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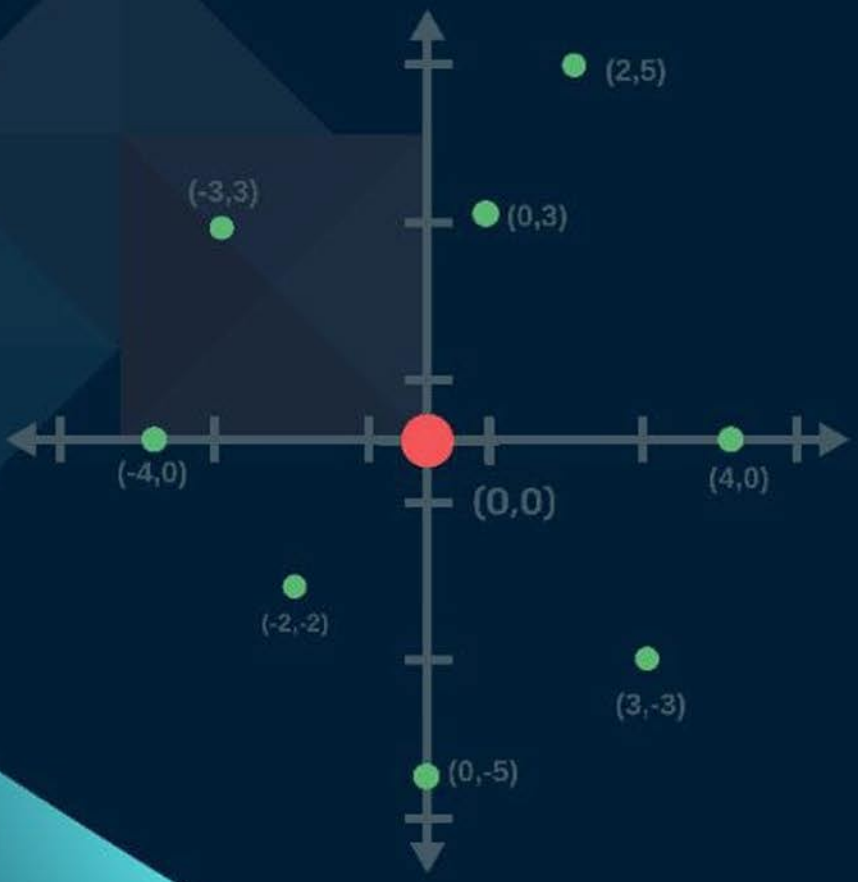

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PENGARUH *COGNITIVE SKILLS* TERHADAP HASIL BELAJAR MATEMATIKA SECARA DARING

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Abstrak

Pandemi covid 19 yang terjadi mengakibatkan proses pembelajaran dilaksanakan secara daring, namun pembelajaran daring ditemukan memiliki banyak kendala sehingga untuk mengefektifkan pembelajaran daring maka kemampuan kognitif siswa harus dioptimalkan. Studi kuantitatif ini bertujuan menganalisis faktor *cognitive skills* siswa yang dapat mempengaruhi hasil belajar matematika secara daring dan untuk mendeskripsikan variabel *cognitive skills* yang dominan pengaruhnya. Penelitian ini merupakan penelitian kuantitatif survei dilakukan pada bulan Januari-Maret 2021 dengan melibatkan siswa salah satu SMA di Kota Makassar sebanyak 155 orang yang terdiri dari 95 orang perempuan dan 60 orang laki-laki. Variabel penelitian terdiri atas variabel eksogen yaitu *cognitive skills* (metakognisi, kemampuan pemahaman membaca, kebutuhan kognisi, dan intelegensi), sedangkan variabel *endogen* adalah hasil belajar matematika. Instrumen yang digunakan untuk mengkur variabel eksogen adalah kuisioner angket dan tes intelegensi yang memenuhi uji validitas dan reliabilitas. Variabel endogen yaitu hasil belajar diperoleh dari nilai dokumentasi hasil belajar matematika siswa (nilai raport). Data diolah dengan analisis deskriptif dan analisis infrensial menggunakan *structural equation modeling* (SEM). Hasil penelitian menunjukkan bahwa metakognisi dan intelegensi berpengaruh positif dan signifikan terhadap hasil belajar matematika secara daring, hal tersebut bermakna bahwa semakin tinggi metakognisi dan intelegensi yang dimiliki oleh siswa, maka hasil belajar siswa tersebut akan semakin meningkat. Sedangkan, kemampuan pemahaman membaca dan kebutuhan kognisi ditemukan berpengaruh tidak signifikan terhadap hasil belajar matematika secara daring, hal tersebut bermakna bahwa kemampuan pemahaman membaca dan kebutuhan kognisi belum cukup memberi bukti bahwa dapat mempengaruhi hasil belajar matematika secara daring. Adapun variabel *cognitive skills* yang memberikan pengaruh dominan terhadap hasil belajar matematika secara daring adalah intelegensi dengan kontribusi sebesar 19,53%. Hal ini menunjukkan bahwa intelegensi memberikan pengaruh yang besar dalam proses belajar matematika secara daring.

Kata Kunci: cognitive skills, hasil belajar matematika, pembelajaran daring

THE EFFECT OF COGNITIVE SKILLS ON ONLINE MATHEMATICS LEARNING OUTCOMES

Abstract

The covid 19 pandemic that occurred resulted in the learning process being carried out online, but online learning was found to have many obstacles so that in order to make online learning effective, students' cognitive abilities must be optimized. This quantitative study aims to analyze the cognitive skills of students that can influence online mathematics learning outcomes and to describe the cognitive skills variables that have the dominant influence. This research is a quantitative survey research conducted in January-March 2021 involving 155 high school students in Makassar City, consisting of 95 women and 60 men. The research variables consisted of exogenous variables, namely cognitive skills (metacognition, reading comprehension ability, cognitive needs, and intelligence), while the endogenous variables were the results of learning mathematics. The instruments used to measure exogenous variables are questionnaires and intelligence tests that meet the validity and reliability tests. The endogenous variable is learning outcomes obtained from the documentation value of students' mathematics learning outcomes (report scores). The data was processed by descriptive analysis and inferential analysis using structural equation modeling (SEM). The results of the study indicate that metacognition and intelligence have a positive and significant effect on online mathematics learning outcomes, it means that the higher the metacognition and intelligence possessed by students, the student's learning outcomes will increase. Meanwhile, reading comprehension

skills and cognitive needs were found to have no significant effect on online mathematics learning outcomes, this means that reading comprehension skills and cognitive needs have not provided sufficient evidence that they can affect online mathematics learning outcomes. The cognitive skills variable that gives the dominant influence on online mathematics learning outcomes is intelligence with a contribution of 19.53%. This shows that intelligence has a great influence on the online learning process of mathematics.

Keywords: cognitive skills, mathematics learning outcomes, online learning

1. Pendahuluan

Corona virus (SARS-CoV-2) yang telah mewabah mulai akhir Tahun 2019 ke hampir seluruh negara di dunia menjadi alasan WHO menetapkan COVID-19 sebagai pandemi mulai April 2020 (Putri, 2020). Pandemi yang terjadi mengakibatkan perubahan yang signifikan terhadap semua aspek kehidupan termasuk bidang pendidikan (Astini, 2020).

Sekitar 1,6 miliar pelajar di 190 negara dengan 94% populasi sekolah dunia terkena dampak penutupan sekolah (Adinda, 2020). Indonesia sendiri sekirar 7,5 juta mahasiswa dan 45 juta pelajar sekolah dasar dan menengah harus belajar dari rumah (Amindoni, 2020). Oleh karena itu, dalam rangka pemenuhan kebetuhan dasar peserta didik dalam mendapatkan pelayanan pendidikan selama pandemi, sehingga pemerintah menetapkan kebijakan pendidikan dimasa pandemi melalui pembelajaran dari rumah atau pembelajaran dalam jaringan (daring) (Kemendikbud, 2020).

Bukan cuma di Indonesia yang telah mengeluarkan kebijakan tentang pembelajaran daring selama pandemi, namun hal tersebut juga dilakukan diberbagai negara seperti Nigeria (Azubuike et al., 2021); Korea Selatan, (Baber, 2021); Pakistan, (Rafique et al., 2021); dan di Malaysia, (Azlan et al., 2020). Berbagai upaya dan metode yang dilakukan untuk memastikan kegiatan pembelajaran Daring tetap berjalan secara maksimal seperti sistem pembelajaran virtual (Ehrlich et al., 2020); perubahan kurikulum dan penyiapan evaluasi daring (Daniel, 2020); e-learning laboratorium virtual (Ray & Srivastava, 2020); koneksi digital dan teknologi dan pembelajaran jarak jauh, (Nuere & de Miguel, 2020); dan (Schneider & Council, 2020). Indonesia sendiri telah dilakukan berbagai metode seperti pembelajaran melalui TVRI, *whatsapp group*, *google meet*, *zoom*, dan *mailing list* (Wahyuddin et al., 2020); (Astini, 2020) dan (Haqien & Rahman, 2020); serta penggunaan video tutorial dan penggunaan media android (Batubara & Batubara, 2020) dan (Ramdani et al., 2020).

Pembelajaran daring memiliki banyak kelebihan seperti persepsi positif siswa terhadap pembelajaran daring yang mengintegrasikan Teknologi Informasi dan Komunikasi (TIK) (Lubis, 2018); pembelajaran lebih efektif (Zahra & Wijayanti, 2020); dan kecanggihan Teknologi Informasi dan Komunikasi (TIK) dalam pembelajaran membuat arus pertukaran informasi menjadi sangat cepat serta komunikasi menjadi seolah-olah tanpa batas (Belawati, 2020).

Namun, pembelajaran daring juga memiliki banyak kekurangan seperti memunculkan kecemasan siswa (Lailiyah et al., 2021); aksebilitas jaringan yang rendah (Handayani, 2020); keterbatasan sarana parasana (Dwi et al., 2020); kebutuhan finansial lebih tinggi (Almaiah et al., 2020); kesiapan guru belum maksimal (Kahfi, 2020); penguasaan teknologi masih rendah (A. Purwanto et al., 2020); serta ketidakpuasan siswa dalam pembelajaran (Napitupulu, 2020). Oleh karena itu, untuk meminimalisir kelemahan dan kekurangan dalam pembelajaran daring sehingga pendidik harus memberi upaya optimal untuk mengefektifkan pembelajaran di masa pandemik, salah satu cara yaitu dengan mengoptimalkan kemampuan kognifif siswa. Kemampuan kognitif diperlukan untuk melakukan tugas dari wujud sederhana hingga paling kompleks (Basri, 2018); kemampuan kognitif merupakan rangkaian proses mental atau aktivitas pikiran seseorang dalam memperoleh informasi, mempresentasikan, dan mentransformasikan informasi sebagai pengetahuan (Suharnan, 2005). Faktor dan kemampuan kognitif memainkan peran penting dalam pemecahan masalah dan hasil belajar siswa (Dimyati, 2006; Ozturk et al., 2020).

Cognitive skills merupakan suatu hal yang harus dimiliki seorang siswa karena dapat membantu siswa menganalisis konsep, prinsip, dan aturan dari suatu permasalahan (Nurazizah et al., 2017). *Cognitive skills* berkaitan dengan kecerdasan yang menekankan aspek intelektual berupa keterampilan berpikir, pengetahuan, dan memecahkan masalah (Utari, 2013).

Seseorang yang memiliki kemampuan kognitif, mampu memahami, menghafal, mengaplikasi, mensintesis menganalisis, dan mengevaluasi (Adiwisastra & Basjaruddin, 2017). Demikian juga yang dikemukakan (Muloke et al.,

2017) bahwa cognitive skills membantu individu untuk beradaptasi dengan lingkungannya.

Seseorang memiliki kemampuan kognitif bila mampu memaksimalkan kemampuan otak dalam menjalankan fungsi kecepatan berpikir, logika, penalaran, serta merekronstruksi pengetahuan seseorang secara spontan dalam banyak hal (Barak & Levenberg, 2016). Individu tersebut akan mampu melakukan penalaran logis, memiliki kreativitas, dan sensitivitas terhadap masalah (Solihat, 2010).

World Economic Forum Tahun 2020 juga telah menetapkan 15 indikator keterampilan utama yang menjadi kriteria kebutuhan dunia kerja Tahun 2025 diantaranya *critical thinking* dan *analysis* yang merupakan turunan dari *cognitive skills*, (World Economic Forum, 2020). Oleh karena itu, *cognitive skills* dianggap sebagai keterampilan untuk mengatasi tantangan global pada era ini dan masa yang akan datang. Terdapat beberapa variabel yang memberi kontribusi terhadap pembentukan *cognifive skills* sesorang diatarnya *metacognition* (Karakelle, 2012), *reading comprehension skill* (Dabarera et al., 2014; Guven & Cabakcor, 2013); *intelegensi* (Stankov, 2000; Veenman et al., 2004); dan *need for cognition* (Karakelle, 2012). Hal yang sama juga diutarakan Lins de Holanda Coelho et al., (2020) bahwa *cognifive skills* terdiri atas *metacognition, reading comprehension skill*, *intelegensi*, dan *need for cognition*.

Metakognisi adalah kesadaran, keyakinan dan pengetahuan seseorang tentang proses dan cara berpikir pada hal-hal yang mereka lakukan sendiri sehingga meningkatkan proses belajar dan memori. *Reading comprehension skill* adalah serangkaian proses yang dilakukan pembaca untuk menemukan informasi dan memahami informasi yang terkandung dalam sebuah teks bacaan/ buku matematika.

Intelegensi adalah kemampuan seseorang yang bersifat umum dan potensial. *Need for cognition* adalah kemampuan seseorang untuk mencari, memperoleh dan berpikir kritis serta cermat tentang informasi agar bisa memahami dalam belajar matematika.

Sayangnya *cognitive skills* yang merupakan salah satu keterampilan yang dibutuhkan dalam dunia kerja dimasa yang akan datang belum optimal dimiliki oleh siswa di Indonesia yang dapat dilihat dari peringkat tes (PISA) 2018 yang hanya menempatkan Indonesia berada di peringkat 71 dari 78 negara, (OECD, 2018); Daya saing SDM Indonesia urutan 50 dari 141 Negara, (Schwab, 2019). Selain itu, terdapat juga beberapa hasil penelitian yang melaporkan rendahanya hasil belajar matematika di Indonesia seperti (Amir & Kurniawan, 2020; Sukardjo & Salam, 2020; Yahya & Bakri, 2020; Astuti et al., 2020; Fitrianti et al., 2020; Rahayu & Agustika, 2020).

Demikian juga dilihat pada ujian nasional mata pelajaran matematika tingkat SMA hanya rata-rata 52,01 atau berada pada kategori rendah, (Puspendik, 2019). SMA Negeri 4 Kota Makassar sendiri masih memiliki kemampuan matematika yang rendah jika dilihat dari penguasaan materi ujian nasional Tahun 2019 yang hanya mencapai 42.92 untuk materi ajlabar, 28.49 untuk materi kalkulus, 30,05 untuk materi geometri dan trigonometri, serta 29.70 untuk materi statistika, (Puspendik, 2019).

Berbagai penelitian terdahulu yang telah dilakukan dibeberapa negara yang berkaitan dengan *cognitive skills* seperti Vittadinic et al. (2021) di Italia yang membahas tentang keterampilan kognitif untuk mengukur efisiensi sekolah; dan Mikus et al. (2021) di Jerman membahas tentang peran orang tua dalam perkembangan kemampuan kognitif siswa. Indonesia sendiri juga telah banyak dilakukan seperti Muamar dan Rahmi (2017) membahas tentang penerapan metode praktikum dalam meningkatkan kemampuan kognitif dan Zamista dan Kaniawati (2016) meneliti tentang penerapan pembelaran pogil dalam meningkatkan keterampilan kognitif, serta Reynaldo et al. (2021) yang meneliti tentang peran *video game* dalam meningkatkan kemampuan kognitif.

Namun, penelitian tersebut masih sebatas meneliti hal-hal yang dapat meningkatkan kemampuan *cognitive skills* serta uji coba penerapan metode pembelajaran dalam rangka meningkatkan kemampuan kognitif siswa dan belum ada sama sekali yang meneliti dan mengukur tentang *cognitive skills* siswa khususnya dalam pembelajaran daring, demikian juga dalam pembelajaran daring dimasa masa pendemi ini belum ada yang meneliti tentang bagaimana kontribusi kemampuan kognitif serta dampaknya terhadap hasil pembelajaran daring.

Padahal penelitian yang mengukur tentang *cognitive skills* serta dampaknya terhadap hasil belajar matematika secara daring sangat penting untuk dilakukan dengan harapan dapat memberikan dasar teori serta penguatan tentang pentingnya memperhatikan dan mengoptimalkan faktor-faktor kognitif siswa khususnya dalam pembelajaran daring.

Hasil penelitian ini juga diharapkan dapat dijadikan sebagai rujukan dalam pengembangan

cognitive skills siswa dalam menunjang peningkatan kualitas proses dan hasil belajar matematika, khususnya dalam pembelajaran yang dilakukan secara daring. Temuan penelitian ini juga dapat menjadi bahan referensi bagi dosen dan guru dalam pengembangan kualitas dan hasil belajar matematika melalui optimalisasi faktor *cognitive skills* siswa. Oleh karena itu, tujuan utama dari penelitian ini adalah menganalisis dan mendeskripsikan faktor *cognitive skills* siswa yang dapat mempengaruhi hasil belajar matematika secara daring, serta untuk mendeskripsikan variabel yang dominan berpengaruh terhadap hasil belajar matematika secara daring.

2. Metode Penelitian

Penelitian ini merupakan penelitian kuantitatif, survei dilaksanakan pada bulan Januari - Maret 2021. Populasi penelitian ini yaitu siswa salah satu SMA di kota Makassar sebanyak 540 orang yang tersebar pada 18 kelas dengan tiga tingkatan yang berbeda yaitu kelas X, XI, dan XII.

Teknik pengambilan sampel dalam penelitian ini dilakukan dengan teknik *stratified random sampling* dan diperoleh sebanyak 155 orang yang terdiri atas 95 orang perempuan dan 60 orang laki-laki yang berada pada tingkatan kelas XI.

Prosedur riset dirancang dengan empat tahapan yaitu 1) Persiapan: dengan melaksanakan kajian induktif, riset literatur serta sumber yang relevan, membuat rencana dan jadwal riset, menyusun dan memvalidasi instrument; 2) Penerapan: pemberian angket kusioner serta tes intelegensi, dan pengumpulan informasi yang revan; 3) Analisis informasi: mereduksi serta analisis informasi lewat analisis deskriptif serta infrensial dengan structural equation modeling (SEM); dan 4) Penarikan kesimpulan: analisis serta penilaian yang valid digunakan sebagai dasar dalam menarik kesimpulan yang sahih.

Variabel penelitian dan teknik pengumpulan data diuraikan sebagai berikut: Variabel metakognisi diukur menggunakan angket skala likert 1-5 dengan 8 item pernyataan yang dikembangkan sendiri oleh peneliti dan divalidasi ahli serta memenuhi uji validitas dan realibiltas. Variabel *need for cognition* diukur dengan instrumen baku yang dikembangkan oleh Lins de Holanda Coelho et al. (2020) yang ditranslate dalam Bahasa Indonesia dengan 6 item pernyataan dan telah di uji validitas dengan realibilitas tes sebesar 0,876.

Variabel kemampuan membaca diukur dengan tes kemampuan pemahaman membaca yang dikembangkan oleh Ridwan (2010). Variabel intelegensi diukur dengan tes intelegensi menggunakan tes skala Stanford-Binet, (Rohmah, 2011).

Data hasil belajar matematika diambil dari nilai dokumentasi hasil belajar matematika siswa di sekolah (nilai raport). Data hasil penelitian diolah dengan analisis deskriptif guna untuk mendeskripsikan kategori masing-masing variabel dengan mengacu pada Tabel 1 berikut.

Tabel 1. Kategori Deskriptif Variabel Penelitian

No	Skor	Kategori	Skor	Kategori
1	1,00 – 1,80	Rendah	< 50	Sangat Rendah
2	1,81 – 2,60	Kurang	50 – 62	Rendah
3	2,61 – 3,40	Cukup	63 – 74	Sedang
4	3,41 – 4,20	Tinggi	75 – 86	Tinggi
5	4,21 – 5,00	Sangat Tinggi	> 87	Sangat Tinggi

Sumber: Eilifsen et al. (2014) dan N. Purwanto (2012)

Selanjutnya analisis infrensial diolah dengan mengunakan teknik analis structural equation modeling (SEM) melalui program amos versi 21 yang digunakan sebagai dasar menjawab rumusan masalah.

3. Hasil dan Pembahasan

3.1 Hasil

Hasil penelitian ini terdiri atas hasil analisis deskriptif dan hasil analisis infrensial. Hasil analisis deskriptif masing-masing variabel dituangkan pada Tabel 2 berikut.

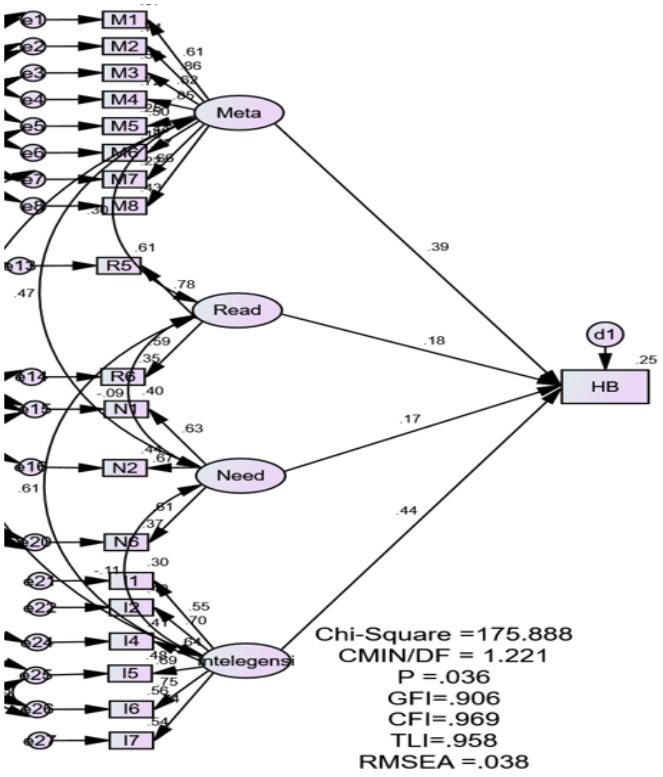
Tabel 2. Hasil Analisis Deskriptif Variabel Penelitian

No	Kegiatan	Mean	Kategori
1	Metakognisi	3,96	Tinggi
2	Kemampuan pemahaman membaca	3,08	Cukup
3	Kebutuhan kognisi	3,21	Cukup
4	Intelegensi	3,25	Cukup
5	Hasil Belajar	84,11	Tinggi

Sumber: Data Olahan

Berdasarkan tabel 2, *cognitive skills* siswa berada pada kategori cukup. Selanjutnya dari keempat indikator pembentuk *cognitive skills* diperoleh bahwa metakognisi berada pada kategori tinggi sedangkan *reading comprehension skill*, *intelegensi*, dan *need for cognition* berada pada kategori cukup. Demikian juga halnya dengan hasil belajar, dilaporkan berada pada kategori tinggi. Hasil penelitian ini menemukan bahwa kemampuan metakognisi siswa lebih tinggi dibanding dengan kemampuan pemahaman membaca, kebutuhan kognisi, dan intelegensinya.

Selanjutnya hasil analisis infrensial dengan *structural equation modeling* (SEM) diperoleh model model akhir sebagaimana tertuang pada gambar 1 berikut.



Gambar 1. Model Fit

Adapun evaluasi kriteria *goodness of fit indices* sebagaimana tertera pada Tabel 3 berikut.

Tabel 3. Hasil Evaluasi Kriteria Goodness of Fit Indices

Goodness of fit index	Cut-off Value	Hasil Model	Ket
χ^2 – Chi-square	Diharapkan kecil	175,88	Baik
Sign.Probability	≥ 0,05	0,036	Baik
CMIN/DF	≤ 2,00	1,221	Baik
RMSEA	≤ 0,80	0,038	Baik
GFI	≥ 0,90	0,906	Baik
AGFI	≥ 0,90	0,863	Marginal
TLI	≥ 0,95	0,958	Baik
CFI	≥ 0,95	0,969	Baik

Sumber: Data Olahan

Lebih lanjut, untuk menjawab rumusan masalah dapat dilihat dari hasil *regression weights* pada Tabel 4 berikut.

Tabel 4. *Regression Weights*

Hubungan Variabel	Estimate	S.E.	C.R	P	Estimate Standardize
Metakognisi ← Hasil Belajar	6,230	2,075	3,003	0,003	0,392
Kemampuan pemahaman membaca ← Hasil Belajar	7,520	5,511	1,365	0,172	0,183
Kebutuhan kognisi ← Hasil Belajar	2,577	2,049	1,258	0,209	0,172
Intelegensi ← Hasil Belajar	2,875	0,876	3,282	0,001	0,442

Sumber: Data Olahan

Penjelasan tabel 4, diuraikan sebagai berikut:

a. Metakognisi berpengaruh positif dan signifikan terhadap hasil belajar berdasarkan nilai p = 0.003 < α =0.005 dengan besar pengaruh sebesar 15,36% diperoleh dari $(0,392)^2$ x 100%.

b. Kemampuan pemahaman membaca berpengaruh tidak signifikan terhadap hasil belajar berdasarkan nilai $p = 0.172 > \alpha = 0.005$.
c. Kebutuhan kognisi berpengaruh tidak signifikan terhadap hasil belajar berdasarkan nilai $p = 0.209 > \alpha = 0.005$.
d. Intelegensi berpengaruh positif dan signifikan terhadap hasil belajar berdasarkan nilai $p = 0.001 < \alpha = 0.005$ dengan besar pengaruh sebesar 19,53% diperoleh dari $(0{,}442)^2$ x 100%.

3.2 Pembahasan

Berdasarkan hasil penelitian yang telah diuraikan sebelumnya, selanjutnya dilakukan pembahasan secara mendalam berdasarkan temuan penelitian diuraikan sebagai berikut.

a. Pengaruh Metakognisi (*Metacognition*) terhadap Hasil Belajar

Dalam penelitian ini metakognisi diukur dengan delapan indikator yaitu pengetahuan deklaratif, prosedural, kondisional, perencanaan, manajemen strategi, pemahaman, strategi debugging, dan evaluasi. Berdasarkan hasil penelitian ditemukan bahwa metakognisi berpengaruh positif dan signifikan terhadap hasil belajar matematika, hal ini bermakna bahwa semakin tinggi metakognisi yang dimiliki siswa, maka hasil belajar siswa tersebut akan semakin meningkat. Hal ini berarti terjadi kesesuaian antara hipotesis dengan data yang diperoleh sekaligus menguatkan pandangan bahwa metakognisi memiliki peranan penting dalam mengatur dan mengontrol proses kognitif seorang dalam belajar serta berpikir (Tohir et al., 2018). Metakognisi sangat perlu dimiliki siswa dalam memberi motif dan sumber daya kognitif siswa sebagai kendali dan strategi untuk menangani tugas dan memperoleh hasil belajar yang baik (Biggs, 1988).

Hasil penelitian ini sejalan dengan hasil penelitian (Wahyuddin, 2016; Sari, 2020; Nirfayanti & S, 2021; Setiawan et al., 2020; Wihasta Jagat Wicaksana et al., 2021) yang menyimpulkan bahwa terdapat hubungan positif dan signifikan metakognisi dengan hasil belajar matematika. Demikian juga temuan (Dewi et al., 2013) menyimpulkan bahwa terdapat pengaruh positif keterampilan metakognisi terhadap keterampilan berkomunikasi siswa. Siswa dengan kemampuan metakognitif tinggi mampu menggunakan kemampuan metakognitifnya dalam memecahkan masalah (Suryaningtyas & Setyaningrum, 2020).

Siswa dengan kemampuan metakognitif tinggi memiliki pemecahan masalah matematika yang sangat baik, siswa dengan kategori sedang memiliki pemecahan masalah matematis yang baik, dan siswa kategori rendah memiliki kemampuan pemecahan masalah matematika pada kategori cukup (Fitrih et al., 2018). Dalam hal proses pembelajaran, metakognisi juga ditemukan memiliki dampak positif pada pembelajaran siswa (Bakar & Ismail, 2020).

Namun, berbeda dengan hasil penelitian (Arriah, 2016) bahwa pengaruh metakognisi terhadap prestasi belajar matematika secara langsung adalah negatif tapi tidak signifikan demikian juga metakognisi tidak ditemuka berpengaruh langsung dan tidak langsung terhadap hasil belajar matematika (Hasanah A.R., 2021).

b. Pengaruh Kemampuan Pemahaman Membaca (*Reading comprehension skills*) terhadap Hasil Belajar

Kemampuan pemahaman membaca dalam penelitian ini diukur dengan 6 indikator yaitu tingkat ingatan (C1), tingkat pemahaman (C2), tingkat penerapan (C3), tingkat analisis (C4), tingkat sintesis, dan tingkat evaluasi (C6). Dalam hal kemampuan pemahaman membaca ditemukan bahwa kemampuan pemahaman membaca berpengaruh tidak signifikan terhadap hasil belajar matematika.

Hal ini memberi gambaran bahwa data yang diperoleh dari subjek penelitian belum mampu membuktikan bahwa kemampuan pemahaman membaca tidak berpengaruh signifikan terhadap peningkatan hasil belajar matematika yang berarti bahwa untuk meningkatkan hasil belajar matematika tidak cukup hanya dengan kemampuan pemahaman membaca yang dimiliki oleh siswa, namun harus ditunjang dengan faktor-faktor lain.

Temuan ini mendukung hasil penelitian sebelumnya yang menyimpulkan bahwa keterampilan pemahaman membaca siswa secara keseluruhan tidak berkorelasi signifikan dengan kinerja matematika (Imam et al., 2013). Lebih lanjut, temuan yang sama diungkapkan bahwa tidak ada bukti yang menunjukan bahwa kemampuan pemahaman membaca dapat mempengaruhi prestasi matematika (Vista, 2013).

Oleh karena itu, kinerja matematika yang buruk dapat dijelaskan oleh faktor lain yang tidak terkait dengan keterampilan pemahaman membaca.

Meskipun hasil penelitian ini telah menemukan bahwa kemampuan pemahaman membaca berpengaruh tidak signifikan terhadap hasil belajar matematika, namun tidak berarti

bahwa kemampuan pemahaman membaca dapat diabaikan begitu saja karena banyak pula hasil penelitian terhadulu seperti (Assari, 2013) dan (Rudyanto, 2017) yang menemukan bahwa terdapat pengaruh signifikan kemampuan pemahaman membaca terhadap prestasi belajar matematika.

Selain itu, dalam hal kemampuan pemecahan masalah matematika ditemukan memiliki hubungan yang positif dan signifikan dengan kemampuan membaca (Subekti, 2016) dan (Ozturk et al., 2020). Siswa dengan kemampuan pemahaman membaca lemah mengalami kesulitan dalam menerjemahkan representasi simbolik ke dalam teks matematika (Duru & Koklu, 2011).

Siswa dengan keterampilan pemahaman membaca yang lebih lemah menyebabkan pencapaian akademik yang lebih rendah (Trakulphadetkrai et al., 2020); serta keterampilan pemahaman membaca diperlukan seumur hidup semua bidang kehidupan termasuk matematika, sehigga matematika dan membaca saling melengkapi (Gomez et al., 2020).

c. Pengaruh Kebutuhan Kognisi (*Need for Cognition*) terhadap Hasil Belajar

Kebutuhan kognisi dalam penelitian ini diukur dengan 6 indikator yaitu masalah kompleks, memiliki tanggungjawab, kemampuan berpikir, pemecahan masalah, dan tantangan. Dari hasil penelitian ditemukan bahwa kebutuhan kognisi berpengaruh tidak signifikan terhadap hasil belajar, hal ini memberi gambaran bahwa ternyata kebutuhan kognisi hanya mampu memberi pengaruh yang sangat kecil terhadap hasil belajar, sehingga belum cukup bukti dapat dikatakan bahwa kebutuhan kognisi dapat memberi kontribusi terhadap peningkatan hasil belajar matematika yang berarti bahwa untuk meningkatkan hasil belajar tidak cukup hanya dengan kebutuhan kognisi yang dimiliki oleh siswa, namun harus didukung dengan faktor-faktor lain.

Hasil penelitian ini sejalan dengan pendapat (Petty et al., 2009) mengemukakan bahwa individu yang memiliki kebutuhkan kognisi tinggi belum tentu lebih rasional daripada mereka memiliki kebutuhan kognisi rendah karena kebutuhan kognisi termasuk ke dalam teori kepribadian sistem ganda atau teori kognitif-pengalaman yang menjelaskan bahwa orang memiliki dua sistem pemrosesan informasi yaitu sistem rasional dan sistem pengalaman. Sistem rasional lebih cenderuh memiliki kemampuan logis, kemampuan verbal, dan relatif tidak emosional sedangkan sistem pengalaman lebih cenderung intuitif.

Temuan ini berbeda dengan beberapa penelitian sebelumnya yang menemukan korelasi yang signifikan antara kebutuhan kognisi dan kinerja akademik serta kemandirian intelektual, (Elias & Loomis, 2002) dan (Fortier & Burkell, 2014). Demikian juga temuan Sadowski dan Cogburn bahwa siswa dengan skor *need for cognition* kategori tinggi lebih terbuka pada pengalaman baru daripada individu dengan skor yang rendah (Suri & Monroe, 2001). Serta individu yang tinggi dalam kebutuhan berkognisi selalu tertantang untuk melakukan kegiatan kognitif, sedangkan siswa dengan kebutuhan kognisi rendah lebih suka terlibat dalam tugas kognitif hanya ketika mereka ada kepentingan (Jati & Diana, 2019).

Oleh karena itu, meskipun kebutuhan kognisi ditemukan memiliki pengaruh yang sangat kecil dan tidak signifikan dalam meningkatkan hasil belajar, namun kebutuhan kognisi tetap penting menjadi perhatian karena juga banyak penelitian yang menjelaskan bahwa siswa dengan kebutuhan kognisi tinggi sering terlibat dalam kegiatan pembelajaran mendalam, menggunakan strategi seperti pemrosesan kritis, berhubungan dan penataan sedangkan siswa dengan tingkat kebutuhan kognisi rendah menggunakan strategi seperti menghafal dan berlatih, (Cazan & Indreica, 2014).

Kebutuhan kognisi atau kebutuhan untuk terlibat dalam dan menikmati pemikiran merupakan sifat individu yang stabil yang ditemukan mempengaruhi beberapa aspek kinerja akademis, seperti penulisan esai, kinerja tes di kelas, kinerja tes standar, dan nilai rata-rata siswa (IPK).

Satu temuan yang konsisten adalah bahwa mereka yang membutuhkan kognisi tinggi cenderung memiliki IPK lebih tinggi daripada mereka yang membutuhkan kognisi rendah. Demikian pula, telah ditemukan bahwa mereka yang sangat membutuhkan kognisi lebih cenderung menghadiri kelas berbakat, mencapai skor yang lebih tinggi pada tes pengetahuan, cenderung tidak bosan (Neigel et al., 2017).

d. Pengaruh Intelegensi terhadap Hasil Belajar

Dalam penelitian ini intelegensi diukur dengan empat indikator yaitu penalaran verbal, penalaran kuantitatif, penalaran visual abstrak, dan penalaran jangka pendek. Hasil penelitian ditemukan bahwa intelegensi berpengaruh positif dan signifikan terhadap hasil belajar matematika, hal ini bermakna bahwa semakin tinggi intelegensi yang dimiliki siswa, maka hasil belajar siswa tersebut akan semakin meningkat.

Hal ini berarti terjadi kesesuaian antara hipotesis dengan data yang diperoleh sekaligus menguatkan pandangan (Masliani, 2018) bahwa intelegensi merupakan salah satu faktor internal yang mempengaruhi prestasi akademik seseorang. Untuk menyerap materi dalam pembelajaran dibutuhkan kemampuan intelegensi dari setiap siswa.

Siswa yang memiliki kemampuan intelegensi tinggi cenderung lebih cepat memahami dan menguasai konsep-konsep pembelajaran jika dibandingkan dengan siswa yang rendah kemampuan inteligensinya. Hal ini membuat intelegensi sangat diperhitungkan dalam proses pembelajaran, karena intelegensi merupakan bagian dalam pembelajaran yang terkait dengan pengembangan keterampilan fisik dan motorik, (Fajar, 2017).

Hasil penelitian ini sejalan dengan penelitian relevan yang menemukan bahwa terdapat hubungan yang signifikan antara intelegensi dengan hasil belajar matematika yang berarti bahwa semakin tinggi intelegensi yang dimiliki siswa maka hasil belajar matematika akan semakin tinggi yang dikemukakan oleh (Jainuri, 2015; Tayibu, 2016; Haryati & Budiyono, 2016; Izzaty et al., 2017; Sapri et al., 2019). Individu dalam menyelesaikan permasalah baik secara cepat atau lambat, maka faktor yang turut menentukan adalah faktor inteligensi dari individu yang bersangkutan, (Walgito, 2010).

Selanjutnya dijelaskan bahwa hasil penelitian ini berbeda dengan hasil penelitian terdahulu yang menjelaskan bahwa intelegenci memprediksi siswa hasil belajar secara signifikan, tetapi dengan nilai korelasional yang rendah sebagaimana yang jelaskan oleh (Nor et al., 2016) dan tidak ada korelasi yang signifikan variabel intelegensi dengan hasil belajar, (Susilowati, 2012).

Heller, Monks, dan Passow juga menjelaskan bahwa anak-anak yang memiliki kecerdasan tinggi belum tentu memiliki kehidupan yang sukses dan menyenangkan. 100 anak yang memiliki IQ tinggi di California diteliti sejak tahun 1920 hingga tahun 2000. Diantara mereka ada yang menjadi orang terkenal, diantaranya senator, sebagian menerima hadiah nobel untuk iptek, menjadi bintang film terkenal, sutradara tersohor, novelis dan sebagainya.

Namun ada juga diantara mereka yang menjadi pembersih kantor, tukang sapu jalan, dan pekerja kasar lainnya (Wimbarti, 2000). Dengan demikian orang-orang yang memiliki kemampuan IQ yang tinggi tidak selamanya akan berhasil dalam hidupnya. Penelitian serupa menunjukkan tidak selamanya siswa yang memiliki prestasi belajar rendah dan memiliki kesukaran belajar berasal dari siswa yang memiliki inteligensi rendah. Kenyataan menunjukkan beberapa siswa yang memiliki IQ diatas rata-rata memiliki prestasi belajar yang rendah dan beberapa memiliki permasalahan dalam belajar, (Izzaty et al., 2017).

Pada akhirnya, temuan penelitian secara keseluruhan dapat dilaporkan bahwa metakognisi dan intelegensi berpengaruh positif dan signifikan terhadap hasil belajar sedangkan kemampuan pemahaman membaca dan kebutuhan kognisi berpengaruh tidak signifikan terhadap hasil belajar. Variabel yang memberi pengaruh dominan terhadap hasil belajar adalah intellegensi dengan besarnya pengaruh sebesar 19,53%.

Selain itu, terdapat keterbatasan peneliti dimana dalam penelitian ini terdapat instrument yang hanya diadopsi secara langsung dari penelitian sebelumnya, selain itu partisipan dalam penelitian ini hanya melibatkan satu sekolah dan hasil data hasil belajar hanya diambil dari nilai dokumentasi hasil belajar matematika siswa di sekolah. Sehingga, penelitian lebih lanjut diharapkan dapat mengembangan instrument secara mandiri serta melibatkan responden dari berbagai sekolah dan berbagai wilayah sehingga populasi lebih heterogen.

4. Kesimpulan

Hasil penelitian menyimpulkan bahwa (1) metakognisi dan intelegensi berpengaruh positif dan signifikan terhadap hasil belajar matematika secara daring, (2) kemampuan pemahaman membaca dan kebutuhan kognisi tidak berpengaruh signifikan terhadap hasil belajar matematika secara daring, (3) intelegensi memberikan pengaruh dominan terhadap hasil pembelajaran belajar secara daring dengan konstribusi sebesar 19,53%.

Berdasarkan temuan penelitian, maka direkomendasikan agar metakognisi dan intelegensi ditingkatkan melalui berbagai cara, misalnya metakognisi siswa ditingkatkan melalui strategi kognitif dalam pembelajaran serta meningkatkan intelegensi siswa melalui latihan terstruktur.

Selain itu, juga direkomendasikan penelitian lebih lanjut yang berkaitan dengan *cognitive skills* agar dapat mengembangan instrument secara mandiri serta melibatkan responden dari berbagai sekolah dan berbagai wilayah sehingga populasi lebih heterogen.

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MATHEMATICS CONNECTION ABILITY FOR JUNIOR HIGH SCHOOL STUDENTS BASED ON LEARNING INDEPENDENCE LEVEL

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Abstract

Mathematical connection ability is one of the basic mathematics skills that must be possessed by junior high school students. It turns out that so far, the student's learning outcomes in terms of mathematics have not been encouraging. This study aims to describe the mathematical connection skills of junior high school students in solving a problem in terms of learning independence. This research is a qualitative descriptive study on eighth-grade students in a junior high school in Lamongan district, East Java. Data was collectied using test questions, interviews, and questionnaires. This study obtained the following results: 1) one subject (S2) who has high mathematical connection ability with low learning independence, 2) one subject (S1) who has moderate mathematical connection ability with moderately high learning independence, and 3) two subjects (S3 & S4) who have low mathematical connection skills with low learning independence. The internal causes of the lack of mathematical connection skills and student learning independence are the lack of practice questions, the lack of motivational stimulus to encourage students to study independently. While external factors are the level of test questions that are tested too difficult and the lack of supporting learning information sources.

Keywords: ability analysis, independence learning level, mathematical connection ability

1. Introduction

Mathematics is a science in schools that must be learned by all students starting from elementary school, junior high school, middle school, high school, to college. It is because mathematics is a tool that can develop thinking (Burton, 1984; Silver & Others, 1990). Science and mathematics cannot be separated from other sciences and are always related to one another and also related to everyday life (Kiray, Gok, & Bozkir, 2015; Ng, Lay, Areepattamannil, Treagust, & Chandrasegaran, 2012). Therefore, every student feels the need to have mathematical connection skills to support their understanding of mathematics.

In the 2004 curriculum, the ability to connect mathematically is one of the basic mathematical skills that must be possessed and mastered by junior high school students. Regarding the importance of mathematical connections, NCTM argues, "when students can connect mathematical ideas, their understanding is deeper and more lasting" (National Council of Teachers of Mathematics, 2009). The meaning of these words is that when a student can connect mathematical ideas, their thinking will be deeper and will be stored in their memory for a long time. In mathematics and science concepts are hierarchical and each concept is related to one another means that when we learn a certain concept, it is necessary to first study the previous concepts as a prerequisite (Septian & Rizkiandi, 2017; Suhandri, Nufus, & Nurdin, 2017). However, in reality, in terms of mathematical connections, Indonesian school student and Mexican re-university student learning outcomes have not been satisfactory at all (Anita, 2014; Diana, Suryadi, & Dahlan, 2020; García-García & Dolores-Flores, 2021; Kenedi, Helsa, Ariani, Zainil, & Hendri, 2019).

For this paper, the following definition applies: Mathematical connection refers to the ability to recognise and make connections between mathematical ideas, between mathematics and other subjects, and between mathematics and everyday life.

It takes the effort or attention of educators so that student learning outcomes can be achieved. One of the student factors that can bring out their potential to succeed in achieving satisfactory learning outcomes is learning independence (Arista & Kuswanto, 2018; Mulyono, 2017; Suhendri, 2015). Another researcher states that a process within a person to play an active role and not depend on others to achieve certain goals in learning is the definition of learning independence (Fajriyah, Nugraha, Akbar, & Bernard, 2019; Rustyani, Komalasari, Bernard, & Akbar, 2019).

Based on the discussion above, the researchers were very interested in conducting a study listed in the title.

2. Method

The paper uses descriptive qualitative research. The descriptive method is an analytical method that clearly describes the conditions of the thing being studied by collecting data, and then the data is classified, analyzed, and interpreted. The qualitative method is a process linked to everyday reality. This study aims to describe and examine the connection abilities of junior high school students in solving problems in terms of learning independence.

This research was conducted with subjects consisting of 4 students of class VIII in a junior high school in the city of Lamongan. The four subjects will be referred to as Subject 1 (S1), Subject 2 (S2), Subject 3 (S3), and Subject 4 (S4). Analysis of the data obtained from 3 essay questions on the subject's mathematical connection ability, interviews, transcribing interview results, and learning independence questionnaires was completed. The questions and questionnaires used are shown in Figure 1 and Figure 2.

QUESTIONS

1. Find the value of $7^{2022} + 7^{2022} + 7^{2022} + 7^{2022} + 7^{2022} + 7^{2022} + 7^{2022}$.
2. Joni has money marked with the numbers 1, 2, 4, 6, and 9. From these numbers, an odd number consisting of five digits will be formed, provided that no number is repeated. What is the difference between the largest and the smallest numbers formed?
3. The 2052th letter of the pattern O, L, I, M, P, I, A, D, E, S, A, I, N, S, N, A, S, I, O, N, A, L, O, L, I, M, P, I, A, D, E, S, A, I, N, S, ... is?

Figure 1. Question Instrument

No	Statement	Answer			
		1	2	3	4
1	I study math at least 1 hour per day without the teacher's orders				
2	I study math at least 1 hour per day without being ordered by my parents				
3	I'm passionate about learning math				
4	I am enthusiastic about mathematics				
5	I am driven to learn math				
6	I like maths				
7	I study the material before being taught by the teacher				
8	I prepare questions for the teacher related to math material that has not been understood				
9	I'm happy if the teacher gives math assignments				
10	I immediately do the math assignments given by the teacher				
11	If the teacher explains the material and I don't understand it, then I ask the teacher about the material				
12	I go to the library to read and study math books				
13	I am confident in doing math problems				
14	I am optimistic in solving problems in mathematics				
15	I do my math test without cheating				
16	I am optimistic about expressing opinions related to math material				
17	I am confident in carrying out math group learning activities				
18	When discussing, I believe I can complete group assignments				
19	I collect math assignments on time				
20	I collect the math group work report on time				
21	I re-learn the math problems that have been discussed				
22	I make a summary/digest related to the math material that I have learned				
23	I'm working on group assignments				
24	I re-learn math problems that were answered incorrectly				

Description of the answer: (1) = never / disagree; (2) = never / not agree; (3) = often / agree; (4) = always / strongly agree

Figure 2. Questionnaire Instrument

There are 3 instruments used in this study, namely questions to measure the ability of mathematical connections; the interview rubric was asked by the researcher to find out the information he wanted to know; documentation in the form of recordings, student answer sheets, and learning independence questionnaires. The student learning independence questionnaire rubric is presented in Table 1.

Table 1. Learning Independence Questionnaire Rubric

Aspects measured	Indicator	Statement number	Number of statements
Learning independence	Passion for learning	1, 2, 3, 4, 5, 6	6
	Courage and initiative	7, 8, 9, 10, 11, 12	6
	Confident	13, 14, 15, 16, 17, 18	6
	Responsible	19, 20, 21, 22, 23, 24	6
Total			**24**

The scoring technique on the student learning independence questionnaire is as follows. Number of items per aspect $= 6$; minimum score $= 1$; minimum value $= 1 \times 6 = 6$; maximum score $= 4$; maximum value $= 4 \times 6 = 24$; number of interval classes $= 5$.

$$Interval\ distance = \frac{maximum\ value - minimum\ value\ of}{number\ of\ interval\ classes} = \frac{24 - 6}{5} = 3.6$$

Table 2. Conversion of Classification of Student Learning Independence

Score	Criteria
$20.4 \leq Score \leq 24$	Very high
$16.8 \leq Score < 20.4$	High
$13.2 \leq Score < 16.8$	Fairly high
$9.6 \leq Score < 13.2$	Low
$6 \leq Score < 9.6$	Very low

To obtain a mathematical connection ability test score, it is carried out scoring using an assessment adopted from Nursaniah, Nurhaqiqi, & Yuspriyati (2018), which can be seen in Table 3 below.

Table 3. Scoring of Mathematical Connection Ability

Measured Aspects of	Student Answers	Score
Between Mathematical Topics	Answers are correct, recognize and understand the use of mathematical concepts.	4
	Answers are correct according to the criteria requested but some are not quite right.	3
	Answers are correct, do not match some of the criteria requested.	2
	There is an answer that does not match the criteria.	1
	No answer	0
Connections Mathematics in daily life	Answers are correct, recognize and understand the use of mathematical concepts in everyday life.	4
	Answers are correct according to the criteria requested but some are not quite right.	3
	Answers are correct, do not match some of the criteria requested.	2
	There is an answer that does not match the criteria.	1
	No answer	0

The categorization of mathematical connection ability test scores by Agustiani (2020), was adopted in this study. It can be seen in Table 4 below.

Table 4. Categorization of Students' Mathematical Connection Abilities

Score Range (100%)	**Category**
Value ≥ 80	High
$65 \leq$ Value < 80	Medium
Value < 65	Low

3. Result and Discussion

The results obtained by researchers after testing students by giving them mathematical connection ability test questions along with an independence questionnaire study are presented below.

3.1 The Subject Classification

The results of the classification of learning independence subjects are obtained according to the calculations in Table 2 and the categorization of students' mathematical connection abilities in Table 4, and the subject classifications results are shown in Table 5 as follows.

Table 5. Research Results Categories

Subjects	Independence Learning	Mathematical Connections	Score
S1	High enough	Medium	68.5
S2	Low	High	80.25
S3	Low	Low	60.24
S4	Low	Low	61.37

Based on the data in Table 5, we can see that the first subject (S1) has a high enough independence learning level, and S2, S3, S4 are subjects with low independence learning levels. In Table 5, we can also see that there is one subject (S2) who have high mathematical connection ability with low learning independence, one subject (S1) who has moderate mathematical connection ability with fairly high learning independence, and two subjects (S3 & S4) who have low mathematical connection ability with low learning independence.

3.2 The Mathematical Connections of Subjects

The researcher used 3 essay questions to measure the mathematical connection ability and the assessment was according to the rubric in Table 3. After obtaining the test scores for each subject, they categorized their mathematical connection abilities based on independent learning. The following is a description of the answers and interviews on each subject.

The Subject 1

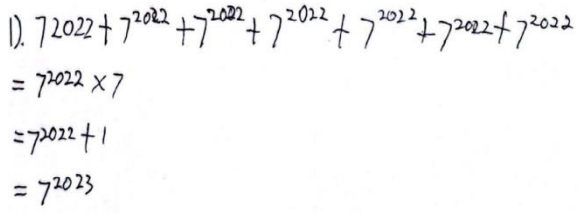

Figure 3. The answer to question number 1 by S1

Figure 3 shows that S1 is quite capable of using connections between mathematical topics, and can solve problems quite well. Related to this, the following is an excerpt from the researcher's (Q) interview instrument with the first subject (S1).

Q : In number one, what was asked?
S1 : Determine the value of …
Q : What is known?
S1 : 7^{2022}
Q : How many results did you get?
S1 : 72023 (Seventy-two thousand twenty-three)
Q : Are you sure it's true?
S1 : Yes

The interview quoted on script 1 shows that S1 has not been able to use connections between mathematics topics.

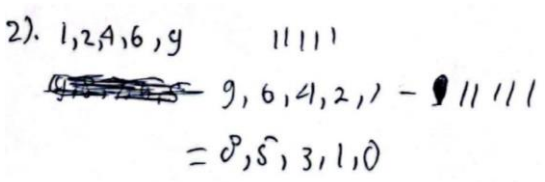

Figure 4. The answer to question number 2 by S1

Figure 4 shows that S1 is quite capable of using connections in everyday life, and can solve problems quite well. Related to this, the following is an excerpt from the researcher's interview instrument with the first subject (S1).

Q : What is the second known number?
S1 : 1, 2, 4, 6, and 9
Q : What was asked about number two?
S1 : Silence... (for a moment)
Number difference
Q : What number?
S1 : The biggest and the smallest
Q : What results did you get?
S1 : 8, 5, 3, 1, 0

The interview excerpt on script 2 shows that S1 is quite capable when using connections in everyday life.

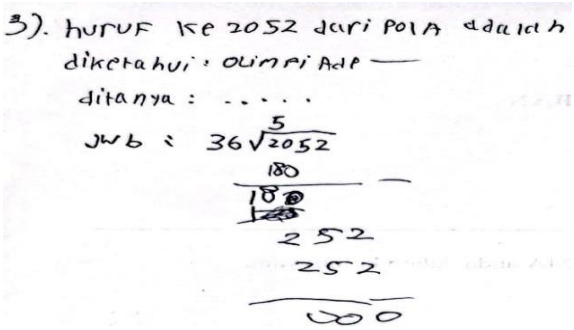

Figure 5. The answer to question number 3 by S1

Figure 5 shows that S1 is quite capable of using connections between mathematical topics, and can solve problems quite well. Related to this, the following is an excerpt from the researcher's interview instrument with the first subject (S1).

Q : Where did this number 36 come from?
S1 : From the name of the olympiad the same...
Silent
Q : So where did 2052 come from?
S1 : From the letter
P : That includes what is known what is being asked
S1 : Asked

The interview excerpt in script 3 shows that S1 has not been able to use connections between mathematical topics properly according to the specified criteria.

The Subject 2

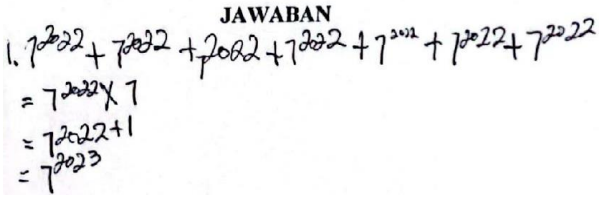

Figure 6. The answer to question number 1 by S2

Figure 6 shows that Subjek 2 can use connections between mathematical topics, and can solve problems well. Related to this, the following is an excerpt from the researcher's interview instrument with the second subject (S2).

Q : For question number one, what was asked?
S2 : Determine the value of
Q : What do you know about question number one?
S2 : $7^{2022} + 7^{2022} + 7^{2022} + 7^{2022} + 7^{2022} + 7^{2022} + 7^{2022}$
Q : What is the number one result?
S2 : 7^{2023}
Q : Where did the results come from?
S2 : 7^{2022+1}
Q : Why don't you write what you know and ask?
S2 : Forgot sir

The interview excerpt in script 4 shows that S2 can use connections between mathematical topics. It can be seen that S2 has been able to solve problem number 1 well.

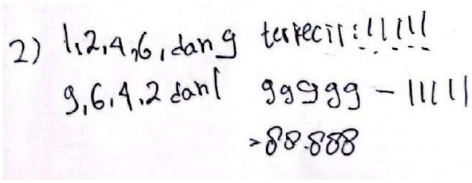

Figure 7. The answer to question number 2 by S2

Figure 7 shows that S2 is able to use mathematical connections in everyday life and can solve problems quite well according to the criteria but some are not quite right in the answers. Related to this, the following is an excerpt from the researcher's interview instrument with subject 2 (S2).

Q : For question number two, what do you know?
S2 : numbers 1, 2, 4, 6 and 9
Q : What is being asked for question number two?
S2 : The difference between the largest and the smallest number
Q : From this question, what is the biggest number?
S2 : Nine
Q : What about the smallest?
S2 : One

Q : What is your biggest number?
S2 : 99999
Q : What's the smallest number?
S2 : 11111
Q : What are you doing?
S2 : Subtracted
Q : Are you sure?

The interview excerpt on script 5 shows that Subject 2 is capable of using mathematical connections in everyday life. It indicates that S2 has been able to solve question number 2 quite well according to the criteria but there is something that is not quite right from the answer.

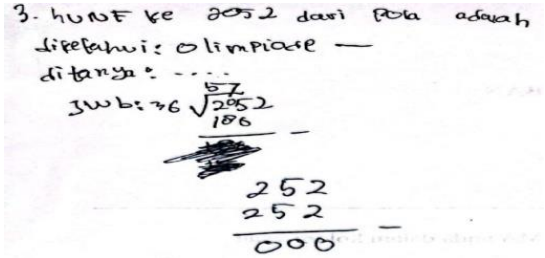

Figure 8. The answer to question number 3 by S2

Figure 8 shows that S2 has not been able to use connections between mathematical topics properly according to the specified criteria. Related to this, the following is an excerpt from the researcher's interview with the S2.

Q : What do you know about the third question?
S2 : National Science Olympiad
Q : For what is asked?
S2 : 2052
Q : Have you finished answering question number three?
S2 : Not yet
Q : Where are these 36 from?
S2 : From the letters of the national science olympiad

The interview excerpt in script 6 shows that S2 has not been able to use connections between mathematical topics properly according to the specified criteria.

The Subject 3

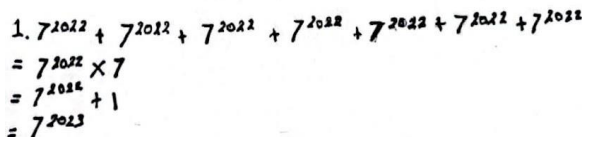

Figure 9. The answer to question number 1 by S3

Figure 9 shows that S3 is quite capable of using connections between mathematical topics and can solve problems quite well. Related to this, the following is an excerpt from the researcher's interview with S3.

Q : For question number one, how many results did you get?
S3 : 7^{2023}
Q : Then what is known about what is being asked from question number one?
S3 : Determine the value of
Q : Determine what the value includes? including what is known, or is it included in the question?

The interview excerpt in script 7 shows that S3 has not been able to use connections between mathematical topics well.

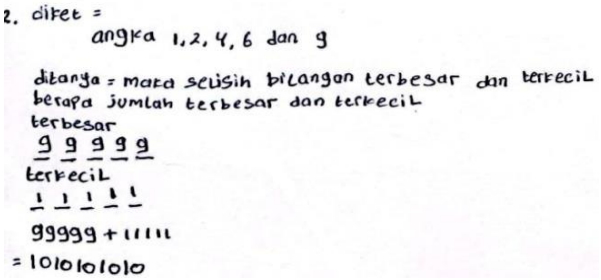

Figure 10. The answer to question number 2 by S3

Figure 10 shows that S3 is able to use mathematical connections in everyday life, and solves problems quite well but does not meet the criteria. Related to this, the following is an excerpt from the researcher's interview with S3.

Q : What do you know about the second question?
S3 : Silent...
Q : What is known?
S3 : 1, 2, 4, 6, and 9
Q : What is the question that is being asked?
S3 : Difference between the largest and smallest numbers
Q : How much do you get for the results?
S3 : Silent...
Q : For the results?
S3 : Silent...
Q : Are you sure about this answer?
S3 : Not yet

Interview quotes on script 8 show that S3 has not been able to use connections in everyday life well.

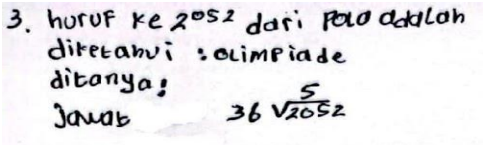

Figure 11. The answer to question number 3 by S3

Figure 11 shows that S3 has not been able to use connections between mathematical topics well. Related to this, the following is an excerpt from the interview instrument of the researcher with S3.

Q : For number three, haven't you?
S3 : Silent...
Q : How come this is not done number three why?
S3 : Silence... (for a moment). Not yet

The interview excerpt from script 9 shows that S3 has not been able to use connections between mathematical topics well.

The Subject 4

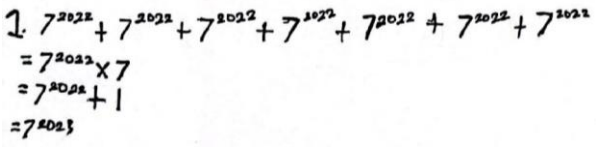

Figure 12. The answer to question number 1 by S4

Figure 12 shows that S4 is quite capable of using connections between mathematical topics and can solve problems quite well. Related to this, the following is an excerpt from the researcher's interview with S4.

Q : Question number one, what was asked?
S4 : Determine the value of
Q : Then what is known?
S4 : 7000 uh... seven 2022
Q : How come the number one that is known and asked is not written down?
S4 : Forgot

The interview excerpt on script 10 shows that S4 has not been able to use connections between mathematical topics well.

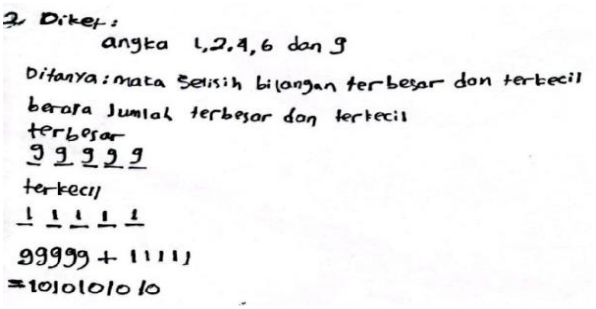

Figure 13. The answer to question number 2 by S4

Figure 13 shows that S4 is quite capable when using connections in everyday life, and solves problems quite well but does not meet the criteria. Related to this, the following is an excerpt from the researcher's interview with S4.

Q : For question number two, how many results did you get?
S4 : (Silence for a moment)
Q : What do you know from question number two?
S4 : 1, 2, 4, 6, and 9
Q : Then what was asked?
S4 : Difference between the largest and smallest numbers
Q : What will the difference between the largest and the smallest numbers be?
S4 : (Silence for a moment)
Plus
Q : If the difference is added?
S4 : (He was silent)

The interview excerpt on script 11 shows that the S4 has not been able to properly use the connection in everyday life.

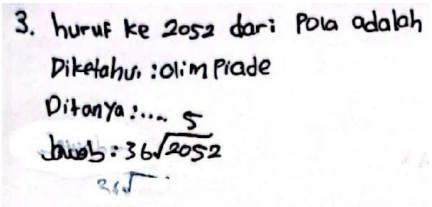

Figure 14. The answer to question number 3 by S4

Figure 14 shows that S4 is not good at using connections between math topics. The following excerpt from the researcher's interview instrument with the fourth subject (S4).

Q : For number three, haven't you?
S4 : Not yet
Q : Why isn't this done, why?
S4 : Can't

The interview excerpt on script 12 shows that S4 has not been able to use connections between mathematical topics well.

Regarding the results obtained, it shows that the low mathematical connection of students is because students seem to have difficulty understanding the tests given, often they work according to their assumptions but do not understand the concept. Shodikin, et al. (2019) found pre-service teachers did similar actions. In this study, the ability of mathematical connections in modeling existing problems is still not good, students often forget and don't write it down. When conducting interviews, many of the subjects looked nervous and afraid, making it difficult for them to express their hearts or thoughts. The learning independence of the four subjects, revealed three with results in line with some reseach results that suggest the learning independence of students is still low (Anita, 2014; Diana et al., 2020; García-García & Dolores-Flores, 2021; Kenedi et al., 2019; Wastono, 2015).

In tackling these problems, teachers or educators could often give practice questions requiring mathematical connections when learning takes place, teachers could also hold story sessions in front of the class, for each student so that they could bring out their potential thinking and heart without feeling nervous or afraid anymore. The

teacher also should provide learning innovations so that when learning takes place the main focus is on the students, no longer teachers, to help them become independent in learning, to think critically, and to think learning is fun and no longer boring. The role of parents is also needed to motivate their children to be more active and independent in learning.

4. Conclusion

The low ability of students in mathematical connection and independent learning contributes to their difficulty working on problems. They were not able to understand the concept. Internal factors that influenced this include the students themselves, lack of practice questions, lack of motivational stimulus to encourage students to study independently. External factors that affected students include the level of questions given that were too difficult.

Based on the results of this study, it is recommended for teachers to always motivate students in the learning process, increase practice questions, encourage independent study, never give up spirit and choose a learning model that is more oriented to student needs. To strengthen the ability of mathematical connections, teachers can get used to reflecting on student understanding, at the beginning and at the end of learning.

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THE INFLUENCE OF ETHNOMATHEMATICS BASED LEARNING ON MATHEMATICS PROBLEM-SOLVING ABILITY: A META-ANALYSIS

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Abstract

The introducer of ethnomathematics defined ethnomathematics as mathematics practised among identified cultural groups. Ethnomathematics positively impacts the learning process either as a Moderate or an approach to, for example, problem-solving ability. Previous researchers have carried out several studies on implementing ethnomathematical-based learning to improve students' problem-solving ability. However, the analysis shown is very varied, so it still raises doubts about the impact of learning using ethnomathematics on mathematical problem-solving abilities. This study aims to determine the correlation between ethnomathematical-based with students' problem-solving skills. This study uses meta-analysis research, which combines several experimental Studies that collate the effectuality of ethnomathematical-based learning and regular instruction on improving the mathematical problem-solving ability. Relevant studies were searched through e-resources from Perpusnas databases with the specified keywords. There are 106 studies obtained from the search query. Fourteen studies were selected according to the inclusion and exclusion criteria. Meta-Mar was used to determine the joined effect size by analysing the selected studies. This study shows that the joined effect size of applied ethnomathematical-based learning in improving mathematical problem-solving skills is 1,04 and was classified as a strong effect. Therefore, it is deduced that ethnomathematical-based learning relies on mathematical problem-solving abilities. Statistically, the implementation of ethnomathematics-based learning in improving mathematical problem-solving ability is also influenced by the study's characteristics at the level of education.

Keywords: a meta-analysis, ethnomathematics, mathematical problem-solving

1. Introduction

Learning is an active process carried out by teachers to develop the various potentials possessed by students (Hamidah, Junaedi, Mulyono, & Kusuma, 2021) to achieve a specific competence. The government has established several competencies for primary and secondary education levels in learning mathematics. After studying mathematics, it is expected that students can master one of the competencies or abilities that are pretty important, namely problem-solving skills or problem-solving skills (RI, 2016). In line with the government, the National Council for Teacher Mathematics (NCTM), an international mathematics education organisation, published a guideline called Principles and Standards for School Mathematics (PSSM) in 2020. PSSM contains standards regarding four main parts, one of which is content standards and process standards. Content standards describe five main content that students need to learn explicitly, while process standards highlight how to acquire and apply knowledge related to that content. NCTM writes that students need to master the four skills to learn the five main content in the guidelines. One of the essential skills mastered by students is problem-solving ability. Apart from being the goal of learning mathematics, problem-solving skills are also the primary tool for applying mathematics (NCTM, 2000).

In addition, NCTM also states that problem-solving is an essential ability that cannot be separated from mathematics. During the problem-solving process, students are encouraged to describe their way of thinking so that in the future, they can implement, develop, and determine the most appropriate strategy to find solutions to other problems in different contexts and situations. In addition, students with mathematical problem-solving abilities are also equipped with ways of thinking, habits, perseverance, curiosity, and self-confidence when facing different conditions (NCTM, 2000). Thus, problem-solving skills need to be given more attention, especially in learning mathematics, known as mathematical problem-solving. Problem-solving is the primary ability and needs to be developed through learning activities in the classroom.

Nevertheless, mathematics learning in schools has not been optimally oriented to developing students' potency. Mathematics learning tends to be oriented towards the application of routine procedures. In practice, students are asked to listen more to what the teacher says, then repeat to solve the questions as exemplified by the teacher. This activity takes place regularly with similar activities in learning activities.

Mathematics learning needs to be wrapped by the teacher into engaging learning and provide a learning experience for students. There are various exciting approaches and learning models that can be implemented in mathematics learning activities. Asstutiningtyas, for example, said that learning rooted in culture is an example of an exciting and fun mathematics learning approach (Astutiningtyas, Wulandari, & Farahsanti, 2017). Culture-based mathematics learning is known as ethnomathematics. Ethnomathematics presents mathematics learning that integrates it with values, norms, and products of human thought rooted in various people's lives. With ethnomathematical-based learning, it is hoped to foster a love for the homeland and students' culture, preserve the environment, and describe how mathematics benefits life (Zaenuri & Dwidayati, 2018).

Ethnomathematics can be viewed as an approach to learning mathematics to foster student motivation. With ethnomathematics, teachers try to contextualise or relate the subject matter with a real situation daily, with existing local cultural values or practices (Zaenuri & Dwidayati, 2018). This statement is in line with Frudental's statement in Zaenuri that "Mathematics must be connected to reality" or mathematics as close as possible to students' daily lives and related to situations experienced by students in everyday life (Zaenuri & Dwidayati, 2018). By bringing real-life situations into mathematics learning, students will feel that mathematics is a science that is close to their lives, so they no longer regard it as a science that has no use. Students can see how mathematics plays a role and benefits in life. Thus, cultural phenomena in the local environment are aspects that cannot be separated from learning mathematics in schools.

Uloko and Imoko in Astutiningtyas stated that ethnomathematical-based learning applied in mathematics learning in Japan and China succeeded in bringing the country into a developed country (Astutiningtyas et al., 2017). For example, in Japan, when studying mathematics, students face a real problem relevant to their daily lives and adapt to the surrounding environment to be solved it according to their mindset (Hamidah et al., 2021). In line with Japan, China conducts mathematics learning by including character education by utilising local culture since elementary school. China is known as a country with solid independence and implements an education system with high standards so that technological products produced by China can be

enjoyed by consumers around the world (Zaenuri & Dwidayati, 2018).

Ethnomathematics in learning mathematics, according to Schoenfield in Zaenuri, can be used to 1) encourage students to think that mathematics is an inseparable part of everyday life; 2) improve the ability to find relationships between mathematical concepts in various contexts through mathematical problem-solving activities both individually and in groups (Zaenuri & Dwidayati, 2018). This statement shows a positive relationship between ethnomathematics and mathematical problem-solving ability.

Many studies have been carried out on the implementation of ethnomathematical-based learning, especially to analyse the influence of its implementation on increasing mathematical problem-solving abilities. Several studies have shown such results. Asstutiningtyas' research shows that the mastery of mathematics can be improved through learning with ethnomathematics (Astutiningtyas et al., 2017). In addition, according to Astuningtyas, the mathematical problem-solving ability can be improved by involving ethnomathematics. Research conducted by Nofitasari and Zaenuri Mastur showed similar results. They wanted to know whether the peer tutoring model with ethnomathematical bases affected students' problem-solving abilities. They limit the subject of mathematics to rectangular material. Nofitasari and Zaenuri Mastur mention a positive and significant relationship between the learning model and problem-solving abilities and conclude that problem-solving abilities can be improved by implementing peer tutoring models with ethnomathematical bases in learning mathematics (Nofitasari & Zaenuri Mastur, 2016). Based on the results of the above studies, we can say that learning mathematics using an ethnomathematical-based approach will improve mathematical problem-solving abilities. Nisrina showed different results from most research results with similar topics. The results of his research show that ethnomathematics does not have a significant effect on students' problem solving skilss (Nisrina, Agustin, & Mahmudah, 2021). However, the analysis shown is very varied, so it still raises doubts about the impact of learning using ethnomathematics on mathematical problem-solving abilities. This result certainly creates confusion among teachers whether or not to use an ethnomathematical approach in learning mathematics.

For this reason, it is necessary to analyse, combine, and synthesise study results related to the application of ethnomathematical-based learning to describe in depth how much influence this learning has on increasing mathematical problem-solving abilities compared with the application of the ordinary learning. Yustinaningrum re-analyse the effect of the problem-based learning model on students' mathematical problem solving abilities (Yustinaningrum, 2021). Priska and Mawardi find the effect of the problem solving learning model and the problem posing learning model in improving critical thinking skills (Priska & Mawardi, 2021). There are also several other meta-analytical studies aimed at analyzing the themes of problem solving, critical thinking, and ethnomathematics separately such as Safaria et al. (2021), Nugroho et al. (2020), and Aisyah (2022). However, no meta-analysis has been found that specifically aims to analyze the relationship between ethnomatics-based learning and problem-solving abilities. In addition, several research backgrounds also need to be described, such as the year, level of education of the subjects involved, many samples, publication sources, and learning models. This description is intended to find out what characteristics allow the application of ethnomathematical-based learning to be better and have a greater influence on increasing mathematical problem-solving abilities.

2. Method

This study uses meta-analysis. This study follows a similar stages, namely determine inclusion criteria; literature search and data coding; evaluate study quality; analysis statistic and build an interpretation. In addition, this approach was also chosen because the researcher attempted to analyse the measure given by each study regarding the magnitude of the influence of a variable on another variable. For this purpose, a meta-analysis technique is used. The meta-analysis technique is an analytical technique that combines the results of the corresponding Studies to be analysed statistically to find the combined effect of each study used (Cohen, Manion, & Morrison, 2007).

The procedures in this study are: 1) the formulation of the research problem; 2) search of relevant literature; 3) study coding; 4) statistical analysis by calculating effect size; 5) withdrawal of interpretation of results and examination of publication bias; 6) preparation of reports/ conclusions (Valentine, Hedges, & Cooper, 2009).

In the first step, the formulation of the research problem is how much influence the application of ethnomathematical-based learning has on mathematical problem-solving abilities. The next step is to search the relevant literature by first

determining the inclusion criteria to confirm the literature's specifications.

Population and Sample

The studies involved in the meta-analysis are the results of Studies that lie in the researcher's criteria. The meta-analysis in this study was conducted by combining and analysing several studies that have been published in journals or proceedings with the same theme, namely the application of ethnomathematical-based learning and its effect on mathematical problem-solving abilities.

The unit of analysis of ethnomathematical themes in mathematics learning is articles obtained from the digital library owned by National Library with publication dates starting from January 2015 to June 2022 or for the last 8 years, finding a total of 106 articles as the population of this study. The search criteria are limited to journal articles with full text availability.

The number of articles obtained was so large, the decision of the number of samples used in this study was carried out through a screening process (inclusion and exclusion), and a procedure for assessing the quality and relevance of 106 articles using the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) developed by Moher, Liberati, Tetzlaff, Altman, and The PRISMA Group (Moher, Liberati, Tetzlaff, & Altman, 2009).

Inclusion and Exclusion Criteria

All literature obtained in the initial search was examined and selected to be selected as the primary study using the inclusion and exclusion criteria. Inclusion criteria in this study are:

a. Academic article journal
b. Whole country
c. Education fields
d. All publications from January 2015 to June 2022
e. The type of research is limited to semi-experimental design with unequal control group experimental design, post-test control group design only, and one-group design with pretest-posttest.
f. The subjects involved are elementary, junior and senior high school students and higher education at the Strata 1 level

The literature obtained was selected based on the inclusion criteria that have been set. While the exclusion criteria were adopted from Priola's research (2016), are:

a. The title is irrelevant
b. No full text available
c. Removal of duplicate articles
d. Abstract is irrelevant
e. Non-empirical research
f. Required data (sample size, average, and standard deviation) not available.

The Studies were searched among the theme of applying ethnomathematical-based learning to mathematical problem solving through https://e-resoureces.perpusnas.go.id by the keywords: "ethnomathematics", "ethnomathematics problem solving", "ethnomathematics learning problem solving", "ethnomathematics problem solving", "ethnomathematics problem solving", "ethnomathematics learning, problem-solving". Based on the inclusion criteria, there were 106 articles obtained from this searching. Next is to select, which article will be excluded from this result. Based on the exclusion criteria, there were only 14 articles remain while the others are excluded from the result. These 14 articles were then used as primary study sources.

The source of the primary study is then coded. The coding is done through manual coding instruments using Microsoft Excel. The coding process was carried out by writing down the information involved in the analysis process: study code, author's name, year of publication, title, source, research design, statistical information (many samples, mean, and standard deviation of both groups). The publication period is divided into four categories: 1) 2015 to 2016; 2) 2017 to 2018; 3) 2019 to 2020, and 4) 2021 to 2022. Furthermore, based on the founded articles, the education level categories are made into four classifications: basic or elementary education level, junior secondary education level or SMP/MTS, upper secondary education level or SMA/MA, and higher education level for the S1 program. The number of samples is classified into samples with a size of less than or equal to 30 and more than or equal to 31.

Statistical analysis was performed first by calculating the Effect Size (ES). ES is a measure that describes how much influence a variable, namely the implementation of ethnomathematical-based learning, has on other variables, namely the ability to solve mathematical problems. The ES calculation used in this study uses Hedges statistics based on the Standardised Mean Difference (SMD) (Retnawati, Apino, Kartianom, Djidu, & Anazifa, 2018). Therefore, the ES calculation was performed by comparing the mean and standard deviation of the two groups (experimental and control groups) with various outcome measures. The ES in this meta-analysis was interpreted

according to the classification of Cohen et al. (2007), which is presented in Table 1.

Table 1. . The ES Interpretation

Effect Size (ES)	Interpretation
0 – 0,20	Weak Effect
0,21 – 0,50	Modest Effect
0,51 – 1,00	Moderate Effect
>1,00	Strong Effect

After calculating the ES, the next step is to test for homogeneity. Homogeneity testing is intended to determine the analytical estimation model (Retnawati et al., 2018). Determination of the model is done by checking the *p-value* on the Q-statistics. This test's null hypothesis (H_0) is that the primary study ES used in the analysis is homogeneous. If the *p-value* is below 0.05, the null hypothesis is rejected, meaning the ES is heterogeneous. Therefore, it was determined that the random-effects model as the estimation model was used. On the other hand, if the *p-value* is above 0.05, the null hypothesis is accepted, which means the ES is homogeneous, so it is determined that the fixed effects model is the estimation model used (Retnawati et al., 2018).

The next step is publication bias testing. This study uses several published Studies for analysis. Publication bias testing is intended to ensure that these Studies are representative of all other Studies examining the same issue. In addition, this test was also carried out to prevent the suggestion that the Studies included in this study were only Studies with significant ES and did not include Studies with low ES, thereby creating a target research bias due to concerns that the meta-analysis might overestimate the actual ES. Publication bias testing was carried out using a funnel plot and Rosenthal's File-N Safe (FNS) (Retnawati et al., 2018). This study used funnel plots as the first step in testing publication bias. To help determine whether there is a possibility of publication bias, the researcher used FNS Rosenthal. The FNS Rosental will be used if the ES is distributed asymmetrically or not completely symmetrically distributed (Tamur, Juandi, & Kusumah, 2020). If $\frac{FNS}{5k+10} > 1$, where k is the number of primary studies used, the research is not influenced or free from publication bias (Paloloang, Juandi, Tamur, Paloloang, & Adem, 2020). If there is no publication bias, then the next stage of meta-analysis can be continued.

The last step is to produce a report on the results or draw a conclusion based on the hypothesis testing. The null hypothesis in this test is that there is no significant effect of applying ethnomathematical-based learning on increasing mathematical problem-solving abilities compared to ordinary learning models. For the fixed effect estimation model, hypothesis testing can be done by examining the *p-value* (Retnawati et al., 2018). If the *p-value* is above 0.05, the null hypothesis is accepted, and vice versa. For the random effect estimation model, which means that there are differences in the characteristics of the Studies involved, an analysis of the characteristics of certain Studies is carried out, and then draws conclusions based on the results of the analysis of these characteristics (Borenstein, Hedges, Higgins, & Rothstein, 2010).

3. Result and Discussion

The main objective of this research is to describe the effect of learning by applying ethnomathematics to problem-solving abilities through a combined ES analysis of the Studies used. The list of studies that meet the inclusion criteria is presented in the following table.

Table 2. Studies used in the analysis

Study No	Name of Journal/ Proceeding & URL
Study 1	Unnes Journal of Mathematics Education URL: https://bit.ly/37Q4yWJ
Study 2	JRAMathEdu (*Journal of Research and Advances in Mathematics Education*) URL: https://bit.ly/3xZRaKa
Study 3	Jurnal Pendidikan Matematika Universitas Lampung URL: https://bit.ly/3vQE8My
Study 4	SENPIKA II (Seminar Nasional Pendidikan Matematika) URL: https://bit.ly/3vQE6nU
Study 5	Unnes Journal of Mathematics Education URL: https://bit.ly/3vYgKgi
Study 6	PRISMA, Prosiding Seminar Nasional Matematika URL: https://bit.ly/3rYLQmO
Study 7	Jurnal Pendidikan Matematika Raflesia URL: https://bit.ly/36YEJmR
Study 8	Jurnal Pendidikan Matematika Raflesia URL: https://bit.ly/3y70EUh
Study 9	Unnes Journal of Mathematics Education URL: https://bit.ly/37T5Ekz
Study 10	JNPM (Jurnal Nasional Pendidikan Matematika) URL: https://bit.ly/3EYqif6
Study 11	Unnes Journal of Mathematics Education URL: https://bit.ly/3MFo2vS
Study 12	Journal of Physics: Conference Series (JPCS) URL: https://bit.ly/3vV2nsK
Study 13	Unnes Journal of Mathematics Education URL: https://bit.ly/3y16KFv

Study 14	Jurnal Math Educator Nusantara (JMEN): Wahana Publikasi Karya Tulis Ilmiah di Bidang Pendidikan Matematika URL: https://bit.ly/3Lxbx5E

The tool used to calculate the primary Study-Study ES, standard error, and confidence interval of each study is Meta-Mar Free Online – Meta-Analysis Service with Hedges statistics based on Standardized Mean Difference (SMD) presented in the following table.

Table 3. Primary study coding results

No	Authors	ES	ES interpretation	SE	Confidence Intervals	
					Lower Bound	Upper Bound
1	Prabawa & Zaenuri, 2017	1,059	Strong	0,282	0,507	1,612
2	Nur et. al, 2020	0,561	Moderate	0,260	0,051	1,070
3	Kurniawati et. al, 2018	3,220	Strong	0,391	2,452	3,987
4	Hidayati & Restapaty, 2019	0,468	Modest	0,247	-0,016	0,951
5	Nofitasari et. al, 2016	0,927	Moderate	0,262	0,413	1,441
6	Yunitasari & Zaenuri, 2020	1,250	Strong	0,277	0,707	1,794
7	Yanti et. al, 2018	1,277	Strong	0,254	0,779	1,775
8	Lubis & Widada, 2020	1,415	Strong	0,269	0,889	1,942
9	Maulana et. al, 2020	1,277	Strong	0,310	0,669	1,884
10	Aprilyani & Hakim, 2020	0,846	Moderate	0,262	0,333	1,360
11	Bahri et. al, 2018	0,523	Moderate	0,255	0,023	1,023
12	Irawan et. al, 2018	0,942	Moderate	0,246	0,459	1,424
13	Abdullah, Z, & H, 2015	0,454	Modest	0,254	-0,044	0,952
14	Astutiningtyas et. al, 2017	0,824	Moderate	0,289	0,258	1,390

Based on the table above, each of the 14 primary studies has an ES that varies from 0.454 to 3,220. Based on Cohen (2007), data obtained that six studies have strong ES, which means that ethnomathematical-based learning in these six studies strongly influences mathematical problem-solving abilities. In addition, six studies have Moderate ES, which means that ethnomathematical-based learning in these six studies has a Modest effect on mathematical problem-solving abilities. Also, two studies have Modest ES, which means that ethnomathematical-based learning has a modest effect on mathematical problem-solving abilities.

The above result indicates that the study was not influenced or free from publication bias. It means there is no publication bias; in other words, the studies involved in the research are representations of other similar studies so that there is no need for additional studies to be added to the study as a result of the absence of publication bias (Paloloang et al., 2020).

Next is to calculate the combined ES of all primary studies involved in the study. Prior to that, the estimation model was first determined through homogeneity testing. The information needed for the homogeneity test is as follows.

Table 4. ES Distribution Homogeneity Test

Heterogeneity			
Chi-Square	***df***	***P-Value***	***I-Square***
53,68	13	0,00	75,8

Table 4 shows that the *p-value* = 0.00 which means that the p-value <0.05. Therefore, the null hypothesis in this test is rejected, which means that the ES is heterogeneous. Therefore, an estimation model in a random-effects model was used to determine the combined ES. Furthermore, the funnel plot is presented in the following figure.

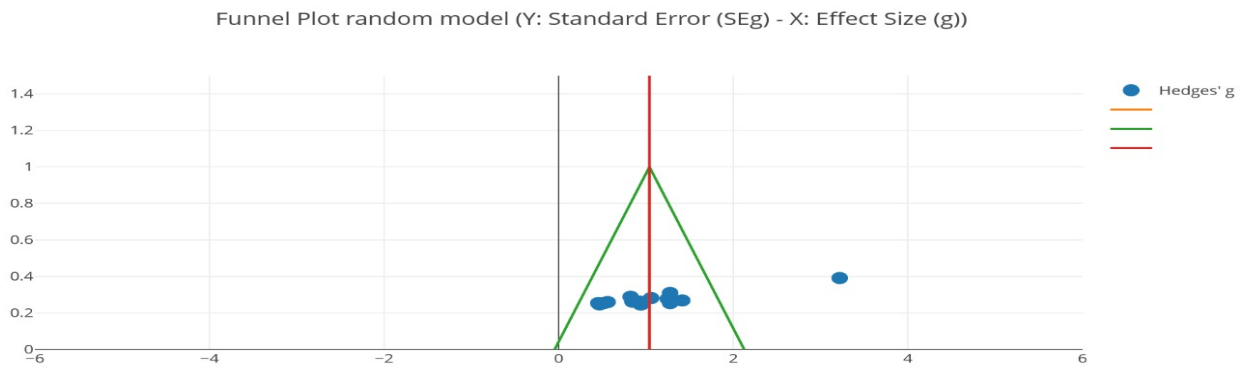

Figure 1. *Funnel Plot*

Based on Figure 1, it is found that the ES distribution is not completely symmetrical around the vertical line. Therefore, detecting it can be done using Rosenthal's Fail-N Safe (FNS) from 14 studied studies. From the calculation, it was found that the FNS value = 994.55. With *k* being the number of studies used, we obtain $\frac{FNS}{5k+10} = \frac{994,55}{5(14)+10} = \frac{994,55}{80} = 12,43 > 1$. Table 5 presents the calculation for the two estimation models. The main information displayed in this table is ES and *p-value.*

Table 5. ES value based on estimation model

Models	n	*Effect Size* and 95% Confidence Intervals				*Tes of null (2-Tail)*	
		Effect Size	SE	Lower Bound	Upper Bound	Z-Value	P-Value
Fixed Effect Model	14	0,97	0,072	0,827	1,11	13,408	0,00
Random Effect Model	14	1,04	0,148	0,747	1,326	7,02	0,00

Using the random effect estimation model shows that the p-value = 0.00 or the p-value is less than 0.05. Based on the criteria for testing the hypothesis, it can be said that overall, the ethnomathematical-based learning model has a significant effect on mathematical problem-solving abilities when compared to the ordinary learning model. This conclusion is in line with other studies, such as the research conducted by Oktovianus. Oktovianus conducted a study to determine whether or not the application of ethnomathematics-based mathematics learning affected student learning outcomes. Oktovianus concluded that ethnomathematics-based mathematics learning has a significant influence and is also more effective in improving learning outcomes when compared to other groups of students who apply the usual learning model (Oktovianus, 2021). Based on this result, it can be seen that ethnomathematics-based learning mathematics is an alternative for teachers to improve student learning outcomes, especially in learning mathematics.

In addition, based on the random-effects model with a 95% confidence level, the combined ES of the entire study was 1.04, which, based on the interpretation of Cohen et al. (2007), this ES was classified as a strong effect. Thus, it can be said that the ethnomathematical-based learning model has a strong effect on increasing mathematical problem-solving abilities compared to ordinary learning models.

According to Coe (2002), the combined ES of 1.04 indicates that students' mathematical problem-solving ability in the experimental group is higher than the mathematical problem-solving ability of 84% of students in the control group. In the previous homogeneity test, information was obtained that the primary ES Study data followed a heterogeneous distribution. The next step is to analyse the characteristics of the study, which are suspected to be the cause of the inhomogeneity of the ES data on mathematical problem-solving abilities. For this reason, an analysis of the characteristics of the study was carried out, namely: year of research, level of research, sample size, and learning model. The analysis results of these characteristics can be seen in the following table.

Table 6. Study Characteristics Analysis Results

Study Characteristics	Kategori	n	*Hedge's g*	*Test of null (2-Tail)*		Batas Bawah	Batas Atas
				Z-value	*p-value*		
Publication year	2015 – 2016	2	0,69	2,901	0,0037	0,223	1,15
	2017 – 2018	6	0,97	8,161	0,0000	0,740	1,209
	2019 – 2020	5	1,03	5,67	0,0000	0,677	1,392
	2021 – 2022	1	1,06	3,623	0,000132	0,517	1,603
Educational level	SD	2	1,08	5,644	0,0000	0,703	1,451
	SMP/MTS	9	0,78	7,541	0,0000	0,577	0,982
	SMA/MA	2	1,37	7,386	0,0000	1,005	1,732
	Higher Education	1	0,82	2,853	0,004325	0,258	1,39
Sample Size	30 or below	5	0,97	7,203	0,0000	0,703	1,228
	31 or above	9	0,9	7,286	0,0000	0,656	1,138
Learning Model	Problem Based Learning	5	0,77	4,154	3.3e-05	0,408	1,138
	Realistic Mathematics	3	1,21	8,203	0,0000	0,924	1,504
	Project-Based Learning	1	1,06	3,758	0,000171	0,507	1,612
	Contextual Learning	1	0,56	2,157	0,031027	0,051	1,070
	Peer Tutor	1	0,93	3,536	0,000407	0,413	1,441
	Inquiry	1	1,19	4,252	2.1e-05	0,643	1,742
	Assurance, Relevance, Interest, Assessment, Satisfaction Learning	1	0,85	3,229	0,001242	0,333	1,360

From the table above, for the characteristics of the study in the form of the year of research, it can be seen that the study conducted in 2015 – 2016 had an ES of 0.69, which was classified as a Modest effect, equivalent to the study in 2017 – 2018 which had an ES of 0.97 which was also classified as the Moderate effect. The 2019 – 2020 and 2021 – 2022 show ES of 1.03 and 1.06, respectively, classified as strong effects. Based on the characteristics of the publication year, it can be seen that the *p-value* is less than 0.05, which indicates that each group in the research year has a significant influence on the application of ethnomathematical-based learning to improve mathematical problem-solving abilities. By giving attention to the lower and upper limits of each year group, it is found that there is a wedge between the lower and upper limit intervals; this indicates that the effect of each year group is the same. It means that all groups of research years have the same effect on applying ethnomathematical-based learning to mathematical problem-solving abilities with Moderate and strong ES categories. This result is in line with research conducted by (Nugroho et al., 2020) which showed that the environmental-based learning ES (ethnomathematics) studied from 2016 to 2020 were in the Moderate and strong categories.

For the educational level, it can be seen that the study conducted at the elementary level gave an ES of 1.08, which was classified as a strong effect, barely better than the study at the high school level, which gave an ES of 1.37, which was classified as a strong effect. The junior high school level study gave an ES of 0.78 which was classified as a Modest effect, similar to a study conducted in universities with an ES of 0.82, which was classified as a Modest effect. Based on the characteristics of the education level study, a *p-value* of less than 0.05 was obtained, indicating that each level of education significantly influences applying ethnomathematical-based learning to improve mathematical problem-solving abilities. By paying attention to the upper and lower bound intervals for each level of education starting from Elementary School (0.703 – 1.451), Junior High School (0.577 – 0.982), Senior High School (1.005 – 1.732), and Higher Education (0.258 – 1.39) information are obtained that there is no interval intersection. The lower and upper bound values are at the junior and senior high school levels. It shows that junior and senior high school education levels have a different effect on applying ethnomathematical-based learning models to mathematical problem-solving abilities. High school education has a more effective influence than junior high school level. It means that the application of ethnomathematical-based learning in improving mathematical problem-solving abilities is influenced by the characteristics of the education level study. These results show a difference from the research conducted by Tungga (2021), which states that the level of education studied, namely the junior and senior high school levels, in the application of ethnomathematics has the same effect on student learning outcomes that fall into the category of strong effects.

For sample size characteristics, it appears that studies with a sample size of below or equal to 30 people have an ES of 0.97, and those with a sample size of above or equal to 31 people have an ES of 0.90, or both based on sample size, both are in the Modest effect category. Furthermore, the characteristics of the study sample size have a *p-value* of less than 0.05, which indicates that each sample size has a significant effect on the application of ethnomathematical-based learning to improve mathematical problem-solving abilities. Since the lower and upper bound intervals in studies with a sample size of 30 or below (0.703 – 1.228) as well as in studies with a sample size of 31 or above (0.656 – 1.138), there is a wedge between the lower and upper limit intervals in both study groups. Thus, the two-sample size groups have the same effect on applying ethnomathematical-based learning to mathematical problem-solving abilities.

For the learning model characteristics, it can be seen that the ES Study, which was carried out by applying an ethnomathematics-based realistic learning model, was 1.21, and the Project-Based Learning model was 1.06. Both are in the category of strong effects. Meanwhile, Peer Tutor Learning provides an ES of 0.93, barely better than the ES of Assurance, Relevance, Interest, Assessment, Satisfaction learning models of 0.85, which are in Moderate effect. In addition, the application of Problem Based Learning and ethnomathematical-based Contextual Learning models gave ES of 0.77 and 0.56, respectively, which were in the same category and had a Moderate effect on mathematical problem-solving abilities. Based on the characteristics of the learning model, the p-value is less than 0.05, which indicates that each type of learning model that applies ethnomathematical-based learning has a significant effect on increasing mathematical problem-solving abilities. By paying attention to the lower and upper limits of each study characteristic based on the learning model, information is obtained that the implementation of the Project-Based Learning model is in the interval 0.408 – 1.138; the application of the Realistic Mathematics model is in the interval 0.924 – 1.504; Project-Based Learning model is in the interval 0,507 – 1,612; Contextual Learning model is in the interval 0.05 – 1.070; Peer Tutor models are in the interval 0.413 – 1.441; Inquiry model is in the interval 0.643 – 1.742; and the Assurance, Relevance, Interest, Assessment, Satisfaction learning model is in the interval 0.333 – 1.360. It was found that there is a wedge between the upper limit interval and the limit on the characteristics of the study based on the applied learning model. It shows that the effect of the learning model is the same, and ethnomathematical-based learning models have the same effect on mathematical problem-solving abilities with Moderate and strong ES categories.

Based on the findings above, it can be stated that the ethnomathematical-based learning model can be applied as an alternative learning approach to improve mathematical problem-solving abilities, both at a sample size of 30 people or below or 31 people or above. Ethnomathematics-based learning models suggested to improve mathematical problem-solving skills include Project-Based Learning models, Realistic Mathematics learning models, Project Based Learning models, Contextual Learning models, Peer Tutor models, inquiry models, and Assurance, Relevance, Interest, Assessment learning models. , Satisfaction. Based on the characteristics of the education level study, it was found that the junior and senior high school education levels were the cause of the inhomogeneity of the combined ES in the influence of the application of ethnomathematical-based learning on students' mathematical solving abilities. It means that the application of ethnomathematical-based learning in improving mathematical problem-solving abilities is influenced by the characteristics of the level of education. The magnitude of the ES obtained for each study characteristic shows that ethnomathematical-based learning will have the most significant impact when applied to a realistic mathematics learning model at the high school level.

4. Conclusion

The meta-analysis results of 14 primary studies that discuss the effect of applying ethnomathematical-based learning on mathematical problem-solving abilities show that the combined ES of the study is 1.04. Based on Cohen et al. (2007) classification, this figure is included in the range of strong effect sizes. This means that applying the ethnomathematics-based learning model has a strong influence on increasing mathematical problem-solving abilities. Besides being more artificial, the effect given is also more effective when compared to the application of ordinary learning models. By judging the characteristics of the primary study, it can be concluded that junior and senior high school education levels have different effects on mathematical problem-solving abilities. In other words, the application of ethnomathematical-based learning in improving mathematical problem-solving abilities is influenced by the characteristics

of the level of education. Various findings in this meta-analysis conclude that mathematical problem-solving abilities can be improved by applying one of the alternative models in mathematics learning, namely the ethnomathematical-based learning model.

Furthermore, it is recommended that further researchers use other, more diverse study characteristics to get a more in-depth study and find other more exciting things.

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KEMAMPUAN REPRESENTASI MATEMATIS CALON GURU MATEMATIKA PADA MATA KULIAH TEORI PELUANG

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Abstrak

Dalam memahami pembelajaran matematika, representasi dianggap sebagai pintu masuk dalam menyelesaikan berbagai persoalan matematia yang rumit. Kemampuan representasi matematis berkaitan dengan pengungkapan gagasan metematika memanfaatkan berbagai macam cara antara lain: bahasa tulis, bahasa lisan, gambar, simbol, contoh, diagram, grafik, atau contoh nyata lainnya menjadi representasi. Desain penelitian yang digunakan adalah penelitian campuran (*Mixed Method*). Subyek pada penelitian ini sebanyak 17 mahasiswa calon guru matematika, tetapi kemudian dipilih 3 (tiga) orang sebagai subyek yang diwawancarai. Terdiri dari subyek dengan kategori tinggi (S1), subyek dengan kategori sedang (S2) dan subyek dengan kategori rendah (S3). Pengumpulan data dilakukan dengan menggunakan istrumen tes berupa soal uraian pada mata kuliah teori peluang. Dari hasil tes tersebut kemudian setelah diperiksa mahasiswa dipilih mewakili tiap kategori. Selanjutnya dengan menggunakan hasil tes mahasiswa dilakukan wawancara untuk membandingkan antara hasil wawancara dengan jawaban mahasiswa. Hasil tes tertulis dan hasil tes wawancara selanjutnya dianalisis untuk mengetahui kemapuan representasi mahasiswa. Hasil penelitian ini menunjukan bahwa kemampuan representasi matematis mahasiswa pada mata kuliah teori peluang masih tergolong rendah, hal ini dapat dilihat pada 3 (tiga) subyek setelah mencocokan hasil tes tertulis dan hasil tes wawancara. Individu dengan kategori tinggi mampu memenuhi indikator representasi ekspresi atau persamaan matematis dan representasi verbal. Subyek dengan kategori sedang mampu memenuhi indikator representasi atau ekspresi matematis. Subyek kategori rendah tidak mampu memenuhi salah satu dari ketiga indikator kemampuan representasi matematis.

Kata Kunci: calon guru matematika, kemampuan representasi matematis

MATHEMATICAL REPRESENTATION ABILITY OF PROSPECTIVE MATHEMATICS TEACHER IN PROBABILITY COURSES

Abstract

In understanding mathematics learning, representation is considered an entry point in solving various complex mathematical problems. The ability of mathematical representation is related to the expression of mathematical ideas using various ways, including written language, spoken language, pictures, symbols, examples, diagrams, graphs, or other real examples as representations. The research design used is mixed research (Mixed Method). The subjects in this study were 17 prospective mathematics teacher students, but then 3 (three) people were selected as subjects to be interviewed. Consists of subjects with high category (S1), subjects with medium category (S2), and subjects with low category (S3). Data collection was carried out using test instruments in the form of description questions in the probability theory course. From the test results, after being examined, students were selected to represent each category. Furthermore, by using the results of student tests, interviews were conducted to compare the results of interviews with student answers. The results of the written test and the results of the interview test were then analyzed to determine the student's representational ability. The results of this study indicate that students' mathematical representation skills in the probability theory course are still relatively low, this can be seen in 3 (three) subjects after matching the results of the written test and the results of the interview test. Individuals with high categories can meet the indicators of expression representation or mathematical equations and verbal representations. Subjects in the medium category were able to fulfill the indicators of mathematical representation or expression. Low subjects were not able to fulfill one of the three indicators of mathematical representation ability.

Keywords: mathematical representation ability, prospective mathematics teacher

1. Pendahuluan

Matematika sebagai salah satu dari bidang studi yang sering ditemui pada berbagai jenjang pendidikan. Berkaitan dengan istilah matematika, (Kartika, 2018) menyebutkan bahwa matematika dipandang sebagai salah satu bidang studi penting yang berfungsi untuk meningkatkan kemampuan menghitung, mengukur dan memanfaatkan konsep-konsep matematika sehingga dapat diimplementasikan pada kehidupan sehari-hari. Belajar matematika selamanya tidak sekedar berbicara tentang numeric (angka), tetapi lebih dari pada itu (Puspaningtyas, 2019), artinya matematika dapat dimanfaatkan untuk menyelesaikan berbagai permasalahan nyata dalam kehidupan sehari-hari.

Dalam belajar matematika, individu diharapkan dapat memanfaatkan pemikiran dan pengetahuan secara bersamaan sehingga mampu menyelesaikan persoalan matematika secara benar. Berpikir merupakan bagian yang tidak terpisahkan dari kehidupan manusia setiap saat (Puspaningtyas, 2019). Berpikir kritis matematis seharusnya dipunyai tiap siswa agar membantu dirinya menyelesaikan berbagai persoalan dalam kehidupan sehari-hari (Hidayat & Sari, 2019). Selain kemampuan berpikir kritis matematis, para mahasiswa dan siswa seyogyanya mampu berpikir dengan menggunakan matematika tingkat tinggi, bersikap kritis dan kreatif, teliti, terbuka dan obyektif, menghargai keunikan matematika, memiliki keingintahuan, dan memiliki minat yang tinggi ketika mempelajari matematika (Dewi & Septa, 2019). Selain kemampuan di atas, (NTCM, 2000) menyebutkan bahwa terdapat 5 (lima) kompetensi penting yang hendaknya dimiliki oleh tiap siswa dan mahasiswa belajar matematika adalah kemampuan penalaran, komunikasi, pemecahan masalah, koneksi matematika, dan representasi matematis. Dari kelima kompetensi diatas salah satu kompetensi yang paling penting adalah kemampuan representasi matematika.

Representasi adalah sentral dari pembelajaran matematika (Komalasari, 2021). Kemampuan representasi matematis menjadi sangat penting dan dapat mendorong peserta untuk mampu menciptakan ide-ide dan mengungkapkan gagasan matematika, serta mempemudah siswa yang hendak meningkatkan kemampuan matematisnya (Muhamad, 2016). Selanjutnya berkaitan dengan kemampuan representasi matematis, (Goldin, 1998) mengungkapkan bahwa berbagai cara seperti ungkapan lisan, ungkapan tulis, diagram, simbol, grafik, model atau bentuk lainnya dapat mengungkapkan gagasan dari matematika itu sendiri. Lebih lanjut (Sulastri et al., 2017) menyebut bahwa representasi dimaksudkan untuk mentranslasikan suatu problem atau gagasan ke dalam wujud yang baru, seperti mengubah bentuk (*image*) gambar ataupun bentuk nyata ke bentuk simbol menggunakan kalimat atau kata-kata.

Untuk mengukur kemampuan representasi matematis, dipakai beberapa indikator. (Kusumawardani & Mega, 2021) menyebut bahwa untuk mengetahui kemampuan representasi dipakai beberapa indikator yaitu menampilkan kembali gagasan yang telah dipahami, menyajikan ulang hal yang ditanyakan, mengungkapkan ide atau gagasan yang hendak digunakan untuk menemukan solusi terhadap persoalan yang telah diketahui informasinya, menuliskan langkah-langkah penyelesaian masalah, menginterpresentasikan hasil penyelesaian, dan mengecek kembali hasil penyelesaian masalah. Selanjutnya (NTCM, 2000) menetapkan indikator dari kemampuan representasi matematis diantaranya yaitu memakai representasi tujuannya untuk mengomunikasi gagasan dari matematiks, memilih, melakukan translasi antar representasi matematis, merekam atau mencatat, menginterprestasi situasi nyata, mengenal, memodelkan, memanfaatkan kondisi fisik, dan sosial matematis untuk memecahkan masalah matematika. Indikator kemampuan representasi matematis pada penelitian ini adalah (1) representasi visual yaitu kemampuan menyusun representasi visual menjadi sebuah visualisasi atau model matematika; (2) representasi persamaan matematika atau ekspresi matematika adalah kemampuan dalam menyusun model atau persamaan matematis; (3) representasi verbal yaitu kemampuan untuk menulis kembali sebuah persamaan dengan kata-kata.

Representasi matematis merupakan bagian yang sangat penting dalam mempelajari mata kuliah teori peluang. Teori peluang merupakan bidang matematika yang memiliki kaitan dengan analisis probabilitas dan kejadian acak. Tujuan utama dari teori peluang yaitu proses stokastik, peubah acak, dan peristiwa. Ini adalah pengabstraksian matematika bukan-determinasi dari peristiwa atau acuan terukur, baik peristiwa tunggal atau tampaknya berkembang secara acak dari waktu ke waktu (Wikipedia, 2022). Mata kuliah teori peluang adalah mata kuliah yang diajarkan pada mahasiswa tingkat atas dengan berbagai topik yang diajarkan memuat bahasan tentang: konsep-konsep teori peluang yaitu analisis kombinatorik, aksioma peluang, distribusi peluang, dan nilai harapan. (Fatri et al., 2019) menyebutkan bahwa ketika dites peserta didik tampaknya keliru dalam membuat perhitungan

dikarenakan peserta didik tidak mampu merepresentasikan wawasannya dengan baik mengakibatkan siswa kesulitan dalam memahami masalah matematika sehingga menemukan solusi yang akurat. Hal demikian tidak saja terjadi pada kelompok siswa sekolah menengah tetapi terjadi juga pada ingkatan mahasiswa terutama pada mata kuliah yang memerlukan kemampuan untuk memodelkan masalah matematis.

Materi teori peluang merupakan mata kuliah yang selalu melibatkan proses representasi dalam mempelajarinya sehingga mahasiswa diharapkan memiliki kemampuan representasi yang baik sehingga dapat menyelesaikan tiap topik dengan benar. Berkaitan dengan hal tersebut, penelitian ini dimaksudkan untuk menganalisis kemampuan representasi matematis mahasiswa calon guru matematika mata kuliah teori probabyslic (Teori peluang). Penelitian dilakukan untuk menganalisis kemampuan matematis calon guru matematika pada 3 (tiga) subyek yaitu subyek berkemampuan amat baik (tinggi), sedang (middel) dan rendah (low).

2. Metode Penelitian

Desain dari penelitian ini adalah penelitian campuran (*Mixed Method)* sebagaimana yang diuangkapkan oleh (Sukestiyarno, 2021) yaitu penelitian yang dilakukan dengan menggabungkan metode penelitian kuantitatif dan kualititif, tetapi dalam pelaksanaannya kedua penelitian digunakan dengan memperhatikan urutan dapat diurutkan kuantitatif kemudian kualititif atau kualitatif kemudian kuantitaf. Penelitian ini dilakukan menggunakan tahapan kuantitatif kemudian kualititaf. Mahasiswa diberikan tes tertulis kemudian hasil tes digunakan sebagai acuan untuk memperoleh data kuantitatif, dari data kuantitatif tersebut digunakan sebagai acuan untuk mengalisis data kualitatif berdasarkan data hasil kerja mahasiswa. Tahapan dalam penelitian ini yaitu Subyek dalam penelitian ini sebanyak 17 mahasiswa calon guru matematika.

Berikut soal tes yang diberikan kepada mahasiswa.

"*Obet hendak pergi dari kota A ke kota C melalui kota B. kota A dan kota B dihubungkan oleh 5 jalur kereta api, kota B ke kota C dihubungkan oleh 4 jalur kereta api. Tentukanlah banyaknya cara Obet pulang pergi dari kota A ke kota C melalui kota B*?"

Setelah mengerjakan soal tes di atas kemudian hasil tes diperiksa lalu dikelompokan mahasiswa berdasarkan kategori yaitu kemampuan tinggi, sedang dan rendah. Berdasarkan kategori kemampuan mahasiswa. Pengelompokan kategori kemampuan mahasiswa berdasarkan hasil tes dengan mengacu pada acuan patokan sebagaimana yang dikemukakan oleh (Ratumanan & Laurens, 2015) yang dimodifikasi menjadi tiga kategori yaitu tinggi, sedang dan rendah sebagaimana tabel di bawah ini.

Tabel 1. Analisis Acuan Patokan

Interval	Kategori
$x \geq 75$	Tinggi
$60 \leq x < 75$	Sedang
$x < 60$	Rendah

Sebelum tes diberikan kepada mahasiswa, intrumen terlebih dahulu divalidasi. Hasil validasi menunjukkan bahwa intrumen yang digunakan valid dan dapat digunakan. Selain soal tes tertulis, pedoman wawancara yang digunakan memperoleh gambaran tentang kemampuan representasi matematis mahasiswa visual, representasi persamaan atau ekspresi matematis dan kemampuan representasi verbal. Pedoman wawancara digunakan untuk mencocokan jawaban hasil tes tertulis mahasiswa dengan jawaban yang dipahami oleh mahasiswa.

Teknik analisis data yang digunakan yaitu analisis data kuantitaif dan analisis data kulitatif. Data kuantitatif dalam penelitian ini merupakan data kemampuan representasi matematis pada soal teori peluang yang dianalisis menggunakan statistik deskriptif dengan mengacu pada tiga indikator utama. Dari hasil tes tersebut kemudian tiga mahasiswa dipilih mewakili tiap kategori untuk dilakukan wawancara. Sedangkan analisis data dalam penelitian ini menggunakan teknik analisis data menurut Miles dan Huberman (Mataheru dkk, 2021) yaitu reduksi data, penyajian data dan penarikan kesimpulan.

3. Hasil dan Pembahasan

Hasil dari tes yang diberikan pada mahasiswa calon guru matematika merupakan soal hasil tes pada mata kuliah teori peluang yang diikuti oleh sebanyak 17 mahasiswa. Dari 17 mahasiswa tersebut kemudian berdasarkan hasil hasil tesnya dikelompokan berdasarkan kategori tinggi, sedang dan rendah sebagaimana tabel di bawah ini.

Tabel 2. Pengelompokan hasil tes mahasiswa

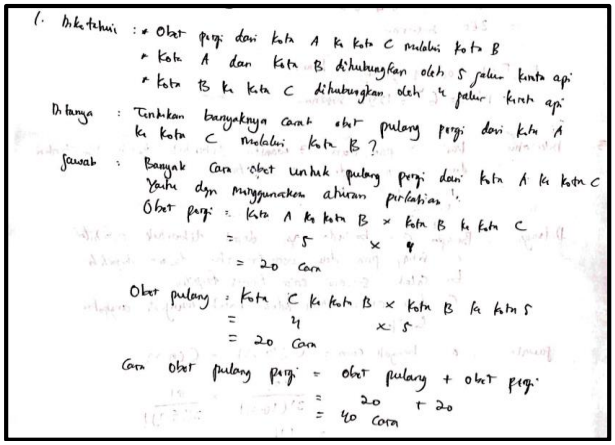
Interval	Kategori	Frek	Persen (%)
$x \geq 75$	Tinggi	3	17.6
$60 \leq x < 75$	Sedang	9	52.9
$x < 60$	Rendah	5	29.5
Total		**17**	**100**

Sumber: Data Olahan

Berdasarkan tabel 2 di atas, maka mahasiswa tedapat sebanyak 3 orang atau (17.6%) mahasiswa dengan kategori tinggi, 9 orang atau (52.9%) mahasiswa dengan kategori sedang dan terdapat 5 orang atau (29.5%) dengan kategori rendah. Dari hasil pengelompokan tersebut kemudian diambil 3 mahasiswa sebagai subyek untuk dianalisis hasil tes dan diwawancarai untuk mewakili setiap kategori. Subyek yang diambil yaitu S1 untuk kategori tinggi, S2 untuk kategori sedang dan S3 untuk kategori rendah. Berikut deskripsi kemampuan representasi matematis calon guru matematika hasil tes dari setiap kategori.

3.1 Subjek dengan kategori tinggi (S1)

Subyek pada kategori tinggi (S1) tidak dapat menyelesaikan permasalahan terkait dengan kaidah pencacahan yaitu banyak cara berpergian antar kota. Subyek S1 tidak dapat mengubah sebuah informasi menjadi representasi visual atau tidak dapat mengubah soal cerita menjadi representasi visual masalah. Untuk kemampuan representasi persamaan atau ekspresi matematis merupakan kemampuan dalam membuat persamaan atau model matematis, Subyek S1 dapat menyusun langkah-langkah penyelesaian dengan tepat, tetapi masih belum mendapatkan solusi. Subyek S1 juga tidak mampu menyelesaikan tahap akhir yaitu mengalikan jumlah jalur yang ditempuh. Berkaitan dengan representasi verbal yaitu kemampuan dalam menyusun urutan penyelesaian dengan menggunakan kata-kata, subyek S1 mampu menuliskan dan menyusun secara matematis secara logis namun hanya beberapa yang tetap. Subyek S1 menyelesaikan langkah-langkah urutan dalam menyelesaian soal namun S1 tidak dapat menuliskan kesimpulan dari jawaban yang diperoleh. Hasil pekerjaan dari S1 terlihat pada gambar di bawah ini.


1. Diketahui : • Obat pergi dari kota A ke kota C melalui kota B
• kota A dan kota B dihubungkan oleh 5 jalur kereta api
• kota B ke kota C dihubungkan oleh 4 jalur kereta api
Ditanya : Tentukan banyaknya cara obat pulang pergi dari kota A ke kota C melalui kota B ?
Jawab : Banyak cara obat untuk pulang pergi dari kota A ke kota C yaitu dgn menggunakan aturan perkalian.
Obat pergi : kota A ke kota B × kota B ke kota C
= 5 × 4
= 20 cara
Obat pulang : kota C ke kota B × kota B ke kota A
= 4 × 5
= 20 cara
Cara obat pulang pergi = obat pulang + obat pergi
= 20 + 20
= 40 cara

Gambar 1. Hasil pekerjaan Subyek S1 pada soal kaidah pencacahan

Pada Gambar 1 menunjukkan bahwa subyek S1 hanya mampu pada dua kemampuan representasi yaitu visual dan persamaan atau ekspresi matematis. Subyek S1 mampu menemukan model matematis yang cocok untuk model matematis yang tepat pada soal namun tidak dapat menyelesaikan soal hingga akhir. Selain itu subyek S1 dapat menulis urutan penyelesaian dengan kata-kata namun pada tahap akhir tidak dibuat soal sesuai yang dengan yang dikehendaki oleh. Hasil analisis diatas diperkuat oleh kutipan wawancara dengan subyek S1. Berikut kutipan wawancara dengan subyek S1.

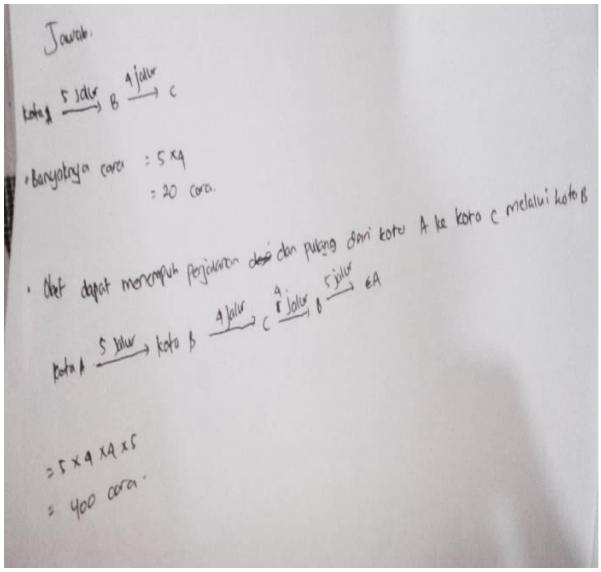
P : apakah kamu memahami soal yang ditanyakan?
S1 : saya paham soalnya
P : kenapa tidak dibuat model yang sesuai dengan soal?
S1 : saya tidak kepikiran pak
P : kenapa hasil akhirnya tidak kamu temukan?
S1 : yang saya tahu prosesnya berulang jadi hanya dijumlahkan bukan dikalikan.
P : kenapa tidak ada kesimpulan yang kamu tulis?
S1 : Saya lupa menulisnya karena saya pikir sudah dapat jawaban akhir

Hasil wawancara peneliti dengan subyek S1 telihat bahwa soal yang ditanyakan dipahami namun tidak terpikir untuk dibuat modelnya. Dengan tidak dibuat model matematis oleh subyek S1 maka berdampak pada penyelesaian akhir dimana suyek S1 beranggapan bahwa hasil akhir yang diperoleh adalah hasil penjumlahan karena aktivitas yang dilakukan hanya berulan dan bukan satu urutan kejadian yang saling berkaitan sehingga jawaban akhirnya adalah hasil penjumlahan dan bukan perkalian. Selain subyek S1 tidak lengkap dalam menemukan solusi akhir, subyek S1 juga tidak dapat menuliskan kesimpulan karena subyek S1 beranggapan bahwa hasil pekerjaannya telah selesai pada jawaban akhir.

3.2 Subjek dengan kategori sedang (S2)

Subyek pada kategori tinggi (S2) tidak dapat membuat representasi secara lengkap pada permasalahan terkait dengan kaidah pencacahan yaitu banyak cara berpergian antar kota. Subyek S2 tidak dapat mengubah sebuah informasi menjadi representasi visual atau tidak dapat mengubah soal cerita menjadi representasi visual masalah dimana subyek S2 tidak bisa menyusun model yang sesuai cocok dengan informasi yang ditanyakan pada soal. Pada kemampuan representasi persamaan atau ekspresi matematis, subyek S2 hanya memahami model matematika yang cocok dengan yang ditanyakan pada tes namun tidak dapat menyusunnya dalam langkah-langkah yang berurutan tetapi subyek S2 dapat menemukan

solusi yang cocok dengan yang ditanyakan pada soal. Berkaitan dengan representasi verbal, subyek S2 tidak mampu menuliskan penjelasan secara matematis masuk akal pada tiap langkah penyelesaian meskipun menemukan hasil akhir. Subyek S2 juga tidak dapat menuliskan kesimpulan dari jawaban yang diperoleh. Hasil pekerjaan dari S2 dapat ditampilkan pada gambar Gambar 2.



Gambar 2. Hasil pekerjaan Subyek S2 pada soal kaidah pencacahan

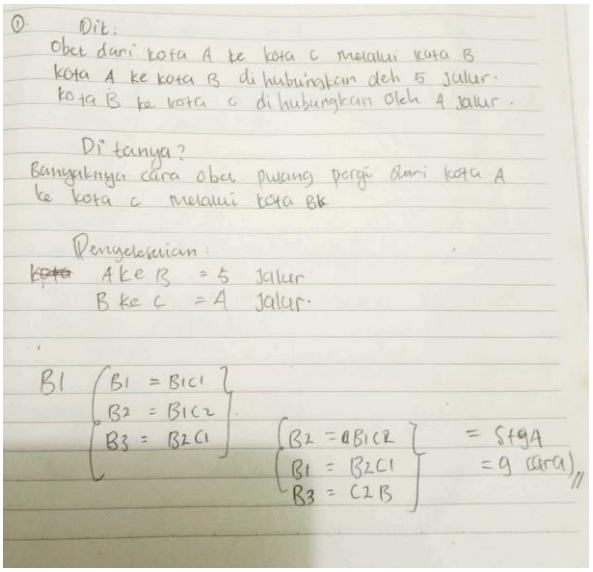
Pada Gambar 2 menunjukkan bahwa subyek S2 memahami soal yang ditanyakan. Subyek S2 juga memahami model matematis yang tepat dengan yang ditanyakan di soal, tetapi tidak dapat menyusun model matematis yang sesuai dengan pertanyaan. Subyek S2 tidak mampu menuliskan secara lengkap urutan kerja dalam menyelesaikan soal tetapi subyek S2 dapat menemukan jawaban akhir yang diinginkan pada soal. Subyek S2 tidak dapat mampu menuliskan urutan dalam mengerjakan soal dan tidak dapat menyimpulkan hasil pekerjaannya. Hasil analisis diatas diperkuat oleh kutipan wawancara dengan subyek S2. Berikut kutipan wawancara dengan subyek S2.

P : apakah kamu memahami soal yang ditanyakan?
S2 : Saya paham soalnya
P : kenapa tidak dibuat model yang sesuai dengan soal?
S2 : Tidak terpikir pak
P : kenapa hasil akhirnya kamu benar?
S2 : Yang saya tahu prosesnya saling terkait jadi hasil akhirnya dikalikan.
P : Kenapa tidak ada kesimpulan yang kamu tulis?
S2 : Saya lupa menulisnya

Hasil wawancara peneliti dengan subyek S2 telihat bahwa soal yang ditanyakan dipahami namun tidak terlihat model matematika dari soal tersebut. Subyek S2 tidak mampu membuat model secara matematis dari soal yang ditanyakan. Subyek S2 menemukan hasil akhir yang yang benar dari pertayaan tetapi tidak dapat menuliskan langkah-langkah pekerjaan yang tepat sehingga dapat menjelaskan tahap-tahap dalam penyelesaian soal. Selain itu subyek S2 juga tidak dapat menuliskan kesimpulan karena subyek S2 beranggapan bahwa hasil pekerjaannya telah selesai pada jawaban akhir.

3.3 Subjek dengan kategori rendah (S3)

Subyek pada kategori rendah (S3) tidak dapat membuat representasi secara lengkap pada permasalahan terkait dengan kaidah pencacahan yaitu banyak cara berpergian antar koat. Subyek S3 tidak dapat mengubah sebuah informasi menjadi representasi visual atau tidak dapat mengubah soal cerita menjadi representasi visual masalah dimana subyek S3 tidak mampu membuat model yang cocok dengan informasi yang ditanyakan pada soal. Pada kemampuan representasi persamaan atau ekspresi matematis, subyek S3 tidak mampu menyusun urutan penyelesaian, subyek S3 juga tidak menemukan jawaban dari penyelesaian soal. Berkaitan dengan representasi verbal, subyek S3 menulis urutan penyelesaian secara bertahap namun lupa menuliskan kesimpulan dari jawabannya. Hasil pekerjaan dari S3 ditampilkan pada gambar berikut ini.



Gambar 3. Hasil pekerjaan Subyek S3 pada soal kaidah pencacahan

Pada Gambar 3 menunjukkan bahwa subyek S3 kurang memahami soal yang ditanyakan. Subyek S3 juga tidak menyusun model matematis yang sesuai dengan yang dikehendaki soal. Subyek S3 juga tidak dapat menuliskan tahap-tahap dalam

menyelesaikan soal. Subyek S3 dapat menuliskan urutan dalam mengerjakan soal dan tidak menuliskan kesimpulkan hasil pekerjaannya. Hasil analisis diatas diperkuat oleh kutipan wawancara dengan subyek S2. Berikut kutipan wawancara dengan subyek S2.

P : apakah kamu memahami soal yang ditanyakan?
S3 : Saya kurang paham soalnya
P : kenapa tidak dibuat model yang sesuai dengan soal?
S3 : Saya lupa pak
P : kenapa hasil akhirnya tidak dapat?
S3 : saya lupa cara mengerjakannya.
P : Kenapa tidak ada kesimpulan yang kamu tulis?
S3 : Saya lupa menulisnya

Hasil wawancara peneliti dengan subyek S3 telihat bahwa soal yang ditanyakan kurang dipahami oleh subyek sehingga tidak dapat menyusun model matematis dari soal yang diketahui. Subyek S3 tidak dapat menyusun presentasi matematis untuk soal. Subyek S3 juga dapat menulis langkah-langkah namun tidak dapat menuliskan kesimpulan akhir dari hasil pekerjaannya.

Hasil analisis kemampuan representasi matematis dari ketiga subyek di atas ditampilkan pada tabel dibawah ini. Tabel ini dimodikasi berdasarkan tabel indikator yang dikembangkan oleh (Ramadhana et al., 2022), kemudian dianalisis untuk mengetahui kemampuan representasi matematis mahasiswa calon guru matematika.

Tabel 3. Analisis Kemampuan Representasi Matematis Calon Guru Matematika

Kode Subyek	Indikator Utama	Proses Representasi
S1	Representasi visual	1. Subyek dapat memahami soal yang diberikan 2. Tidak dapat menampilkan model dari soal yang diberikan sehingga tidak terlihat model matematika yang ditampilkan secara visual dari soal yang diajukan
	Representasi persamaan atau ekspresi matematis	3. Subyek mampu menyusun persamaan atau ekspresi matematis, namun salah mendapatkan solusi akhir
	Representasi verbal	4. Subyek mampu menuliskan kembali tahap-tahap penyelesaian dengan kata-kata, dapat menuliskan jawaban secara matematis serta masuk diakal tetapi hanya sebagian lengkap dan benar. 5. Subyek tidak menuliskan kesimpulan akhir
S2	Representasi visual	1. Subyek mengerti soal yang diberikan 2. Tidak dapat menampilkan model dari soal yang diberikan sehingga tidak terlihat model matematika yang ditampilkan secara visual dari soal yang diajukan
	Representasi persamaan atau ekspresi matematis	3. Subyek tidak tidak dapat menyusun persamaan atau ekspresi matematis, namun mendapatkan solusi dari penyelesaian
	Representasi verbal	4. Subyek tidak dapat menuliskan tahap-tahap penyelesaian dengan kata-kata, subyek juga tidak mampu menuliskan keterangan secara matematis. 5. Subyek tidak dapat menuliskan kesimpulan akhir
S3	Representasi visual	1. Subyek kurang mengerti soal tes 2. Subyek tidak dapat menampilkan model dari soal yang diberikan sehingga tidak terlihat model matematika yang ditampilkan secara visual dari soal yang diberikan
	Representasi persamaan atau ekspresi matematis	3. Subyek tidak mampu menyusun persamaan atau ekspresi matematis, tidak mendapatkan solusi dari penyelesaian
	Representasi verbal	4. Subyek tidak dapat menuliskan urutan kerja dengan kata-kata. Subyek juga tidak mampu menuliskan penjelasan matematis. 5. Subyek tidak dapat menuliskan kesimpulan akhir

Dari tabel 3 di atas diperlihatkan bahwa pada indikator kemampuan visual, subyek S1 dan S2 keduanya memahami soal sedangkan subyek S3 kurang memahami soal yang diberikan . Ketiga subyek tidak dapat menampilkan secara visual model dari soal yang diberikan sehingga tidak terlihat model matematika yang ditampilkan secara visual dari soal yang diberikan.

Berkaitan dengan indikator kedua dari kemampuan representasi matematis mahasiswa, subyek S1 mampu menyusun persamaan atau ekspresi matematis, namun salah mendapatkan solusi akhir. Subyek S2 tidak mampu menyusun persamaan atau ekspresi matematis, namun mendapatkan solusi dari penyelesaian. Hal ini dikarenakan subyek S2 memahami dengan maksud cara kerja dari penyelesaian soal, hanya saja tidak

mampu menunjukkan dalam bentuk persamaan atau ekspresi matematis. Subyek S3 tidak mampu menyusun persamaan atau ekspresi matematis, tidak mendapatkan solusi dari penyelesaian.

Indikator representasi verbal subyek S1 mampu menyusun urutan dari penyelesaian dengan menggunakan kata-kata, mampu menyusun urutan kerja secara matematis dan masuk dapat diterima tetapi hanya sebagian hasil pekerjaan lengkap dan benar. Subyek S2 tidak dapat menuliskan tahap-tahap penyelesaian dengan kata-kata, subyek juga tidak mampu menuliskan penjelasan secara matematis masuk akal dan tidak lengkap. Subyek S3 tidak dapat menuliskan urutan-urutan dari matematis dengan kata-kata, subyek juga kurang menuliskan penjelasan matematis, terlihat juga ketiga subyek tidak mampu menuliskan kesimpulan akhir.

Berdasarkan deskripsi hasil tes dan wawancara dari 3 (tiga) subyek menunjukkan bahwa semakin kuat kemampuan matematis seseorang maka semakin tinggi juga kemampuan representasi yang dimiliki dalam menyelesaikan tes matematika. Tinggi rendahnya kemampuan representasi matematis seseorang diduga dipengaruhi oleh kemampuan individu seseorang pada mata pelajaran matematis.

Berdasarkan hasil penelitian dan analisis terhadap hasil tes tertulis 17 orang mahasiswa calon guru, diperoleh gambaran kemampuan representasi matematika pada kategori tinggi sebanyak 3 orang atau (17.6%), kategori sedangan sebanyak 9 orang (52.9%), dan kategori rendah 5 orang (29.5%). Pengelompokan tersebut didasarkan pada kemampuan siswa dalam menyelesaikan soal berdasarkan indikator-indikator kemampuan representasi matematis yaitu kemampuan representasi visual, kemampuan representasi persamaan atau ekspresi matematis dan kemampuan representasi verbal.

Hasil analisis data menunjukan bahwa mahasiswa dengan kategori tinggi hanya mampu memenuhi kemampuan representasi matematis visual, sedangkan tidak mampu memenuhi kemampuan represtasi persamaan atau ekspresi matematis dan kemampuan representasi verbal. Subyek dengan kategori sedang tidak mampu memenuhi kemampuan visual, mampu memenuhi kemapuan representasi persamaan atau ekspresi namun tidak lengkap, dan mampu memenuhi kemampuan representasi verbal. Mahasiswa dengan kategori rendah tidak mampu memenuhi kemampuan representasi visual dan representasi persamaan atau ekspresi, mampu memenuhi kemampuan representasi verbal meski tidak lengkap.

Berdasarkan analisis data hasil wawancara yang dilakukan untuk mencocokan jawaban mahasiswa dengan hasil tes tertulis tidak terdapat perbedaan dimana dari hasil wawancara jawaban mahasiswa menunjukkan kesamaan antara jawaban mahasiswa dengan hasil tes tertulis mahasiswa. Mahasiswa pada tiga kategori belum mampu memenuhi ketiga indikator kemampuan representasi matematis. Ketidakampuan mahasiswa dalam memenuhi indikator kemampuan representasi matematis dipengaruhi oleh kemampuan individu mahasiswa. Selain kemampuan individu seseorang, pengetahuan awal seseorang berkaitan dengan mata kuliah prasyarat yang mendukung mata kuliah tersebut. Bekaitan dengan kemampuan matematis, (Kartika, 2018) mengatakan bahwa siswa memliki kemampuan dalam memahami konsep-konsep matematika apabila mampu merumuskan strategi menyelesaikaan, menerapkan perhitungan, menggunakan simbol untuk representasi gagasan, dan mengubah ke bentuk lain dalam pembelajaran matematika.

Hasil dari penelitian ini sejalan dengan hasil penelitian yang dilakukan (Ulya & Rahayu, 2020) menyatakan bahwa siswa masih mengalami kesulitan dalam menyelesaikan soal berkaitan dengan kemampuan representasi simbolik, representasi verbal dan representasi visual. Selanjutnya (Kumalasari, 2020) mengatakan bahwa dalam menyelesaikan tes, peserta didik masih sulit dalam menyelesaikan soal-soal representasi dalam dalam pemecahan masalah matematika seperti simbol, gambar, tabel. Selain indikator utama yang masih perlu mendapat perhatian dalam menyelesaikan soal-soal representasi, (Mataheru et al., 2021) menyebutkan bahwa kemampuan representasi matematis merupakan kemampuan yang berhubungan erat dengan kemampuan dasar dalam berpikir matematis, memahami ide-ide, dan menggunakannya dalam memecahkan masalah yang dihadapi.

Penelitian ini terbatas pada kemampuan representasi matematis mahasiswa calon guru matematika. Kemungkinan besar ada faktor-faktor lain yang berperan penting dalam mempengaruhi kemampuan representasi matematis calon guru matematika. Sehingga penelitian selanjutnya dapat terfokus pada tinjauan lain yang lebih mendalam sehingga dapat terukur jelas kemampuan representasi matematis calon guru.

4. Kesimpulan

Kemampuan representasi matematis matematis calon guru masih rendah. Hal ini terlihat dari hasil tes pada soal teori peluang menunujukkan bahwa mahasiswa dengan kategori tinggi sebanyak 3 orang (17.6%), mahasiswa dengan kategori sedang sebanyak 9 orang (52.9%) dan mahasiswa dengan kategori rendah sebanyak 5 orang (29.5%). Ini menunujukkan bahwa kemampuan representasi matematis calon guru masih berada pada kategori rendah.

Kemampuan representasi matematis mahasiswa calon guru matematika merupakan kemampuan dasar yang harus dimiliki oleh setiap individu terutama dalam menyelesaikan persoalan matematis. Ha ini dikarenakan kemampuan representasi merupakan kemampuan dasar yang sangat menentukan langkah awal dalam penyelesaian berbagai persoalan matematis yang rumit. Kemampuan representasi memiliki hubungan yang erat dengan kemampuan mengubah soal menjadi representasi visual, kemampuan mengubah persoalan nyata menjadi model matematis atau persamaan matematis, dan kemampuan verbal atau kemampuan menyusun langkah-langkah dalam menyelesaikan soal-soal hingga pada penyelesaian akhir

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THE EFFECT OF GIVING ILL-STRUCTURED MATH PROBLEM AND WELL-STRUCTURED MATH PROBLEM ON THE SELF-EFFICACY OF JUNIOR HIGH SCHOOL STUDENTS

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Abstract

This study aimed to determine the effect of giving ill-structured problems and well-structured problems to students' self-efficacy. The study population was class VIII students at Junior High School 1 Ngawen Blora which consisted of an experimental class and a control class with the selection of samples using purposive sampling technique. This research is a quantitative research with a comparative problem formulation that compares the increase in self-efficacy between students who are given well-structured math problems and ill-structured math problems. The data analysis technique used was t-test dependent and t-test independent. The results showed that: 1) there is an effect of giving ill-structured math problems on students' self-efficacy at a significant level of 0.05; 2) there isn't an effect of giving well-structured math problems on students' self-efficacy at a significant level of 0.05; 3) there is a difference in changes in student self-efficacy between giving ill-structured math problems and giving well-structured math problems at a significant level of 0.05

Keywords: ill-structured problem, self-efficacy, well-structured problem

1. Introduction

Mathematics is one of the important sciences, because it is related to all aspects of life. However, not all humans have good ability to understand mathematics, this can be seen through the Program for International Study Assessment (PISA) survey in 2018 under the Organization for Economic Cooperation and Development (OECD) 79 countries. Putrawangsa & Hasanah (2022) said that PISA 2018 results shows around 72% of indonesian students are categorized as having low ability on mathematical literacy. Based on these data, it can be said that the ability of mathematics in Indonesia is quite low. Budiono (in Ulandari, Hudiono, & Bistari, 2015) states that the curriculum used in Indonesia tends to apply questions that only have one answer or well-structured problems in learning mathematics. This causes students to be unfamiliar with looking at problems from different perspectives, so students tend to be afraid of making mistakes in solving problems and this will affect students' self-efficacy. The level of student self-efficacy is very influential in the learning process, because based on research conducted by Sahendra, Budiarto & Fuad (2018) states that there is a relationship between self-efficacy and student learning outcomes, namely the higher the self-efficacy, the higher the academic ability . So that needed several ways to increase students' self-efficacy, one of them is by giving ill-structured math problems in the hope that students can be more confident in their abilities because the ill-structured math problems consist of various types of answers.

Mathematics is always related to problems and problem solving processes. A problem in mathematics is a problem that can be represented, analyzed, and can be solved by mathematical methods. Mathematical method is a method that consists of several steps of solving a mathematical problem which is referred to as a problem solving process. Polya (in Toy, 2007) states that the problem solving process consists of several steps, namely understanding the problem, planning problem solving strategies, carrying out problem solving plans, and reviewing the results obtained. The problem solving process has an important role in the mathematics learning process. In the problem solving process there are several things that affect it. Siswono (in Alifia & Rakhmawati, 2018) states that there are several factors that influence problem solving abilities, including: Initial experience (experience with story problem solving tasks); Mathematical background (students' ability to understand mathematical concepts at different levels which can trigger differences in students' ability to solve problems); Desire and motivation (strong encouragement from within myself such as growing my confidence to be able to complete the given problem or task); and the problem structure (problem structure that given to students, such as verbal or pictorial formats, complexity (level of difficulty), context (background story or theme), language problems, or the form of one problem with another can interfere with students' ability to solve some problem). Of these several factors, there are two factors that are quite interesting to study because they can be observed in the problem solving process. The two factors are desire and motivation factors that can be observed by filling out the questionnaire so that it can be seen from the final score of filling out the questionnaire, and the problem structure which has certain characteristics that can be conditioned by humans.

Desire and motivation factors are factors that quite related to self-efficacy (Lunenburg, 2011). This is because the desire and motivation are related to students' beliefs (Zimmerman, 2000). Self-efficacy is self-confidence in completing certain tasks or actions to achieve a goal (Alifia & Rakhmawati, 2018). Self-efficacy abilities can affect a person's choice of activities, effort, and persistence when solving problems (Bandura, 2010). Self-efficacy is one of important role in life, especially for students who are solving math problems. With the existence of high self-efficacy abilities in students, it is expected to be successful in solving mathematical problems. Because high self-efficacy can create calm in front of the task or students' self-control ability in dealing with the given task and confidence to solve difficult problems. Several studies discuss self-efficacy and student learning outcomes, including research conducted by Ayotola & Adedeji (2009) which states that there is a relationship between self-efficacy and student learning outcomes. This statement is in accordance with research by Sahendra, Budiarto, & Fuad (2018) which states that there is a relationship between self-efficacy and student learning outcomes, namely the higher the self-efficacy, the higher the academic ability. Self-efficacy is also a determinant that influences a person's choice in an effort to persevere in facing difficulties and the mindset and emotional reactions they experience. From some of these explanations, it can be said again that self-efficacy or self-confidence that students have in solving problems is very influential in the mathematics learning process because self-efficacy affects students in the problem solving process and student learning outcomes.

The next factor is the structure of the problem. Based on the structure, problems can be divided into two, namely open problems is problems that have several types of solutions and closed problems is problems that only have one type of solution (Yee, 2002). These two things are one of the elements which make problem divided based on their elements. Based on the elements, problems are divided into ill-structured problems and well-structured problems (Hendriana & Soemarmo, 2014). An ill-structured problem is a problem which there is no complete information, an unstructured problem design, and has various types of solutions. Meanwhile, a well-structured problem is a problem that has a well-defined initial state, has a purpose, and has a clear operating formula for solving calculations (Goel, 1992), so that in the solution there is only one type of correct answer. Chi & Glaser (in Hong & Kim, 2016) state several characteristics of ill-structured problems, including the situations given are not concrete, the problems are not well defined, open-ended, and based on contextual mathematics problems in unstructured conditions. . In accordance with this statement, Kim, Lee, Hong & Kim (in Hong & Kim, 2016) define three components in the ill-structured problem, the three components include authentic (problems presented relating to everyday life outside the school environment), complex (the solution steps are not presented directly in the problem), and open-ended (has several solutions to the problem and the essence of the problem is not presented directly). From some of these explanations, it can be restated the difference between the ill-structured problem and the well-structured problem. Ill-structured problems are open-ended, problems are not presented directly and have a variety of solutions. While the well-structured problem is closed-ended, the problem is presented clearly, and only have one solution.

Based on the previous statement, the characteristics of the ill-structured problem are abstract questions and have several types of solutions so that the solution requires abstraction, reasoning and logic skills, as well as deductive and inductive thinking. In Jean Piaget's theory of cognitive level development (in Ibda, 2015) states that these skills and abilities are possessed by children at the stage of formal operational cognitive development, namely children over the age of 11 years. In Indonesia, Junior High School students are generally 12-15 years old, at this age according to Piaget's theory is the stage of formal operational cognitive development. Therefore, the participants in this study were class VIII junior high school students.

According to information from a grade VIII mathematics teacher who teaches at Junior High School 1 Ngawen Blora, namely Ms.Maspuah states that learning mathematics at the school often uses well-structured math problems rather than ill-structured math problems. According to research conducted by Hong & Kim (2016) it is stated that giving ill-structured problem questions can improve students' abstraction skills. Reinforced by research conducted by Cho & Kim (2020) which states that learning using ill-structured problems can improve students' problem solving abilities. Il-structured math problems are questions that have various solutions so that students can solve these problems according to the abilities possessed by each student. In addition, students can also be more flexible and confident in expressing how to solve these types of questions because they are not based on one type of answer, so that giving ill-structured math problem is expected to increase the level of self-efficacy which can later improve student learning outcomes. Based on the statement and the results of that research, it is necessary to conduct a study on the effect of giving ill-structured math problems and well-structured math problems on the self-efficacy of Junior High School 1 Ngawen students.

Based on that statements, the following hypotheses were formulated, including: 1) there is an effect between giving ill-structured math problems on students' self-efficacy; 2) there is an effect between giving well-structured math problems to students' self-efficacy; 3) there is a difference in changes in student self-efficacy between giving ill-structured math problems and giving well-structured math problems.

2. Method

This research is a quantitative research with a comparative problem formulation that compares the increase in self-efficacy between students who are given well-structured math problems and ill-structured math problems.

Data collection was carried out at Junior High School 1 Ngawen Blora in the even semester 2021/2022 academic year. Data collection was carried out on February 24-19 March 2022.

The population in this study were students of class VIII Junior High School. Sampling was carried out using a purposive sampling technique. The considerations taken are based on mathematical abilities and students' activeness in learning mathematics with the mathematics scores obtained by students as a determining indicator.

This sampling consisted of two classes, namely, Class A as the Experiment Class with the provision of ill-structured math problems and Class B as the Control Class with the provision of well-structured math problems. The number of samples in the study were 31 students, with 15 students in the experimental class and 16 students in the control class. In the experimental class, treatment was given in the form of giving ill-structured problems to students, while in the control class, treatment was given in the form of giving well-structured problems to students.

The instrument in this study consisted of a self-efficacy questionnaire which was adapted from the MSEAQ (Mathematics Self-Efficacy and Anxiety Questionnaire) questionnaire in the dissertation entitled "Mathematics Self-Efficacy And Anxiety Questionnaire" by Diana K. May (2009). ill-structured math problems worksheet, and well-structured math problems worksheets. The task sheet is in the form of contextual math problems on the Pythagorean and circle material that has been tested for feasibility and given 3 times. Below are the example of ill-structured math problems and well-structured math problems that used in this study.

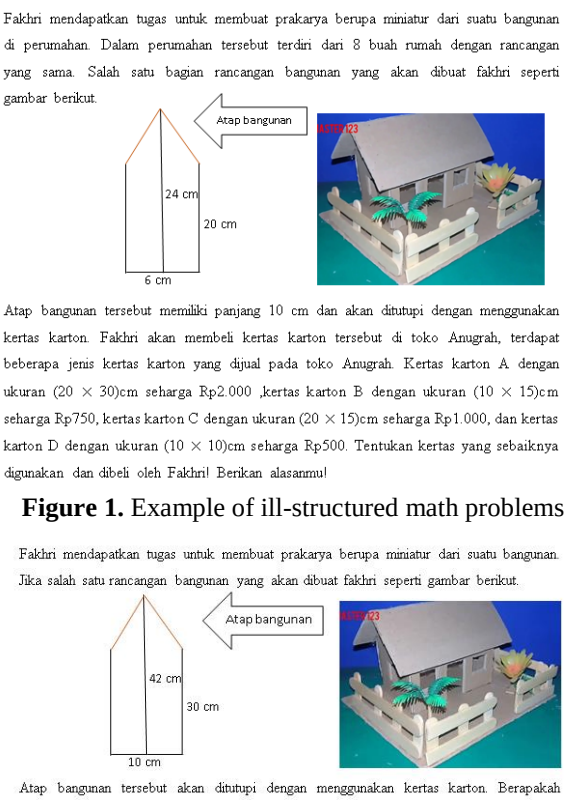

Figure 1. Example of ill-structured math problems

Figure 2. Example of well-structured math problem

The data were obtained from the results of filling out the student self-efficacy level questionnaire before giving the treatment or worksheet and after giving the treatment or worksheet. The following are the variables in the study:

Table 1. Variables in the study

Independent Variable	Giving Ill-structured math problem	Giving well-structured math problem
Control Variable	Class VIII students of Junior High School 1 Ngawen	
Dependent variable	Student Self-efficacy level	

Data analysis techniques to answer the hypothesis using the dependent t-test and independent t-test. The dependent t-test was used to answer the hypothesis about the effect of giving each question on the level of student self-efficacy. The following formula is used to calculate the dependent t-test:

$$t = \frac{\bar{D}}{S\,\bar{x}\,D}$$

The independent t-test was used to answer the hypothesis about the difference in changes of students' self-efficacy levels between two different types of questions. To calculate independent t-test, the data must be normally distributed and homogeneous so normality and homogeneity tests are carried out. Then the independent t-test was calculated with the following formula:

$$t = \frac{\overline{x_1} - \overline{x_2}}{SD\bar{x}}$$

3. Result and Discussion

3.1 Result

Based on the data obtained, the following are the results of calculations to answer the hypotheses that have been made:

The effect of giving math questions*ill-structured problem*on student self-efficacy

To answer this hypothesis, a dependent t-test was conducted. By using manual calculations through Excel the following data are obtained:

H_{01}: There is no effect between giving ill-structured math problems on students' self-efficacy.

H_{a1}: There is an effect between giving ill-structured math problems on students' self-efficacy.

Table 2. The calculation results of the hypothesis 01

t_{count}	Significant level	dk	t_{table}
2.928485	0.05	14	2.14478

Because $t_{count} > t_{table}$, H_{01} is rejected so that it can be stated that there is an effect of giving ill-

structured math problems on students' self-efficacy.

The effect of giving well-structured math problems to students' self-efficacy

To answer this hypothesis, a dependent t-test was conducted. By using manual calculations through Excel the following data are obtained:

H_{02}: There is no effect between giving well-structured math problems to students' self-efficacy.

H_{a2}: There is an effect between giving well-structured math problems to students' self-efficacy.

Table 3. The calculation results of the hypothesis 02

t_{count}	Significant level	dk	t_{table}
0.176634	0.05	15	2.131450

Because $t_{count} < t_{table}$, H_{02} is accepted so that it can be stated that there is no effect of giving well-structured math problems to students' self-efficacy.

Differences in students' self-efficacy changes between giving ill-structured math problems and well-structured math problems

To answer this hypothesis, an independent t-test was conducted. By using manual calculations through Excel the following data are obtained:

a. Test the homogeneity of the experimental class and control class

Table 4. Homogeneity test calculation results

Treatment	F_{count}	Significant level	F_{table}
Beginning	1.004639	0.05	2.42
End	1.224318	0.05	2.42

Because $F_{count} < F_{table}$, it can be stated that the sample data used is homogeneous.

b. Normality test

Experimental class (Sample with ill-structured problem)

Table 5. The calculation results of the normality test on the experimental class

Treatment	P_{count}	Significant level	P_{able}
Beginning	0.926781	0.05	0.881
End	0.897956	0.05	0.881

Because $P_{count} > P_{table}$, it can be stated that the sample data used is normally distributed.

Control class (Sample with well-structured problem questions)

Table 6. The calculation results of the normality test on the control class

Treatment	P_{count}	Significant level	P_{table}
Beginning	0.964149	0.05	0.863
End	0.951124	0.05	0.863

Because $P_{count} > P_{table}$, it can be stated that the sample data used is normally distributed.

Because the sample of data are homogeneous and normally distributed, it is possible to calculate an independent t-test with the following results:

H_{03}: The level of self-efficacy of students by giving ill-structured math problems is not higher or equal to the level of self-efficacy of students by giving well-structured math problems.

H_{a3}: The level of self-efficacy of students by giving ill-structured math problems is higher than the level of self-efficacy of students by giving well-structured math problems.

Table 7. The calculation results of the hypothesis 03

t_{count}	Significant level	dk	t_{table}
-5.01841	0.05	29	2.045230

Because $t_{count} < t_{table}$, H_{03} is accepted so that it can be stated that the level of self-efficacy of students by giving ill-structured math problems is not higher or equal to the level of self-efficacy of students by giving well-structured math problems.

3.2 Discussion

Based on the results of the data analysis, it can be stated as follows:

a. There is an effect of giving ill-structured math problems to the level of student self-efficacy

In the class given the ill-structured problem, the value of $t_{count} = 2.928485$ is greater than t_{table} with a significant level of 0.05, which is 2.144787. In the results of the study, the average level of student self-efficacy decreased. This can be caused by several influencing factors because in the results of the data obtained there are several students who experience an increase in the level of self-efficacy. Among the influencing factors, students are not accustomed to working on ill-structured math problems type, according to information from teachers who teach students often get math problems that only have one type of answer. From that situation, students who were given ill-structured math problems needed more scaffolding. This is in accordance with research by Cho & Kim (2020) which states that the provision of scaffolding can help in the process of solving ill-structured math problems. The next factor is that there is unexpected treatment carried out on the sidelines of the study. The treatment is giving math test results which can have an impact on the psychological

condition of students. This condition is one of the factors that affect the level of student self-efficacy (Alifia & Rakhmawati, 2018; Bandura, 2010; Siegle, D.: MCCoach, 2007).

b. There is no effect of giving well-structured math problems to students' self-efficacy levels

In the class given the well-structured problem, the value of t_{count} = 0.176634 is smaller than t_{table} with a significant level of 0.05, which is 2.131450. In the research results obtained the average level of self-efficacy tends to remain. When collecting data, students who were given well-structured math problems needed less scaffolding than students who were given ill-structured math problems. Based on this, it can be stated that students are used to working with these types of questions, so it does not have much effect on changes in students' self-efficacy levels.

c. There is a significant difference in the change in self-efficacy between students who are given ill-structured math problems and students who are given well-structured math problems

The difference in these changes states that the level of self-efficacy of students who are given well-structured math problems is higher than students who are given ill-structured math problems. The difference in changes in self-efficacy between the experimental class and the control class, the value of t_{count} = -5.01841 is smaller than t_{table} with a significant level of 0.05, which is 2.045230. This change in difference is caused because one of the types of questions given is rarely obtained by students. Students are more accustomed to getting questions with one type of answer (well-structured problem) while in the experiments carried out there are questions that have several types of answers (ill-structured problems) so that it affects the psychological condition of one of the experimental classes which has an impact on changes in the level of self-efficacy student.

Based on some of these statements, it can be restated that there are differences in changes in the level of self-efficacy between students who are given ill-structured math problems and well-structured math problems. The data obtained states that the average self-efficacy of students who are given ill-structured math problems has decreased, while the average self-efficacy of students who are given well-structured math problems tends to remain. This is inconsistent with the initial hypothesis which states that giving math problems ill-structured problems can increase students' self-efficacy levels. Previous research stated that learning with an ill-structured problem approach can improve students' mathematical abstraction skills (Hong & Kim, 2016) and can improve students' mathematical abilities (Cho & Kim, 2020), while the results of the research conducted stated the opposite, namely a decrease in the average level of student self-efficacy when given math problems with ill-structured problems. However, this cannot be generalized completely because there are some students who experience an increase in the level of self-efficacy. The possibility of this happening is caused by other factors that can affect students' self-efficacy levels, such as the experience of having success, the experience of observing other people's performance, verbal persuasion, and students' emotional and physiological conditions (Alifia & Rakhmawati, 2018; Bandura, 2010; Siegle, D.: MCCoach, 2007).

Even though the provision of ill-structured math problems affects the decrease in the average level of students' self-efficacy, it is recommended that these questions be given to students. Because based on several previous studies, the type of ill-structured problem can improve students' mathematical abilities (Cho & Kim, 2020). In addition, in the research conducted, there were several students who experienced an increase in their level of self-efficacy after being given an ill-structured math problem. So it will better if the ill-structured math problems are given alternately with the well-structured math problem so that students are more accustomed to solving these types of problems and can improve students' mathematical abilities.

4. Conclusion

Based on the results of the analysis and discussion, several conclusions can be drawn including: 1) there is an influence between the provision of ill-structured math problems on students' self-efficacy. In the class given the ill-structured problem, the value of t_{count} = 2.928485 is greater than t_{table} with a significant level of 0.05, which is 2.144787; 2) there is no effect between the provision of wel-structured math problems on students' self-efficacy. In the class given the well-structured problem, the value of t_{count} = 0.176634 is smaller than t_{table} with a significant level of 0.05, which is 2.131450; 3) there is a difference in students' self-efficacy changes between giving ill-structured math problems and well-structured math problems. The level of self-efficacy of students

who are given an ill-structured math problems is less than the level of self-efficacy of students who are given a well-structured math problems. The difference in changes in self-efficacy between the experimental class and the control class, the value of t_{count} = -5.01841 is smaller than t_{table} with a significant level of 0.05, which is 2.045230. The difference in changes in the level of self-efficacy is caused by ill-structured math problems that are rarely encountered by students so that students feel foreign and have quite a lot of difficulty in working on the questions. Based on the research results obtained, there are some suggestions from this study including: 1) further research should pay more attention to the condition of the students during the treatment period. Try not to get other factors that students get, for example giving unsatisfactory student learning outcomes with poor teacher feedback, because this can affect students' self-efficacy levels; 2) It is recommended that in giving ill-structured problem questions the teacher provides more scaffolding or verbal persuasion and more encouragement for improvement than when giving well-structured problem questions so that the level of student self-efficacy does not decrease and can still increase the level of students' mathematical abilities; 3) further research should provide guidance and steps for solving ill-structured problems at the beginning of giving questions so that students can more easily understand and solve ill-structured math problems given at the next meeting.

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MATHEMATICAL REPRESENTATION ABILITY OF MATHEMATICS EDUCATION STUDY PROGRAM STUDENTS

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Abstract

This research is descriptive because it aims to describe students' mathematical representation ability. Mathematical representation is related to ways of expressing mathematical ideas. Mathematical representation is divided into verbal, visual/pictorial, and symbolic representations. The subjects of this study were 40 new Mathematics Education study program students. Data were collected using test and interview techniques.

Furthermore, the data were analyzed using descriptive and qualitative statistics. The results showed that only 10% of the students had the mathematical representation ability in the good category, 12.5% in the moderate category, 10% in the poor category, and 67,5% in the very poor category. In detail, for verbal skills, there is 2.5% in the very good category, 7.5% in the good category, 17.5% in the moderate category, 15% in the poor category, and 55% in the very poor category. For the ability of visual/pictorial representation, there is 2.5% in the very good category, 7.5% in the good category, 12.5% in the moderate category, 7.5% in the poor category, and 70% in the very poor category. Furthermore, for the symbolic representation ability, 10% is in a good category, 10% in the moderate category, 7.5% in the poor category, and 72.5% in the very poor category. Based on the classroom observation and interview, the low mathematical representation ability is caused by two main things, namely (1) relatively low prerequisite knowledge and (2) mathematics learning, which is dominated mainly by teachers; learning does not provide opportunities for students to develop mathematical representation skills.

Keywords: mathematical representation, students ability

1. Introduction

Mathematics has a strategic position in Indonesian education. Mathematics needs to be given to all students from elementary school to college. Mathematics is intended to equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as the ability to cooperate. These competencies are needed so students can have the ability to acquire, manage, and use the information to survive in ever-changing, uncertain, and competitive conditions (Ratumanan & Mattitaputty, 2017; Ratumanan & Laurens, 2016).

Several important abilities need to be developed through learning mathematics, including mathematical connections and mathematical representations. National Council of Teachers of Mathematics (NCTM) (2000), describes the existence of 5 (five) standards of mathematical abilities that students must master, namely (1) problem solving, (2) reasoning and proof, (3) communication, (4) connection, and (5) representation.

From the NCTM concept, it is clear that representation is one of the important abilities that must be developed in learning mathematics. Representation is one of the main features of learning mathematics and solving problems. In many mathematics classes, children are often introduced to various representations. Mathematics teachers often use multiple representations, including concrete materials, virtual manipulation, pictures, also written and spoken symbols during instruction (Ahmad., et.al, 2010; Bakar, 2017). Mathematical representation is related to how students identify various aspects of the faced problem, present the problem symbolically or in the form of a mathematical model, choose solving strategies, carry out algorithmic activities, and make interpretations either orally or in writing.

The mathematical representation ability is one of the most important abilities for students and is one of the goals to be achieved in learning mathematics at schools. Student success in problem-solving can not be separated from the role of representation (Bal, 2014; Anwar., et.al, 2016). Representation is very useful in helping students solve a problem more easily. Representation is also useful as a medium to communicate students' mathematical ideas to the teacher or other students. Learning mathematics in class should provide sufficient opportunities for students to practice and develop mathematical representation ability (Sabirin, 2014).

NCTM (2000), further explains that mathematical ideas can be represented in a variety of ways: pictures, concrete materials, tables, graphs, number and letter symbols, spreadsheet views, and so on. The mathematical ideas representation ways are fundamental to how people understand and use those ideas. Many of the representations we now take for granted are the result of the cultural improvement process over the years. When students gain access to mathematically represent their ideas, when they can create representations to capture mathematical concepts or relationships, they acquire a set of tools that significantly expand their capacity to model and interpret physical, social, and mathematical phenomena.

Mathematical representations can be divided into visual representations and non-visual representations. Visual representations include graphs, tables, sketches/drawings, and diagrams; Non-visual representations include numerical representations and mathematical equations or mathematical models (Minarni, et.al, 2016). Representations can also be divided into verbal, numerical, graphical, and algebraic representations. Verbal representations are usually used in proposing a problem and also required in the final interpretation of the results obtained in the solution-finding process. Numerical representations are familiar to students in the early algebraic stage. The numerical approach provides a convenient and effective bridge to algebra and often precedes the use of other representations. The use of numbers is important in gaining the first understanding of a problem and in the specific case investigation. A graphical representation is effective in providing a clear picture of the real value function of real variables.

The graphics are intuitive and very attractive to students who like a visual approach. On the other hand, graphical representations may be less accurate, influenced by external factors (such as scaling), and often only represent part of the problem's domain or range. Its strength as a mathematical tool varies according to the faced task. Algebraic representation is succinct, general, and effective in presenting mathematical patterns and models, therefore, it is a powerful tool. Algebraic objects manipulation is sometimes the only method to justify or prove general statements. However, the algebraic symbols exclusive use (at any stage of learning) can obscure or obstruct the represented objects' mathematical meaning or nature and cause difficulties in some students' interpretations of their results (Friedlander and Michal, 2001). NCTM in (Loc and Phuong, 2019),

divided mathematical representations into visual, symbolic, verbal, contextual, and physical representations.

Villegas, et.al (Villegas, et.al, 2009), divided external representations into 3 (three) types, as follows:

a. Verbal representation: consists of problems that are stated either in writing or orally

b. Pictorial representation: consists of pictures, diagrams, or graphs, as well as all kinds of related actions; and

c. Symbolic representation: consists of numbers, operation signs and relations, algebraic symbols, and all kinds of actions that refer to it.

The relationship between these three representations is described as follows:

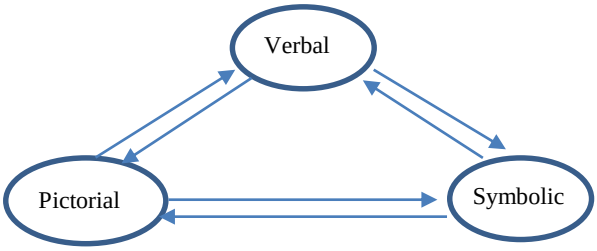


Figure 1. Types of Representation System (Villegas, et.al, 2009)

Mathematical representation clearly is an important process and capability. It allows students to have a clearer picture in a problem solving process. For example, finding a maximum solution in a linear programming problem will be easier if students are able to express the information provided in graphical forms and solve the problem by using various methods. Thus, it is also easier for the students to determine an area between two curves, if they are able to make a graph correctly and express it in a certain integral form (symbolic representation). In conclusion, the study of mathematical representation is one of the important studies in mathematics education.

This study will further examine the mathematical representation ability of students in a mathematics education study program. It will also examine the factors that influence the representation ability. The results of this study will be useful in terms of a more effective mathematics learning arrangement in relation to the development of mathematical representation ability.

2. Method

This research is descriptive research because it aims to describe student's mathematical representation ability and the causing factors. The intended mathematical representation ability will be studied and described more specifically, including (1) verbal representation, (2) visual/pictorial representation, and (3) symbolic representation.

The population of this study was the 1st semester 2020/2021 academic year Mathematics Education study program's new students. The research samples are new students who are Maluku Province's high school graduates. From 47 new students, only 40 came to take the test, so the sample of this research was 40 (85,11%). Data are collected using test and interview techniques. The test is intended to identify the mathematical representation ability. There are 3 (three) questions on the test. On question 1, given the absolute value function, students are asked to draw and determine the value of the function at time t. On question 2, given the center and the radius of two circles, students are asked to draw and determine the length of the tangent of the two circles. On question 3, given two functions, students are asked to describe the two functions and determine the area bounded by the two functions.

The students' works are then assessed using a specially developed rubric to assess verbal, visual, and symbolic representation skills.

Furthermore, referring to the test results, 3 (three) students were selected for further study. They are selected by considering their communication ability. 1 (one) student represented the high or very high representation score group, 1 (one) student represented the moderate representation score group, and 1 (one) student represented the low or very low score group.

Students' representational abilities are divided into 3 (three) groups, namely (1) very high and high categories, (2) moderate categories, and (3) low or very low category. In each group, 1 (one) person was selected for an in-depth interview. A student with a good communication skill was what the researchers needed so that the interview would run well.

The data obtained were then analysed using descriptive statistics and qualitative analysis. The data on the mathematical representation ability test results were analysed using the five scales conversion as follows:

Table 1. Five Scale Value Conversions

Score Interval	Letter	Category
85% ≤ x	A	Very High
70% ≤ x < 85%	B	High
55% ≤ x < 70%	C	Moderate
40% ≤ x < 55%	D	Low
x < 40%	E	Very Low

(Ratumanan & Laurens, 2015)

Data from learning observations and interviews then analyzed using qualitative analysis techniques according to Creswell (2014), namely by the stages (1) preparing and organizing data, (2) data reduction, (3) data presentation, and (4) drawing conclusions. To ensure the validity of the data, triangulation was carried out by comparing the results of the students' work and the results of their interviews.

3. Result and Discussion

From the new students' mathematical representation test, the ability of verbal, pictorial/visual, and symbolic representations can be identified as presented in Table 2 below:

Table 2. Representation Ability

Category	Verbal		Pictorial/Visual		Symbolic		Total	
	f	%	f	%	f	%	f	%
Very Good	1	2.5	1	2.5	0	0	0	0
Good	4	7.5	3	7.5	4	10	4	10
Moderate	7	17.5	5	12.5	4	10	5	12.5
Poor	6	15	3	7.5	3	7.5	4	10
Very Poor	22	55	28	70	29	72.5	27	67.5
Total	40	100	40	100	40	100	40	100

Table 2 above showed that the new students mathematical representation ability is relatively low. Only 10% of students had the mathematical representation ability in the good category, 12.5% in the moderate category (enough); the largest percentage was in the very poor category, namely 67.5%, and 10% in the poor category. In detail, for verbal skills, there are 2.5% in the very good category, 7.5% in the good category, 17.5% in the moderate category, 15% in the poor category, and 55% in the very poor category. For the ability of visual/pictorial representation, there are 2.5% in the very good category, 7.5% in the good category, 12.5% in the moderate category, 7.5% in the poor category, and 70% in the very poor category. Furthermore, for the symbolic representation ability, 10% is in a good category, 10% in the moderate category, 7.5% in the poor category, and 72.5% in the very poor category.

Furthermore, from the results of the interviews, qualitative analysis with 3 (three) selected subjects, the following results were obtained:

3.1 Subject M.S

In question 1, M.S used the definition of absolute value to describe $\boldsymbol{f(t) = -2|t-10|+20}$. M.S described the function f(t) for $\boldsymbol{t \geq 10}$ and for $\boldsymbol{t < 10}$ separately, then combines the two figures.

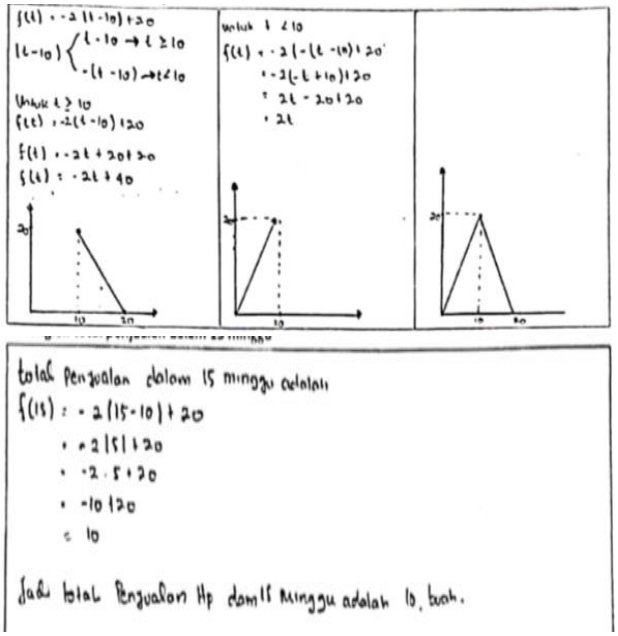


Figure 2. M.S' Solution for Question 1

From the interview, it was known that M.S could correctly explain what was known and asked in the questions. M.S is able to explain the definition of absolute value so that he can use it to elaborate $f(t) = -2|t-10|+20$, namely into $t \geq 10$ and $t < 10$.

But to calculate the total sales in 15 weeks, M.S made a mistake. M.S misinterpreted the question purpose, so M.S was wrong in making mathematical modeling, which is only looking for the value of $f(15)$. In the interview, M.S was able to explain what was asked, namely counting the total sales in 15 weeks, but was doing it wrong again, M.S was only looking for the value of

$f(15)$. When asked what was meant by total sales, then M.S realized the mistake. The following is an excerpt from the interview results:

P	: Why $f(15)$ is sought?
M.S	: in the question, it was asked to calculate the total sales in 15 weeks
P	: What is meant by total sales?
M.S	: Oh, yes, it should be added up
P	: How to add it up?
M.S	: $f(1) + f(2) + f(3) + \cdots + f(15)$
P	: Good, what form or concept that fits it?
M.S	: arithmetic sequence, Sir
P	: What formula should be used to solve this?
M.S	: arithmetic sequence formula, Sir

From the interview above, it can be concluded that M.S made the wrong mathematical modelling and solution because M.S misinterpreted the problem. After being guided through the interview, M.S was able to realize his mistake and explain the concepts and rules that should be used in determining the total sales in 15 weeks.

In question 2, M.S could correctly identify the question, the known, asked and must be done components. M.S was able to make the drawing correctly. It was just incomplete, because M.S did not draw a tangent. However, from the solution and interview, it was known that M.S understood well the steps to solve the problem. When question 2's solution was shown in the interview, M.S realized that the drawing he had made was incomplete, and he could make the outer and inner alliance tangents. From the solutions done by M.S, it was clear that M.S understands and could write the formula to determine the length of the outer alliance tangent correctly and solved question 2 correctly. Therefore, in question 2, it was clear that M.S shows mathematical representation ability, either verbal, visual/pictorial, or symbolic representations.

In question 3, M.S could identify the problem well, M.S could also graph $\boldsymbol{y = x^2 + 4x + 3}$ and $\boldsymbol{y = 2x + 6}$, as well as the area bounded by the two curves. M.S could also write down in detail the steps in making a picture of the two functions. M.S also understood the rules for determining the area bounded by the two functions, namely by using a finite integral. M.S could write the formula correctly, namely $\int_{-3}^{-1}(\boldsymbol{y_1 - y_2})\boldsymbol{dx}$; but in substituting $\boldsymbol{y_1}$ and $\boldsymbol{y_2}$, M.S made a mistake, M.S wrote $\boldsymbol{y_1 = x^2 + 4x + 3}$ and $\boldsymbol{y_2 = 2x + 6}$ instead of $\boldsymbol{y_1 = 2x + 6}$ and $\boldsymbol{y_2 = x^2 + 4x + 3}$. M.S did not pay attention to the position of the image that $\boldsymbol{y_2 > y_1}$ is in the interval [-1, -3], thus a mistake was created in the making of the symbol representation.

As a result, the further solution to determine the area was wrong. M.S also did not make the result interpretation of the integral operation obtained.

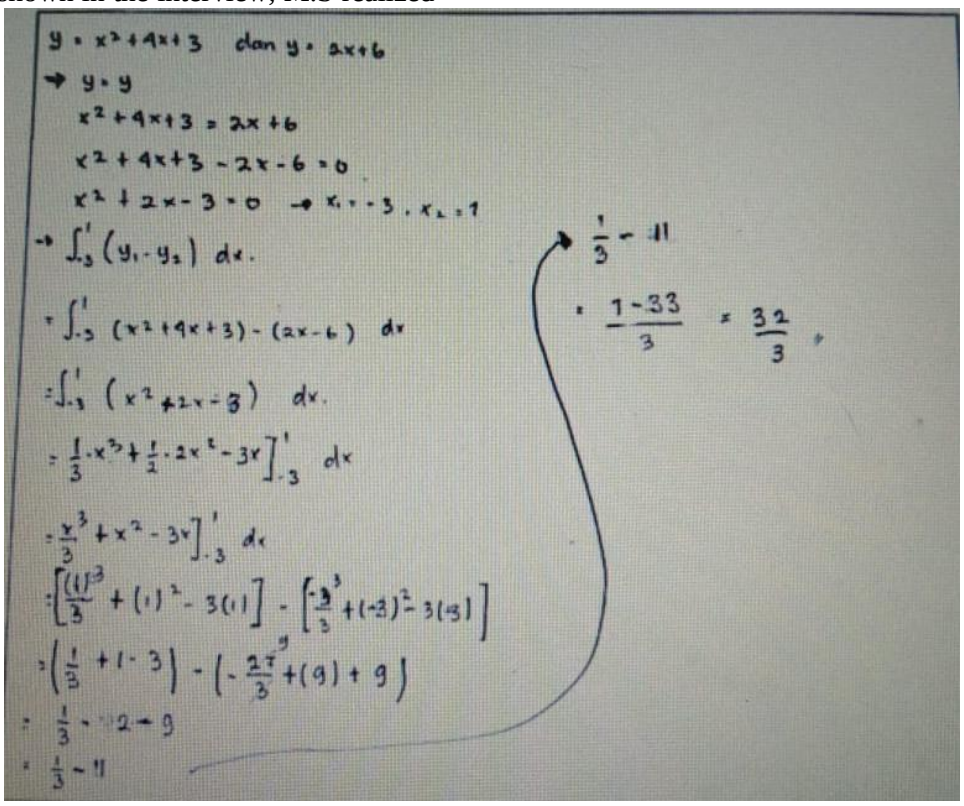


Figure 3. M.S' Solution for Question 3

On the interview, M.S realized the mistakes made in the making of the mathematical model of this problem. Mistakes were made because (1) y_1 and $y_2$were determined based on the order of the functions in the problem, not on the graph position, and (2) there was also an operating error. The following is an excerpt of an interview with M.S.

P	: What to look for in question number 3?
M.S	: The area between the two curves
P	: How to determine the width of the area
M.S	: Integral with a lower bound of -3 and an upper bound of 1 of $(y_1 - y_2)$
P	: Why did you write here that $y_1 = x^2 + 4x + 3$ and $y_2 = 2x + 6$?
M.S	: Just like the question, sir.
P	: What do you mean?
M.S	: in the question it is said that the area is bounded by the curve $y = x^2 + 4x + 3$ and $y = 2x + 6$, so $y_1 = x^2 + 4x + 3$ and $y_2 = 2x + 6$
P	: From these equations, what is the answer you got?
M.S	: $\frac{32}{3}$ Sir
P	: How did you come to that conclusion?
M.S	: (explains as what is written on his/her paper)
P	: Do you think it is correct?
M.S	: (Think quickly) Yes, sir.
P	: Pay attention, please. $\frac{1}{3} - 2 - 9$ (While showing M.S' work) What is the result?
M.S	: (Recalculate) It is $-\frac{32}{3}$, sir.
P	: Can the width of an area be negative?
M.S	: (Think quickly) No, sir.
P	: Then something must be wrong.
M.S	: (Look at his/her paper) Perhaps the $y_1$and $y_2$are swapped.
P	: Then what must you do instead?
M.S	: then it must be $y_1 = 2x + 6$ an $y_1 = x^2 + 4x + 3$

From the description above, it can be concluded that M.S has a relatively good mathematical representation ability. More specifically, M.S's visual/pictorial representation ability was in the very good category, the symbol's representation ability was in the good category, and the verbal representation ability was in the moderate category.

3.2 Subject O.K

In questin 1, O.K did not use the absolute value definition in picture making. O.K also did not make use of $\boldsymbol{t}$ values substitution at the $\boldsymbol{0 \leq t \leq 20}$ interval. O.K was only seek for the $\boldsymbol{f(20) = 40}$ value, then made a graph. As a result, the function $\boldsymbol{f(t) = -2|t - 10| + 20}$ was incomplete. The picture referred to was as follows:

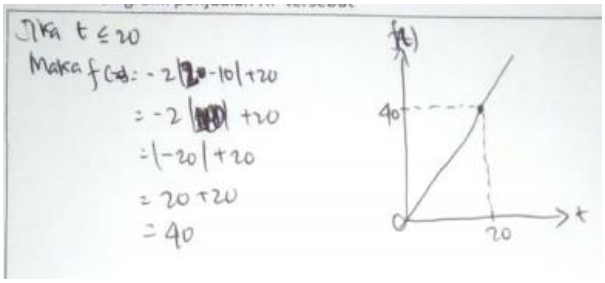


Figure 4. O.K's Solution for Question 1

The mistake made by O.K was due to O.K's lack of understanding of the absolute value concept. From the interview, O.K admitted that O.K forgot the absolute value concept. In creating the function graph, O.K viewed this absolute value function as a linear function. Since $t \leq 20$, then O.K substituted t = 0 and t = 20, so that the coordinates of (0,0) and (20,40) were obtained, the two points were then connected by a straight line.

To determine the total sales in 15 weeks, O.K also made a mistake in representing the symbol, O.K immediately looked for the f(15) value. O.K misinterpreted the asked component in the questions. This was also shown in the results of the following interview:

P	: Try to look back at question number 1 b. What was asked from the question?
O.K	: Calculate the total sales in 15 weeks
P	: The total sales in 15 weeks
O.K	: Yes, Ma'am
P	: Why did you get the result 10?
O.K	: Yes, ma'am, because I immediately replaced the t value with 15 and then looked for the result
P	: It asked for total sales in 15 weeks
OK	: Yes, Ma'am
P	: So, are you sure your answer is correct?
OK	: No, Ma'am
P	: Then, can you redo your answer again?
OK	: Yes, Ma'am. Here's the new answer

O.K then sought for the value of $f(1)$, $f(2), f(3), f(4), \ldots, f(15)$ and added up all those values.

In question 2, O.K understood the purpose of the problem, but he could not make a visual/pictorial representation correctly. O.K understood the outer alliance tanget of two circles, but O.K's drawing was not conscientious, O.K did not pay attention to the specified radius.

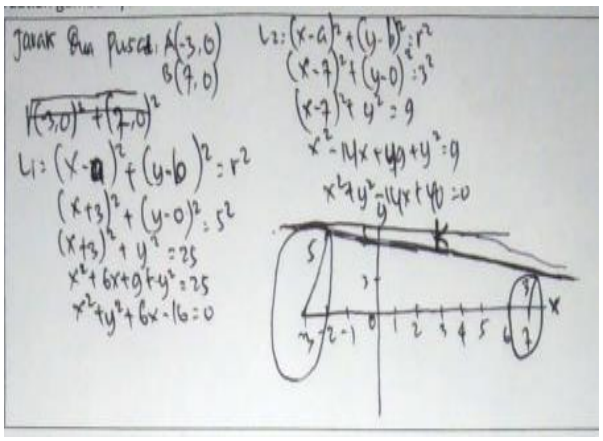
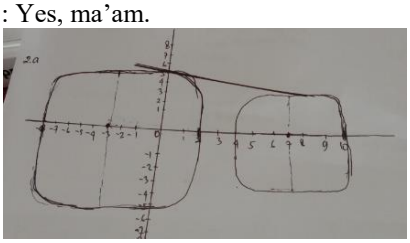


Figure 5. O.K's Solution for Question 2

From the solution above, it was clear that O.K could interpret the known and asked components. O.K made the first circle centered at A (-3,0) with radius 5 and the second circle centered at B (7,0) with radius 3. O.K also drew an alliance tangent of the two circles. O.K could make the visual representation of the given problem. It was just his/her picture that was less accurate. O.K did not notice that the first circle is supposed to intersect the x-axis at (-8,0) and (2,0), likewise the second circle intersects the x-axis at (4,0) and (10,0). During the interview, O.K realized his/her mistake. Below is the interview result:

P : Was your picture correct?
OK : (While looking at his/her picture) I don't know, ma'am.
P : What's the question?
OK : (Read the question)
P : The circle l_1 is centered at …. and the radius is … while the circle l_2 is centered at … dan the radius is …
OK : A (-3,0) and the radius is 5 units, and B (7,0) and the radius is 7 units
P : So, the picture you drew is correct?
OK : No, ma'am.
P : Why did you get it wrong?
OK : I didn't pay attention to the radius of the circle, ma'am.
P : What's the radius?
OK : circle 1's radius is 5 units and circle 2's radius is 3 units. So the picture I drew is wrong.
P : You can draw it again.
OK : Yes, ma'am.



P : Vina your picture is not a circle.
OK : Yes ma'am, I don't have a math compass.
P : …… Why did you draw like that?
OK : Since circle 1 is centered at point A(-3,0) and has a radius of 5 units, then its circle is 5 units away to the left, 5 units to the right, 5 units up and 5 units down. While circle 2 is centered at point B(7,0) and has a radius of 3 units, so circle 2's distance is 3 units to the left, 3 units to the right, 3 units up and 3 units down.

In calculating the alliance tangent length of the two circles, O.K could write the formula correctly, but in the process, O.K made a mistake in substituting the radius of the circles.

In question 3, O.K understood well the known and asked components. O.K understood how to draw linear and quadratic functions. O.K could draw the graph correctly and define the area delimited by the two curves. O.K could also understand the use of definite integrals to determine the area between the two curves; therefore, O.K could make mathematical models correctly. O.K could also substitute the y_1 and y_1 functions correctly. But, O.K made a mistake in the operation, so the end result was wrong.

From the results of the above analysis, it can be concluded that O.K's mathematical representation ability was in the moderate category. Specifically, O.K's visual/pictorial, symbolic, and verbal representation abilities was in the moderate category.

3.3 Subject J.M

In question 1, to draw the function f(t)= -2|t-10|+20, J.M did not use the absolute value definition, but directly used the substitution method:

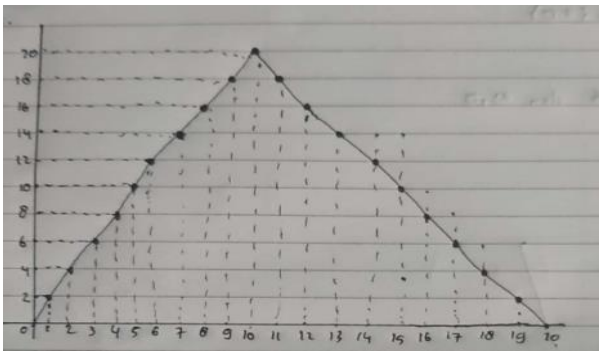


Figure 6. J.M's Solution for Question 1

From the interview, it was known that J.M understood the purpose of the questions, the known and asked components. But J.M did not understand well the concept of absolute value, so to draw a graph, J.M used the substitution of the t value to f(t) to determine the points in the function f(t), then

the points were connected to a curve function f(t) = -2|t-10|+20.

In determining total sales in 15 weeks, J.M did not use the arithmetic series formula, but instead, directly added f(1)+ f(2)+ f(3)+ …+ f(15). In question 2, J.M understood how to draw a circle centered at A (-3,0) with the radius of 5 units, as well as a circle centered at B (7,0) and with a radius of 3 units. Even so, the graph was not smooth, as in the following image.

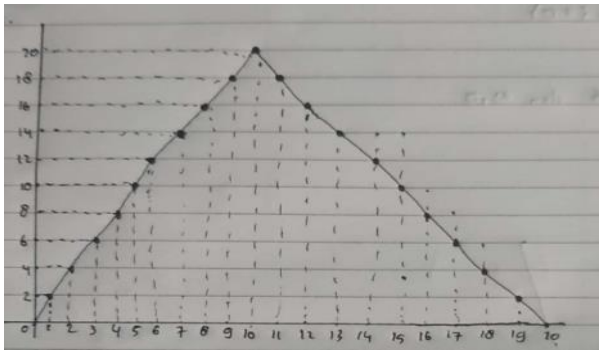


Figure 7. J.M's Solution for Question 2

In that figure, several weaknesses could also be identified, namely (1) the circle was less smooth, so it looks more like an ellipse, and (2) there was no tangent, both the outer and inner tangents. From the interview, J.M did not understand well the concept of tangents, J.M forgot how to calculate the length of the outer and inner tangents.

In question 3, J.M understood that the $y = x^2 + 4x + 3$ and $y = 2x + 6$ curves had to be drawn. He understood that to graph a linear function, the points of intersection of the x-axis and y-axis could be determined, then a straight line connecting the two points was made. However, J.M made a mistake in determining the x-intercept, he got (3, 0), it should be (-3, 0), so J.M drew the graph of $y = 2x + 6$ incorrectly. Likewise in graph of $y = x^2 + 4x + 3$, J.M was wrong in determining the x-intercept, JM obtained the x-intercept, namely (1, 0) and (3,0), it should be (-1, 0) and (-3, 0). Consequently, J.M also erred in graphing the function $y = x^2 + 4x + 3$.

In determining the area bounded by the two curves, J.M was able to determine y_1 and y_2 correctly, but in determining the upper and lower limits, J.M made a mistake. This happened because of errors in graphing the two functions. From the results of J.M's work, it could also be identified that J.M understood the integral rule of $\int x^n dx = \frac{1}{n+1}x^{n+1} + C$ and $\int_a^b f(x)dx = F(b) - F(a)$. However, because J.M made a mistake in determining the upper and lower integral limits, the area obtained was also wrong.

From the results of the above analysis, it could be concluded that J.M's mathematical representation ability is in the low category. Specifically, J.M's visual/pictorial representation ability was in the medium category, J.M's symbolic representation ability was in the very low category, and J.M's verbal representation ability was in a low category.

The results of this study indicated that most new students have relatively low mathematical representation ability. From the tests and interviews results that were enriched with the results of classroom observations at high schools (Sekolah Menengah Atas; SMA).

The first observation was carried out under the theme of relation and function material which was managed by R. The core activities in this study were as follows:

a. The teacher explained the types of relations and how to express them
b. The teacher drew 4 relations in the form of arrow diagrams and directed the students to distinguish between relations and functions.
c. The teacher explained how to write or state relations with pictures and a set of consecutive pairs.
d. The teacher gave questions to work on in groups, students work in groups
e. The teacher directed the class discussion to discuss the students' work.

The second observation was carried out under the theme vector material learning managed by E.T. The core activities in this study were as follows:

a. The teacher briefly explained the material about vectors
b. The teacher explained while writing the properties of vector algebra operations on the blackboard
c. The teacher gave some examples of vector algebra operations.
d. The teacher asked the students to work on the questions selected in the textbook.
e. Students discuss solving problems in groups; the teacher went around each group to monitor their discussions.
f. Groups presented their work and were received responses from other groups.

In grade 1, the teacher pays attention to visual representations by describing relations and functions in the form of arrow diagrams. Also the symbolic representation, by presenting a way of presenting functions in the form of a set of ordered pairs. However, attention to this representation had

not been optimal. In learning, the teacher did not pay attention to variations in presentation from one type of representation to another. For example, a function expressed in the form of an arrow diagram was not converted to a set of consecutive pairs, nor is a function in the form of a set of consecutive pairs to be converted into an arrow diagram or a Cartesian diagram.

In the second lesson, when explaining the concept of vector algebra operations, the teacher did not display a visual representation. The teacher only wrote the algebraic properties of vectors, without making visual representations.

From the description above, it can be identified that two factors caused students' mathematical representation ability as low, namely:

a. Weak prerequisite knowledge. The results of this study showed that 31 students (77.5%) were not able to take pictures correctly. This was due to the relatively low or very low mastery of the absolute value concept, the circle and alliance tangent concept, as well as linear and quadratic functions. In terms of symbolic representation, there are 33 students (82.5%) students whose abilities are low or very low. This was due to the relatively low mastery of absolute value definition, alliance tangent, and the use of integrals in determining the area under the curve. Furthermore, there are 32 students (80%) who have relatively low or very low verbal representation skills. This was due to the inadequate ability of number operations, algebraic operations, and interpretation.

b. Weak learning process. Even though high school high schools/madrasah aliyah/ vocational high schools (SMA/MA/SMK) has implemented a 2013 curriculum that uses a scientific approach to learning, the facts showed that mathematics learning is dominated by teachers using an expository approach. Learning that involves a mathematical representation process has not received attention. The research results of (Ratumanan & Ayal, 2018; Ratumanan & Tetelepta, 2019) showed that there are many weaknesses in learning, namely (1) There is still a tendency for teachers to transfer knowledge, (2) Teachers have not been able to properly facilitate students in observing activities. There has not been any presentation of interesting materials or materials to encourage the observation process to take place properly, (3) The teacher's ability to provoke or motivate students to ask questions is still low; students tend to be silent, are less active in asking questions or expressing opinions, and (4) Reasoning activities (associating) are not going well, teachers are less able to facilitate students in these activities.

4. Conclusion

The results of this study indicated that the mathematics education study program's new students' mathematical representation ability is relatively low. Only 10% of students had the mathematical representation ability in the good category, 12.5% in the moderate category (enough); the largest percentage was in the very poor category, namely 67.5%, and 10% in the poor category. In detail, for verbal skills, there is 2.5% in the very good category, 7.5% in the good category, 17.5% in the moderate category, 15% in the poor category, and 55% in the very poor category. For the ability of visual/pictorial representation, there is 2.5% in the very good category, 7.5% in the good category, 12.5% in the moderate category, 7.5% in the poor category, and 70% in the very poor category. Furthermore, for the symbolic representation ability, 10% is in a good category, 10% in the moderate category, 7.5% in the poor category, and 72.5% in the very poor category.

The low mathematical representation ability is caused by two main things, namely (1) relatively low prerequisite knowledge and (2) mathematics learning that is mostly dominated by teachers; learning does not provide opportunities for students to develop mathematical representation ability.

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KEMAMPUAN NUMERASI PESERTA DIDIK MELALUI IMPLEMENTASI *BLENDED LEARNING* PADA MATERI BILANGAN PECAHAN

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Abstrak

Penelitian ini bertujuan untuk mendeskripsikan kemampuan numerasi peserta didik pada materi bilangan pecahan. Metode penelitian ini adalah jenis penelitian kombinasi. Subjek penelitian sebanyak 31 peserta didik kelas VIIU1 SMP Muhammadiyah 4 Palembang, tetapi dipilih tiga orang sebagai subjek untuk diwawancara. Teknik pengumpulan data pada penelitian ini adalah angket, tes, dan wawancara. Instrumen dalam penelitian ini adalah peneliti dan dibantu dengan angket, soal numerasi, dan pedoman wawancara. Teknik analisis data penelitian ini adalah kuantitatif dan kualitatif dengan tahapan analisis data secara kuantitatif dan dilanjutkan dengan analisis data kualitatif. Hasil penelitian menunjukkan respon peserta didik terhadap pembelajaran *blended learning* sudah baik. Kemampuan numerasi peserta didik setelah diberikan *blended learning* pada bilangan pecahan masih rendah. Hal tersebut terlihat dari hasil tes tertulis yang menunjukkan bahwa peserta didik dengan kategori tinggi hanya 2 orang, kategori sedang 6 orang, dan kategori rendah 23 orang. Berdasarkan hasil tes tertulis dan wawancara yang telah dianalisis berdasarkan dengan indikator kemampuan numerasi, peserta didik mampu menggunakan berbagai macam angka atau simbol matematika dasar terkait dengan matematika dasar dan mampu menganalisis informasi yang ditampilkan dalam berbagai bentuk (grafik, tabel, bagan, diagram). Hal tersebut dapat dilihat dari peserta didik sudah bisa menggunakan konsep dan prosedur pada materi bilangan pecahan. Sebagian besar peserta didik belum mampu menafsirkan hasil analisis untuk memprediksi dan mengambil keputusan, karena peserta didik tidak terbiasa menafsirkan kembali hasil perhitungan ke dalam konteks permasalahan pada soal.

Kata Kunci: bilangan pecahan, *blended learning*, kemampuan numerasi

NUMERACY SKILLS OF STUDENTS THROUGH THE IMPLEMENTATION OF BLENDED LEARNING ON FRACTION NUMBER MATERIALS

Abstract

This study aims to describe the numeracy skills of students in the matter of fractional arithmetic. This research method is a type of combination research. The research subjects were 31 students of class VIIU1 SMP Muhammadiyah 4 Palembang, but three people were chosen as subjects to be interviewed. The data collection techniques in this study were questionnaires, tests, and interviews. The instrument in this study is the researcher and assisted by questionnaires, numeracy questions, and interview guidelines. The data analysis technique of this research is quantitative and qualitative with the stages of quantitative data analysis. The results showed that the response of students to blended learning was good. The numeracy ability of students after being given blended learning on fractional numbers is still low. This can be seen from the results of the written test which showed that there were only 2 students in the high category, 6 in the medium category, and 23 in the low category. Based on the results of written tests and interviews that have been analyzed based on indicators of numeracy skills, students are able to using various numbers or mathematical symbols related to basic mathematics and able to analyze information displayed in various forms (graphs, tables, charts, diagrams). This can be seen in students who are able to use mathematical concepts and procedures on fractional number material. Most of the students are not able interpret the results of the analysis to predict and make decisions, because students are not used to reinterpreting the results of calculations into the context of the problem

Keywords: blended learning, fraction number, numeracy skills

1. Pendahuluan

Kurikulum 2013 menuntut peserta didik untuk mencapai kompetensi yang dibutuhkan pada kecakapan abad 21. Kecakapan abad 21 yang dibutuhkan tersebut ada dalam proses pembelajaran yaitu kecakapan berpikir kritis dan pemecahan masalah, kecakapan berkomunikasi, kecakapan kreativitas dan inovasi, serta kecakapan kolaborasi (Kemdikbud, 2017). Peserta didik diharapkan dapat mencapai kompetensi pada abad 21 melalui penerapan *High Order Thinking Skill* (HOTS) (Ariyana, dkk., 2018). HOTS diperlukan dalam dunia pendidikan untuk menghadapi tantangan global dengan menciptakan sumber daya manusia yang terdidik dan berkualitas di masa depan (Hendarni, dkk., 2019). Kemampuan dasar yang diperlukan dalam penerapan HOTS adalah kemampuan numerasi (Kemdikbud, 2019).

Numerasi adalah kemampuan untuk menerapkan konsep bilangan dan keterampilan operasi hitung di kehidupan sehari-hari (Han, dkk., 2017). Kemampuan numerasi menjadi salah satu cara dalam membantu individu memahami peran matematika di kehidupan sehari-hari, hal tersebut sebagai dasar untuk mempertimbangkan dalam menentukan keputusan yang diambil oleh masyarakat (OECD, 2019). Secara sederhana, numerasi adalah kemampuan peserta didik dalam menerapkan atau mengaplikasikan konsep dan keterampilan dari bilangan untuk mempertimbangkan dan menentukan keputusan di kehidupan sehari-hari.

Numerasi merupakan salah satu kompetensi yang diukur pada Asesmen Kompetensi Minimum (AKM) yang diharapkan menjadi dasar bagi guru, sekolah, dan pemerintah dalam melakukan perbaikan proses belajar mengajar atau memperbaiki mutu pembelajaran. Hal tersebut diharapkan mampu meningkatkan hasil belajar peserta didik dan meningkatkan nilai *Programme for International Student Assessment* (PISA) Indonesia (Kemdikbud, 2020).

Indonesia adalah salah satu negara yang aktif berpartisipasi dalam penilaian peserta didik secara internasional yang diselenggarakan oleh *Organization for Economic Cooperation and Development* (OECD) sejak tahun 2001 yaitu PISA. PISA dilaksanakan setiap tiga tahun untuk menilai peserta didik berusia 15 tahun. PISA berfokus dibidang membaca, matematika, dan sains dengan tujuan untuk memperoleh informasi tentang pengetahuan, keterampilan dan mengukur kemampuan literasi, numerasi dan sains (OECD, 2019). Berdasarkan penilaian PISA terbaru pada tahun 2018 skor yang diperoleh Indonesia sebesar 379 dengan peringkat 72 dari 77 negara (OECD, 2019). Rendahnya hasil penilaian PISA tersebut menggambarkan bahwa kemampuan numerasi peserta didik tergolong rendah. Peserta didik yang memiliki kemampuan numerasi yang baik ketika mampu memecahkan masalah dalam berbagai macam konteks, menganalisis informasi yang ditampilan dalam berbagai bentuk, serta menginterpretasi hasil analisis untuk memprediksi dan membuat kesimpulan atau mengambil keputusan (Mahmud & Pratiwi, 2019; maulidina & Hartatik, 2019).

Salah satu komponen numerasi dalam cakupan matematika adalah bilangan (Han, dkk., 2017). Mengukur kemampuan numerasi dapat dilakukan dengan menggunakan soal numerasi pada materi bilangan, karena numerasi adalah kemampuan peserta didik untuk menerapkan konsep bilangan dan keterampilan operasi hitung di kehidupan sehari-hari. Bilangan merupakan materi yang dipelajari pada semua jenjang pendidikan khususnya sekolah menengah. Salah satu tolak ukur dalam meninjau kurikulum sekolah menengah adalah keterampilan angka yaitu menggunakan, menafsirkan dan membandingkan dalam berbagai bentuk yang terdapat pada materi bilangan pecahan (NCTM, 2007). Bilangan pecahan merupakan salah satu materi matematika pada kurikulum 2013 SMP/MTs yang diajarkan di kelas VII. Hal tersebut berdasarkan Permendikbud Nomor 37 Tahun 2018 yang menyatakan salah satu kompetensi dasar kelas VII yaitu menyelesaikan permasalah yang berkaitan dengan operasi hitung bilangan pecahan.

Beberapa peneliti telah melakukan penelitian yang berkaitan dengan materi bilangan pecahan, namun berdasarkan kenyataannya masih ada peserta didik yang melakukan kesalahan saat menyelesaikan permasalahan. Kesalahan yang dilakukan peserta didik antara lain kesalahan menulis simbol-simbol matematika, kesalahan memahami soal, kesalahan menafsirkan jawaban, kesalahan perhitungan, dan kesalahan tidak menuliskan kesimpulan (Sopamena, 2020). Kesalahan yang dilakukan peserta didik tersebut disebabkan oleh peserta tidak memahami konsep materi bilangan pecahan (Marsela, 2018; Pajrin, 2020; Santi & Sudihartinih, 2019; Badaruddin, dkk., 2016).

Salah satu upaya untuk meningkatkan penilaian peserta didik secara internasional khususnya kemampuan numerasi tersebut hendaknya di sekolah menerapkan pembelajaran dengan menggunakan pendekatan, strategi, dan

metode yang melibatkan peserta didik dapat memahami konsep (Hadi & Novaliyosi, 2019). Berdasarkan penelitian yang dilakukan Nugraha dan Astawa (2019) *blended learning* berpengaruh positif terhadap pemahaman konsep peserta didik. Pembelajaran menggunakan *blended learning* berpengaruh positif ditinjau dari literasi matematika (Aritonang & Safitri, 2021). Menurut Anggraini (2018) salah satu pembelajaran yang dapat membantu peserta didik untuk memahami konsep matematis dengan cara melibatkan peserta didik secara langsung pada saat proses pembelajaran dengan pendekatan *blended learning*. Peserta didik yang diajarkan menggunakan *blended learning* memiliki pemahaman konsep yang baik jika dibandingkan dengan pembelajaran yang tidak menggunakan *blended learning* (Setyaningrum, 2018).

Blended learning secara umum didefinisikan sebagai gabungan dari pembelajaran *face-to-face* atau tatap muka dengan pembelajaran online dengan menggunakan strategi *synchronous* dan *asynchronous* (Chaeruman, 2018). Menurut Garisson & Vaughan (2008) *Blended learning* adalah integrasi dari pembelajaran *face-to-face* atau tatap muka dan pembelajaran online melalui penggunaan teknologi digital untuk mencapai tujuan pendidikan. *Blended learning* adalah pembelajaran tatap muka dan *online* dengan menggunakan strategi *synchronous* dan *asynchronous* dengan menggunakan teknologi untuk mencapai tujuan pendidikan yang telah ditentukan. *Synchronous* adalah jenis interaksi yang dapat dilakukan dengan tatap muka secara langsung seperti melakukan pertemuan pada saat pembelajaran atau bisa dilakukan secara online, sedangkan *asynchronous* adalah jenis interaksi yang tidak harus dilakukan dalam waktu yang bersamaan (Stein & Graham, 2014).

Berdasarkan penjelasan di atas, tujuan dari pelaksanaan penelitian ini untuk menghasilkan deskripsi kemampuan numerasi peserta didik melalui implementasi *blended learning* pada materi bilangan pecahan.

2. Metode Penelitian

Metode penelitian ini adalah jenis penelitian kombinasi (*mixed method)*. Penelitian kombinasi adalah penggabungan antara metode kuantitatif dan metode kualitatif digunakan secara bersama dalam kegiatan penelitian sehingga data yang diperoleh lebih komprehesif, valid, reliabel, dan objektif (Sugiyono, 2017). Tujuan pelaksanaan penelitian untuk menghasilkan deskripsi kemampuan numerasi peserta didik melalui implementasi *blended learning* pada materi bilangan pecahan. Penelitian dilaksanakan di kelas VIIU1 SMP Muhammadiyah 4 Palembang tahun ajaran 2021/2022 yang berjumlah 31 orang. Instrumen penelitian pada penelitian ini yaitu peneliti dibantu dengan soal tes, angket respon dan pedoman wawancara.

Teknik pengumpulan data dalam penelitian ini adalah angket, tes, dan wawancara. Angket digunakan untuk melihat dan mengetahui respon peserta didik setelah dilakukan pembelajaran *blended learning* pada materi bilangan pecahan. Tes yang digunakan berupa soal numerasi berkaitan dengan materi operasi hitung pecahan dengan total 2 soal berbentuk uraian. Wawancara pada penelitian ini menggunakan wawancara semi-terstruktur sesuai dengan pedoman wawancara. Wawancara dilakukan dengan tujuan untuk mengetahui informasi lebih luas dan terbuka tentang cara subjek menyelesaikan soal tes dan menemukan permasalahan.

Penelitian ini dilakukan dengan tahapan persiapan, pelaksanaan, dan analisis data, Tahapan persiapan yaitu observasi, penyusunan dan validasi instrumen penelitian. Validasi intrumen penelitian yaitu kepada *expert review*.

Tahap pelaksanaan terdiri dari pembelajaran menggunakan *blended learning*, pemberian angket respon, tes tertulis, dan wawancara kepada subjek terpilih. Setelah pelaksanaan tes, hasil lembar jawaban peserta didik diperiksa dan dikelompokkan berdasarkan kategori yaitu kemampuan tinggi, sedang, dan rendah. Pengelompokan kemampuan numerasi berdasarkan hasil tes mengacu pada pendapat Ma'sum (dalam Khoirudin, A., dkk, 2017) seperti yang terlihat pada tabel 1.

Tabel 1. Kategori kemampuan numerasi

Kategori	Rentang Nilai
Tinggi	$71 - 100$
Sedang	$41 - 70$
Rendah	≤ 40

Tahap akhir yaitu analisis data. Teknik analisis data yang digunakan dalam penelitian ini adalah kuantitatif dan kualitatif. Tahap analisis data dilakukan secara kuantitatif dan dilanjutkan dengan analisis data secara kualitatif. Data kuantitatif diperoleh dari hasil tes tertulis kemampuan numerasi. Hasil tes tertulis peserta didik pada materi bilangan pecahan diberikan skor sesuai dengan rubrik penskoran dan indikator kemampuan numerasi. Data kuantitatif digunakan sebagai acuan untuk memilih subjek dari masing-masing kategori. Setelah pemilihan subjek sebanyak 3 orang dari masing-masing kategori,

kemudian menganalisis data secara kualitatif. Analisis data tes tertulis secara kualitatif dengan mencocokan hasil tes tertulis dan hasil wawancara sesuai dengan indikator kemampuan numerasi. Indikator kemampuan numerasi terlihat pada tabel 2.

Tabel 2. Indikator kemampuan numerasi

No	Indikator
1	Menggunakan berbagai macam angka dan simbol yang terkait dengan matematika dasar untuk memecahkan masalah dalam berbagai macam konteks kehidupan sehari-hari.
2	Menganalisis informasi yang ditampilkan dalam berbagai bentuk (grafik, tabel, bagan, diagram, dan lain sebagainya).
3	Menafsikan hasil analisis tersebut untuk memprediksi dan mengambil keputusan.

(Han, dkk., 2017)

3. Hasil dan Pembahasan

Proses pembelajaran dilaksanakan sebanyak dua pertemuan menggunakan pembelajaran *blended learning*. Proses pembelajaran di kelas VIIU1 dilakukan oleh peneliti sendiri dengan *blended learning* menggunakan strategi *asynchronous* dan *synchronous. Asynchronous* dilakukan ketika peserta didik terlebih dahulu diberikan materi pelajaran berupa video pembelajaran melalui *youtube*. Pemberian materi pelajaran ini merupakan kegiatan sebelum jam pelajaran terjadwal sehingga peserta didik dapat mengaplikasikan pemahaman pada aktivitas *synchronous*. Setelah diberikan video pembelajaran, dilanjutkan dengan pemberian Lembar Kerja Peserta Didik (LKPD) kepada peserta didik. Kegiatan *asynchronous* ini juga dilakukan setelah kegiatan *synchronous* berlangsung, kegiatan tersebut dilakukan dengan cara memberikan peserta didik latihan soal sebagai evaluasi pembelajaran. *Synchronous* adalah kegiatan pembelajaran yang sudah dijadwalkan. Setelah diberikan materi pelajaran dan LKPD, kemudian peserta didik dan guru berdiskusi tentang materi dan LKPD yang telah dipelajari pada tahap *asynchronous.*

Setelah penerapan pembelajaran menggunakan *blended learning,* peserta didik kelas VIIU1 SMP Muhammadiyah 4 Palembang diberikan lembar angket. Peneliti mengajukan pertanyaan melalui lembar angket yang diberikan secara langsung kepada peserta didik di kelas. Pertanyaan-pertanyaan yang diajukan kepada sudah disusun berdasarkan indikator keefektivitasan pembelajaran, Indikator keefektivitasan pembelajaran tersebut adalah sikap, kemampuan memahami, ketekunan, kesempatan, kualitas pembelajaran (Carroll, 1989). Respon peserta didik berdasarkan jawaban yang telah ditulis oleh peserta didik di lembar angket. Respon peserta didik kemudian dikumpulkan dan disimpulkan berdasarkan dengan indikator yang telah diuraikan di lembar angket. Berikut ini adalah respon peserta didik terhadap pembelajaran *blended learning*.

a. Sikap

Peserta didik tidak takut terhadap pembelajaran yang dilakukan karena materi yang diberikan mudah dipahami dan pembelajarannya lebih menyenangkan, Akan tetapi beberapa peserta didik masih merasa takut pada saat pembelajaran karena menurutnya materinya sangat susah dan peserta didik lebih menyukai pembelajaran dengan tatap muka (*synchronous)*.

b. Kemampuan Memahami

Peserta didik cukup memahami dan mengerti tentang materi operasi hitung bilangan pecahan. Selain itu menurut peserta didik ia cukup memahami materi, namun sering lupa terhadap materi yang diberikan. Peserta didik mengungkapkan beragam pernyataan tentang kesulitan materi operasi hitung bilangan pecahan yang diberikan. Pendapat peserta didik tentang tingkat kesulitan materi antara lain sedang dan sulit. Menurut pendapat peserta didik pembelajarannya sulit karena pembelajaran dilakukan secara daring dan tidak bisa bertanya langsung kepada guru karena waktu pembelajaran yang terbatas.

c. Ketekunan

Peserta didik sebagian besar pernah mengulang kembali video atau materi yang berikan. Menurut pendapat yang disampaikan pada lembar angket, peserta didik mengulang kembali video pembelajaran agar lebih mudah memahami materi yang disampaikan. Akan tetapi, ada beberapa peserta didik yang mengungkapkan pernyataan tidak mengulang video pembelajaran.

Peserta didik mencatat poin-poin penting untuk lebih mudah mengingat, memahami materi, dan mempelajari materi kembali. Peserta didik juga mencari informasi dari sumber lain untuk lebih mudah memahami materi, tetapi sebagian peserta didik mengungkapkan tidak mencari informasi dari sumber lain untuk lebih memahami materi pembelajaran.

d. Kesempatan

Guru memberikan kesempatan kepada masing-masing peserta didik dengan cara menanyakan pendapat tentang materi yang

disampaikan. Selain itu ada beberapa peserta didik berpendapat bahwa guru memberikan kesempatan kepada peserta didik untuk menyampaikan pertanyaan, ide dan pendapat melalui *Whatsapp*. Guru memberikan bimbingan ketika peserta didik yang mengalami kesulitan dengan memberikan penjelasan lagi materi secara rinci dan memberikan kesempatan untuk bertanya secara langsung dan berdiskusi.

e. Kualitas

Peserta didik berpendapat dan mengungkapkan bahwa tidak ada materi yang terlewatkan pada saat proses pembelajaran dan guru menggunakan media pembelajaran berupa video pembelajaran pada setiap pertemuan untuk lebih mudah memahami materi pada saat pertemuan tatap muka (*synchronous)*. Peserta didik berpendapat bahwa mudah dalam mempelajari materi yang diberikan, namun ada juga beberapa peserta didik berpendapat sangat sulit untuk memahami materi pembelajaran.

Setelah pelaksanaan proses pembelajaran menggunakan *blended learning*. Selanjutnya pada pertemuan ketiga yaitu pelaksaaan tes kemampuan numerasi yang terdiri dari dua soal yang berbentuk uraian untuk melihat kemampuan numerasi peserta didik. Tes kemampuan numerasi peserta didik menggunakan materi bilangan pecahan. Soal disusun berdasarkan dengan indikator kemampuan numerasi dan telah divalidasi oleh *expert review*. Soal tes yang digunakan yaitu menggunakan soal numerasi yang disajikan pada gambar 1 dan gambar 2.

Gambar 1. Soal Nomor 1

Gambar 2. Soal Nomor 2

Menentukan nilai tes siswa dengan memberikan skor pada jawaban siswa sesuai dengan rubrik skor yang telah dibuat. Kemudian menurut Rahayu (2018) skor dikonversikan ke dalam rentang nilai (0-100) dengan aturan sebagai berikut.

$$N = \frac{R}{SM} \times 100$$

Keterangan:
N : Nilai siswa
R : Jumlah skor
SM : Jumlah skor maksimum

Nilai tes peserta didik dikelompokan sesuai dengan rentang nilai yang sudah ditentukan. Peneliti menentukan subjek penelitian berdasarkan nilai kemampuan numerasi yang diukur menggunakan interval nilai dari setiap kategori. Kategori kemampuan numerasi peserta didik dapat dilihat pada tabel 3.

Tabel 3. Kategori kemampuan Numerasi Peserta Didik

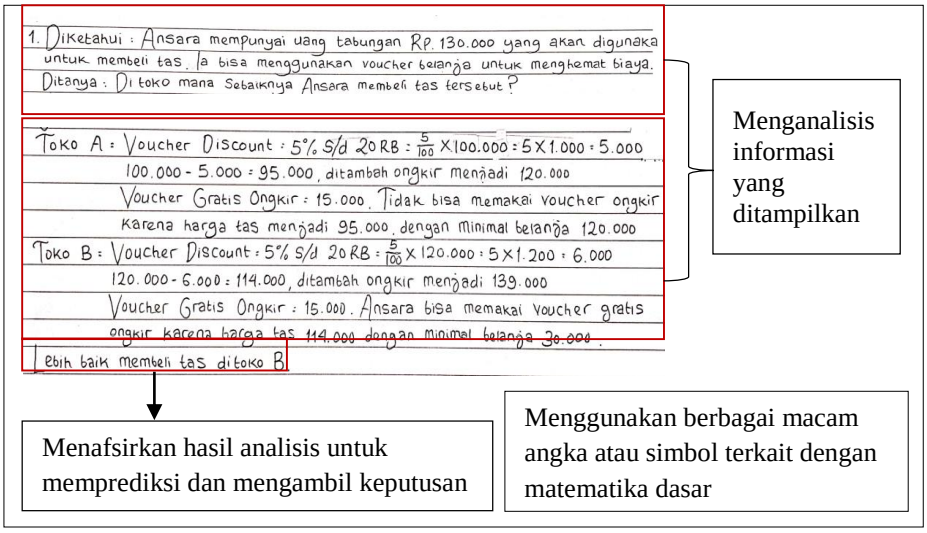
Kategori	Rentang Nilai	Jumlah Peserta didik
Tinggi	$71 - 100$	2
Sedang	$41 - 70$	6
Rendah	≤ 40	23

(Ma'sum, dalam Khoirudin, A., dkk, 2017)

Pemilihan subjek yaitu dipilih masing-masing satu dari setiap kelompok dengan kemampuan berbeda. Pemilihan subjek penlitian digunakan untuk dianalisis secara deskriptif kualitatif kemunculan indikator dari masing-masing kelompok. Kemampuan tinggi dipilih 1 subjek yaitu T1, kemampuan sedang dipilih 1 subjek yaitu S1, dan kemampuan rendah dipilih 1 subjek yaitu R1. Kemampuan numerasi peserta didik pada setiap kategori adalah sebagai berikut.

3.1 Kemampuan Tinggi (T1)

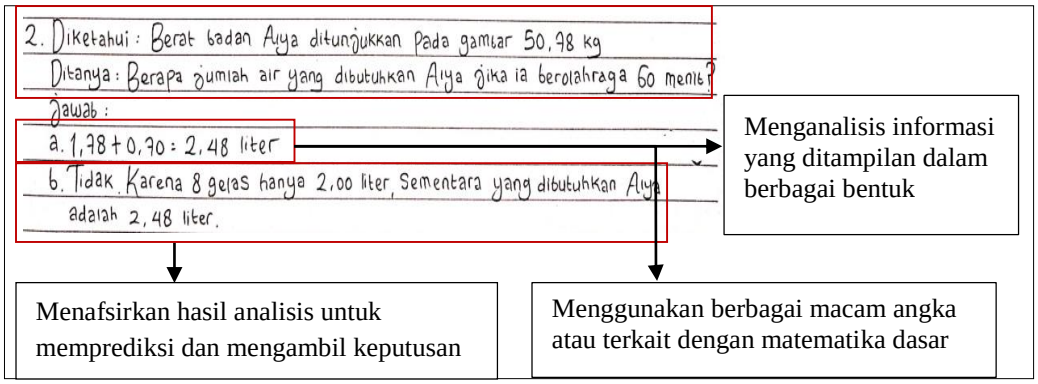
T1 menyelesaikan permasalahan pada soal dengan baik dapat dilihat dari ia memenuhi ketiga indikator kemampuan numerasi. Jawaban subjek T1 nomor 1 terlihat pada gambar 3.



Gambar 3. Jawaban subjek T1 nomor 1

Berdasarkan jawaban T1 nomor 1 pada gambar 3 yang telah dituliskan. T1 sudah memenuhi indikator yaitu menggunakan angka atau simbol terkait dengan matematika dasar, menganalisis informasi yang ditampilkan dalam berbagai bentuk, dan menginterpretasi hasil analisis untuk membuat kesimpulan dari perhitungan yang sudah dilakukan. T1 masih keliru dalam melakukan perhitungan menggunakan voucher gratis ongkir di toko B dan melakukan kesalahan pada pengurangan 139.000 dengan 15.000, sehingga kesimpulan yang dituliskan T1 menjadi kurang tepat. Kesalahan penulisan kesimpulan karena peserta didik melakukan kesalahan pada proses perhitungan (Murtiyasa & Wulandari, 2020). Hal tersebut juga diperkuat dengan dialog wawancara dengan T1 di bawah ini:

P : Bagaimana dengan toko B ?
T1 : Voucher discount 5 per seratus dikali 120.000 sama dengan 6.000, 120.000 – 6.000 sama dengan 114.000 ditambah ongkir menjadi 139.000. Voucher ongkir 15.000, ansara bisa memakai voucher gratis ongkir karena harga tas menjadi 114.000 dengan minimal belanja 30.000
P : jadi kesimpulannya apa ?
T1 : lebih baik membeli tas di toko B



Gambar 4. Jawaban subjek T1 nomor 2

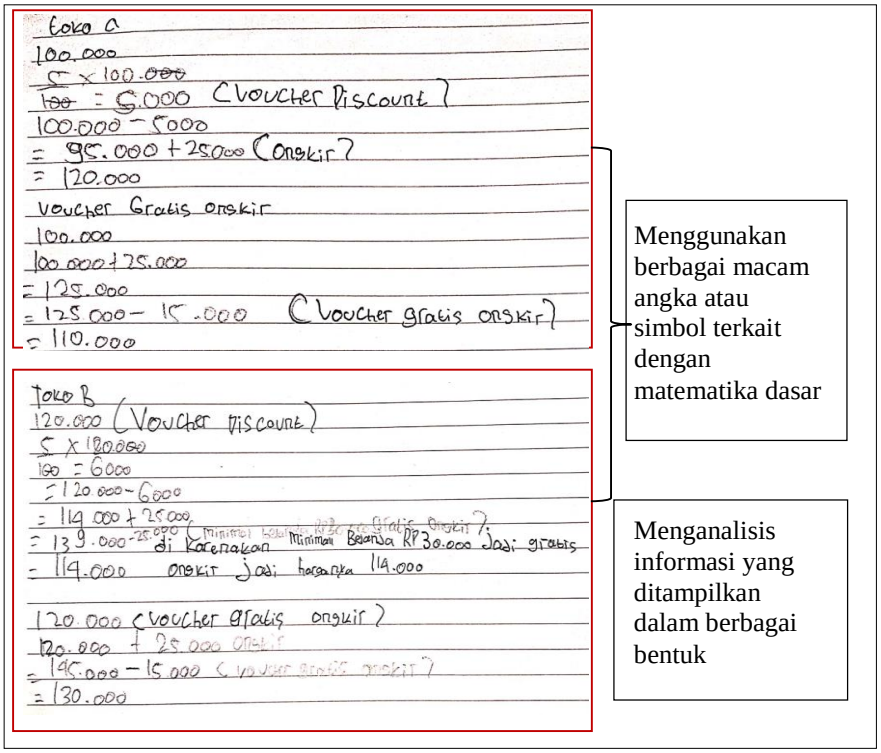
T1 menyelesaikan soal nomor 2 yang terlihat pada gambar 4 dengan baik, karena T1 mampu menggunakan berbagai macam angka atau simbol matematika yang terkait dengan matematika dasar. T1 bisa menggunakan konsep pecahan dalam menyelesaikan permasalahan. Menurut (Jumaini & dkk, 2021) *blended learning* bisa diterapkan untuk pengembangan pemahaman konsep peserta didik. T1 dapat menentukan aspek-aspek yang berhubungan dengan masalah kontekstual terkait dengan konsep dan prosedur matematika. Hal tersebut karena T1 mengikuti proses pembelajaran *blended learning* dengan menggunakan strategi synchronous dan asynchronous dengan sangat baik, sehingga pemahaman konsep bilangan pecahan sudah baik untuk menyelesaikan suatu permasalahan. Hal tersebut juga sejalan dengan Setyaningrum (2018) yang menyatakan peserta didik yang diajarkan menggunakan *blended learning* memiliki pemahaman konseptual yang baik.

T1 juga memenuhi indikator menganalisis informasi yang ditampilkan dalam bentuk gambar serta dapat menafsirkan hasil analisis yang sudah dilakukan untuk menentukan kesimpulan atau mengambil keputusan. Hal tersebut dapat dilihat dari penyelesaian permasalahan yang dituliskan T1 pada gambar 4. T1 mampu menerapkan fakta, aturan, algoritma dalam menemukan solusi dan dapat menerapkan strategi untuk memecahkan masalah, akan tetapi perhitungan yang dituliskan T1 pada jumlah air yang dibutuhkan Alya kurang tepat, hal tersebut disebabkan kesalahan dalam melakukan perhitungan pada pembagian bilangan desimal. Hasil perhitungan yang benar seharusnya adalah 1,69. Sejalan dengan penelitian Zuhri, & dkk (2020) menyatakan peserta didik belum mampu menghitung pembagian desimal dengan benar. Hal tersebut juga dapat dilihat dari dialog wawancara bersama subjek T1 di bawah ini:

P	: Coba T1 jelaskan jawaban yang sudah dituliskan T1
T1	: 1,78 ditambah 0,70 sama dengan 2,48. 1, 78 ini berat badan Alya dibagi dengan 30, 0,70 ini 0,35 dikali 2. aktivitas fisik selama 30 menit sama dengan 0,35 liter, karena Alya berolahraga selama 60 menit, jadi dikali 2.
P	: Jadi kesimpulannya apa nak?
T1	: Slogan tersebut tidak cocok, karena 8 gelas hanya 2 liter, sementara yang dibutuhkan Alva adalah 2,48 liter

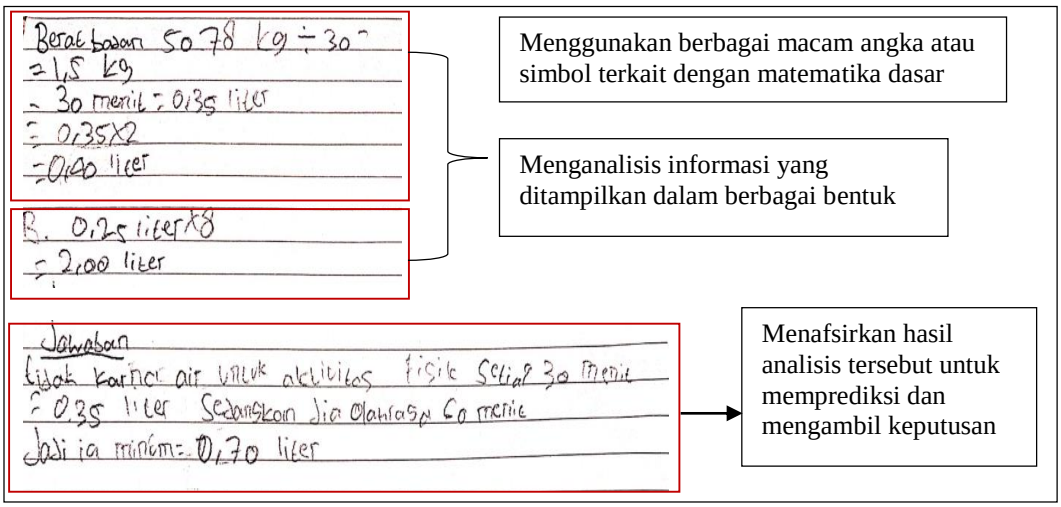
3.2 Kemampuan Sedang (S1)

Berdasarkan jawaban yang sudah dituliskan S1 pada gambar 5, S1 sudah bisa menggunakan angka atau simbol yang berkaitan matematika dasar dan dapat menganalisis informasi yang ditampilkan dalam bentuk gambar. Penyelesaian soal oleh subjek S1 ditunjukkan pada gambar 5 berikut ini.



Gambar 5. Jawaban Subjek S1 Nomor 1

S1 tidak memenuhi indikator ketiga yaitu menginterpretasi hasil analisis dan menentukan kesimpulan untuk mengambil keputusan. Mahmud dan Pratiwi (2019) menyatakan bahwa literasi numerasi peserta didik pada pemecahan masalah dalam konteks kehidupan sehari-sehari salah satunya yaitu kesulitan dalam menentukan kesimpulan dari suatu permasalahan. Analisis informasi yang sudah dilakukan oleh S1 kurang tepat dalam merancang dan menerapkan strategi untuk menemukan solusi dari suatu permasalahan. Hal tersebut juga sejalan dengan penelitian Sari, Zulkardi, & Darmawijoyo (2021) yang menyatakan peserta didik melakukan kesalahan dalam menganalisis informasi disebabkan oleh kesalahan dalam memahami soal dan mengartikan permasalahan.



Gambar 6. Jawaban Subjek S1 Nomor 2

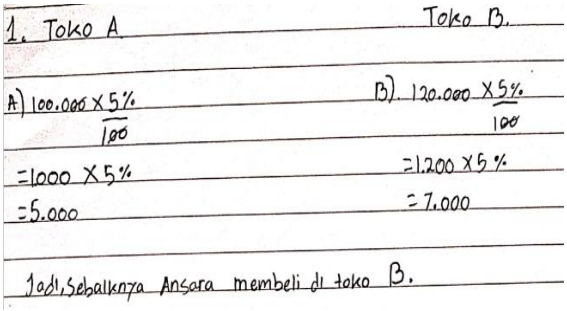
Gambar 6 memperlihatkan jawaban soal nomor 2 subjek S1, S1 sudah menggunakan angka atau simbol matematika dengan baik terkait dengan matematika dasar. Hal tersebut berbeda dengan penelitian Sopamena (2020) yang menyatakan peserta didik masih melakukan kesalahan pada saat menyelesaikan masalah pada materi pecahan yaitu kesalahan menulis simbol-

simbol matematika, kesalahaan memahami soal, kesalahan menafsirkan jawaban, kesalahan perhitungan, dan kesalahan tidak menuliskan kesimpulan. S1 menafsirkan hasil analisis untuk memprediksi dan mengambil keputusan, akan tetapi kurang dalam menganalisis informasi sehingga kesimpulan yang telah dibuat subjek S1 tersebut kurang tepat. Berbeda dengan penelitian yang dilakukan Maulidina dan Hartatik (2019) peserta didik mampu memenuhi indikator menganalisis informasi yang ditampilkan dalam berbagai bentuk (grafik, tabel, bagan, diagram). S1 tidak mengevaluasi kewajaran solusi matematika dalam konteks masalah dan tidak bisa menghubungkan variabel yang ditampilkan dalam bentuk gambar. Hidayatulloh, Fuady, & Walida (2021) juga menyatakan peserta didik kurang maksimal dalam menguraikan jawaban ke dalam dunia nyata seperti penulisan kesimpulan dan mengevaluasi solusi ke dalam konteks dunia nyata. Kemudian S1 juga tidak tepat dalam menentukan kebutuhan air yang dibutuhkan Alya dengan tidak menjumlahan tambahan air untuk tambahan aktivitas fisik setiap 30 menit sama dengan 0,35 liter. Hal tersebut juga dapat dilihat dari wawancara bersama S1 di bawah ini.

S1 : Berat badan alya kan 50,78 kg dibagi 30 bu
P : Jadi berapa S1? 1,5 kg ini ya?
S1 : Ya
P : Kemudian ini untuk 60 menit ya 0,35 x 2?
S1 : Ya
P : Bagaimanan dengan nomor b?
S1 : 0,25 liter x 8, soalnya tadi untuk 8 gelas air kan bu, jadi dikali 8
P : Jadi dapat 2 liter ya?
S1 : Iya bu
P : Bagaimana kesimpulannya?
S1 : Tidak cocok, karena air untuk aktivitas fisik 30 menit 0,35 sedangkan ia kan berolahraga 60 menit, jadi ia minum 0,70 liter

3.3 Kemampuan Rendah (R1)

Berdasarkan dengan jawaban yang sudah dituliskan R1 pada gambar 7, R1 memenuhi indikator menggunakan berbagai macam angka terkait dengan matematika dasar untuk memecahkan permasalahan nomor 1.

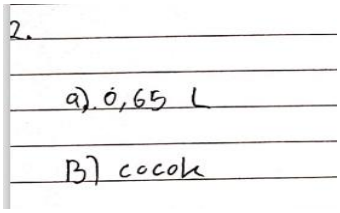


Gambar 7. Jawaban subjek R1 nomor 1

R1 masih belum bisa menggunakan konsep perhitungan bilangan pecahan. Berdasarkan dialog bersama subjek R1 di atas, ia hanya mencari potongan harganya saja, R1 tidak menentukan harga tas setelah diskon. Hal tersebut juga diperjelas dengan dialog wawancara bersama subjek R1.

P : Coba R1 jelaskan apa yang R1 kerjakan?
R1 : Toko A kan 100.000 dikali discount 5 % per 100 disilang nolnya 1000 dikali 5 persen 5000,
P : 5 % itu jadi berapa R1 kalau diubah menjadi pecahan biasa?
R1 : Tidak tahu bu
P : Sekarang yang toko B?
R1 : Toko B 120.000 dikali 5% tadi yang discount 5 per seratus, 1.200 dikali 5 persen jadi 7.000
P : 1.200 dikali 5 itu benar 7.000?
R1 : Iya benar bu 7.000

Jawaban subjek R1 pada soal nomor 2 yang terlihat pada gambar 8 di bawah ini.



Gambar 8. Jawaban subjek R1 nomor 2

R1 tidak memenuhi ketiga indikator kemampuan numerasi, yaitu tidak menggunakan berbagai macam angka atau simbol terkait dengan matematika dasar, tidak menganalisis informasi dengan baik untuk menyelesaikan permasalahan, sehingga untuk indikator menginterpretasi hasil analisis untuk memprediksi dan mengambil keputusan tidak terpenuhi. Hal tersebut dikarenakan subjek R1 tidak mengikuti pembelajaran *blended learning* dengan baik. Pembelajaran menggunakan *blended learning* seharusnya mengikuti pembelajaran *asynchronous* dan *synchronous*, akan tetapi subjek R1 tidak melaksanakan pembelajaran *asynchrnous* sehingga pada saaat pembelajaran *synchronous* berlangsung subjek R1 tidak memahami materi pembelajaran yang diberikan pada tahap *asynchronous*.

4. Kesimpulan

Kemampuan numerasi peserta didik setelah diberikan *blended learning* pada bilangan pecahan masih rendah. Hal tersebut terlihat dari hasil tes yang menunjukkan bahwa peserta didik dengan kategori tinggi hanya 2 orang, kategori sedang 6

orang, dan kategori rendah 23 orang. Peserta didik dengan kategori sedang dan rendah banyak melakukan kesalahan menggunakan konsep pecahan dan kesalahan melakukan perhitungan, hal tersebut menyebabkan peserta didik salah dalam menuliskan penyelesaian.

Kemampuan numerasi peserta didik ketika dianalisis sesuai dengan kemunculan indikator sudah baik. Peserta didik mampu menggunakan berbagai macam angka atau simbol matematika dasar terkait dengan matematika dasar dan mampu menganalisis informasi yang ditampilkan dalam berbagai bentuk, hal tersebut dilihat dari peserta didik sudah bisa menggunakan konsep dan prosedur matematis pada materi bilangan pecahan. Peserta didik belum terbiasa menafsirkan hasil analisis untuk memprediksi dan mengambil keputusan. Hal tersebut karena peserta didik tidak terbiasa menafsirkan kembali hasil perhitungan ke dalam konteks permasalahan pada soal.

Peserta didik dengan kemampuan rendah tidak bisa menggunakan konsep bilangan pecahan dan tidak melakukan perhitungan dengan tepat pada pada saat menyelesaikan permasalahan. Hal tersebut disebabkan peserta didik dengan kemampuan rendah tidak mengikuti proses pembelajaran *blended learning* dengan baik. Peserta didik dengan kategori kemampuan rendah tidak mengikuti pembelajaran *asynchronous* sehingga peserta didik tidak terlibat secara langsung pada tahap pembelajaran *synchronous.*

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