

# The Implementation of Problem-Based Learning Model through Online Learning to Improve Senior High School Students' Problem-Solving Ability in Composition of Functions-Inverse Functions and Mathematical Self-efficacy

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## Abstract

R.R. Adi Hendrastuti (2026) conducted a study entitled "The Implementation of Problem-Based Learning Model through Online Learning to Improve Senior High School Students' Problem-Solving Ability in Composition of Functions-Inverse Functions and Mathematical Self-efficacy." The aim of this study was to analyze and describe the improvement of students' mathematical problem-solving abilities and self-efficacy through the implementation of the Problem-Based Learning (PBL) model in online learning.

The research employed a mixed-method approach using The Embedded Design, which combines quantitative and qualitative methods, with one serving as the main approach and the other as a supporting method. The population consisted of all twelfth-grade students of SMAN 20 Bandung, with two equivalent classes selected as samples based on academic ability: One class served as the experimental group, receiving PBL-based online instruction,

The other served as the control group, receiving expository online instruction. The research instrument was a mathematical problem-solving essay test, and data analysis was conducted using two-way ANOVA. Research Findings : There was a significant difference in problem-solving ability between students who received PBL-based online learning and those who received expository online learning, in terms of Initial Mathematical Ability (IMA), There was a difference in mathematical self-efficacy between the two groups, The problem-solving ability of students taught using PBL was higher than that of students taught using the expository method, There was a positive correlation between mathematical self-efficacy and problem-solving ability.

Conclusion and Relevance : This study reinforces that the Problem-Based Learning (PBL) model, even when applied in an online setting, can:

Improve students' mathematical problem-solving skills, Enhance students' self-efficacy, and Provide a more meaningful learning experience, as students are actively engaged in exploring, reasoning, and



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constructing concepts on their own. This research can serve as a theoretical foundation for mathematics teachers in implementing problem-based learning, especially for topics that require higher-order reasoning such as Composition of Functions\_Inverse Function, and in the context of online or digital learning environments.

**Keywords:** *Problem Based Learning* Model, Direct Instruction, Mathematical Connection Ability, Initial Mathematical Ability

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## PENDAHULUAN

Pendidikan terus mengalami pembaruan dan inovasi untuk menghasilkan sumber daya manusia yang berkualitas, mampu berpikir kritis, kreatif, dan inovatif dalam menghadapi berbagai tantangan masa kini maupun masa depan. Dalam konteks tersebut, peserta didik dituntut tidak hanya menguasai konsep, tetapi juga memiliki kemampuan memecahkan masalah serta keyakinan terhadap kemampuan dirinya sendiri.

Pandemi Covid-19 telah membawa perubahan signifikan dalam sistem pendidikan di Indonesia, terutama melalui penerapan pembelajaran daring dan pembatasan tatap muka. Kondisi ini menuntut pendidik untuk mampu memilih dan menerapkan strategi, model, serta pendekatan pembelajaran yang efektif agar tujuan pembelajaran tetap tercapai secara optimal. Salah satu faktor penting yang memengaruhi keberhasilan pembelajaran, khususnya dalam pembelajaran daring di tingkat Sekolah Menengah Atas (SMA), adalah self-efficacy atau keyakinan diri peserta didik.

Self-efficacy akademik merupakan keyakinan individu terhadap kemampuannya dalam menyelesaikan tugas dan mencapai prestasi belajar. Peserta didik dengan self-efficacy tinggi cenderung lebih percaya diri, gigih, dan mampu menghadapi tantangan akademik. Sebaliknya, peserta didik dengan self-efficacy rendah cenderung ragu terhadap kemampuannya, mudah menyerah, dan kurang optimal dalam menyelesaikan tugas. Hasil wawancara dengan beberapa peserta didik kelas XII di SMA Negeri 20 Bandung menunjukkan bahwa sebagian peserta didik merasa tidak yakin terhadap jawaban yang mereka kerjakan, terutama pada saat evaluasi seperti Ujian Akhir Semester. Kondisi ini berdampak pada rendahnya hasil belajar dan kurang optimalnya kemampuan pemecahan masalah.

Permasalahan tersebut juga terlihat pada materi Komposisi Fungsi. Data hasil ulangan harian dalam tiga tahun terakhir menunjukkan bahwa nilai rata-rata peserta didik masih berada di bawah Kriteria Ketuntasan Minimum (KKM). Hal ini mengindikasikan perlunya alternatif model pembelajaran yang mampu meningkatkan kualitas proses pembelajaran sekaligus memberdayakan peserta didik.

Salah satu model pembelajaran yang berorientasi pada pengembangan kemampuan pemecahan masalah adalah Problem Based Learning (PBL). Model ini menyajikan permasalahan nyata sebagai konteks pembelajaran sehingga mendorong peserta didik untuk berpikir kritis, aktif, dan terlibat langsung dalam proses penyelesaian masalah. Penerapan PBL diharapkan tidak hanya meningkatkan kemampuan pemecahan masalah matematis, tetapi juga memperkuat self-efficacy peserta didik.

Berdasarkan latar belakang tersebut, penelitian ini bertujuan untuk menerapkan model Problem Based Learning melalui pembelajaran daring guna meningkatkan kemampuan pemecahan masalah pada materi Komposisi Fungsi-Invers Fungsi serta self-efficacy matematis peserta didik SMA.

## TUJUAN

1. Kemampuan pemecahan masalah peserta didik yang memperoleh pembelajaran *Problem Based Learning melalui daring* dan peserta didik yang mendapatkan pembelajaran ekspositori melalui daring di tinjau dari KAM.
2. Self-efficacy matematis peserta didik yang memperoleh pembelajaran *Problem Based Learning* melalui daring dan peserta didik yang mendapatkan pembelajaran ekspositori melalui daring ditinjau dari KAM.
3. Kemampuan pemecahan masalah peserta didik yang memperoleh pembelajaran *Problem Based Learning* melalui daring lebih baik dari peserta didik yang mendapatkan pembelajaran ekspositori melalui daring ditinjau dari KAM.
4. Gambaran Self-efficacy matematis peserta didik yang memperoleh pembelajaran *Problem Based Learning* melalui daring dan peserta didik yang mendapatkan pembelajaran ekspositori melalui daring ditinjau dari KAM.
5. Korelasi *self-efficacy* terhadap kemampuan pemecahan masalah matematis peserta didik.

## TINJAUAN PUSTAKA

### Model Problem Based Learning (PBL),

Problem Based Learning (PBL) pertama kali dikembangkan pada pendidikan kedokteran di McMaster University oleh Howard S. Barrows pada akhir 1960-an. PBL merupakan model pembelajaran yang menjadikan masalah dunia nyata sebagai titik awal pembelajaran untuk melatih berpikir kritis, pemecahan masalah, dan perolehan pengetahuan secara bermakna.

Menurut Barrows dan Tamblyn (1980), PBL menggunakan masalah autentik sebagai konteks belajar. Cindy E. Hmelo-Silver (2004) menegaskan bahwa PBL bersifat student-centered dan mendorong penyelidikan mandiri serta kolaboratif melalui masalah terbuka (ill-structured problems). Dengan demikian, PBL menekankan keterlibatan aktif peserta didik, kolaborasi, dan pengembangan keterampilan berpikir tingkat tinggi.

### Landasan Teoretis Problem Based Learning

PBL berlandaskan pada teori konstruktivisme, yang memandang pengetahuan dibangun secara aktif oleh peserta didik.

1. Konstruktivisme Kognitif  
Teori Jean Piaget menekankan proses asimilasi dan akomodasi dalam pembentukan skema pengetahuan. Dalam PBL, masalah yang menantang mendorong rekonstruksi pengetahuan peserta didik.
2. Konstruktivisme Sosial menurut Lev Vygotsky,
3. pembelajaran terjadi melalui interaksi sosial dalam *zone of proximal development*. Diskusi dan kerja kelompok dalam PBL memfasilitasi pembentukan pemahaman bersama.

4. Pembelajaran Kontekstual (Situating Learning)  
PBL menekankan penggunaan masalah autentik sehingga pembelajaran menjadi lebih bermakna dan relevan dengan kehidupan nyata (Savery, 2006).

### **Karakteristik Problem Based Learning**

Karakteristik utama PBL meliputi:

1. Penggunaan masalah autentik sebagai pemicu belajar.
2. Pembelajaran berpusat pada peserta didik.
3. Kolaborasi kelompok kecil sebagai sarana eksplorasi ide.
4. Guru berperan sebagai fasilitator, bukan pemberi solusi.
5. Refleksi dan evaluasi berkelanjutan terhadap proses belajar.

Karakteristik ini menegaskan bahwa PBL menekankan pembelajaran aktif dibandingkan transfer informasi satu arah.

### **Langkah-Langkah Model Problem Based Learning**

Tahapan umum PBL meliputi:

1. Orientasi peserta didik pada masalah kontekstual.
2. Pengorganisasian peserta didik dalam kelompok belajar.
3. Penyelidikan individu dan kelompok.
4. Pengembangan dan penyajian solusi.
5. Analisis serta refleksi proses pemecahan masalah.

Tahapan tersebut melatih peserta didik berpikir sistematis dan analitis.

### **Kemampuan Pemecahan Masalah**

Masalah merupakan situasi yang tidak dapat diselesaikan secara langsung dengan prosedur rutin. Dalam matematika, masalah dibedakan menjadi masalah rutin dan masalah tidak rutin, di mana masalah tidak rutin menuntut kreativitas dan penalaran tingkat tinggi.

Kemampuan pemecahan masalah merupakan tujuan utama pembelajaran matematika, karena memungkinkan peserta didik menggeneralisasikan pengetahuan untuk menyelesaikan masalah lain yang serupa.

Menurut George Polya, pemecahan masalah meliputi empat tahap:

1. Memahami masalah,
2. Merencanakan penyelesaian,
3. Melaksanakan rencana,
4. Memeriksa kembali hasil.

Indikator kemampuan pemecahan masalah mengacu pada standar National Council of Teachers of Mathematics (NCTM), yang mencakup kemampuan merumuskan masalah, menerapkan strategi, dan menggunakan model matematika dalam konteks nyata.

### **Self-efficacy**

Self-efficacy adalah keyakinan individu terhadap kemampuannya dalam mengorganisasi dan melaksanakan tindakan untuk mencapai tujuan tertentu. Konsep ini dikemukakan oleh Albert Bandura, yang menegaskan bahwa self-efficacy memengaruhi pilihan tindakan, ketekunan, dan kinerja individu.

Self-efficacy terdiri atas tiga dimensi, yaitu:

1. Magnitude, berkaitan dengan tingkat kesulitan tugas yang diyakini mampu diselesaikan.
2. Strength, berkaitan dengan kekuatan keyakinan individu terhadap kemampuannya.
3. Generality, berkaitan dengan keluasan bidang tugas yang diyakini dapat dikuasai.

Dalam pembelajaran matematika, self-efficacy berperan penting dalam menentukan ketekunan, kepercayaan diri, dan keberhasilan peserta didik dalam menyelesaikan masalah.

## **METODOLOGI PENELITIAN**

Penelitian ini menggunakan quasi experiment dengan desain faktorial 2×2, yang melibatkan kelas eksperimen (Problem Based Learning melalui daring) dan kelas kontrol (pembelajaran ekspositori melalui daring). Variabel bebas adalah model pembelajaran, variabel terikat adalah kemampuan pemecahan masalah matematis, dan variabel moderator adalah Kemampuan Awal Matematika (KAM) yang dikategorikan menjadi unggul dan asor. Analisis data dilakukan menggunakan ANOVA dua jalur.

Populasi penelitian adalah peserta didik kelas XII SMAN 20 Bandung, dengan sampel dua kelas XII MIPA yang dipilih secara purposive, masing-masing sebagai kelas eksperimen dan kelas kontrol.

Instrumen penelitian meliputi perangkat pembelajaran (silabus, RPP, dan LKPD), tes KAM, serta tes kemampuan pemecahan masalah matematis berupa pretes dan postes pada materi *Komposisi Fungsi dan Invers Fungsi*. Instrumen tes diuji coba terlebih dahulu dan dinyatakan layak digunakan, dengan hasil validitas tinggi–sangat tinggi, reliabilitas tinggi ( $r_{11} = 0,88$ ), tingkat kesukaran bervariasi, serta daya pembeda cukup hingga sangat baik.

Analisis data diawali dengan uji normalitas (Shapiro–Wilk) dan uji homogenitas, kemudian dilanjutkan dengan ANOVA dua jalur menggunakan bantuan SPSS 26.0 untuk menguji perbedaan dan pengaruh interaksi antarvariabel. Prosedur penelitian meliputi kajian pustaka, penyusunan dan validasi instrumen, pemberian pretes, pelaksanaan pembelajaran, pemberian postes, serta analisis data.

## **ANALISA DAN PEMBAHASAN**

Hasil uji prasyarat menunjukkan bahwa data pretes dan postes berdistribusi normal dan homogen, sehingga analisis lanjutan menggunakan ANOVA dua jalur dapat dilakukan. Uji kesamaan dua rerata pretes menunjukkan tidak terdapat perbedaan kemampuan awal antara kelas eksperimen dan kelas kontrol, sehingga kedua kelompok berada pada kondisi awal yang setara.

Hasil ANOVA dua jalur menunjukkan bahwa Kemampuan Awal Matematika (KAM) berpengaruh signifikan terhadap kemampuan pemecahan masalah matematis ( $p = 0,000$ ). Secara empiris, peserta didik yang belajar dengan *Problem Based Learning* (PBL) melalui daring memperoleh rata-rata postes lebih tinggi dibandingkan pembelajaran ekspositori, baik pada kelompok KAM unggul maupun KAM asor. Tidak ditemukan interaksi signifikan antara model pembelajaran dan KAM, yang menunjukkan bahwa PBL efektif pada berbagai tingkat kemampuan awal.

Pada aspek *self-efficacy*, hasil ANOVA menunjukkan bahwa KAM berpengaruh signifikan ( $p = 0,029$ ), sementara pengaruh langsung model pembelajaran dan interaksi tidak signifikan secara statistik. Namun, secara pedagogis, PBL melalui daring mendukung peningkatan *self-efficacy* melalui aktivitas pemecahan masalah, diskusi, dan pengalaman belajar aktif.

Hasil uji korelasi Pearson menunjukkan adanya hubungan positif dan signifikan antara *self-efficacy* dan kemampuan pemecahan masalah matematis ( $r = 0,382$ ;  $p = 0,015$ ), yang berada pada kategori sedang. Hal ini menunjukkan bahwa peningkatan keyakinan diri peserta didik berkaitan dengan peningkatan kemampuan mereka dalam menyelesaikan masalah matematika.

Secara keseluruhan, hasil penelitian membuktikan bahwa *Problem Based Learning* melalui daring lebih efektif dibandingkan pembelajaran ekspositori dalam meningkatkan kemampuan pemecahan masalah matematis, serta mendukung penguatan *self-efficacy*, terutama jika ditinjau dari kemampuan awal matematika peserta didik.

## PENUTUP

Berdasarkan hasil penelitian dan pembahasan pada BAB IV mengenai penerapan model *Problem Based Learning* melalui daring untuk meningkatkan kemampuan pemecahan masalah Komposisi Fungsi dan *self-efficacy* matematis peserta didik dapat diambil kesimpulan sebagai berikut:

1. Terdapat perbedaan kemampuan pemecahan masalah peserta didik yang memperoleh pembelajaran *Problem Based Learning* melalui daring dan peserta didik yang mendapatkan pembelajaran ekspositori melalui daring di tinjau dari KAM.
2. Terdapat perbedaan *self-efficacy* matematis peserta didik yang memperoleh pembelajaran *Problem Based Learning* melalui daring dan peserta didik yang mendapatkan pembelajaran ekspositori melalui daring ditinjau dari KAM.
3. Kemampuan pemecahan masalah peserta didik yang memperoleh pembelajaran *Problem Based Learning* melalui daring lebih baik dari peserta didik yang mendapatkan pembelajaran ekspositori melalui daring ditinjau dari KAM.

4. self-efficacy matematis peserta didik yang memperoleh pembelajaran Problem Based Learning melalui daring lebih baik dari peserta didik yang mendapatkan pembelajaran ekspositori melalui daring ditinjau dari KAM.
5. Terdapat korelasi positif self-efficacy terhadap kemampuan pemecahan masalah matematis peserta didik.

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<b>Object</b>	<b>Font</b>	<b>Alignment</b>	<b>Space above</b>	<b>Space below</b>
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$$\int_0^{r_2} F(r, \varphi) dr d\varphi = [\sigma r_2 / (2\mu_0)] \cdot \int_0^\infty \exp(-\lambda |z_j - z_i|) \lambda^{-1} J_1(\lambda r_2) J_0(\lambda r_i) d\lambda. \quad (1)$$

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Figure 1. IndoMS

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## Acknowledgments ← 12pt, Arial, Bold

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