



Cognitive and Emotional Engagement in Stoichiometry Learning: A Correlational Study

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Abstract

The purpose of this study was to measure the strength of the relationship between students' cognitive and emotional engagement in stoichiometry learning. This research employed a descriptive quantitative approach, including descriptive analysis and correlational analysis. The participants consisted of 70 eleventh-grade students enrolled in the science-track chemistry course, drawn from two classes: Grade XI Chemistry 1 and Grade XI Chemistry 2. Data were collected using a four-point Likert-scale questionnaire measuring cognitive and emotional engagement, as well as through observations, semi-structured interviews, and documentation. The results showed that: (1) students' cognitive engagement was categorized as very high (13%), high (34%), low (43%), and very low (10%); (2) students' emotional engagement was categorized as very high (20%), high (16%), low (53%), and very low (11%); (3) the correlation test between cognitive and emotional engagement was significant ($0.000 < 0.05$), indicating a positive relationship; and (4) the strength of the relationship between cognitive and emotional engagement, as indicated by Spearman's rho, was 0.447, which represents a moderate level of correlation. Therefore, higher cognitive engagement is associated with higher emotional engagement, and vice versa.

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INTRODUCTION

In this era of globalization, the demand for 21st-century skills is increasingly growing. These skills include critical, creative, communicative, collaborative, innovative, and problem-solving abilities (Mantau & Talango, 2023). In education, these skills play a crucial role in the learning process. Unfortunately, evidence from the field indicates that these skills have not yet been well realized. A study by Yunita et al., (2018), based on initial observations and interviews at SMA Negeri 1 Kepahiang, found that students' understanding of learning materials was still relatively low. Most students were only able to memorize information without truly comprehending the content being taught. This condition affected learning outcomes, which had not yet met the Minimum Mastery Criteria (KKM) of 75. One of the causes of this low level of understanding is a teacher-centered learning approach, which makes

students passive and less actively engaged in the learning process (Yuliati, 2017).

Student engagement is essential for achieving effective learning. It encourages active participation, which enhances students' understanding as well as their ability to remember and retain learning material (Safaa Y et al., 2024). In addition, engagement plays an important role in achieving better academic outcomes and personal development, including improvements in social skills, self-confidence, and intrinsic motivation (Abdurrahman, 2022). Student engagement encompasses both cognitive and emotional aspects (Fikrie & Ariani, 2021).

Cognitive engagement refers to students' mental readiness and capacity to complete learning tasks, including the extent of effort they invest in understanding and accomplishing those tasks (Manoppo, 2020). Meanwhile, emotional

engagement relates to students' affective responses during the learning process, such as feelings of interest, boredom, enjoyment, sadness, or anxiety that is, whether they display positive emotions (enthusiasm, enjoyment) or negative emotions (boredom, reluctance, indifference) toward learning activities (Idris et al., 2018).

These two dimensions of engagement cognitive and emotional are interrelated and mutually influential in the learning process. Students' emotional conditions can determine their level of mental readiness, concentration, and effort in understanding and completing learning tasks. Students who display positive emotions, such as enthusiasm and enjoyment, tend to exhibit higher cognitive engagement, whereas negative emotions such as boredom or anxiety can reduce motivation and participation in learning (Parent et al., 2023). Thus, emotional and cognitive engagement are closely connected, as both support each other in shaping an effective and meaningful learning experience.

As an initial field description, interviews with a chemistry teacher at one of the Islamic senior high schools (MAN) in Pontianak indicated that students were generally active and enthusiastic in participating in the learning process. However, the teacher was unable to provide detailed information regarding students' activeness and enthusiasm specifically in chemistry topics, particularly stoichiometry. These findings provide preliminary indications of students' emotional engagement, while their cognitive engagement still needs to be examined more systematically. Cognitive and emotional engagement have been reported to be interrelated and capable of influencing one another (Nakamura et al., 2021; Tu et al., 2025).

One field of study that demands intensive cognitive and emotional engagement is chemistry, which requires not only deep conceptual understanding but also emotional readiness to face learning challenges. Chemistry is a branch of science concerned with the composition, structure, transformation, dynamics, and energetics of matter, involving reasoning and critical thinking skills (Emda, 2017). One learning topic that particularly requires these skills is stoichiometry. Stoichiometry is often perceived as difficult because it heavily involves calculations, making it less appealing to students. This is reflected in students' achievement scores and

learning motivation, which tend to be low (Hemayanti et al., 2020).

According to Romsy et al., (2024), in the context of science education such as stoichiometry, enhancing cognitive and emotional engagement can potentially be achieved through strategies such as gamification, creating a supportive learning environment (Tu et al., 2025), and using student-centered techniques such as role-playing, group work, and simulations (Upadhyay, 2024).

However, although numerous studies have examined student engagement in science learning, most of them still focus on engagement in general or only investigate a single dimension of engagement, either cognitive or emotional, separately. In addition, studies that explore the relationship between these two dimensions within specific chemistry topics, such as stoichiometry, remain very limited. In fact, stoichiometry is a complex topic that requires both conceptual understanding and mathematical skills (Fitriani et al., 2022), thus demanding simultaneous cognitive and emotional engagement (Damayanti & Putri, 2025). On the other hand, research on stoichiometry has predominantly focused on improving learning outcomes or implementing specific instructional strategies, without specifically analyzing the relationship between students' cognitive and emotional engagement. Therefore, this study addresses this gap by analyzing the correlation between cognitive and emotional engagement in learning stoichiometry at the secondary school level, particularly at MAN Kota Pontianak.

Therefore, to obtain a comprehensive understanding of how student engagement influences stoichiometry learning, it is important not only to describe the relationship between cognitive and emotional engagement but also to examine how both dimensions can be enhanced simultaneously. This approach has been effectively used in previous studies to understand the dynamics of student engagement and its impact on academic achievement, as demonstrated by Kahu, (2013), who emphasized the importance of multidimensional engagement in analyzing learning experiences holistically.

Therefore, this study is important to provide a more comprehensive understanding of the relationship between students' cognitive and emotional engagement in learning stoichiometry. The findings of this study are expected to

contribute theoretically to the development of multidimensional engagement research, as well as provide practical contributions to improving the quality of instruction and students' learning outcomes.

METHOD

Participants

The research subjects were focused on two classes taught by the same chemistry teacher. Each class consisted of 34 and 36 students, respectively, for Grade XI Chemistry 1 and Grade XI Chemistry 2, resulting in a total of 70 participants. The selection of these two classes was based on considerations of instructional uniformity. The total number of Grade XI classes at the school was not obtained in detail; therefore, the scope of the study was limited to these two classes.

Research Design and Procedures

The research method employed in this study was a quantitative descriptive approach with a correlational design. This approach was used to examine the relationship between students' cognitive and emotional engagement. Correlational research does not involve manipulation and focuses on relationships among variables across different groups, which may occur at varying levels, to determine the degree and direction of their relationships. Therefore, the purpose of this study was to measure how two or more variables are related to one another and the extent of those relationships (Waruwu et al., 2025).

The research procedures were conducted through classroom observations over four sessions (Fredricks et al., 2016). The observation indicators for cognitive engagement included the strategies used by students during the learning process, while the indicators for emotional engagement encompassed students' feelings or emotional responses during instruction. In addition, a cognitive and emotional engagement questionnaire with a four-point Likert scale was used, as presented in Table 1.

Table 1. Likert Scale Measurement

Responses	Scores for Positive Statements	Scores for Negative Statements
Strongly Disagree (SD)	1	4
Disagree (D)	2	3
Agree (A)	3	2
Strongly Agree (SA)	4	1

(Pranatawijaya & Priskila, 2019).

Furthermore, semi-structured interviews were conducted at the end of the learning activities to obtain more in-depth data (Waruwu et al., 2025). The interview categories were determined based on the interval values of cognitive and emotional engagement levels presented in Table 2.

Table 2. Interval Scores for Cognitive and Emotional Engagement Categories

No	Interval	Categories
1	$X < M - 1,0 \text{ SDi}$	Very Low
2	$M - 1,0 \text{ SDi} \leq X < M$	Low
3	$M \leq X < M + 1,0 \text{ SDi}$	High
4	$X \geq M + 1,0 \text{ SDi}$	Very High

(Djemari, 2008).

Finally, data were also obtained through documentation, in the form of video recordings from observations and students' notebooks as supporting materials for analysis. Thus, the collected data were analyzed to measure the relationship between students' cognitive and emotional engagement based on the correlation coefficient interpretation guidelines presented in Table 3.

Table 3. Guidelines for Interpreting Correlation Coefficients

Coefficient Interval	Level of Relationship
0,00 – 0,199	Very Weak
0,20 – 0,399	Weak
0,40 – 0,599	Moderate
0,60 – 0,799	Strong
0,80 – 1,000	Very Strong

(Sugiyono, 2022).

Instrument

The instrument used in this study was a questionnaire measuring cognitive and emotional engagement using a four-point Likert scale, adapted from Naibert & Barbera, (2022). This instrument was designed to assess the extent to which students are cognitively and emotionally engaged in learning activities. It consisted of ten statements, including five items on cognitive engagement and five items on emotional engagement. The cognitive engagement items comprised three positive statements and two negative statements, while the emotional engagement items consisted of two positive statements and three negative statements. Furthermore, evidence of instrument reliability was collected for individual factors using the omega coefficient (Komperda et al., 2018), where values greater than 0.7 are generally considered to indicate acceptable reliability (Naibert & Barbera, (2022). In addition, language validation was

conducted through expert judgment of the research instrument. This process ensured that the instrument was easily understood and retained the same meaning as the original version, thereby facilitating students' comprehension of each statement item.

Data Analysis

Data analysis is a research stage in which the collected data are processed to address the research questions. This study employed both descriptive and correlational analyses. Descriptive analysis was used to describe students' cognitive and emotional engagement.

Furthermore, correlational analysis was conducted to determine whether there was a relationship between variable X and variable Y. Data processing was carried out using SPSS version 27, including normality testing and hypothesis testing.

The normality test was used to determine whether the obtained data were normally distributed. The criterion applied in this test was that the data were considered normally distributed if the significance value (p-value) in the One-Sample Kolmogorov-Smirnov output was greater than the predetermined alpha level of 0.05 (p-value \geq 0.05) (Suryani et al., 2019). Thus, the data were regarded as normal when the significance value (Sig.) exceeded 0.05.

After the normality test was conducted, the next step was to examine the relationship between students' cognitive and emotional engagement through a correlation test. Before determining the type of correlation test to be used, a normality test was first performed to identify the characteristics of the data distribution. As the data were not normally distributed, Spearman's rank correlation test was applied (Roflin et al., 2022).

RESULTS AND DISCUSSION

This study employed a quantitative descriptive approach to determine the presence and strength of the relationship between cognitive and emotional engagement. The participants were Grade XI students enrolled in the science-track chemistry course at one of the Islamic senior high schools (MAN) in Pontianak, with a sample size of 70 respondents. The questionnaire data were categorized into four levels: very low (VL), low (L), high (H), and very high (VH), based on mean (M) and standard deviation (SD) analyses. The results for cognitive

and emotional engagement categories are presented in Tables 4 and 5.

Table 4. Frequency Distribution of Cognitive Engagement

Categories	Frequency
Very Low	7
Low	30
High	24
Very High	9

Based on Table 4, the distribution of students' cognitive engagement shows that 7 students fall into the very low category, 30 into the low category, 24 into the high category, and 9 into the very high category. These findings indicate that the majority of students are still at a low level of cognitive engagement.

Students in the very low and low categories tend to exhibit passive learning behaviors, minimal initiative, and low participation in the learning process. This condition reflects a lack of cognitive readiness prior to learning, which leads to difficulties in understanding the material, especially in subtopics that require conceptual understanding and logical application, such as percent yield and purity. These findings suggest that low effort in preparing for learning and limited engagement during the learning process are factors that hinder conceptual understanding (Fredricks et al., 2016; Marganingtyas et al., 2025; Zulaika et al., 2024). In line with the findings of Fikrie & Ariani, (2021), mental engagement reflects how students use learning strategies such as analyzing, concluding, and actively organizing information to achieve deeper understanding. Therefore, student engagement plays an important role in enhancing learning effectiveness and supporting overall academic achievement.

In contrast, students in the high and very high categories demonstrate better cognitive engagement, characterized by active participation, learning readiness, and effort in understanding the material. These students tend to prepare independently before learning takes place and are more focused and active during the learning process. This indicates that cognitive engagement is closely related to learning effort and self-regulated learning strategies employed by students (Tu et al., 2025; Upadhyay, 2024).

Theoretically, cognitive engagement is associated with the level of mental effort that students invest in understanding learning

material. Students with high cognitive engagement tend to use deeper learning strategies, such as seeking additional information, reviewing material, and connecting learned concepts. In line with the findings of Irwandi et al., (2024), data show that all self-regulated learning strategies of students fall within the high category (61%–80%). During distance learning, students most frequently used help-seeking strategies to regulate their chemistry learning. Furthermore, findings by Jamaluddin et al., (2025) also indicate that increased cognitive engagement directly contributes to learning outcomes, as students who are more cognitively engaged demonstrate deeper understanding, better problem-solving skills, and higher self-confidence.

Thus, differences in levels of cognitive engagement indicate that learning readiness, motivation, and self-regulated learning strategies are important factors influencing students' success in understanding the material, particularly in stoichiometry, which requires conceptual understanding and logical thinking skills.

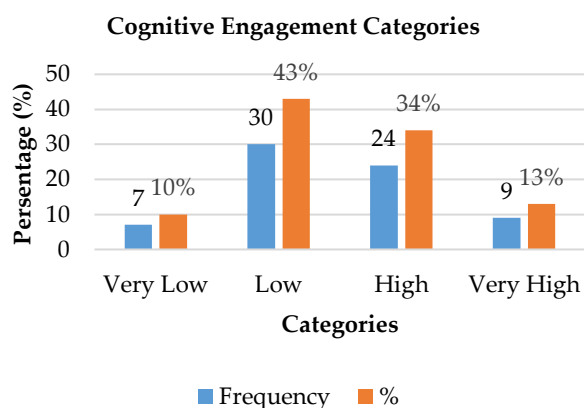


Figure 1. Diagram of Cognitive Engagement Categories

Based on Table 5, the distribution of students' emotional engagement shows that 8 students fall into the very low category, 37 into the low category, 11 into the high category, and 14 into the very high category.

Table 5. Frequency Distribution of Emotional Engagement

Categories	Frequency
Very Low	8
Low	37
High	11
Very High	14

These results indicate that the majority of students are still at a low level of emotional engagement.

Students in the very low and low categories tend to show low interest and enthusiasm toward learning, as well as minimal involvement during the learning process. This condition reflects low intrinsic motivation and a lack of awareness of the importance of preparation before learning. Although some students in the low category have made efforts to study at home, their engagement in the classroom remains low because learning activities are still perceived as an obligation rather than an internal need. This suggests that intrinsic motivation is an important factor in promoting students' emotional engagement. In contrast, students in the high and very high categories demonstrate positive emotional engagement, characterized by enthusiasm, interest, and active participation in learning activities. These students tend to have a sense of responsibility toward their learning and show better readiness, including efforts to prepare themselves before the learning process takes place. This condition indicates a relationship between emotional engagement and positive attitudes toward the learning process.

Theoretically, emotional engagement is related to students' affective responses to learning activities, which play a role in shaping motivation and participation. Students with positive emotional engagement tend to be more motivated, active, and interested in the material being studied. This is in line with the findings of Idris et al., (2018), which state that positive emotions in learning can enhance student participation and engagement. In addition, Inwanti & Setiawan, (2025) also emphasize that high emotional engagement contributes to increased learning motivation, as reflected in students' activeness, independence, and enthusiasm during the learning process.

In the context of learning stoichiometry, emotional engagement becomes particularly important because this topic is often perceived as difficult and requires high concentration. Stoichiometry involves mathematical calculations, understanding of the mole concept, and interpretation of symbolic representations, which can lead to a high cognitive load. In line with the findings of Lumbantoruan et al., (2025), stoichiometric concepts are abstract and require strong mathematical skills, logical reasoning, and

high cognitive engagement. Therefore, students with low emotional engagement tend to feel bored or uninterested, which ultimately hinders their cognitive engagement in understanding the material. Conversely, students with high emotional engagement are better able to cope with learning challenges because they possess stronger motivation and interest.

Thus, emotional engagement is an important factor that needs to be considered in the learning process, particularly for complex topics such as stoichiometry. Teachers need to design learning experiences that enhance students' interest, motivation, and active participation through interactive, contextual, and meaningful approaches to make the learning process more effective.

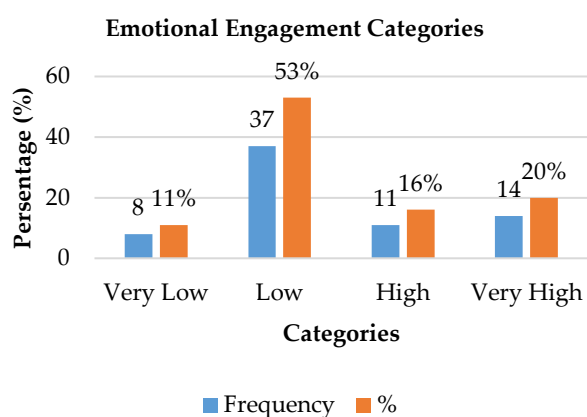


Figure 2. Diagram of Emotional Engagement Categories

The dominance of students in the low category indicates that most students have not yet demonstrated optimal mental effort and emotional engagement in learning stoichiometry. In other words, the majority of students have not shown optimal engagement in stoichiometry learning.

Furthermore, the normality test is used to determine whether the collected data are normally distributed or not. In this study, the One-Sample Kolmogorov-Smirnov test was used. The criterion applied is that the data are considered normally distributed if the significance value or coefficient value (p-value) in the One-Sample Kolmogorov-Smirnov output is greater than the predetermined alpha value of 0.05 (p-value \geq 0.05). This test was conducted using SPSS version 27.0 for Windows, as shown in Table 6.

Table 6. Normality Test Results for Cognitive and Emotional Engagement

	Statistics	df	Sig.
Cognitive	0.186	70	0.000
Emotional	0.259	70	0.000

Based on Table 6, the normality test results indicate that the data for cognitive and emotional engagement were not normally distributed, with significance values less than 0.05 ($0.000 < 0.05$). Therefore, a non-parametric analysis was used to examine the relationship between cognitive and emotional engagement, specifically Spearman's rank correlation test. The results of this correlation analysis are presented in Table 7.

Table 7. Correlation Test Results for Cognitive and Emotional Engagement

	N	Sig.	rho
Cognitive	70	0.000	0.447
Emotional	70	0.000	0.447

Based on Table 7, the results of the correlation test between cognitive and emotional engagement show a significance value of 0.000 (< 0.05), indicating a positive relationship. This positive relationship suggests that the higher the students' emotional engagement, the higher their cognitive engagement in learning stoichiometry tends to be. Meanwhile, the strength of the relationship between cognitive and emotional engagement is indicated by a Spearman's rho coefficient of 0.447, which falls into the moderate category. A moderate correlation indicates that emotional engagement alone is not sufficient to fully explain students' cognitive engagement. Other factors, such as prior knowledge, teaching strategies, and the conceptual difficulty of stoichiometry, may also play important roles. This is reflected in the average percentages of cognitive and emotional engagement shown in Figure 3.

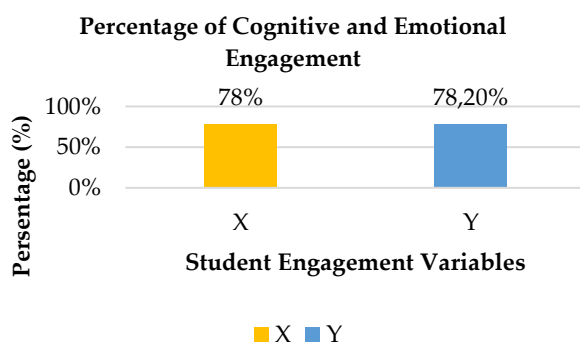


Figure 3. Percentage of Cognitive and Emotional Engagement

These results indicate that emotional engagement, such as interest and feeling challenged, can encourage students to become more cognitively engaged in understanding the material and solving problems. This aligns with Pietarinen et al., (2014) who stated that learning engagement is a multidimensional construct consisting of interacting cognitive and emotional aspects.

Although the relationship observed was at a moderate level, this suggests that emotional engagement is not the only factor influencing students' cognitive engagement. Other factors, such as the characteristics of stoichiometry material, instructional strategies, and students' prior abilities, may also affect cognitive engagement during the learning process (Marlan et al., 2020).

CONCLUSION

Based on the discussion above, it can be concluded that there is a positive and significant relationship between students' cognitive and emotional engagement in stoichiometry learning in Grade XI at one of the Islamic senior high schools (MAN) in Pontianak, with a Spearman's rho correlation coefficient of 0.447, indicating a moderate level of correlation. Descriptive analysis showed that both cognitive and emotional engagement were in the high category, with averages of 78% and 78.2% of the maximum score, respectively. This indicates that the higher the students' emotional engagement, the higher their cognitive engagement in understanding concepts and solving stoichiometry problems. Nevertheless, emotional engagement is not the only factor influencing cognitive engagement. Other factors, such as the difficulty level of the material, instructional strategies, and students' prior abilities, also play a role in shaping overall learning engagement. Therefore, to further enhance student engagement, teachers can utilize engaging learning media, implement diverse instructional strategies, and create a pleasant and supportive learning environment.

BIBLIOGRAPHY

Abdurrahman. (2022). Media Pembelajaran Asik Dan Menyenangkan Untuk Meningkatkan Motivasi Belajar Mahasiswa Dalam Mata Kuliah Bahasa Indonesia Mega. *Students' Difficulties At Elementary School In Increasing Literacy Ability.*, 5(2), 1014-1026.

Damayanti, Y. D., & Putri, R. A. (2025). Cognitive Load Reduction Strategy In Learning Stoichiometry For

3t Students: An Approach To Overcoming Cognitive Load In Chemistry Numeration. *International Journal Of Active Learning*, 10(1), 18–23.

Djemari, M. (2008). *Teknik Penyusunan Instrumen Tes Dan Nontes*.

Emda, A. (2017). Laboratorium Sebagai Sarana Pembelajaran Kimia Dalam Meningkatkan Pengetahuan Dan Keterampilan Kerja Ilmiah. *Lantanida Journal*, 5(1), 83.

Fikrie, & Ariani, L. (2021). Keterlibatan Siswa (Student Engagement) Di Sekolah Sebagai Salah Satu Upaya Peningkatan Keberhasilan Siswa Di Sekolah. *Ulul Albab: Majalah Universitas Muhammadiyah Mataram*, 28(2), 112–125.

Fitriani, A. R., Rahmawati, A., & Lathifa, U. (2022). Phenomenology Of Conceptual Understanding Ability , Representation , And Student Algorithm On Stoichiometry Materials 1) SMAIT Alam Harapan Ummat Purbalingga , Indonesia 2) Universitas Islam Negeri Walisongo Semarang , Indonesia 3) SMP Negeri 1 Undaan. *Journal Of Educational Chemistry*, 4(1), 9–18. <https://doi.org/10.21580/Jec.2022.4.1.9744>

Fredricks, J. A., Filsecker, M., & Lawson, M. A. (2016). Student Engagement, Context, And Adjustment: Addressing Definitional, Measurement, And Methodological Issues. *Learning And Instruction*, 43, 1–4.

Hemayanti, K. L., Muderawan, I. W., & Selamat, I. N. (2020). Analisis Minat Belajar Siswa Kelas Xi Mia Pada Mata Pelajaran Kimia. *Jurnal Pendidikan Kimia Indonesia*, 4(1), 20–25.

Idris, I. H., Syamsurizal, S., & Muhammad, D. (2018). Peningkatan Cognitive Engagement Siswa Dalam Pembelajaran Dengan Pendekatan POE (Predict-Observe-Explain) Dan Multimedia Interaktif Yang Dikembangkan Sendiri. *Edu-Sains: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, 7(2), 21–31.

Inwanti, S. N., & Setiawan, & D. (2025). Jurnal Pendidikan MIPA. *Jurnal Pendidikan MIPA*, 26(April), 212–226.

Irwandi, D., Sholihat, R. N., & Nuraida, F. (2024). Hubungan Antara Self-Regulated Learning Dengan Prokrastinasi Akademik Siswa Pada Pelajaran. *Jurnal Tahsinia*, 5(5), 754–767.

Jamaluddin, A. Bin, Bahri, A., Pratiwi, A. C., & Lembang, A. M. (2025). Jurnal Pendidikan MIPA. *Jurnal Pendidikan MIPA*, 26(January), 36–50.

Kahu, E. R. (2013). Framing Student Engagement In Higher Education. *Studies In Higher Education*, 38(5), 758–773. <https://doi.org/10.1080/03075079.2011.598505>

Komperda, R., Pentecost, T. C., & Barbera, J. (2018). Moving Beyond Alpha : A Primer On Alternative Sources Of Single-Administration Reliability Evidence For Quantitative Chemistry Education Research. *Journal Of Chemical Education*, 95(9), 1477–1491.

- <https://doi.org/10.1021/Acs.Jchemed.8b00220>. This Lumbantoruan, D. L., Yulita, I., & Umara, Y. (2025). Analisis Kesulitan Siswa Sma Dalam Memahami Materi Stoikiometri Dan Upaya Remediasi Yang Efektif (Doctoral Dissertation, Universitas Maritim Raja Ali Haji).
- Manoppo, A. J. (2020). Keterlibatan Kognitif Pada Prestasi Belajar Mahasiswa. *Nutrix Journal*, 4(2), 51–59.
- Mantau, B. A. K., & Talango, S. R. (2023). Pengintegrasian Keterampilan Abad 21 Dalam Proses Pembelajaran (Literature Review). *Irfani (E-Journal)*, 19(1), 86–107.
- Marganingtyas, A., Fadhiilah, U., & Nurlaili, M. A. M. (2025). Pengaruh Keterlibatan Siswa, Motivasi Belajar Siswa Dan Metode Mengajar Guru Terhadap Hasil Belajar Kimia Siswa. *Integrative Perspectives Of Social And Science Journal*, 2(3), 3446–3462.
- Marlan, Syaiful, & Anwar. (2020). Penggunaan Strategi Pembelajaran Aktif Untuk Meningkatkan Efektivitas Pembelajaran. *Urnal Manajer Pendidikan*, 15(April), 41–50.
- Naibert, N., & Barbera, J. (2022). Development And Evaluation Of A Survey To Measure Student Engagement At The Activity Level In General Chemistry. *Journal Of Chemical Education*, 99(3), 1410–1419.
- <https://doi.org/10.1021/Acs.Jchemed.1c01051>
- Nakamura, S., Phung, L., & Reinders, H. (2021). The Effect Of Learner Choice On L2 Task Engagement. *Studies In Second Language Acquisition*, 43(2), 1–14.
- <https://doi.org/10.1017/S027226312000042X>
- Parent, G. A. G. A., Gunawan, A., & Hermawati, E. (2023). Hubungan Kecerdasan Emosional Dengan Hasil Belajar Kognitif Siswa Pada Pembelajaran Tematik. *BADA'A: Jurnal Ilmiah Pendidikan Dasar*, 5(2), 374–385.
- <https://doi.org/10.37216/Badaa.V5i2.1087>
- Pietarinen, J., Soini, T., & Pyha, K. (2014). Students ' Emotional And Cognitive Engagement As The Determinants Of Well-Being And Achievement In School. *International Journal Of Educational Research*, 67, 40–51. <https://doi.org/10.1016/J.Ijer.2014.05.001>
- Pranatawijaya, V. H., & Priskila, R. (2019). Penerapan Skala Likert Dan Skala Dikotomi Pada Kuesioner Online. *Jurnal Sains Dan Informatika*, 5(November), 128–137. <https://doi.org/10.34128/Jsi.V5i2.185>
- Roflin, E., Rohana., & Riana, F. (2022). Analisis Korelasi Dan Regresi. Penerbit NEM.
- Romsy, A., Widodo, J. P., & Slamet, J. (2024). Empowering Slow Learners: Gamification ' S Impact On Students ' Engagement And Academic Performance In An LMS For Undergraduate Students. *International Journal Of Information And Education Technology*, 14(2), 193–203. <https://doi.org/10.18178/Ijiet.2024.14.2.2040>
- Safaa Y, E.-M., Francis, J. M., & Hartig, A. J. (2024). Pendidikan Kimia Penelitian Dan Praktik. 799–814.
- Sugiyono. (2022). Metode Penelitian Kuantitatif, Kualitatif, Dan R&D. Alfabeta.
- Suryani, A. I., Syahribulan, K., & Mursalam, M. (2019). Pengaruh Penggunaan Metode Mind Mapping Terhadap Hasil Belajar Ilmu Pengetahuan Sosial Murid Kelas V SDN No . 166 Inpres Bontorita Kabupaten Takalar. (JKPD) *Jurnal Kajian Pendidikan Dasar*, 4(166).
- Tu, Y., Wang, Q., & Huang, C. (2025). Facilitating Students ' Emotional Engagement In Synchronous Online Learning: A Systematic Literature Review. *The International Review Of Research In Open And Distributed Learning*, 26(1), 261–282.
- Upadhyay, M. P. (2024). Exploring Public Secondary Students ' Classroom Participation In Communicative Language Teaching In Gauriganga Nepal 1. *Contemporary Research: An Interdisciplinary Academic Journal*, 7(2), 138–152.
- Waruwu, M., Natijatul, S., Utami, P. R., & Yanti, E. (2025). Metode Penelitian Kuantitatif: Konsep , Jenis , Tahapan Dan Kelebihan. *Jurnal Ilmiah Profesi Pendidikan*, 10(1), 917–932.
- Yuliati, Y. (2017). Literasi Sains Dalam Pembelajaran IPA. *Jurnal Cakrawala Pendas*, 3(2), 21–28.
- Yunita, S., Rohiat, S., & Amir, H. (2018). Analisis Kemampuan Berpikir Kritis Mata Pelajaran Kimia Pada Siswa Kelas XI IPA SMAN 1 Kepahiang. *Alotrop*, 2(1), 33–38.
- Zulaika, A., Erlina, E., & Sahputra, R. (2024). Jurnal Pendidikan MIPA. *Jurnal Pendidikan MIPA*, 14(4), 1078–1090.