
The Influence of Self-Determination and School Belongingness on Students' Engagement in Science Education

CATHERINE B. GIPOLAN

Graduate School

J. V. Ferriols National High School

catherine.gipolan@hcdc.du.ph

Abstract — Low student engagement in science threatens scientific literacy and innovation. The influence of self-determination and school belongingness on students' engagement in science education was verified. Through a diagnostic design, data were collected from 299 respondents via stratified random sampling and analyzed using multiple linear regression. Findings showed that students' self-determination was high, school belongingness was very high, and engagement in science education was high. Predictive variables significantly influenced students' engagement in science education, explaining 23% of the variance ($R^2 = .23$), supporting Self-Determination Theory. Future studies may explore other variables, including the competence component of Self-Determination Theory (SDT) and qualitative insights, while school leaders and educators foster supportive, student-centered environments to enhance science engagement.

Keywords: *Influence of self-determination, school belongingness, students' engagement, science education*

I. INTRODUCTION

Low levels of engagement in science education among learners worldwide (Grabau, 2022) pose a pressing global challenge that threatens the development of scientific literacy and future innovation. Research findings across colleges in the United States and Canada indicate that low engagement in science education is a critical issue for advancing students' academic and

intellectual growth (Zilvinskis, Rocconi, & McCormick, 2021). In Australia, students in public schools were found to exhibit low participation, limited engagement in classroom activities, and low attentiveness (Tomaszewski et al., 2023). In China, Chen et al. (2023) found that many university students showed only average to moderately low levels of overall academic engagement. Similarly, in England, Quinlan et al. (2021) observed reduced participation in academic tasks, decreased involvement in learning activities, and a general decline in engagement across all dimensions. Moreover, Aker & Ellis (2019) reported a noticeable decline in students' engagement in science across 79 studies conducted in multiple countries.

In the Philippine context, many students demonstrate limited engagement in science, which continues to hinder efforts to strengthen both academic achievement and scientific literacy (Datu, J. A. D., & Noltemeyer, A., 2024). Furthermore, a recent study in the said country found that science students in tertiary education exhibit moderate levels of engagement, suggesting difficulties maintaining active participation in science learning (Briones et al., 2023). Additionally, research across various regions in the Philippines has revealed that low interest and engagement in science education are prevalent, negatively impacting students' overall academic performance (Saludes & Langub, 2023).

Low student engagement in science has long been recognized as a major challenge in education, often leading to poor academic performance, decreased motivation, and underdeveloped critical-thinking skills (Fredricks et al., 2019). This low-level engagement undermines learners' ability to apply scientific knowledge to real-world problems and discourages them from pursuing careers in science, technology, engineering, and mathematics (STEM) (National Research Council, 2012), thereby worsening the global shortage of STEM professionals essential for innovation and national development (UNESCO, 2023).

Despite continuous efforts to enhance science education, a significant research gap remains in understanding the underlying causes of low engagement, particularly in local Philippine schools (Grabau, 2022). Although self-determination and school belongingness individually relate to student engagement, few studies have explored their combined impact on students' engagement in science education within a local context (Datu & Noltemeyer, 2024; Palomo & Chagas, 2022; Famero, 2021). Understanding how students' self-determination and school belongingness interact

can guide interventions tailored to local educational settings (Palomo & Chagas, 2022). The persistence of this gap contributes to the continued decline in students' interest and performance in science, hindering the development of scientific inquiry, critical thinking, and sustained engagement in STEM fields. It is for this reason that this study is conducted.

This study aimed to determine the relationship between self-determination and school belongingness and their connection to junior high school students' engagement in science education. The study specifically aimed to determine the levels of students' self-determination in terms of awareness of self and perceived choice; school belongingness in terms of contentment in school and obedience of school rules; engagement in science education in terms of cognitive, behavioral, emotional, and social dimensions, determine the significant relationship between self-determination, school belongingness, and the students' engagement in science, and determine the significance of the individual and combined influence of self-determination and school belongingness on students' engagement in science. This study was anchored on the Self-Determination Theory of Deci & Ryan (1985).

II. METHODOLOGY

This study employed diagnostic research design. This design is appropriate because it allows the researcher to describe the current levels of the variables and examine their relationships without manipulating respondents' natural setting (Best & Kahn, 2016). Moreover, it is a structured, problem-oriented research design used to examine present conditions, identify relevant patterns or relationships, and describe the strength of the determinant factor in influencing the outcome (Wisenthige, 2023; Samanth, 2024).

This study was conducted in 2 public schools of Cluster 5, Division of Davao City. These schools were chosen as research sites because they provide secondary-level science education and offer a suitable environment for investigating the relationships among self-determination, school belongingness, and student engagement.

The respondents in this study were Grade 10 junior high school students enrolled in science classes at 2 large public schools in Cluster 5, Davao City, during School Year (SY) 2025–2026. From a total population of 1177 students, a representative sample of approximately 299 was selected using Slovin's formula with a 5% margin of error, a method commonly applied and accepted in recent research (Vijayakumar, 2023). The study employed stratified random sampling, dividing the population by school, and selecting respondents proportionally to ensure unbiased representation of the 2 schools in cluster 5 (Lee, 2025).

The survey technique was used in gathering data. It is a method for collecting data through questionnaires or interviews (Creswell & Creswell, 2023) to obtain standardized information about respondents' attitudes, perceptions, or behaviors (Cohen et al., 2021). It is particularly useful in descriptive and correlational studies, as it enables researchers to describe trends and examine relationships among variables (W. Lawrence Neuman, 2020; Creswell & Creswell, 2023). It is advantageous for data collection from large, diverse populations, produces quantifiable data for analysis, supports generalization, enables rapid data collection, and ensures replicability through standardized procedures (Oranga & Matere, 2025).

Three adapted and modified questionnaires were used in this study, and validators employed a five-point Likert scale to assess the instruments, yielding a mean rating of 4.66, interpreted as very highly valid (Likert, 1932). Specifically, a 4-point Likert scale was used to evaluate participants' responses across the three research instruments, ranging from 1 – Strongly Disagree to 4 – Strongly Agree, to avoid central tendency bias (Koo, 2025). The first instrument, the self-determination questionnaire, was adapted from Chorosiewski, K. A. (2015). It consists of 10 items designed to assess students' self-determination, which includes two key indicators: awareness of self and perceived choice, with a Cronbach's alpha of 0.802. The second instrument, the school belongingness questionnaire, was adapted from Akar-Vural *et al.* (2013) and measured through two key indicators: contentment in school and obedience to school rules. It consists of 9 items with a Cronbach's alpha of 0.763. The third instrument, the students' engagement in science education questionnaire, was adapted from Wang et al. (2016) and assessed using four indicators: cognitive, behavioral, emotional, and social engagement. It comprises 33 items with a Cronbach's alpha of 0.860.

In this study, data analysis techniques used were descriptive, correlation, and regression analyses. Descriptive analysis summarizes data using measures such as the mean, frequency, and standard deviation, providing a clear overview of patterns and distributions without determining relationships between variables (Gravetter & Wallnau, 2021). In this study, the mean statistic was used to summarize and describe the levels of students' self-determination, school belongingness, and engagement in science education. Moreover, the correlational analysis is used to determine the strength and direction of relationships between variables without establishing causation (Creswell & Creswell, 2023; Borg et al., 2021). The Pearson Product-moment correlation was used to determine the strength and direction of the relationship between self-determination, school belongingness, and students' engagement in science education. Lastly, regression analysis is a statistical method used to examine relationships between variables and predict outcomes by identifying the strength and significance of predictors (Field, 2024); hence, it was utilized in this study to determine the extent to which self-determination and school belongingness influence students' engagement in science education and their individual contributions to the criterion variable.

The matrix, which contains the scale, descriptive level, and corresponding interpretation for each variable, is presented and is specifically used to describe the levels of self-determination, school belongingness, and students' engagement in science education.

<i>Range of Mean</i>	<i>Descriptive Level</i>	<i>Self-Determination</i>	<i>School Belongingness</i>	<i>Students' Engagement in Science Education</i>
3.26- 4.00	Very High	Very Strong	Very Strong	Consistently engaged
2.50-3.25	High	Strong	Strong	Frequently engaged
1.75-2.49	Low	Weak	Weak	Occasionally engaged
1.00-1.74	Very Low	Very Weak	Very Weak	Rarely engaged

To measure and interpret the standard deviation, the following standard scheme is followed.

Standard Deviation Value Ranges and Interpretation

<i>Range</i>	<i>Description</i>	<i>Interpretation</i>
$SD \leq 0.50$	High Consistent Responses	Strong and uniform perception
$SD = 0.51 - 1.00$	Moderate Consistent Responses	Acceptable consistency
$SD = 1.01 - 1.50$	Low Consistent Responses	Differing views or experiences
$SD > 1.50$	Very Low Consistent Responses	High variability and lack of consensus

The significance of the correlation is tested at a 0.05 confidence level. For the interpretation scale of r-value, the following scheme is used:

<i>Computed r</i>	<i>Descriptive Interpretation</i>
± 1.00	Perfect correlation
Between $\pm 0.75 - \pm 0.99$	High correlation
Between $\pm 0.31 - \pm 0.50$	Moderately low correlation
Between $\pm 0.01 - \pm 0.30$	Low correlation
0.00	No correlation

The degree of influence and the overall predictive effects of Self-determination and School Belongingness on Students' Engagement in Science Education were analyzed through multiple

linear regression analysis, with unstandardized and standardized beta coefficients, assuming a linear relationship among the variables.

For the Scale of Beta (β) Coefficient Strength, the following scheme is used:

β Value Range	Strength of Influence
+ 0.00 - + 0.09	Very Weak
+ 0.10 - + 0.29	Weak
+ 0.30 - + 0.49	Moderate
+ 0.50 - + 0.69	Strong
+ 0.70 and above	Very Strong

The study complied with established ethical standards and obtained approval from the Holy Cross of Davao College–SMILE ethics committee prior to data collection. Permissions to conduct the study were subsequently obtained from the Department of Education (DepEd) Division of Davao City SDS Office, the cluster 5 PSDS, and the school principals. To ensure voluntary participation, informed consent was obtained from parents or guardians, and student assent was obtained. Participants were clearly informed about the study's purpose, procedures, potential risks and benefits, and their right to withdraw at any time without penalty. Confidentiality and privacy were strictly maintained throughout the study. No personal identifiers were collected, and all data were stored securely and used solely for research purposes in compliance with the Data Privacy Act of 2012. Results were reported in aggregate form to protect participants' identities. Additionally, careful scheduling and systematic data management procedures were implemented to minimize risks, ensure accuracy, and uphold the integrity of the research process.

III. RESULTS AND DISCUSSIONS

Table 1 is descriptive table. It contains the variables involved, namely, self-determination, school belongingness, and students' engagement in science education; and the number of samples, standard deviation, mean, and descriptive level specifically corresponding with each of the variables.

TABLE 1
DESCRIPTIVE STATISTICS (N = 299)

Variables	Standard Deviation	Mean	Descriptive Level
Student Self-Determination	0.44	3.14	High
<i>Awareness of Self</i>	<i>0.56</i>	<i>3.13</i>	<i>High</i>
<i>Perceived Choice</i>	<i>0.50</i>	<i>3.14</i>	<i>High</i>
School Belongingness	0.41	3.42	Very High
<i>Contentment in School</i>	<i>0.51</i>	<i>3.37</i>	<i>Very High</i>
<i>Obedience of School Rules</i>	<i>0.45</i>	<i>3.48</i>	<i>Very High</i>
Student Engagement in Science Education	0.35	3.19	High
<i>Cognitive Engagement</i>	<i>0.42</i>	<i>3.23</i>	<i>High</i>
<i>Behavioral Engagement</i>	<i>0.50</i>	<i>3.17</i>	<i>High</i>
<i>Emotional Engagement</i>	<i>0.41</i>	<i>3.11</i>	<i>High</i>
<i>Social Engagement</i>	<i>0.40</i>	<i>3.27</i>	<i>Very High</i>

Specifically, the table shows that the self-determination variable had a mean of 3.14, which is described as high. It suggests that the respondents have a strong sense of self-determination. All indicators obtained a high level. The standard deviation of 0.44 is described as high consistent, indicating strong and uniform responses. Furthermore, the school belongingness variable had a mean of 3.42, which is described as very high, indicating that respondents feel a strong sense of belongingness in their school environment. All indicators are described at a very high level. The standard deviation of 0.41 is described as high and consistent, signifying strong and uniform perception. Finally, the students' engagement in science education variable obtained a mean of 3.19, described as high, signifying that respondents are frequently engaged in science classes. All indicators obtained a high level, except for social engagement, which obtained a very high level. A standard deviation of 0.35 is considered highly consistent, indicating strong and uniform perception.

Self-determination and students' engagement in science education are both interpreted at a high level, indicating that respondents demonstrate awareness of their preferences, regularly exercise choice and independence in learning, and are actively engaged in science classes. Moreover, school belongingness is interpreted as very high, signifying that respondents have a strong sense of connection to their school environment.

Table 2 is correlational table. It presents the predictive and criterion variables. It shows the r-value, p-value, decision on the null hypothesis, and the corresponding interpretation.

TABLE 2
CORRELATION TABLE (N=299)

Variables	Student Engagement in Science Education			
	r-value	p-value	Decision on H_0	Interpretation
Student Self-Determination	0.41	0.000	Reject H_0	Moderately Low Positive, Significant
School Belongingness	0.37	0.000	Reject H_0	Moderately Low Positive, Significant

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

Specifically, the table shows that the correlation between self-determination and students' engagement in science education obtained a p-value of 0.000, which is lower than the 0.05 level of significance; hence, the null hypothesis was rejected, indicating that the correlation is statistically significant. The r-value of 0.41 reflects a moderately low positive correlation between self-determination and students' engagement in science education. This finding implies that higher levels of self-determination are associated with greater engagement in science learning. Similarly, school belongingness obtained a p-value of 0.000, which is lower than the 0.05 level of significance; hence, the null hypothesis was rejected, indicating that the correlation is statistically significant. The r-value of 0.37 shows a moderately low positive correlation between school belongingness and students' engagement in science education. This suggests that students who experience a stronger sense of belonging in school tend to demonstrate higher engagement in science education.

Both self-determination and school belongingness show a significant positive relationship with students' engagement in science education. This indicates that higher levels of self-determination and school belongingness are associated with greater student engagement in science learning.

Table 3 is regression table. It contains the variables, unstandardized beta coefficient, standard error, standardized beta coefficient, t-value, p-value, decision on null hypothesis, and corresponding interpretation

TABLE 3
REGRESSION TABLE (N=299)

Student Engagement in Science Education							
Variables	Unstandardized Coefficients		Standardized Coefficients			Decision on H_0	Interpretation
	B	Std. Error	Beta	t	Sig.		
(Constant)	1.58	0.17	—	9.21	0.000	—	—
Student Self-Determination	0.26	0.04	0.32	6.11	0.000	Reject	Positive Significant Influence
School Belongingness	0.23	0.05	0.26	4.93	0.000	Reject	Positive Significant Influence

$R = 0.48$ | $R^2 = 0.23$ | $F = 236$ | $p = <.001$

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

Specifically, the table shows that the self-determination variable obtained a standardized coefficient of 0.32 with a corresponding p-value of 0.000. Since the p-value is less than 0.05, the null hypothesis is rejected. It indicates that its 32% influence on students' engagement in science education is statistically significant. Likewise, the school belongingness variable obtained a standardized beta coefficient of 0.26 with a corresponding p-value of 0.000. Since the p-value is less than 0.05, the null hypothesis is rejected, indicating that 26% degree of influence on students' engagement in science education is significant. Finally, an R-square value of 0.23 with a corresponding p-value of 0.000 indicates that the self-determination and school belongingness variables have a significant combined influence of 23% on students' engagement in science education.

Self-determination and school belongingness both show a significant influence on students' engagement in science education, indicating that higher levels of student self-determination and sense of school belongingness exert a positive and statistically significant influence on student engagement in science education. Since both predictors were significant at

the .05 level, the null hypotheses were rejected, confirming that student self-determination and school belongingness have meaningful and significant combined influences on student engagement in science education.

Summary of Findings

Based on statistical results, it was specifically found that both Self-determination and School belongingness are significantly correlated with Students' Engagement in Science Education, implying that students who have higher levels of self-determination and school belongingness tend to be more engaged in science class. The finding affirms previous studies claiming that self-determined students tend to demonstrate stronger motivation, engagement, and persistence, which contribute to more meaningful learning experiences and academic success (Howard et al., 2021; Chiu, 2022). In addition, this finding is consistent with Korpershoek et al. (2020), who reported that fostering a sense of school belonging enhances students' cognitive, emotional, and behavioral engagement, including in science education.

In contrast, Wilks (2016) found that self-determination does not consistently predict engagement outcomes, and Gao et al. (2020) claimed that school belongingness does not significantly predict student engagement, which is instead mainly driven by environmental and physiological factors. The study by Wilks (2016) involved only 33 samples; Gao et al. (2020) involved only 23 samples, while the current study had 299 samples.

Furthermore, the findings of this study indicated that both Self-Determination and School Belongingness have a significant distinct influence on Students' Engagement in Science Education, suggesting that students who are self-determined and have a sense of belongingness tend to be more active and engaged in science class. This result affirms previous studies claiming (Assefa et al., 2025). Similarly, Chiu et al. (2023), in their SDT-based research on STEM education, claimed that learning environments that support autonomy (self-determination) and relatedness (school belongingness) enhance students' interest, identity formation, and engagement.

However, the current study negates the study of Dulfer et al. (2024), who found that although students experienced a sense of belonging, this did not consistently translate into active engagement, particularly in online learning contexts, and Wu (2024) emphasized that engagement is influenced more by external support systems than by internal motivational factors alone. The study by Dulfer et al. (2024) had 20 samples; the study by Wu (2024) had 30 samples; and the current study had 299 samples.

Conclusion

The findings revealed that both self-determination and school belongingness have a significant influence on students' engagement in science education, showing the importance of fostering both personal motivation and a supportive school environment. Thus, teachers should promote autonomy and active participation, while school administration should ensure that students feel valued and connected. Overall, improving engagement requires a balanced approach that nurtures both students' self-determination and school belongingness.

Based on findings, it was concluded that the combined 23% influence of self-determination and school belongingness as predictors of students' engagement in science education is significant. Hence, the Self-Determination Theory (SDT), which posits that when the basic psychological needs—autonomy (self-determination), competence (excluded in this study), and relatedness (school belongingness) are satisfied, individuals are more likely to demonstrate higher levels of motivation and engagement in learning, was supported.

Recommendations

Future researchers may conduct the same studies exploring other variables not covered in this study, and include the competence component of Self-Determination Theory (SDT) to provide a more comprehensive understanding of students' engagement in science education. Furthermore, qualitative research may be undertaken to explore emerging themes and sub-themes, on which other potential variables to explore may be based. Moreover, school administrators, policymakers,

and teachers should collaboratively promote students' engagement in science by creating supportive, student-centered environments that foster autonomy and relatedness through choice, collaboration, and positive relationships, and by implementing programs that strengthen students' sense of school belonging.

REFERENCES

- [1.] Abolghasemi Hedeschi, M., Arefi, M., & Farokhzadian, J. (2025). Examining the relationship between school belonging, academic support, and emotional self-awareness among high school students. *International Journal of School Health*. Advance online publication.
- [2.] Akar-Vural, R., Yılmaz-Özelçi, S., Çengel, M. & Gömleksiz, M. (2013). The development of the “Sense of Belonging to School” Scale. *Egitim Arastirmalari Eurasian Journal of Educational Research*. 53, 215-230.
- [3.] Aker, K., & Ellis, A. (2019). *The relationship between math engagement and achievement: A meta-analysis*. *Educational Psychology Review*, 31(3), 735–777. <https://doi.org/10.1007/s10648-019-09477-7>
- [4.] Assefa, Y., Tilwani, S. A., Moges, B. T., & Majeed, H. (2025). Unpacking student engagement and its mediating role in predicting the relationship between self-determination and academic satisfaction among undergraduate students in higher education. *Social Sciences & Humanities Open*, 12, 101797. <https://doi.org/10.1016/j.ssaho.2025.101797>
- [5.] Asur, Anjelo O & Antiga, Edziel W & Balondo, Ian Jane M & Besario, Mariel S & Dacula, Maria Eloiza J & Gelaga, Aj Y & Laguna, Lyka A & Nuñezes, Shaira E & Tandoc, Cassie Hazel L & Anna Marie O. Pelanda, 2026. "Sense of Belonging and Autonomous Learning Ability as Determinants to Students' Engagement," *International Journal of Research and Innovation in Social Science*, *International Journal of Research and Innovation in Social Science (IJRISS)*, vol. 10(2), pages 3804-3815, February.
- [6.] Best, J. W., & Kahn, J. V. (2016). *Research in education* (10th ed.). Pearson
- [7.] Borg, W. R., Gall, M. D., & Gall, J. P. (2021). *Educational research: An introduction* (11th ed.). Pearson Education.

-
- [8.] Briones, R. M., Garcia, M. T., & Ramos, P. D. (2023). *Student engagement and academic performance in science courses: A Philippine perspective*. International Journal of Science Education, 45(8), 1279–1296. <https://doi.org/10.1080/09500693.2023.2185402>
- [9.] Chen, A., Garcia, R., & Smith, L. (2023). Multidimensional sense of belonging in higher education contexts. *The Review of Higher Education*, 47(2), 201-225.
- [10.] Chiu, T. K. F. (2022). Applying self-determination theory to explain student engagement in online learning. *Journal of Educational Computing Research*, 60(3), 739–761. <https://doi.org/10.1177/07356331211019927>
- [11.] Chiu, T. K. F., Ismailov, M., et al. (2023). *Using Self-Determination Theory to explain student STEM interest and identity development*.
- [12.] Chorosiewski, K. A. (2015). *An examination of self-determination, student participation in extracurricular activities, and psychological well-being among juniors in one Massachusetts (U.S.) public high school* (Doctoral dissertation, Northeastern University). Northeastern University Library Digital Repository.
- [13.] Cohen, L., Manion, L., & Morrison, K. (2021). *Research methods in education* (9th ed.). Routledge. <https://doi.org/10.4324/9780429054884>
- [14.] Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE.
- [15.] Datu, J. A. D., & Noltemeyer, A. (2024). *Sense of relatedness and science engagement among Filipino high school students*. *Psychology in the Schools*, 61(8), 3410–3420. <https://doi.org/10.1002/pits.23224>
- [16.] Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press.
-

-
- [17.] Dulfer, N., Gowing, A., & Mitchell, J. (2025). Building belonging in online classrooms: relationships at the core. *Teaching in Higher Education*, 30(4), 1024–1040. <https://doi.org/10.1080/13562517.2024.2349993>
- [18.] Famero, A. M. (2021). *Perceptions and predictors of science motivation under the realm of self-determination theory among Grade 10 public school students*. Romblon State University Research Journal, 3(2), 14–21. <https://ojs.rsu.edu.ph/index.php/rsurj/article/view/45>
- [19.] Fredricks, J. A., Wang, M.-T., Saxton, E., Butler, T., & Hong, J. S. (2019). *Student engagement, learning, and well-being: A meta-analysis and empirical review*. Review of Educational Research, 89(6), 947–995. <https://doi.org/10.3102/0034654319888995>
- [20.] Field, A. (2024). *Discovering statistics using IBM SPSS statistics* (6th ed.). SAGE Publications.
- [21.] Gao, N., Shao, W., Rahaman, M. S., & Salim, F. D. (2020). *n-Gage: Predicting in-class emotional, behavioural and cognitive engagement in the wild*. ArXiv. <https://arxiv.org/abs/2007.04831>
- [22.] Grabau, T. (2022). *The global challenge of low student engagement in science: A perspective*. UNESCO Publishing. Gravetter, F. J., & Wallnau, L. B. (2021). *Statistics for the behavioral sciences* (11th ed.). Cengage Learning.
- [23.] Goodenow, C. (1993). *The psychological sense of school membership among adolescents: Scale development and educational correlates*. Psychology in the Schools, 30(1), 79–90. <https://doi.org/10.1002/1520-6807>
- [24.] Howard, J. L., Gagné, M., & Bureau, J. S. (2017/2021 updates). Testing a continuum structure of self-determination theory. *Contemporary Educational Psychology*, 49, 216–226. <https://doi.org/10.1016/j.cedpsych.2017.02.002>
- [25.] Korpershoek, H., Canrinus, E. T., Fokkens-Bruinsma, M., & de Boer, H. (2020). The relationships between school belonging and students' outcomes: A meta-analysis. *Educational Research Review*, 31, 100347. <https://doi.org/10.1016/j.edurev.2020.100347>
-

-
- [26.] Lee, T. S. (2025). *Sampling techniques for social science research* (2nd ed.). Oxford University Press.
- [27.] Li, X., Zhang, Y., & Wang, Y. (2024). Perceived feedback and school belonging: The mediating role of subjective well-being among adolescents. *Frontiers in Psychology*, 15, 1450788. <https://doi.org/10.3389/fpsyg.2024.1450788>
- [28.] Likert, R. (1932). *A technique for the measurement of attitudes*. *Archives of Psychology*, 140, 155.
- [29.] Mtshweni, B. V. (2024). Sense of belonging and academic persistence among undergraduate university students: The chain mediation effect of emotional and academic adjustment. *Journal of Psychology in Africa*, 34(2), 176–183. <https://doi.org/10.1080/14330237.2024.2335868>
- [30.] National Research Council. (2012). *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press.
- [31.] Neuman, W. L. (2020). *Social research methods: Qualitative and quantitative approaches* (8th ed.). Pearson.
- [32.] Oranga, J., & Matere, A. (2025). Quantitative research: Types, advantages, generalizability & limitations. *Open Access Library Journal*, 12, 1–9.
- [33.] Palomo, S., & Chagas, M. L. (2022). *Sense of school belongingness as a predictor of student academic motivation*. *International Journal of Research Studies in Education*, 11(3), 405–426. <https://doi.org/10.5861/ijrse.2022.191>
- [34.] Quinlan, K. M., Jerrim, J., & Marks, R. (2021). The role of emotions in student learning and engagement: Insights from psychology and education. *Oxford Review of Education* 47(6),
- [35.] Ryan, R. M., & Deci, E. L. (2020/2023). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press.
-

-
- [36.] Saludes, A. S., & Langub, A. S. (2023). *Low interest and engagement in science education: The case of Filipino students*. Philippine Journal of Education and Research, 5(2), 55–72.
- [37.] Samanth, M. (2024, May 17). *A brief introduction to research methodology*. IJCRT, 12(5). <https://doi.org/10.2139/ssrn.4866355>
- [38.] Tomaszewski, W., Xiang, N., & Huang, Y. (2023). School climate, student engagement and academic achievement across school sectors in Australia. The Australian Educational Researcher, 51, 667–695.
- [39.] UNESCO. (2023). STEM education for global development. UNESCO Publishing.
- [40.] Vijayakumar, M. (2023). *Practical handbook on research methodology and statistical analysis*. Lulu Publishing Services.
- [41.] Wang, M.-T., Fredricks, J. A., Ye, F., Hofkens, T. L., & Schall, J. S. (2016). *The math and science engagement scales: Scale development, validation, and psychometric properties*. Learning and Instruction, 43, 16–26. <https://doi.org/10.1016/j.learninstruc.2016.01.008>
- [42.] Wilks, V. K. (2016). *A study of the self-determination of high school students in a blended learning environment* (Doctoral dissertation, Gardner Webb University). https://digitalcommons.gardner-webb.edu/education_etd/190/
- [43.] Wisenthige, K. (2023) Research Design. In: Saliya, C.A., Ed., *Social Research Methodology and Publishing Results: A Guide to Non-Native English Speakers*, IGI Global, 74-93. <https://doi.org/10.4018/978-1-6684-6859-3.ch006>
- [44.] Wu, Q. (2024). *Effects of self-determination theory on student engagement* (Doctoral dissertation, Syracuse University). <https://surface.syr.edu/etd/>
- [45.] Zilvinskis, J., Rocconi, L., & McCormick, A. C. (2021). *The relationship between student engagement and academic outcomes in higher education*. Research in Higher Education, 62(2), 163–183. <https://doi.org/10.1007/s11162-020-09593-y>
-