities of educators and students in each cycle. The results stated that students experienced an increase in the ability to understand mathematical concepts seen from the pre-cycle percentage of 13.89%, cycle I of 66.67%, cycle II of 83.33% and reached the KKM score ≥78 and in accordance with the research target of 80%. This is supported by the activities of students and the activities of educators who also experienced an increase in each cycle in the good category. So it can be said that using the application of the ADDIE learning model assisted by the desmos application can improve the ability of students' understanding of mathematical concepts in trigonometry material.*
***Keywords:*** *Concept Understanding; ADDIE model; Desmos*

## 1. Introduction

Mathematics is the highest science. Mathematics is one of the few sciences taught systematically from elementary to college level (Mutaqin et al., 2023). Some Indonesian students always shy away from mathematics. In everyday life, we cannot avoid anything related to mathematics. With this it is known that mathematics plays an important role for education.

In learning mathematics, students need an ability that can help solve math problems. Correspondingly, a goal of learning mathematics is to understand concepts (Pratiwi & Tsurayya, 2023). Every student's basic skills in learning mathematics start with conceptual understanding (Sunarto et al., 2021). Conceptual understanding is the foundation of *Higher Order Thinking Skills* (HOTS) (Hendriana, 2019). (Setiawan et al., 2023; Utami & Kusumah, 2023) Find low scores in students' ability to understand. There are factors that result in the ability to understand mathematical concepts are not optimal, namely students do not have the opportunity to get a further understanding of the material taught (Praja et al., 2021). Thus, students are accustomed to learning by memorizing but not understanding (Maknun et al., 2021). Even though understanding the concept of learning mathematics is more important than just memorizing the material (Fahrudin et al., 2018). In line with that, in general, failure to learn mathematics is caused by students do not understand mathematical concepts and are unable to solve mathematical problems (Arifin et al., 2023).

Based on the results of the initial observation description test (pre-cycle) in class X-D SMAN 83 Jakarta, it was found that the number of students who were able to understand mathematical concepts

with a complete category of 5 people and incomplete 31 people with a completion percentage of 13.89%, thus the ability to understand mathematical concepts in the class was classified as a low category. This happens because classroom learning is still centered only on educators which causes low ability to understand mathematical concepts in the classroom. When learning takes place, students are still passive because during learning educators only provide material through the lecture method, students rarely ask questions or express opinions. Intergroup discussions rarely occur so that interaction between students or educators is still not established during the learning process. In line with that, teacher-centered learning causes: (1) students are not interested in learning and feel lazy, (2) student activities when in class are less productive, (3) students are still confused in solving problems from educators, (4) students only follow instructions from educators when solving problems, (5) students are less creative in solving problems, and (6) learners are accustomed to cheating answers from their peers (Syarifuddin, 2020).

The high ability of students to understand mathematical concepts if they can apply, remember, sequence back the ideas that have been learned and can solve mathematical problems(Nuraeni & Nugraheni, 2022). Correspondingly, when they are able to meet the indicators, then they are considered to have mathematical comprehension skills (Sari et al., 2023). Thus, the indicator of the ability to understand mathematical concepts becomes one of the clues in a learning achievement. Indicators of understanding mathematical concepts are being able to understand, recognize, and prioritize mathematical procedures, concepts, and principles and ideas (Arifin et al., 2023). Researchers adopt indicators of the ability to understand mathematical concepts from several studies and formulate the indicators into: (1) rearrange concepts, (2) determine the characteristics of processes or ideas, (3) maintain concepts learned with counterexamples, (4) display ideas with a number of mathematical symbols, including tables, graphs, diagrams, and figures (Ardila et al., 2022; Gusmania & Agustyaningrum, 2020; Praja et al., 2021; Sibarani et al., 2021).

Solutions to solve these problems need to be improved to the learning process with a learning model system. The learning model itself is a tool that supports and supports the learning process. ADDIE is one example of a new approach to education (Rosita, 2019). The ADDIE model is a learning system with a simple and easy to learn basis (Pribadi, 2009). This learning model has a systematic, efficient, effective approach and produces an interactive process (Darsono et al., 2019; Hidayat & Nizar, 2021; Marbun, 2021) and can create innovative teaching and learning activities when educators can elaborate between teaching materials and media (Ulum et al., 2020).

The ADDIE model is commonly used as a development model however, there are some studies such as(Amarullah & Wahidah, 2021; Arini et al., 2013; Asmara, 2021; Darsono et al., 2019; Dewi et al., 2013; Dwipayanti et al., 2013; Hidayat & Nizar, 2021; Istiqomah et al., 2022; Rosdianto et al., 2019; Rosita, 2019; Siwardani et al., 2015; Subur & Rahayu, 2021; Ulum et al., 2020; Wijayanti, 2016) What makes the Addie model a learning model is reinforced by the statement (Molenda, 2003) which states there is no original and authoritative version of the ADDIE model that can be revealed and interpreted, there is no real or authentic meaning for the term, anyone is free to embed whatever attributes they want on this label as they see fit. So researchers apply the ADDIE model as a learning model system.

In addition to requiring the right learning model system, educators can use media to make lesson concepts more interesting, effective, and efficient is one way to make learning fun and more meaningful (Hendriana, 2019). In line with that, educators can also use various latest technologies, one of which is the Desmos application which is an online and free graphing calculator for educators and students (Taufik & Pagiling, 2021). It is of course ideal for efficient and effective visualization of abstract mathematical objects. Especially mathematics subjects trigonometric material that requires graphic visualization (Ishartono et al., 2018). This site is able to help educators visualize the subjects they teach so as to make learning more fun. Ultimately, educators can provide learners with a level of proficiency in operating sites that they can use independently to find out more about the math topics they teach. Thus, the skill of operating the Desmos application is important for mathematics educators in high school.

Based on this presentation, researchers want to investigate the potential of Addie's learning model to improve student understanding. The difference between this research and the previous one lies in the subject used is X-D class students at SMAN 83 Jakarta with trigonometry material and also examines

Journal of Tadris Mathematics (JTMT)
Volume 4 No. 2, 2023, P-ISSN (2745-956X), E-ISSN (2745-9551)
Website: https://journal.uiad.ac.id/index.php/Jtm

how educators and students work on addie learning. The novelty of this study is using the help of the media application desmos.

## 2. Method

The research method used is classroom action research. This study chose the model (Arikunto et al., 2007) because researchers argue that there needs to be an initial observation stage (pre-cycle) to identify problems in the classroom before conducting research. The following is an overview of the stages of the arikunto model cycle.

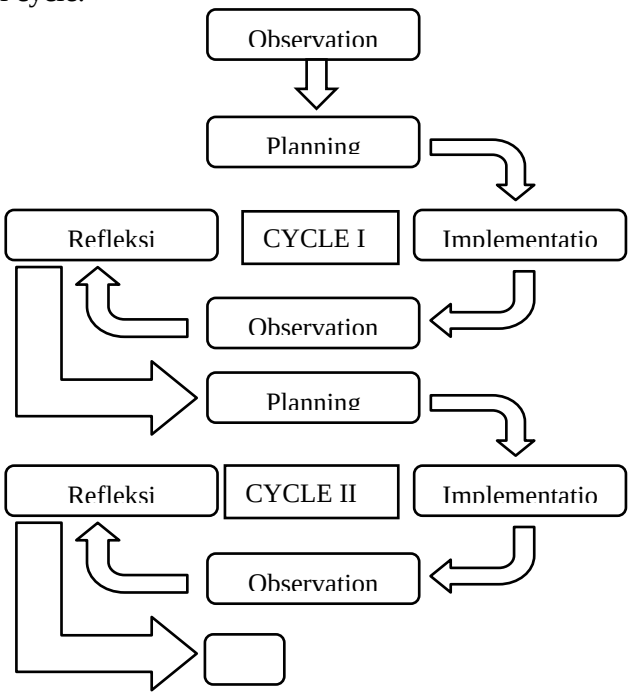


**Figure 1. Action Reserch Model Suharsimi Arikunto**

There are four stages of the classroom action research cycle, namely: planning, implementation, observation, and reflection. After carrying out the pre-cycle, researchers carried out cycles I and II. The subjects of the study were 36 students from class X-D SMAN 83 Jakarta, 14 of whom were men and 22 of them were women. The material provided is trigonometric material, because this material is mostly about story problems, so they need mathematical literacy to overcome these problems.

Data collection methods include test and non-test instruments, both of which have been validated by a teacher and an expert lecturer in mathematics. Test instruments such as test sheets, descriptions of the ability to understand mathematical concepts in each cycle, as well as non-test tools such as observation sheets, student and educator activities, and documentation. Data analysis through quantitative descriptive analysis examines the results of student tests conducted at the end of each cycle. Meanwhile, qualitative data analysis is analyzing the results of observations of student and educator activities.

Quantitative descriptive analysis is used to measure the increase in the capacity of learners in understanding mathematical ideas on trigonometric content in classes X-D. This research uses learning tools such as teaching modules by applying the ADDIE and LKPD learning models applied through the Desmos application. Using formula 1 below, calculate the value of each indicator of understanding mathematical concepts.

$$\frac{Total\ score\ for\ each\ indicator}{The\ maximum\ score\ for\ each\ indicator} \times 100 \quad ...(1)$$

*Source : (Yuliani et al., 2018)*

Table 1 shows the categories of values for the ability to understand mathematical concepts in each indicator.

Journal of Tadris Mathematics (JTMT)
Volume 4 No. 2, 2023, P-ISSN (2745-956X), E-ISSN (2745-9551)
Website: https://journal.uiad.ac.id/index.php/Jtm

**Table 1. Value Category Ability to Understand Mathematical Concepts**

| Value | Category |
|---|---|
| 85,00 − 100 | Excellent |
| 70,00 − 84,99 | Good |
| 55,00 − 69,99 | Enough |
| 40,00 − 54,99 | Low |
| 0,00 − 39,99 | Very low |

*Source : (Argawi & Pujiastuti, 2021)*

Calculate the completeness value of the ability to understand individual mathematical concepts of students with formula 2.

$$score = \frac{Score}{Maksimum\ score} \times 100 \ldots(2)$$

*Source : (Yuliani et al., 2018)*

Adapun kategori ketuntasan belajar yang di sesuaikan dengan KKM sekolah tersebut pada Tabel 2. The category of learning completeness is adjusted to the school's KKM in Table 2.

**Table 2. Categories Completeness**

| Value | Category |
|---|---|
| ≥ 78 | Complete |
| < 78 | Incomplete |
| KKM = 78 | |

Calculate the percentage of completion results of the description test with formula 3 as follows:

$$Percentage = \frac{\sum students\ who\ have\ completed\ their\ studies}{\sum students} \times 100 \ldots(3)$$

*Source : (Miria & Fahriza, 2022)*

The results of the calculation of the percentage of results of the ability to understand mathematical concepts, then categorized into table 3.

**Table 3. Category Percentage Results Ability to understand mathematical concepts**

| Percentage | Category |
|---|---|
| 0% - 39% | Very low |
| 40% - 54% | Low |
| 55% - 74% | Keep |
| 75% - 89% | Tall |
| 90% - 100% | Very high |

*Source : (Septripiyani & Novtiar, 2021)*

After quantitative descriptive analysis, then researchers analyze qualitative data. Qualitative data analysis using observation sheets of student learning activities and educators' teaching skills in mathematics learning with the ADDIE learning model assisted by the Desmos application media. The collected data is then evaluated by calculating the score according to the following formula 1.

$$score = \frac{descriptor\ appears}{maximum\ amount} \times 100 \ldots(4)$$

*Source : (Miria & Fahriza, 2022)*

Calculate the average value of the ability to understand mathematical concepts with formula 2 below.

$$average\ score = \frac{total\ score\ obtained}{number\ assessment\ indicators} \ldots(5)$$

*Sumber : (Yuliani et al., 2018)*

**Table 4. Percentage Category of Observations**

| Percentage | Category |
|---|---|
| 85% − 100% | Excellent |
| 70% − 85% | Good |
| 65% − 70% | Enough |

Journal of Tadris Mathematics (JTMT)
Volume 4 No. 2, 2023, P-ISSN (2745-956X), E-ISSN (2745-9551)
Website: https://journal.uiad.ac.id/index.php/Jtm

| | |
|---|---|
| 50% – 65% | Less |
| 0% – 50% | Very lacking |

*Source : (Sunarto et al., 2021)*

The achievement of the researcher's target is 80% completeness of students in class X-D who have increased the ability to understand mathematical concepts so that student learning activities and educator teaching skills activities also increase to reach a score of 80% with good criteria being a benchmark for success in this study.

## 3. Results and Discussion

The study lasted for two cycles, each consisting of two meetings. The main results of this study consisted of observations of student activities and educator activities, as well as tests describing the ability to understand mathematical concepts in trigonometric material. The inaugural meeting of the first cycle will be on Tuesday, March 28, 2023. The activities of educators and learners are assessed by an observer. The following are observationsof cycle I activity contained in paragraph 5 below.

**Table 5. Results of Activity Observation in Cycle I**

| No | Types of activities | Cycle I | | |
|---|---|---|---|---|
| | | Score | Percentage | category |
| 1 | Student activities | 43 | 63,24% | Less |
| 2 | Educator activity | 82 | 78,85% | Good |

In table 5, the results of the analysis showed that student activities obtained a score of 43 with a percentage of 63.24% in the less category. Meanwhile, educator activities obtained a score of 82 with a percentage of 78.85% in the good category. The second meeting takes place on March 30, 2023. Researchers provide a cycle I description test to find out the improvement of students' ability to understand mathematical concepts. The analysis data are shown in table 6.

**Table 6. Cycle I Description Test Results Score**

| Number of learners | Complete | Unfinished | Percentage |
|---|---|---|---|
| 36 | 24 | 12 | 66,67% |

Based on the KKM determined by the school, students are considered complete learning when the results of the description test obtain more than or equal to 78. In table 6, the results of the analysis show that of 36 students who obtained the completeness category, 24 people with a percentage of 66.67%. This shows that most learners have reached KKM. However, it has not reached the research target with a percentage of 80%. Therefore, this study needs to be revisited. Before continuing in cycle II, researchers need to analyze problems or shortcomings in cycle I by conducting analysis at the reflection stage.

Based on reflection on the first cycle, it is known that there are shortcomings when teaching and learning activities, namely researchers do not manage time optimally and the state of students who are fasting makes them less focused when learning is in progress, because learning is carried out in the fasting month of Ramadan (Herowati & Barokah, 2023). As a result, the problems given are not resolved properly and are less active in asking. After identifying weaknesses in cycle I, researchers continued to improve cycle II to improve the quality of the teaching and learning process. Cycle II activities, the first meeting on Tuesday, April 4, 2023. The activities of students and educators are reassessed by the same observer. The following are the results of observations of cycle II activity in table 7 below.

**Table 7. Results of Activity Observation in Cycle II**

| No | Types of activities | Cycle II | | |
|---|---|---|---|---|
| | | Score | Percentage | category |
| 1 | Student activities | 55 | 80,88% | Good |
| 2 | Educator activity | 92 | 88,46% | Good |

In table 7, the analysis results show that student activities obtained a score of 55 with a percentage of 80.88% in the good category. Meanwhile, educator activities obtained a score of 92 with a percentage of 88.46% in the good category. The next meeting is on April 6, 2023. Researchers provide a cycle II description test to know the magnitude of the increase in the ability of students when understanding mathematical concepts. The analysis data are shown in table 6.

**Table 8. Cycle II Description Test Results Score**

| Number of learners | Complete | Unfinished | Percentage |
|---|---|---|---|
| 36 | 30 | 6 | 83,33% |

Based on the results of the analysis of the cycle II description test in table 8 stated that of the 36 students who achieved completeness, 30 people with a percentage of 83.33%. This shows that most students have achieved KKM and have achieved the research target with a percentage of more than 80%. So, although the completeness of student learning is not perfect, it is true that with each cycle, students become better able to understand mathematical concepts and do their assignments.

Based on the Classroom Action Research carried out, it can be seen that learning using the ADDIE model assisted by the desmos application carried out in class X-D lasts for two cycles, affecting the improvement of students' ability to understand mathematical concepts in trigonometric material. (Rosita, 2019) By applying the addie learning model using handout media can achieve a level of completeness of learning outcomes. In research (Wijayanti, 2016) Also said that through the Addie learning model with the help of mind organizers increase student learning achievement. (Darsono et al., 2019) The ability of students when understanding mathematical concepts using mind mapping-assisted addie models is more effective than using models *problem based learning*. Research (Ulum et al., 2020) also stated learning outcomes with the ADDIE model are more effective. In addition to improving the ability to understand mathematical concepts, students are also more active in teaching and learning activities, thus affecting the activities of students and educators who also experience an increase when this ADDIE learning model is applied. In line with (Arini et al., 2013) states students are prepared to think critically, and logically when faced with unusual problems or situations when they are confronted with the ADDIE learning framework.

## 4. Conclusion

In this study, trigonometric material was studied in two cycles of class actions. It was shown that there was an increase in the mathematical understanding of learners influenced by the ADDIE model with the help of desmos applications used in both cycles. This is reflected in the increasing success of student and educator activities which result in the completeness of student learning. It is hoped that educators and other researchers who will research classroom actions can better understand how learners spend their time and find ways to make them more active in lessons. In addition, Classroom Action Research can be conducted over a longer period of time. This will allow the characterization of learners to be clearer and the learning process to achieve better results.

## Bibliography

Amarullah, R. Q., & Wahidah, N. F. (2021). Pengaruh Penerapan Model Pembelajaran ADDIE Terhadap Hasil Belajar Siswa Pada Mata Pelajaran Fiqih. *Jurnal Pendidikan Islam*, *18*(1), 108–118. https://doi.org/10.34001/tarbawi.v18i1.1977

Ardila, A., Marzal, J., & Siburian, J. (2022). Analisis Kemampuan Pemahaman Konsep Siswa dalam Memahami Materi Trigonometri Kelas X IPS. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(1), 423–444. https://doi.org/10.31004/cendekia.v6i1.1064

Argawi, A. S., & Pujiastuti, H. (2021). Analisis Kemampuan Pemahaman Konsep Matematis Siswa Sekolah Dasar Pada Masa Pandemi Covid-19. *Al Khawarizmi: Jurnal Pendidikan Dan Pembelajaran Matematika*, *5*(1), 64–75. https://doi.org/10.22373/jppm.v5i1.9974

Arifin, N. S., Fitri, H., Rusdi, & Rahmat, T. (2023). Pengaruh Model Pembelajaran Aptitude Treatment Interaction (ATI) Terhadap Kemampuan Pemahaman Konsep Matematika Siswa. *Jurnal Pendidikan Dan Konseling*, *4*, 1707–1715. https://doi.org/10.31004/jpdk.v5i1.11534

Arini, N. K., Syahrudin, H., & Sudatha, I. G. W. (2013). Pengaruh Model Pembelajaran Addie Terhadap Keterampilan Berpikir Kritis Dalam Pembelajaran IPA Siswa Kelas V di Desa Pedawa. *Mimbar PGSD UNDIKSHA*. https://doi.org/10.23887/jjpgsd.v1i1.670

Asmara, L. Y. (2021). Perbedaan Hasil Belajar Kognitif Dengan Model Pembelajaran Addie Strategi Holistic Learning Berbasis Lesson Study Dan Model Addie Di Sma N 7 Rejang Lebong. *Jurnal BIOEDUSCIENTIFIC*, *2*(1), 40–50. https://doi.org/10.36085/bioeduscientific.v2i1.1480

Darsono, P., Netriwati, & Negara, H. S. (2019). Evektivitas Model Pembelajaran Addie Berbantuan Mind Mapping Terhadap Kemampuan Pemahaman Konsep Matematis. *APOTEMA : Jurnal Program Studi Pendidikan Matematika*, *5*(1), 40–47. http://194.59.165.171/index.php/APM/article/view/283

Dewi, K. T., Suastra, I. W., & Pujani, N. M. (2013). Pengaruh Model Pembelajaran Analyze, Design, Develop, Implement, Evaluate (Addie) Terhadap Keterampilan Berpikir Kritis Dan Pemahaman Konsep Fisika. *E-Journal Program Pascasarjana Universitas Pendidikan Ganesha Program Studi IPA*, *3*(1), 1–5. https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/982

Dwipayanti, N. A., Sudhita, I. W. R., & Parmiti, D. P. (2013). Pengaruh Model Pembelajaran ADDIE Berbantuan Media Konkret Terhadap Hasil Belajar IPA Siswa Kelas V SD Negeri 1 Pangkungparuk. *MIMBAR PGSD Undiksha*, *1*(1). https://doi.org/10.23887/jjpgsd.v1i1.836

Fahrudin, A. G., Zuliana, E., & Bintoro, H. S. (2018). Peningkatan Pemahaman Konsep Matematika melalui Realistic Mathematic Education Berbantu Alat Peraga Bongpas. *ANARGYA: Jurnal Ilmiah Pendidikan Matematika*, *1*(1), 14–20. https://doi.org/10.24176/anargya.v1i1.2280

Gusmania, Y., & Agustyaningrum, N. (2020). Analisis Pemahaman Konsep Matematis Mahasiswa pada Mata Kuliah Trigonometri. *Jurnal Gantang*, *5*(2), 123–132. https://doi.org/10.31629/jg.v5i2.2493

Hendriana, B. (2019). Lembar Kerja Peserta Didik Berbasis Cabri 3D Untuk Meningkatkan Pemahaman Konsep Matematis Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *8*(1), 112–120. https://doi.org/10.24127/ajpm.v8i1.1740

Herowati, M. N., & Barokah, R. N. (2023). Peningkatan Hasil Belajar Matematika Melalui Model Pembelajaran Blended Learning Berbasis Blog Pada Peserta Didik Di Mtsn 2 Jember. *LITERASI*, *1*(1), 111–124. https://literasi.mtsn2jember.sch.id/index.php/ltr/article/view/8

Hidayat, F., & Nizar, M. (2021). Model Addie (Analysis, Design, Development, Implementation and Evaluation) Dalam Pembelajaran Pendidikan Agama Islam. *Jurnal Inovasi Pendidikan Agama Islam (JIPAI)*, *1*(1), 28–38. https://doi.org/10.15575/jipai.v1i1.11042

Ishartono, N., Kristanto, Y. D., & Setyawan, F. (2018). Upaya Peningkatan Kemampuan Guru Matematika Sma Dalam Memvisualisasikan Materi Ajar Dengan Menggunakan Website Desmos. *The 8th University Research Colloquium 2018*, *september*, 78–86. http://repository.urecol.org/index.php/proceeding/article/view/332/323

Istiqomah, Jamaludin, & Khusnul Auliya. (2022). Melatih Keterampilan Proses Sains Peserta Didik Dengan Menerapkan Model Pembelajaran ADDIE Pada Materi Getaran Dan Gelombang Untuk Smp Kelas VIII. *Jurnal Pengabdian Magister Pendidikan IPA*, *5*(2), 234–239. https://doi.org/10.29303/jpmpi.v5i2.1608

Maknun, C. L., Rosjanuardi, R., & Jupri, A. (2021). Using Graphic Calculator in Trigonometric Learning: a Didactical Design for Teacher. *MaPan*, *9*(1), 85. https://doi.org/10.24252/mapan.2021v9n1a6

Marbun, P. (2021). Disain Pembelajaran Online Pada Era Dan Pasca Covid-19. *CSRID (Computer Science Research and Its Development Journal)*, *12*(2), 129. https://doi.org/10.22303/csrid.12.2.2020.129-142

Miria, Y., & Fahriza, N. (2022). Peningkatan Kemampuan Berpikir Kreatif Melalui Model Problem Based Learning. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(4), 3662–3670. https://doi.org/10.24127/ajpm.v11i4.5814

Molenda, M. (2003). In Search of the Elusive Cadre. *Performance Improvement*, *18*(3), 330. https://doi.org/10.1002/pfi.21461

Mutaqin, E. J., Herman, T., Wahyudin, W., & Muslihah, N. N. (2023). Hypothetical Learning Trajectory in Place Value Concepts in Elementary School. *Mosharafa: Jurnal Pendidikan Matematika*, *12*(1), 125–134. https://doi.org/10.31980/mosharafa.v12i1.1313

Nuraeni, A., & Nugraheni, E. A. (2022). Upaya Meningkatkan Pemahaman Konsep Matematika Melalui Model Pembelajaran Kooperatif Tipe Stad Kelas VII.1 MTs. *Proximal: Jurnal Penelitian Matematika …*, *5*, 139–148. https://doi.org/10.30605/proximal.v5i2.1851

Praja, E. S., Setiyani, S., Kurniasih, L., & Ferdiansyah, F. (2021). Analisis Kemampuan Pemahaman Matematis Siswa Smk Kelas Xi Pada Materi Vektor Selama Pandemi Covid-19. *Teorema: Teori Dan Riset Matematika*, *6*(1), 12. https://doi.org/10.25157/teorema.v6i1.4539

Pratiwi, V. E., & Tsurayya, A. (2023). Analisis Kemampuan Pemahaman Konsep Ditinjau Dari Kecerdasan Logis Matematis Pada Materi Fungsi Komposisi. *Jurnal Tadris Matematika (JTMT)*, *4*(1), 94–102. https://doi.org/10.47435/jtmt.v4i1.1820

Pribadi, R. B. A. (2009). *Model Model Desain Sistem Pembelajran*. PT.Dian Rakyat.

Rosdianto, H., Sulistri, E., & Munandar, N. (2019). *Penerapan model pembelajaran ADDIE untuk meningkatkan keterampilan proses sains siswa pada materi kinematika gerak lurus*. *5*(1), 53–58. https://doi.org/10.25273/jpfk.v5i1.2947

Rosita. (2019). Penerapan Model Pembelajaran Addie Untuk Meningkatkan Hasil Belajar Akuntansi Siswa Pada SMK PABA Binjai. *Liabilities (Jurnal Pendidikan Akuntansi)*, *2*(1), 68–87. https://doi.org/10.30596/liabilities.v2i1.3336

Sari, L. M., Sutirna, & Firmansyah, D. (2023). *Analisis Kemampuan Pemahaman Konsep Matematis Berdasarkan Gaya Belajar Siswa*. *6*(1), 207–218. https://doi.org/10.22460/jpmi.v6i1.14034

Septripiyani, K., & Novtiar, C. (2021). Analisis Kemampuan Pemahaman Konsep Matematis Siswa Kelas VII Pada Materi Bentuk Aljabar di Masa Pandemi Covid-19. *Jurnal Pembelajaran Matematika Inovatif (JPMI)*, *4*(6), 1709–1722. https://doi.org/10.22460/jpmi.v4i6.1709-1722

Setiawan, S., Julrissani, J., & Savira, L. (2023). Analisis Kemampuan Pemahaman Konsep Matematis Siswa Pada Materi Bangun Ruang Sisi Datar. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(1), 80. https://doi.org/10.24127/ajpm.v12i1.5106

Sibarani, J. D., Gusmania, Y., & Hanggara, Y. (2021). Analisis Kemampuan Pemahaman Konsep Matematis Siswa Dalam Materi Trigonometri Kelas X Ips 2 Sman 17 Batam. *Cahaya Pendidikan*, *6*(2), 128–138. https://doi.org/10.33373/chypend.v6i2.2794

Siwardani, N. W., Dantes, N., & Sunu, I. A. (2015). Pengaruh Model Pembelajaran Addie Terhadap Pemahaman Konsep Fisika Dan Keterampilan Berpikir Kritis Siswa Kelas X Sma Negeri 2 Mengwi Tahun Pelajaran 2014/2015. *Jurnal Administrasi Pendidikan*, *6*(1), 1–10. https://doi.org/10.23887/japi.v6i1.1590

Subur, R. Y., & Rahayu, S. (2021). Perbandingan Model Pembelajaran ADDIE dan PAIKEM Hasil Belajar Anatomi Fisiologis Kebidanan STIKIM, Indonesia. *Jurnal Ilmiah Kebidanan Indonesia*, *11*(3), 479–486. https://doi.org/10.33221/jiki.v11i03.1275

Sunarto, M. T., Laa, S. P. Y. O., Mahtuum, Z. A., Siagian, G. T., & Afrilianto, M. (2021). Meningkatkan Kemampuan Pemahaman Matematis Siswa SMP melalui Pendekatan Kontekstual. *Mosharafa: Jurnal Pendidikan Matematika*, *10*(1), 85–94. https://doi.org/10.31980/mosharafa.v10i1.730

Syarifuddin, S. (2020). Efektivitas Penerapan Model Learning Cycle Terhadap Pemahaman Konsep Matematika Materi Teorema Pythagoras Siswa Kelas Viii Smp Negeri 3 Salomekko Kabupaten Bone. *JTMT : Journal Tadris Matematika*, *1*(1), 20–26. https://doi.org/10.47435/jtm.v1i1.394

Taufik, A. R., & Pagiling, S. L. (2021). Penggunaan Desmos dalam Memvisualisasikan Pembelajaran Matematika Bagi Guru MGMP Matematika Kabupaten Merauke. *MATAPPA : Jurnal Pengabdian Kepada Masyarakat*, *4*, 122–128. https://doi.org/10.31100/matappa.v4i1.887

Ulum, M. K., S, E. E., & Ysh, A. Y. S. (2020). Keefektifan Model Pembelajaran ADDIE terhadap Hasil Belajar Matematika. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *4*, 98–106. https://doi.org/10.23887/jppp.v4i1.24774

Utami, A. J. L., & Kusumah, Y. S. (2023). Analisis Kemampuan Pemahaman Konsep Matematis Pada Materi Sistem Persamaan Linear Dua Variabel. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(1), 1385. https://doi.org/10.24127/ajpm.v12i1.6985

Wijayanti, R. A. R. (2016). Peningkatan Prestasi Belajar Siswa Melalui Model Pembelajaran Addie Dan Media Mind Organiser. *Jurnal Pendidikan Dan Pembelajaran Matematika (JP2M)*, *2*(1), 2016. https://doi.org/10.29100/jp2m.v2i1.214

Yuliani, I., Kanzunnudin, M., & Rahayu, R. (2018). Penerapan Model Creative Problem Solving Berbantuan Media Bongkar Pasang untuk Peningkatan Berpikir Kreatif Matematika Siswa Sekolah Dasar. *ANARGYA: Jurnal Ilmiah Pendidikan Matematika*, *1*(1), 29–36. https://doi.org/10.24176/anargya.v1i1.2283

**M A T H L I N E**
**JURNAL MATEMATIKA DAN PENDIDIKAN MATEMATIKA**
**ISSN 2502-5872 (Print)**
**ISSN 2622-3627 (Elektronik)**

Volume 8 Number 3, August 2023, 893-904

# IMPROVING STUDENTS' MATHEMATICAL COMMUNICATION ABILITY THROUGH PROBLEM-BASED LEARNING ASSISTED BY BAAMBOOZLE

**Febbyana Ilwan Kajori[1*], Benny Hendriana[2]**
[1,2]Departement of Mathematics Education, Universitas Muhammadiyah Pro.Dr. Hamka, Jakarta Province, Indonesia

[*]Correspondence: febbykajori@gmail.com

***ABSTRACT***
Mathematical communication ability is a must-have ability for students but several studies show students' communication ability are still low. This study aims to improve students' mathematical communication ability through Problem-Based Learning assisted by Baamboozle in opportunity material. Baamboozle is an learning media that helps teachers to present an outline of material concepts, increases students' sense of cooperation to gain knowledge and makes learning activities more enjoyable. The subject of this study was located at one of the South Jakarta State Senior High Schools in class X-4 with a total of 33 students. The classroom action research method was chosen as a research method that adapts the Kemmis and Taggart methods. Data were collected using tests, and analyzed descriptively qualitatively. The results of the study revealed a rise in the percentage of students who had high-level of mathematical communication ability in each cycle, in the first cycle recording 63.64% and in the second cycle recording 78.79%. Therefore, Problem-Based Learning assisted by Baamboozle can improve ability of mathematical communication and make learning activities more active and fun.
**Keywords :** Baamboozle, Mathematical Communication Skills, Problem-Based Learning

**How to Cite:** Kajori, F. I & Hendriana, B. (2023). Improving Students' Mathematical Communication Ability Through Problem-Based Learning Assisted By Baamboozle. *Mathline: Jurnal Matematika dan Pendidikan Matematika, 8*(3), 893-904. http://doi.org/10.31943/mathline.v8i3.467

## PRELIMINARY

Mathematics has the most important factor for developing and training individual ways of thinking in social life. Mathematics is an important field of study that touches all aspects of life, from science to technology (Syahril et al., 2021). The concept of mathematics subject requires sufficient activity to learn and understand it. Mathematics is also a means of logical, analytical and systematic thinking.

The importance of mathematics does not make students happy to learn mathematics. In fact, mathematics is still a subject that students fear (Nindayanti & Bernard, 2022). Students feel afraid of being wrong if they can't solve problems, get bad grades or get scolded by the teacher. Fear will make them difficult to express their thoughts and opinions in their own language when learning mathematics (Domo & Mujib, 2022).

In learning mathematics students are trained to think mathematically. During the process of learning, the teacher is no longer just a person who provides information but also directs and provides opportunities for students to be able to construct their own knowledge and understanding of mathematics such as communicating mathematics.

The ability to communicate when learning mathematics plays an important role so there is a requirement to enhance the mathematical communication abilities of the students (Anim et al., 2022). The sharing of ideas and articulating comprehension of mathematical concepts is a communicative strategy utilized in the process of learning (Yunita & Siswanto, 2023). Students who are proficient in communicating mathematically will be skilled in applying mathematical ideas (Yuliani et al., 2022). Having good verbal and written mathematical communication abilities will make it easier for them to organize and interpret their thoughts to solve problems (Noer et al., 2022). Mathematical communication skills refer to the ability to express solutions to a given scenario or problem based on information obtained through oral and written communication using graphics, symbols or diagrams (Nufus et al., 2022).

Improving mathematical communication ability is important, but there are several studies show that multiple researches indicate that the math communication abilities of students are still inadequate. Not understanding mathematical concepts is a major factor in the impairment of mathematical communication ability (Lingga & Wardani, 2023). Another cause is because students do not understand problem solving indicators (Mardiyah & Kadarisma, 2021). The inadequate mathematical communication abilities of students can be attributed to their lack of enthusiasm for learning (Marniati et al., 2021). The teacher remains the center of learning which results in inadequate communication skills because students tend to imitate the problem-solving methods provided by the teacher, thus hindering the growth of their own concepts during learning (Rusmana et al., 2022).

The researcher made observations and collected data on students' mathematical communication ability in class X-4 at one of the South Jakarta State Senior High Schools. The researcher obtained Table 1 data from the results of students' mathematical communication ability tests which were used as pretest results. The researcher uses the guidelines for the category of students' mathematical communication ability from (Shofiyah & Hendriana, 2021).

**Table 1. Results of Mathematical Communication Ability in Class X-4**

| Ability Category | Student Population | Percentage |
|---|---|---|
| High | 10 | 30,3% |
| Medium | 12 | 36,36% |
| Low | 11 | 33,34% |

Table 1 shows that the majority of students in the medium to low category mathematical communication ability. Only 10 students (30.3%) with high mathematical communication ability. From these data indicate that there are problems during the learning process. Observations in class show that various factors contribute to the emergence of problems, such as: (1) teachers who do not use visual aids or other media during learning that involve students directly, causing them to be disinterested and inactive in class; (2) students only copy the information conveyed by the teacher without giving feedback; (3) students' reluctance to ask questions, engage in discussions, and debate topics they find challenging; (4) students' lack of confidence in presenting their solutions; and (5) a large number of students had difficulty maintaining their focus during the study session.

According to the conditions described, improvements are needed to the learning model. Problem-Based Learning (PBL) is an instructive approach to learning that encourages students to engage with various challenges that have been designed to focus on the learning process (Husna & Kurniasih, 2023). A learning model that can enhance the exchange of students' concepts by implementing Problem-Based Learning (Lubis & Dewi, 2023). PBL is a teaching model that puts the focus on students and allows them to take charge of their learning process. (Navarro-Durán et al., 2023). They are encouraged to determine the knowledge needed to understand and deal with the issues presented during learning (Orfan et al., 2021). PBL approach is an effective way to enhance the math communication skills of students (Mirna et al., 2023). The PBL model is problem solving based learning and can train students' independence and communication skills in groups (Kanah & Mardiani, 2022). Problem-Based Learning can maximize students' mathematical communication ability and students' attitudes become more positive where they can communicate their ideas when solving problems (Sitopu et al., 2022).

The utilization of interactive learning media enhances the efficiency of learning models (Gumiandari & Ratnawati, 2021). Learning media is a means of presenting information that helps teachers to present an outline of material concepts, increases curiosity and encourages students to acquire knowledge (Akramunnisa et al., 2023).

One of the interactive learning media is Baamboozle. The media is used not when presenting the core material the teacher uses after all the material has been conveyed when

reviewing the material. Baamboozle is an educational tool in the form of a web-based game that offers interactive and interesting quiz games as this platform can deliver amusement (Saud et al., 2022). Baamboozle serves as an learning media that presents group quizzes without requiring students to establish an account (Sa'diyah et al., 2020). Baamboozle is an interactive game website that allows students to work well together so that a sense of responsibility for the success of the group arises (Mariani et al., 2022). Baamboozle can make the learning model more effective because the use of online games in groups when learning will balance the material taught by the teacher, train and develop a sense of responsibility and teamwork, attract student interest in learning and improve students' ability to communicate So, Baamboozle can be used as an option in arousing student enthusiasm for learning.

There are several studies that have proven that the use of Problem-Based Leaning (PBL) can improve students' mathematical communication ability, including: (1) The use of Problem-Based Learning models can improve students' communication ability and independence well compared to conventional learning classes (Aprila & Fajar, 2022); and (2) Problem-Based Learning shows better results on students' communication ability and independence in groups and student-centered learning will be created (Wati & Loviana, 2022). It has been previously explained that there has been research related to PBL being able to improve mathematical communication ability, but there has been no research using learning media such as Baamboozle.

Based on the problems above, it is necessary to find the best solution so that the students' mathematical communication ability in class X-4 at the State Senior High School in South Jakarta can be improved. One solution that can be done is to use the Problem-Based Learning. The advantages of learning media such as Baamboozle are expected to make learning activities more effective and more enjoyable. Thus the aim of the study was to improve students' mathematical communication ability through Problem-Based Learning assisted by Baamboozle in opportunity material.

## METHODS

The research approach utilized in this study is classroom action research. The stages of this study were adapted according to the patterns suggested by Kemmis and Taggart, namely: (1) Planning: The researcher preparing learning tools, making observation sheets of learning activities, making Student Worksheets, preparing post tests, setting up the quiz on Baamboozle; (2) Implementation: researchers carry out learning activities in accordance

with the stages that have been prepared; (3) Observation: observers and researchers observe and record important things and obstacles during learning activities; and (4) Reflection: analyzing the actions taken during learning activities.


**Figure 1. Quiz On Baamboozle**

In this study the steps of the activities carried out in the first and second cycles were the same. Learning begins with (1) preliminary activities, including: the class leader leading a prayer, the teacher greets students and checks the completeness of the uniforms, then the teacher asks about student attendance, the teacher guides students to clean the class, and the teacher conveys the purpose and mechanism of learning; (2) the core activities, including: the teacher showing videos of contextual problems about the opportunities after that students raise questions and opinions on these problems, students are formed in groups to complete worksheets which later one of the groups will present the results of their answers, the teacher will guide and assess the discussion process during students complete worksheets in groups, and then the teacher displays several problems as exercises through Baamboozle where students in their group solve the problems given, students conclude today's learning material according to the input given by the teacher and the responses of other groups; (3) closing activities, including: the teacher giving students the opportunity to ask questions, the teacher gives 20 minutes for students to do the test in each cycle, then the teacher directing students to study the next material, and learning is closed by praying together.

Classroom action research in this study was carried out in two cycles. This study was conducted in class X-4 with a total of 33 students in the period from March to April 2023, to be precise in the month of Ramadan. The place for this research is located South Jakarta Senior High School. The object of this study is the opportunity material.

Research success indicator in classroom action research are benchmarks in determining whether the research carried out is successful or not. If 75% of the total students achieve research success indicator then the cycle in research can be stopped (Arikunto et al., 2007). Data on students' mathematical communication abilities in the form of test results are

used to see how well students complete the opportunity material. The test is given twice, namely once in the first cycle and once in the second cycle (in each cycle has different test question). This is done to identify whether there is an increase of more than 75% of the total students who have high category mathematical communication ability.

Data collection techniques are carried out using test and non-test instruments that have been validated by experts. Test instruments such as essay test sheets in each cycle and non-test instruments such as observation sheets of learning teacher's and students's activities. Data were collected using tests, and analyzed descriptively qualitatively. This data was obtained based on the data of cycles I and II. The data in this study is an increase in student's mathematical communication ability from test results and activity percentage in each cycle. The steps to analyze the data ar as follows:

The test scores are calculated based on the formula (Shofiyah & Hendriana, 2021) as follows:

$$Score = \frac{the\ total\ score\ of\ each\ indicator}{maximum\ total\ score} \times 100 \ldots. (1)$$

To determine the category of students' mathematical communication ability, it is obtained by matching the percentage of descriptive values contained in Table 2.

**Table 2. Mathematical Communication Ability Category**

| Mathematical Communication Ability Category | Test Scores |
|---|---|
| High | $\geq 72{,}82$ |
| Medium | $50{,}10 < x < 72{,}82$ |
| Low | $\leq 50{,}10$ |

Source: (Shofiyah & Hendriana, 2021)

The average percentage score of teacher's and student's activities are calcultes based on the formula (Annabila et al., 2018) as follow:

$$Score = \frac{the\ total\ score\ obtained}{maximum\ total\ score} \times 100\% \ldots. (2)$$

To determine the category of teacher and student activity obtained by matching the percentage of descriptive values contained in Table 3 and Table 4.

**Table 3. Teacher Activity Percentage Score Category**

| Percentage (%) | Category |
|---|---|
| 87,5–100 | Excellent |
| 75–87,49 | Good |
| 50–74,99 | Enough |
| 0–49,99 | Less |

**Table 4. Student Activity Percentage Score Category**

| Percentage (%) | Category |
|---|---|
| 81–100 | Excellent |
| 61–80 | Good |

| Percentage (%) | Category |
|---|---|
| 41–60 | Enough |
| 0–40 | Less |

Source: (Annabila et al., 2018)

## RESULT AND DISCUSSION

As reported by the test in the first and second cycles outcomes, classroom action research in class X-4 with the learning process carried out using Problem-Based Learning assisted by Baamboozle with the aim of knowing the increase in students' mathematical communication ability on opportunity material. In student learning activities an increase in learning outcomes in each cycle can be seen in Table 5.

**Table 5. Test Results in Cycle I and II**

| Ability Category | Cycle I | | Cycle II | |
|---|---|---|---|---|
| | Student Population | Percentage | Student Population | Percentage |
| High | 21 | 63,64% | 26 | 78,79% |
| Medium | 6 | 18,18% | 4 | 12,12% |
| Low | 6 | 18,18% | 3 | 9,09% |

The assessment at the end of each cycle can be seen in Table 5 showing that the data on students' mathematical communication ability which are in the high category have increased. In cycle I, the total percentage of students who had high mathematical communication ability was 63,63% (21 students) and this percentage increased in cycle II with a result of 78,70% (26 students). Meanwhile, the medium to low category experienced a decrease from cycle I to cycle II. For the category of medium mathematical communication ability in cycle I of 18,18% (6 students) to 12,12% (4 students) in cycle II and for the category of low mathematical communication ability in cycle I of 18,18% (6 students) to 9,09% (3 students). The data explains that more than 75% of all students have high mathematical communication skills in cycle II. This proves that through the Baamboozle-assisted Problem Based-Learning it can have an impact on increasing the mathematical communication ability of X-4 students on opportunity material.

This situation is similar to various researches on the proficiency of students in conveying mathematical concepts that can be enhanced by Problem-Based Learning (PBL). PBL shows better results on communication ability than compared to conventional learning (Layliyyah et al., 2022). Improving mathematical communication ability after applying the PBL model has a positive effect for students (Kristina et al., 2023).

Problem-Based Learning assisted by Baamboozle will improve mathematical communication ability and also increase learning activities. The use of Baamboozle is

considered effective in increasing student motivation, as evidenced by the enthusiasm of students in following the learning, students are more active and interactive in communicating, and many students are enthusiastic in participating all learning activities. The use of interactive media such as Baamboozle makes learning mathematics more fun and attracts students' attention.

There is a reflection material from cycle I that must be repaired, including: (1) the use of time that has not been maximized; (2) there are still certain students who remain inactive while learning math. Based on the conclusions of interviews with three students, they said the reason they were not active during learning because they were not focused and had reduced concentration in learning due to fasting. One of the causes of disruption of learning concentration is because they have not eaten so that students' concentration is disturbed (Dewi et al., 2020); and (3) there are students who are shy and not brave to present their answers. If students feel shy and afraid when presenting their work, it will cause their communication skills to not be optimal (Purnamasari & Afriansyah, 2021). After analyzing the actions taken during the learning activities, the researcher obtained reflection materials to correct deficiencies in cycle II.

Based on those considerations at the reflection stage of cycle I, the researcher corrected the deficiencies that occurred and maintained the things that were already good. Solutions from learning activities in the first cycle, including: (1) make planning and learning schemes better; (2) the teacher provides an understanding of the importance of consuming food prior to fasting; (3) the teacher practiced the ice breaking technique when the students started to lose concentration. The application of ice breaking technique during the learning process will make students excited again, increase concentration and feel refreshed (Muharrir et al., 2022); (4) giving added value to students who dare to argue or present answers. Giving rewards will trigger students to increase their self-confidence (Nurbayanti, 2023).

Observation and assessment of learning will be carried out by researchers and mathematics teacher (observers). The math teacher and researcher will evaluate the activities by giving scores and notes on the observation sheet of teacher and students.

**Table 6. Percentage Results of Teacher Activity Observation Sheets**

| Meeting | Score | Criteria |
|---|---|---|
| Cycle I | 68% | Enough |
| Cycle II | 80% | Good |

Table 8 shows an increase in teacher activity. In the first cycle, 68% of teachers with sufficient criteria then increased in cycle II to 80% with good criteria in carrying out the research stages.

**Table 7. Percentage Results of Student Activity Observation Sheets**

| Meeting | Score | Criteria |
|---|---|---|
| Cycle I | 75,57% | Good |
| Cycle II | 85% | Excellent |

Table 9 shows an increase in student activities. In the first cycle, 75,57% of students with good criteria took part in learning, then increased in cycle II to 85% of students in participating in learning with excellent criteria.

## CONCLUSION

As reported by the results and discussion, it has been established students in X-4 grade, studying at a Senior High Schools located in the South Jakarta are known to have significantly improved their mathematical communication skills through Problem-Based Learning assisted by Baamboozle. This indicates the percentage of students with high mathematical communication skills from pre-test to the second cycle. The pretest results were only 30.3% of all students in the category of high mathematical communication ability, then increased to to 63.64% in cycle I and 78.79% in cycle II.

## REFERENCES

Akramunnisa, A., Jumarniati, J., & Ekawati, S. (2023). The Effectiveness Of Three Dimentional Shapes Learning Media Android Based On Students Of SDN 43 Takkalala After Covid-19 Pandemic. *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, *8*(1), 170–180. https://doi.org/10.31943/mathline.v8i1.348

Anim, A., Saragih, S., Napitupulu, E. E., & Sari, N. (2022). Analisis Proses Jawaban Siswa Pada Kemampuan Komunikasi Matematik Melalui Model Process Oriented Guided Inquiry Learning (POGIL). *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, *7*(1), 66–76. https://doi.org/10.31943/mathline.v7i1.245

Annabila, C. I., Taib, N. E., & Nurasiah. (2018). Implementasi Model Pembelajaran Aktif Tipe Peer Lessons Untuk Meningkatkan Aktivitas Belajar Siswa Kelas VIII SMP NEGERI 1 Kuala Kabupaten Bireuen. *Prosiding Seminar Nasional Biotik*, *6*(1), 728–734. https://repository.ar-raniry.ac.id/id/eprint/5407

Aprila, B., & Fajar, A. A. (2022). Pembelajaran Model Problem Based Learning Untuk Mengembangkan Kemandirian Belajar Dan Hubungannya Terhadap Kemampuan Komunikasi Matematis Dan Berpikir Kritis Matematis Siswa SMP. *Pasundan Journal of Mathematics Education : Jurnal Pendidikan Matematika*, *Vol 12 No 1*, 15–29. https://doi.org/10.23969/pjme.v12i1.5408

Arikunto, S., Suhardjono, & Supardi. (2007). *Penelitian Tindakan Kelas*. Bumi Aksara.

Dewi, N. P. S. R., Citrawathi, D. M., & Giana, G. S. (2020). Hubungan Pola Sarapan Dengan Konsentrasi Belajar Siswa SMP NEGERI 2 Banjar. *Wahana Matematika Dan Sains: Jurnal Matematika, Sains, Dan Pembelajarannya*, *14*(1), 1858–0629. https://ejournal.undiksha.ac.id/index.php/JPM/article/view/23195

Domo, S. M., & Mujib, A. (2022). Analisis Kemampuan Komunikasi Matematis Siswa MTs Pada Materi Persamaan Linier Satu Variabel Melalui Pembelajaran Active Learning. *PERISAI: Jurnal Pendidikan Dan Riset Ilmu Sains*, *1*(1), 23–28. https://jurnal.serambimekkah.ac.id/index.php/perisai

Gumiandari, S., & Ratnawati. (2021). Profil Guru Profesional Abad 21 Dalam Perspektif Mahasiswa Iain Syekh Nurjati Cirebon. *Al-Tarbiyah: JURNAL PENDIDIKAN* , *31*, 27–39. https://doi.org/10.24235/ath.v%vi%i.8493

Husna, A. U., & Kurniasih, M. D. (2023). Influence Of The Liveworksheet Assisted Problem-Based Learning Model On Students' Mathematical Literacy Ability. *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, *8*(2), 503–520. https://doi.org/10.31943/mathline.v8i2.419

Kanah, I., & Mardiani, D. (2022). Kemampuan Komunikasi dan Kemandirian Belajar Siswa Melalui Problem Based Learning dan Discovery Learning. *PLUS MINUS : Jurnal Pendidikan Matematika*, *2*(2), 255–264.

Kristina, A., Barus, K., & Saputro, M. (2023). Penerapan Model Problem Based Learning Terhadap Kemampuan Komunikasi Matematis Siswa Ditinjaudari Kemandirian Belajar Siswa Pada Materi Himpunan di Kelas VII SMP NEGERI 01 Tayan Hulu Iwit Prihatin IKIP PGRI Pontianak. *Student Scientific Creativity Journal (SSCJ)*, *1*(1), 141–151. http://digilib.ikippgriptk.ac.id/id/eprint/1540/

Layliyyah, R., Wisudaningsih, E. T., & Rahayu, E. (2022). Pengaruh Model Pembelajaran Problem Based Learning Terhadap Kemampuan Komunikasi Matematis Siswa Kelas VII. *Jurnal Pendidikan Dan Konseling*, *4*(4), 345–351. https://journal.universitaspahlawan.ac.id/index.php/jpdk/article/view/5231

Lingga, N. S., & Wardani, H. (2023). Analisis Kemampuan Koneksi Matematis Siswa MTs pada Materi Kubus dan Balok. *Jurnal MathEducation Nusantara*, *6*(1), 19–26. https://jurnal.pascaumnaw.ac.id/index.php/JMN

Lubis, A. N., & Dewi, I. (2023). Penerapan Problem-Based Learning Berbantuan Edmodo untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa Kelas XI di SMA Negeri 11 Medan T.A. 2022/2023. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(1), 562–579. https://doi.org/10.31004/cendekia.v7i1.2067

Mardiyah, N. S., & Kadarisma, G. (2021). Analisis Kemampuan Komunikasi Matematis Siswa SMA Pada Materi Barisan Dan Deret. *Jurnal Pembelajaran Matematika Inovatif*, *4*(6). https://doi.org/10.22460/jpmi.v4i6.1621-1628

Mariani, S. D., Larasati, D. A., Prasetya, S. P., & Stiawan, A. (2022). Pengaruh Pembelajaran Hybrid Learning Menggunakan Media Baamboozle Terhadap Hasil Belajar Dan Minat Belajar Siswa SMP. *Jurnal Dialektika Pendidikan IPS*, *2*(2), 206–216. https://ejournal.unesa.ac.id/index.php/PENIPS/index

Marniati, M., Jahring, J., & Jumriani, J. (2021). Analisis Kemampuan Komunikasi Matematis Siswa Dalam Memecahkan Masalah Berdasarkan Motivasi Belajar Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(2), 880–890. https://doi.org/10.24127/ajpm.v10i2.3523

Mirna, M., Yulanda, S., Martin, S. N., Jamaris, J., & Solfema, S. (2023). Analisis Peningkatan Kemampuan Komunikasi Matematis Siswa dengan Penerapan Model Problem Based Learning. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(1), 645–657. https://doi.org/10.31004/cendekia.v7i1.1922

Muharrir, Herdah, & Effendy, R. (2022). Penggunaan Ice Breaking dalam Meningkatkan Motivasi Belajar Peserta Didik pada Mata Pelajaran Pendidikan Agama Islam Kelas VIII SMP Muhammadiyah Pinrang. *Al-Ishlah: Jurnal Pendidikan Islam*, *20*(2), 179–186. https://doi.org/10.35905/alishlah.v20i2.3318

Navarro-Durán, D., Félix-Herrán, L. C., Membrillo-Hernández, J., Craig, K. C., Ramírez-Cadena, M. J., & Ramírez-Mendoza, R. A. (2023). Active learning to develop disciplinary competencies related to automatic control in engineering curricula using low cost do-it-yourself didactic stations. *Frontiers in Education*, *7*, 1–13. https://doi.org/10.3389/feduc.2022.1022888

Nindayanti, R., & Bernard, M. (2022). ANALISIS MINAT BELAJAR SISWA SMP KELAS VII BERBANTUAN MIT APP INVENTOR PADA MATERI ARITMATIKA SOSIAL. *Jurnal Pembelajaran Matematika Inovatif*, *5*(3), 751–758. https://doi.org/10.22460/jpmi.v5i3.751-758

Noer, S. H., Gunowibowo, P., & Triana, M. (2022). Pengaruh Kecerdasan Emosional Dan Kemampuan Awal Terhadap Kemampuan Komunikasi Matematis Siswa Dalam Pembelajaran Online. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(1), 482–492. https://doi.org/10.24127/ajpm.v11i1.4464

Nufus, N., Sridana, N., Junaidi, & Amrullah. (2022). Pengaruh Model Pembelajaran Kooperatif Tipe Think Pair Share terhadap Kemampuan Komunikasi Matematika Siswa Kelas VIII SMPN 21 Mataram Tahun Ajaran 2021/2022. *Jurnal Riset Pendidikan Matematika Jakarta*, *4*(2), 35–42. https://doi.org/10.21009/jrpmj.v4i2.25085

Nurbayanti, Z. S. (2023). Penerapan Model Pembelajaran Cooperative Learning Materi Meraih Ketakwaan Dengan Berpuasa Dalam Meningkatkan Hasil Belajar Siswa Kelas VIII D. *Seminar Nasional Pendidikan Profesi Guru Agama Islam*, *3*(1), 693–700. https://ojs.fkip.ummetro.ac.id/index.php/matematika/article/view/4464

Orfan, S. N., Akramy, S. A., Noori, A. Q., & Hashemi, A. (2021). Afghan Lecturers' Perception of Problem-Based Learning: A Case Study of Takhar University. *Journal of Problem-Based Learning*, *8*(2), 62–68. https://doi.org/10.24313/jpbl.2021.00059

Purnamasari, A., & Afriansyah, E. A. (2021). Kemampuan Komunikasi Matematis Siswa SMP pada Topik Penyajian Data di Pondok Pesantren. *Plusminus: Jurnal Pendidikan Matematika*, *1*(2), 207–222. https://journal.institutpendidikan.ac.id/index.php/plusminus/article/view/pv1n2_02

Rusmana, I. M., Amdani, D., & Susilawati. (2022). Upaya Meningkatkan Kemampuan Komunikasi Matematis Siswa dengan Menggunakan Model Pembelajaran Kooperatif Tipe Think Talk Write (TTW). *Prosiding Diskusi Panel Nasional Pendidikan Matematika*, *8*, 341–348. https://proceeding.unindra.ac.id/index.php/DPNPMunindra/article/view/6056

Sa'diyah, I., Savitri, A., Febiola, S., Widjaya, G., Wicaksono, F., Danny, A., & Wibisono, R. (2020). Peningkatan Keterampilan Mengajar Guru SD/MI melalui Pelatihan Media Pembelajaran Edugames Berbasis Teknologi: Quizizz dan Baamboozle. *Jurnal Publikasi Pendidikan*, *11*(3), 198–204. http://ojs.unm.ac.id/index.php/

Saud, S., Aeni, N., & Azizah, L. (2022). Leveraging Bamboozles and Quizziz to Engage EFL Students in Online Classes. *International Journal of Language Education*, *6*(2), 169–182. https://doi.org/10.26858/ijole.v6i2.24301

Shofiyah, & Hendriana, B. (2021). Analisis Kemampuan Komunikasi Matematis Peserta Didik Pada Pembelajaran Dalam Jaringan (Daring) Secara Synchronous. *Online)*

*Journal of Educational and Language Research*, *1*(5), 2807–2937. http://bajangjournal.com/index.php/JOEL

Sitopu, J. W., Purba, I. R., & Asriyati, D. (2022). Komunikasi Matematis Siswa Melalui Model Problem Based Learning (PBL). *JPMR*, *07*(02), 66–75. https://ejournal.unib.ac.id/index.php/jpmr

Syahril, R. F., Saragih, S., & Heleni, S. (2021). Development Of Mathematics Learning Instrument Using Problem Based Learning Model On The Subject Sequence And Series For Senior High School Grade XI. *Jurnal Prinsip Pendidikan Matematika*, *3*(1), 9–17. https://doi.org/10.33578/prinsip.v3i1.62

Wati, A., & Loviana, S. (2022). Komunikasi Matematis Siswa Diukur Dari Problem Based Learning Dengan Pendekatan Saintifik. *Linear : Journal of Mathematics Education*, *3*(1), 14–27. https://e-journal.metrouniv.ac.id/index.php/linear/article/view/4672

Yuliani, E. N., Arnawa, I. M., Musdi, E., & Hidayat, A. (2022). Pengembangan Perangkat Pembelajaran Matematika Berbasis Strategi React Untuk Meningkatkan Kemampuan Komunikasi Matematis. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(1), 407–418. https://doi.org/10.24127/ajpm.v11i1.4340

Yunita, M., & Siswanto, R. D. (2023). Analysis of Mathematical Communication Ability in Solving Story Problems Based on Mathematical Ability and Gender. *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, *8*(1), 181–193. https://doi.org/10.31943/mathline.v8i1.327