

Analysis of Numeracy Ability by Learning Style Among Tenth-Grade Students at SMA YPPK Teruna Bakti Jayapura

¹ Iman Al Amin Wahyudi, ² Dewi Kristika Findia Ning Tyas, ³ Elsi Sirampun

^{1 2 3} Mathematics Education Study Program, Faculty of Teacher Training and Education

Universitas Cenderawasih, Jayapura, Indonesia

Email: iman.nimbo@gmail.com

Corresponding author: iman.nimbo@gmail.com

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Abstract

This study aims to describe the numeracy ability of tenth-grade students at SMA YPPK Teruna Bakti Jayapura in relation to their visual learning style, auditory learning style, and kinesthetic learning style on the topic of the System of Linear Equations in Three Variables (SPLTV). A descriptive qualitative approach was employed. The research subjects consisted of three students selected through purposive sampling to represent each learning style. Data were collected through a learning-style questionnaire (VAK model), a written test based on SPLTV problems, semi-structured interviews, and documentation, with data validity ensured through methodological and source triangulation. Data were analyzed through data reduction, data display, and conclusion drawing. The results showed that all three subjects were in the high numeracy ability category, with scores of 94 (visual), 90 (auditory), and 92 (kinesthetic). The subject with a visual learning style excelled in representation and structured problem-solving steps; the subject with an auditory learning style excelled in mathematization and verbal explanation but was weaker in written communication; whereas the subject with a kinesthetic learning style was able to construct mathematical models well but needed to improve accuracy. Overall, the class numeracy ability distribution showed that 43.48% of students were in the high category, 13.04% in the medium category, and 43.48% in the low category. These findings indicate that learning style is not the only determinant of numeracy ability.

Article information

Keywords:

kemampuan numerasi, gaya belajar, SPLTV

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan kemampuan numerasi peserta didik kelas X SMA YPPK Teruna Bakti Jayapura ditinjau dari gaya belajar visual, auditorial, dan kinestetik pada materi Sistem Persamaan Linear Tiga Variabel (SPLTV). Penelitian ini menggunakan pendekatan deskriptif kualitatif. Subjek penelitian terdiri atas tiga peserta didik yang dipilih secara purposive sampling untuk mewakili masing-masing gaya belajar. Data dikumpulkan melalui angket gaya belajar (model VAK), tes tertulis berbasis soal SPLTV, wawancara semiterstruktur, dan dokumentasi, kemudian diuji keabsahannya menggunakan triangulasi teknik dan sumber. Analisis data dilakukan melalui reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa ketiga subjek berada pada kategori kemampuan numerasi tinggi, dengan skor 94 (visual), 90 (auditorial), dan 92 (kinestetik). Subjek visual unggul dalam representasi dan penyajian langkah penyelesaian yang terstruktur; subjek auditorial unggul dalam matematisasi dan penjelasan lisan namun lemah dalam komunikasi tertulis; sedangkan subjek kinestetik mampu menyusun model matematika dengan baik tetapi perlu meningkatkan ketelitian. Secara keseluruhan, distribusi kemampuan numerasi kelas menunjukkan 43,48% peserta didik berkategori tinggi, 13,04% sedang, dan 43,48% rendah. Temuan ini mengindikasikan bahwa gaya belajar bukan satu-satunya faktor penentu kemampuan numerasi, melainkan juga dipengaruhi oleh penguasaan konsep, kemampuan awal, kebiasaan belajar, dan ketelitian peserta didik.

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✉ **Corresponding Author:** (1) Iman Al Amin Wahyudi, (2) Fakultas Keguruan dan Ilmu Pendidikan (3) Universitas Cenderawasih, Jayapura, (4) Jayapura, Indonesia, Indonesia, (5) Email: iman.nimbo@gmail.com

1. Introduction

Education is a learning process intended to transform individuals' ways of thinking in addressing everyday problems while expanding their mastery of theory and skills in accordance with applicable curriculum policies (Sari, 2022). As demands for higher-order thinking skills increase, mathematics learning in Indonesia needs to shift from merely memorizing concepts toward developing the ability to analyze and solve real-world problems logically (Utami, 2024). This ability is closely related to numeracy literacy, which has been shown to have a significant relationship with students' ability to solve mathematics problems (Zulfa, 2023).

Numeracy is the ability to use numbers, symbols, and basic mathematical concepts to solve everyday problems and analyze data presented in various formats, such as graphs, tables, and charts (Rachmawati, 2023). This ability extends far beyond mere calculation because it involves reasoning, argumentation, and mathematical representation, making it one of the main components assessed in the National Assessment (Asesmen Nasional) since 2021.

In fact, Indonesian students' numeracy ability remains relatively low. The 2022 Programme for International Student Assessment (PISA) results showed that Indonesian students' mean mathematics score was only 366, substantially below the OECD average of 472, and that only 18% of Indonesian students attained Level 2 or above (OECD, 2023). National studies reinforce this picture; Qoriyani and Widiyastuti (2023) found that only 53.33% of students were categorized as proficient in solving context-based numeracy problems.

Low numeracy ability is influenced by internal factors, such as foundational mathematics

ability, motivation, interest, self-confidence, and learning style, as well as external factors, such as the quality of instruction and environmental support (Cakranegara, 2024; OECD, 2023). A learning style is a characteristic way in which students acquire, organize, and process information to facilitate effective learning (Evasufi, 2024) and is generally categorized as visual, auditory, or kinesthetic (Putri, 2021). Karmeliana and Ladyawati (2023) showed that students with a visual learning style tend to produce systematic numeracy responses; those with an auditory learning style excel at oral explanations despite less organized writing; and those with a kinesthetic learning style work more quickly but with less accuracy.

At the senior high school level, the System of Linear Equations in Three Variables (SPLTV) is a foundational topic in tenth-grade numeracy that requires an understanding of relationships among variables, algebraic manipulation, and systematic solution strategies (Lubis, 2021). It is also relevant to contextual problems such as production calculations and simple financial analysis (Hidayanto & Lisrahmat, 2023). At SMA YPPK Teruna Bakti, the diversity of learning styles among tenth-grade students presents both a challenge and an opportunity in SPLTV instruction, as each learning style requires a different approach to presenting the material (Putri, 2022).

Based on the foregoing, this study was conducted to describe the high numeracy ability of tenth-grade students at SMA YPPK Teruna Bakti Jayapura in terms of visual, auditory, and kinesthetic learning styles in the context of SPLTV. This study is expected to provide in-depth insights into how learning styles influence the ways students understand, model, and solve numeracy problems, while also serving as a basis for recommendations

for more adaptive instruction.

2. Methods

Research design

This study employed a descriptive qualitative approach to describe students' numeracy ability based on visual, auditory, and kinesthetic learning styles. According to Creswell (2014), qualitative research is used to investigate and understand, in detail and depth, meanings derived from social or human issues.

Research setting, time, and participants

The study was conducted at SMA YPPK Teruna Bakti, Jayapura City, Papua Province, during the second semester of the 2025/2026 academic year, from September 2025 to June 2026. The initial participants were 23 students in class X-E1. Using purposive sampling, three primary participants representing the high numeracy ability category within each learning style were selected: EP (visual), VK (auditory), and FY (kinesthetic).

Instruments and data collection techniques

The research instruments consisted of the researcher as the primary instrument and supporting instruments, including a VAK model learning-style questionnaire validated by Prihatin (2014), a written test comprising three contextual constructed-response SPLTV problems, and a semi-structured interview guide. Data were collected through the learning-style questionnaire, a written numeracy ability test, interviews, and documentation. The numeracy test was assessed using six indicators: communication, representation, mathematization, use of symbolic language and operations, selection of problem-solving strategies, and reasoning and argumentation (Karmeliana & Ladyawati, 2023).

Trustworthiness and data analysis techniques

Data trustworthiness was examined through methodological and source triangulation, namely by comparing test results, interviews, observations, and documentation, as well as across study participants. Data analysis followed the stages of data reduction, data display, and conclusion drawing (Lailani, 2022), with numeracy test scores classified as high ($80 < \text{score} \leq 100$), medium ($60 < \text{score} \leq 80$), and low ($0 \leq \text{score} \leq 60$).

3. Results and discussion

Learning-style questionnaire and numeracy ability test results

The learning-style questionnaire results for 23 students in class X-E1 showed that 10 students (43.48%) had a visual learning style tendency, 3 students (13.04%) had an auditory learning style tendency, and 10 students (43.48%) had a kinesthetic learning style tendency. The numeracy ability test results showed scores ranging from 8 to 94, with 10 students (43.48%) categorized as high, 3 students (13.04%) as medium, and 10 students (43.48%) as low. Problem 1 had the highest achievement percentage (62.90%), followed by Problem 2 (60.43%), whereas Problem 3 had the lowest achievement percentage (50.58%) because it required interpretation of calculation results across all possible contextual responses rather than merely solving the mathematical model.

Table 1. Distribution of learning styles and numeracy ability categories among students in class X-E1

Table 1 shows that the visual group was dominated by the high category (7 of 10 students), the auditory group also tended to be in the high category (2 of 3 students), whereas the kinesthetic group was dominated by the low category (9 of 10 students). Nevertheless, the presence of one kinesthetic subject in the high category indicates that learning style is not the sole determinant of numeracy ability but is also influenced by students' conceptual

Learning style	Number (n)	High	Medium	Low
Visual	10 (43.48%)	7	2	1
Auditory learning style	3 (13.04%)	2	1	0
Kinesthetic learning style	10 (43.48%)	1	0	9
Total	23 (100%)	10	3	10

mastery, prior ability, and accuracy, in line with Marlina and Muhdar (2024), who stated that numeracy ability is more strongly determined by students' prior readiness and logical thinking patterns.

Based on the high category in each group, three primary research subjects were selected, as presented in Table 2.

Table 2. Numeracy ability scores of the research subjects

Subject	Learning style	Test score	Category
EP	Visual learning style	94	High
VK	Auditory learning style	90	High
FY	Kinesthetic learning style	92	High

Numeracy ability of the visual subject

Subject EP obtained a score of 94 and was able to meet nearly all indicators of numeracy ability across the three problems. In the problem involving the construction of a model for ribbon length, EP completely identified the known and requested information, used consistent variables, and efficiently selected a combination of substitution and elimination methods. This finding is consistent with Utami et al. (2024), who showed that students with a visual learning style excel in systematic calculation and pattern recognition. EP's shortcomings were evident in the ticket-price and game-duration problems, in which EP did not provide a complete final conclusion or examine all possible contextual answers, although EP was able to explain them accurately orally during the interview. This indicates that visual strengths in structured written representation are not always accompanied by completeness in interpreting the final results.

Numeracy ability of the auditory subject

Subject VK obtained a score of 90 and demonstrated strong mastery of mathematization, symbolic operations, and the selection of solution strategies, including the ability to perform operations involving fractions and simplify equations. However, VK tended not to explicitly write variable definitions or final conclusions on the answer sheet. VK's understanding became clearer when given the opportunity to explain the process orally during the interview, consistent with auditory characteristics that rely on listening and verbal communication (Karmeliana & Ladyawati, 2023). This finding confirms that written responses alone may provide an incomplete picture of auditory students' understanding.

Numeracy ability of the kinesthetic subject

Subject FY obtained a score of 92 and was able to construct a mathematical model, select an appropriate substitution strategy, and explain the rationale for each step of the solution, demonstrating reasoning rather than mere trial and error. FY's shortcomings were primarily related to accuracy, such as failing to include units, omitting verification of the results, and not exploring all alternative answers in the game-duration problem. This finding is consistent with Utami et al. (2024), who stated that students with a kinesthetic learning style may have good numeracy ability but still be weak in identifying the core pattern of a problem.

Similarities, differences, and learning implications

All three subjects demonstrated similarities in their mastery of SPLTV concepts: they were able to construct mathematical models, use substitution or elimination, and provide reasons for the strategies they selected. The most prominent differences concerned how they communicated the solution process: the visual subject excelled in structured written presentation, the auditory subject excelled in oral explanations, and the kinesthetic subject excelled in acting quickly but needed to improve accuracy. The differences observed in the third problem—which required interpreting all possible answers—indicate that the procedural ability to solve SPLTV problems is not necessarily accompanied by the ability to interpret results contextually, consistent with Ladyawati and Maftuh (2025).

These findings imply that SPLTV-based numeracy instruction should give balanced attention to the stages of understanding the problem, constructing a model, selecting a strategy, checking the results, and drawing conclusions. Students with a visual learning style can be supported through tables,

diagrams, and structured solution steps; students with an auditory learning style through discussions and activities involving oral explanations before writing; and students with a kinesthetic learning style through hands-on activities, such as transaction simulations or variable cards, while also being habituated to recheck their work.

4. Conclusion

Students with high numeracy ability across the three learning styles were all able to understand problems, construct mathematical models, and appropriately select strategies for solving SPLTV problems, but they demonstrated different patterns in presenting and communicating their results. Students with a visual learning style excelled in structured written presentation but did not always provide complete final conclusions; students with an auditory learning style excelled in oral explanations but were weak in written representation; whereas students with a kinesthetic learning style acted quickly and actively but needed to improve the accuracy and completeness of their answers. Thus, learning style influences how students process and communicate numeracy information, but it is not the only factor determining students' level of numeracy ability.

Teachers are recommended to adapt SPLTV instructional approaches to the diversity of students' learning styles while also habituating students to a final answer-checking step. Students are recommended to identify their respective learning styles and become accustomed to writing the solution process in full. Schools are recommended to facilitate teacher training in differentiated instructional strategies. Future research is recommended to expand the scope of subjects, educational levels, and materials and may use quantitative or mixed-methods approaches to

statistically examine the effect of learning styles on numeracy ability.

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