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THE MEDIATING EFFECT OF ACHIEVEMENT EMOTIONS ON THE RELATIONSHIP BETWEEN TEACHER COMMUNICATION BEHAVIOR AND THE ATTITUDE OF STUDENTS TOWARD SCIENCE

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ABSTRACT
The goal of this study is to investigate whether achievement emotions explain the relationship between teacher communication behavior and the attitude of students toward science. This study employed a descriptive and correlational research approach. Using stratified random sampling, 274 grade 10 students were selected as respondents from six public secondary schools in New Corella District, Davao del Norte Division during the school year 2023-2024. Furthermore, this study employed three adapted survey questionnaires validated to collect data, which were treated using mean, standard deviation, Pearson-r, regression analysis and Sobel test. The findings revealed that teacher communication behavior is oftentimes observed, their attitude toward science is sometimes observed and their achievement emotions are moderately felt. The results also showed a significant relationship between teacher communication behavior and the attitude of students toward science. Achievement emotions also positively correlate with the attitude of students toward science. The results also revealed a significant relationship between teacher communication behavior and achievement emotions. Moreover, the findings indicate that achievement emotions partially mediate the relationship between teacher communication behavior and the attitude of students toward science. These findings prompt educators and administrators to enhance and expand programs and interventions with the goal of improving teacher communication behaviors, and achievement emotions to enhance student's attitudes toward science. Moreover, it is imperative to replicate the study across other contexts and locales to substantiate the findings and enhance understanding of these variables on a larger scale.

KEYWORDS: *Science Education, teacher communication behavior, attitude of students toward science, achievement emotions, descriptive and correlational designs, mediation analysis, New Corella District, Davao del Norte, Philippines.*

BACKGROUND OF THE STUDY

Educators were concerned about students' attitude toward science because there is a notable decline in interest for science among students (Mirana, 2019). Ineffective teacher communication behavior in the classroom failed to engage students adequately, resulting in reduced interest and attitude of students toward science subject (Osborne, 2019). Student's achievement emotions lead to negative emotional reactions among students like boredom and anxiety which may result in disengagement, eventually hampering their interest in science subject (Pekrun et al., 2020). In addition, these emotions can inhibit learning as it can lower student's motivation, hinder learning performance and pose long-term problem to student's attitude toward learning science. In this sense, the attitude towards science needs to be restored for a student to regain interest and engage with science education (Santiago, 2022).

In Jambi City, Indonesia Maison et al. (2020) conducted a study pertaining to the attitude of junior high school students toward science. Results show that only 18.4% or 25 out of 136 students reported who have a positive attitude toward science. Students do not like science classes because they think the subjects are hard and students are not willing to spend more time outside the classroom on science learning and shows low interest in science-related activities. In addition, in Cambodia, Kao and Shimizu (2020) found that only 20% of students are interested in a career in science, as they think it is one of the toughest subjects. Results indicate that students have negative attitude toward science which reflects poorly in their performance on the subject. Furthermore, Susilana and Pribadi (2021) mentioned that these attitudes as loneliness, boredom, and an overall disinterest in studying science.

In the Philippines, specifically in Zamboanga del Sur, Robledo (2020) reported that students generally have a negative attitude toward science. Students find it difficult to concentrate and are easily distracted in the subject. Moreover, students perceive science as a challenging subject, which is reflected in their low scores and negatively impacts their academic performance. According to Pedrona (2020), poor academic outcomes result from students' negative attitude toward science, and such an attitude are contributed by factors like peer pressure, motivation, and high anxiety levels.
In addition, there is a concerning science attitude shown among the students from high schools of the public secondary in New Corella District, Division of Davao del Norte. In consideration

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of the consolidation of scores obtained by Grade 10 students of SY 2022-2023, test scores posted an aggregate percentage of 72.5%, lower than the target set at 75% through DepEd Order No. 55, Series 2016. Furthermore, there is a decline in student's attitude in science as indicated by fewer students pursuing the STEM (Science, Technology, Engineering, and Mathematics) strand. There were only 289 students for S.Y 2022-2023 for the STEM course, while this number dropped to 208 students in S.Y 2023-2024, reflecting a decline in enrollment. This decline in STEM enrollment highlights the need to address issue of student's attitude toward science to rebuild interest and encourage student's involvement in STEM course.

These problems above related to student's attitude toward science could have been brought by teacher's communication behavior and achievement emotions (Jia et al., 2020). Literature review indicates that student's attitude toward science is deeply influenced by teacher communication behavior and achievement emotions, producing a dynamic interaction that influences student's engagement in the subject (Xie et al., 2021). There are studies connected to association between teacher's communication behavior and student's attitude toward science (Sierto, 2023). Another piece of research indicated that a student's achievement emotions correspond to student's attitude towards science (Zhao, 2019). In addition, the attitude of students toward science has been discussed with respect to various relationships to other factors, such as science achievements (Robledo, 2020), social support (Abirin, 2022), teaching methods (Fulmer et al., 2019), and procedural skills (Mirana, 2019). The research gap marked by the researcher in the relevant literature of studies exists in that literature the mediating effect of achievement emotions relating to teacher communication behavior as well as on the student's attitude toward science. The gap this study aims to fill is the substantial correlation between teacher communication behavior and student's attitude toward science, the link between achievement emotions and student's attitude toward science, and the connection between teacher communication behavior and achievement emotions. It did this by using several instruments to explore these relationships, in turn, providing insights to be applied for educational practice improvement, policies, and curriculum development. Specifically, it aimed to improve teacher communication behavior and a positive attitude among students towards science.

It had already been found that students develop a rather negative outlook regarding science. Therefore, urgent research is necessary to address such an attitude among them for increasing their attitude toward the scientific subject and thus better involvement with proficiency. This study will certainly be beneficial for the students, thereby improving the student's attitudes toward science. Therefore, it might increase students' interest in STEM jobs that ultimately contribute to economic development and progress. Furthermore, the findings of the study would be reported to the respective forums, LAC sessions, and science training events held at the school, district, and division levels as an affirmation of commitment to the community. This will ensure that the results are made available to relevant individuals and be used to inform educational practices in science. The dissemination will include presentations, forums, workshops, and sharing through social media educational platforms.

STATEMENT OF THE PROBLEM

The study aimed to explore if achievement emotions explain the relationship between teacher communication behavior and the attitude of Grade 10 students toward science in the New Corella District, Division of Davao del Norte.

This specifically seeks to address the following questions:

1. What is the extent of teacher communication behavior of students in terms of:
   1.1 challenging;
   1.2 encouragement and praise;
   1.3 non-verbal support;
   1.4 understanding and friendly; and
   1.5 controlling?
2. What is the extent of attitude of students toward science in terms of:
   2.1 science instructor;
   2.2 anxiety in science;
   2.3 enjoyment of science; and
   2.4 science in society?
3. What is the level of achievement emotion of students in terms of:
   3.1 class-related emotions;
   3.2 learning-related emotions; and
   3.3 test-related emotions?
4. Is there a significant relationship between:
   4.1 teacher communication behavior and attitude of students toward science?
   4.2 achievement emotions and attitude of students toward science?
   4.3 teacher communication behavior and achievement emotions?
5. Do achievement emotions significantly mediate the relationship between teacher communication behavior and the attitude of students toward science?

METHODOLOGY

RESEARCH DESIGN

This research is descriptive and correlational in form under the quantitative approach. This approach entails the gathering and analysis of numerical data that enables the computation of averages, prediction, and observation of trends or causative relationships between variables (Bhandari, 2020). This method collects and assesses numerical data systematically in testing hypotheses or in answering questions regarding certain phenomena. It is very much applied in the social sciences to measure variables and observe their relationships or correlation between variables (Gawryszewski, 2019). This design was used in this study to determine, describe, and measure teacher communication behavior, achievement emotions, and students' attitudes toward science.

Descriptive approaches focus on systematically and accurately characterizing a population, circumstance, or phenomenon (Mc Combes, 2019). This may also be used to study that population or group of people for a better understanding of their attitudes, beliefs, and behaviors (Mc Combes, 2022). Due to inherent

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simplicity, flexibility, and ability to adapt to a variety of research scenarios, quantitative descriptive methodologies are also extensively utilized in research studies (Doyle et al., 2020). A correlational research methodology involves the study of how variables are interrelated in such a manner that variables are neither controlled nor manipulated. It identifies both direction as well as the strength with which two or more variables interrelate (Bhandari, 2020).

Descriptive approach was utilized in this study considering the study gathered and analyzed the data by developing a descriptive summary of teacher communication behavior, achievement emotions, and student's attitude toward science. Whereas, correlational design was applied to use statistical tools for data analysis that assess the strength of the linear link among teacher communication style, achievement emotions, and attitudes toward science from the students.

In addition, mediation analysis was employed in this research. Nguyen et al. (2021) reported that mediation analysis is one of the essential statistical techniques for describing complicated systems. It may be applied in order to probe the direction of causal relations between variables and test how much of the variance is accounted for by the mediator. In particular, mediation analysis would be pursued in order to determine if attitudes toward science and achievement emotions might serve as mediators between teacher's communication behavior and other relevant variables and thereby provide some form of identification of the causal pathway and proportion of variance as explained by the mediator.

STATISTICAL TREATMENT OF DATA

The analysis and interpretation employed the following statistical tools:

Mean: This value summarizes a large data set, also known as the arithmetic mean. This is used to evaluate the levels of teacher communication behavior, achievement emotions, and students' attitudes toward science, addressing research questions 1, 2, 3, and 4.

Standard Deviation: This quantifies the dispersion of a data collection in relation to its mean. It indicates the extent of dispersion or concentration of scores around the mean, addressing research questions 1, 2, and 3.

Pearson r: This quantifies the strength of the linear correlation between two variables. It was used to indicate correlation and assess the significance of relationships between achievement emotions and teacher communication behavior, achievement emotions and students' attitudes toward science, and teacher communication behavior and students' attitudes toward science, addressing research questions 4, 4.1, 4.2, and 4.3.

Regression Analysis. This was used to determine whether the data meets the required criteria for mediation analysis. This step ensured that the data was appropriate for examining the relationship between variables.

Sobel Test: It was employed to ascertain the mediating effect of achievement emotions on the relationship between teacher communication behavior and students' attitudes towards science, utilizing mediation analysis through the Sobel test, so addressing research question 5.

RESEARCH RESPONDENTS

Grade 10 students are the respondents in this study from six public secondary schools in New Corella District, Division of Davao del Norte for the 2023-2024 school year. The total number of students in these schools is 951, distributed as follows: School A is comprised of 132 students, School B is comprised of 25 students, School C is comprised of 21 students, School D is comprised of 110 students, School E is comprised of 627 students, and School F is comprised of 36 students. The Raosoft Sample Size Calculator, set at 95% confidence level (Z-Score = 1.96) and a 5% margin of error, determined a sample size of 274.

Furthermore, participants are selected from the six public secondary schools in the New Corella District using a stratified random sampling technique. This sampling method entails to divide the population into distinct subgroups or strata and randomly select individuals from each subgroup (Basti et al.,2021). Six schools that were chosen for this study made up the six strata. The ideal sample sizes for each school are as follows: 38 students from School A, 7 from School B, 6 from School C, 32 from School D, 181 from School E which was divided into eight substrata, and 10 from School F.

RESULTS AND DISCUSSION

The following are the results of the study.

Table 1

Summary on the Extent of Teacher Communication Behavior

Indicators	Mean	SD	Description
Challenging	3.88	0.94	Highly Extensive
Encouragement and Praise	3.84	0.97	Highly Extensive
Non-Verbal Support	3.76	0.88	Highly Extensive
Understanding and Friendly	3.85	0.97	Highly Extensive
Controlling	3.70	0.98	Highly Extensive
Overall Mean	**3.81**	**0.95**	**Highly Extensive**

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he teacher communication behavior obtained a mean value of 3.81, which corresponds to a highly extensive descriptive equivalent. This indicates that students oftentimes observe teacher communication behavior. In addition, 0.95 is the overall standard deviation suggesting that the respondents' answers are nearly aligned with the mean, indicating consistency in their responses to this specific variable.

Moreover, the findings are parallel to Xie and Derakhshan's (2021) proposition that students exhibit a highly extensive level of teacher communication behavior. Within the context of their study, students show active engagement and effective communication toward teachers, which enhances their understanding of science. Rui et al. (2024) added the importance of feedback, noting that timely and specific feedback promotes deep learning by helping students identify areas for improvement and fostering critical thinking and problem-solving. Additionally, Lam (2023) argues that frequent formative feedback encourages self-reflection and autonomy, empowering students to control their learning process.

Table 2

Summary on the Extent of Student's Attitude Toward Science

Indicators	Mean	SD	Description
Anxiety in Science	2.86	1.19	Moderately Extensive
Enjoyment in Science	3.32	1.09	Moderately Extensive
Science in Society	3.59	1.07	Highly Extensive
Overall Mean	**3.43**	**1.09**	**Moderately Extensive**

The over-all mean of the attitude of students toward science is 3.43, which falls in the moderately extensive descriptive equivalent. The finding implies that the attitude toward science of the students is sometimes observed. Additionally, 1.09 is the standard deviation which implies that the majority of the respondents have provided comparable answers. This suggests that students have demonstrated coherence in their answers to this particular variable.

Moreover, Sahin and Yilmaz (2020) provide evidence to support the findings that students display a moderately wide attitude to science. According to these researchers, within the ambit of their study, when students are motivated and engaged; the attitudes that these manifests have been associated with variation in achievement levels among their subjects. Liu and Yu (2019) further indicate that incoherent motivation leads to mixed outcomes, since extrinsic factors such as teaching style or peer influence play a crucial role in keeping the students interested. Moreover, Archer and DeWitt (2020) indicate that positive dispositions must be developed through intentional strategies in specific to develop long-term commitment towards science, especially when their initial interest is only moderately developed.

Table 3

Summary of the Level of Achievement Emotions

Indicators	Mean	SD	Description
Class-related emotions	3.29	1.19	Moderate
Learning-related emotions	3.31	1.15	Moderate
Test-related emotions	3.29	1.16	Moderate
Overall Mean	**3.24**	**1.17**	**Moderate**

The overall mean of 3.24 was obtained for student's achievement emotions with a descriptive equivalent of moderate. The responses of the data are spread around the mean due to a standard deviation of 1.17. Hence, it can be said that the students have reacted in an invariant manner concerning the variable at hand. It shows that students encourage well-balanced motivation, emotional regulation, and continued engagement. It further implies that students remain interested in learning and do not feel constant stress or pressure to do so, and they understand and manage their emotional reactions to any situation occurring in the class well. In addition, they very often associated the best performance with productive and lasting pursuit of success, during which time students are involved but not overwhelmed. Overall, it indicates a balance emotional engagement but there may be opportunities to enhance emotional responses to specific areas such as class-related and test-related experiences.

The findings are similar to the study of Adebajo (2023), suggesting that students who have moderate achievement emotions, like slight anxiety or pride, would have enhanced emotional regulation, which in turn leads to balanced motivation and persistent academic engagement. This was also supported by the Reeve (2024), indicating that moderate emotional responses can even boost performance since students are sufficiently motivated to exert effort without being overwhelmed by their emotions, which can prevent them from performing at their best. Moreover, Saleem (2022) highlighted that those well-balanced emotional experiences create positive emotions like interest and pleasure, which keep students involved in the learning process over time and develop a productive resilience attitude towards academic activities.

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Table 4
Significant Relationship Between Teacher Communication Behavior, Achievement Emotions and the Attitude of Students toward Science

Variables Correlated	r-values	p-values	Remarks
Teacher Communication Behavior and Student's Attitude Toward Science	0.435	0.000	Significant
Achievement Emotions and Student's Attitude Toward Science	0.603	0.000	Significant
Teacher Communication Behavior and Achievement Emotions	0.355	0.000	Significant

Table 4 illustrates that there is a low positive correlation between teacher communication behavior and the students' attitude toward science as indicated by the r-value of 0.435. The correlation is significant as evidenced by the p-value of <0.05. This suggest that improved teacher communication behavior is related to a positive attitude of the Grade 10 students toward science. The findings are supported by Chan et al. (2021) who have reported a low positive consistent correlation of teacher's communication behavior and attitude in the learning science. In addition, Sierto (2023) found out that those teacher communication behaviors consisting of the posing of challenging questions, giving encouragement and praise, offering non-verbal support, showing understanding and friendliness, and control behavior of teachers are all very well correlated with student attitudes towards science.

However, the correlation between achievement emotions and student's attitudes towards science indicates a moderate positive r-value of 0.603. The achievement emotions of students exhibit a significant positive correlation with attitudes toward science at a p-value less than 0.05. This indicates that achievement emotions among students of Grade 10 are quite high, and their attitude towards science is also high. In addition, the findings correspond to the studies of Camacho et al. (2021), indicating that there is a positive association of achievement emotions with students' attitudes towards science. This was also supported by the idea of Pekrun et al. (2020) that achievement emotions, including interest and pride were highly connected to a more positive attitude towards learning subjects, including science. In addition, Membiela et al. (2023), also emphasized that students who have positive achievement emotions in science, such as interest and excitement in the subject, are able to foster favorable attitudes towards learning science.

Moreover, the correlation between teacher communication behavior and achievement emotions with an r-value of 0.355, denotes a low positive correlation between teacher communication behavior and achievement emotions. It implies that there is a significant positive relationship between teacher communication behavior and achievement emotions ($p<0.05$). This indicates that achievement emotions among students of Grade 10 are quite high, and their attitude towards science is also high. Furthermore, the findings are supported by Derakhshan and Zare (2021) who have found a slight, yet low positive correlation between teacher communication behavior and achievement emotions. In their research, they suggest that while effective teacher communication behavior such as providing clear instruction may slightly influence achievement emotions, other factors play a more significant role in shaping student's achievement emotions. Hence, the results presented show that although the meaning of teacher communication might be relevant for students, this is part of the long list of factors associated with achievement emotions displayed by students, as Zhao (2019) pointed out.

Table 5
Sobel Test on the Type of Mediation

Type of Mediation **Significant** **Sobel z-value** **5.38211** **p = <0.000001**		
95% Symmetrical Confidence Interval **Lower 0.12386** **Higher 0.26574**		
Unstandardized Indirect Effect **a*b 0.1948** **se 0.03619**		
Effective Size Measures	R^2 Measures (Variance)	
Standardized Coefficients		
Total: 0.435	0.189	
Direct: 0.253	0.055	
Indirect: 0.182	0.133	
Indirect to Total Ratio: 0.419	0.706	

Table 5 shows explicitly indicates the Sobel test results on the significance of mediation effect. Sobel test was used to test the hypothesis that the interaction between teacher communication behavior and student's attitude toward science is influenced by achievement emotions. That is, independent and dependent variables have an indirect relationship with the mediator

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variable. Furthermore, the significance of the mediation effect is supported by a Sobel z-value of 5.38211 which exceeds the threshold of z-value >1.96 from standard hypothesis testing. Additionally, the result is considered statistically significant at the 5% significance level since the p-value is calculated at 0.001 thereby providing sufficient evidence to reject the fourth null hypothesis in this study. The unstandardized indirect effect (a*b= 0.1948) indicates the size of the indirect effect through the mediating variable (achievement emotions) with a standard error (se=0.03619), suggesting a more reliable estimate. The confidence interval provides a range of values (Lower: 0.12386, Higher: 0.26574) within which the true indirect effect (a*b) is likely to lie, with 95% confidence supporting further the conclusion that the mediation effect is significant.

Meanwhile, the effect size (β=0.182) measures how much of the effect of teacher communication behavior (IV) on student's attitude toward science (DV) can be attributed to the indirect path (IV to MV to DV). The total effect (β=0.435) is the summation of both direct and indirect effects. The direct effect (β=0.253) is the size of the correlation between teacher communication behavior (IV) and student's attitude toward science (DV) with achievement emotions (MV) included in the regression. The indirect to total ratio index reveals a beta of 0.419 with an R-square value of 0.706. This means that about 70.6 percent of the total effect of the IV on the DV goes through the MV, and approximately 29.4 percent of the total effect is either direct or mediated by other variables not included in the model.

RECOMMENDATIONS

The study's findings and conclusions lead to the following recommendations:

1. The students should attend academic or subject-specific orientation to acknowledge and identify how their emotions, such as excitement, frustration, or nervousness, influence their attitudes toward science. Attending in these orientations help students gain valuable insights into how teacher communication affects emotional responses and how these emotions in turn, affect their motivation and attitude toward learning science. This awareness enables students better manage their emotions effectively, fostering a more positive and engage approach to their studies.
2. Science teachers should adopt a holistic approach by understanding how their communication influences the emotions and attitudes of students towards science. This awareness can help them design activities that promote positive emotions and engagement. Professional development program, including workshops and training, must emphasize the enhancement of communication skills to positively influence student's emotional responses, leading to better engagement and learning in science.
3. Parents can facilitate the participation of their children in learning science by cultivating positive emotions toward the subject and maintain open communication with teachers to determine how teacher behavior impact their child's emotional responses and performance. By developing a supportive learning environment that addresses learning related emotions, parents can help improve student's attitude and experiences in science.
4. School administrators should prioritize professional development programs to enhance teacher's communication skills, enabling them to respond to student's emotional reactions to science. By promoting, a school culture that emphasizes emotional well-being, administrator can foster an environment where students develop a positive attitude toward science.
5. The Department of Education would be able to develop the diverse need of students, identify key factors influencing achievement emotions, and determine effective instructional methods to improve teacher communication. They would also implement professional development programs to provide teachers with communication tools and set guidelines for teacher-student interaction to ensure effective participation in science education.
6. Future researchers should explore how various achievement emotions, such as pride, frustration, and anxiety, influence students' interest in science and how teacher communication strategies influence these emotions. They can also examine the long-term effects of teacher communication on students' emotions and attitudes at different grade levels and cultural settings and assess interventions or professional development programs that improve teacher communication and their effects on students' emotional reactions to science.

CONCLUSIONS

Based on the findings of the study, the subsequent conclusions have been derived:

1. Teacher communication behavior perceived of the Grade 10 students is highly extensive.
2. Grade 10 student's attitude toward science is moderately extensive.
3. Grade 10 student's achievement emotions are moderate.
4. A significant and low positive relationship exists between teacher communication behavior and the attitude of students toward science among Grade 10 students. Thus, the higher they perceived teacher communication behavior, the higher their attitude toward science. In addition, a significant and moderate positive relationship exists between achievement emotions and the attitude of students toward science. Thus, the higher student's achievement emotions, the higher their attitude toward science. Moreover, a significant and moderate positive relationship exists between teacher communication behavior and achievement emotions. Thus, the higher students perceived teacher communication behavior, the higher their achievement emotions.
5. Achievement emotions partially mediate the relationship between teacher communication behavior and the attitude of students toward science.

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REFERENCES

1. *Abirin, S. G. (2022). Social Support and Students' Attitude toward Home-Based Education. Docens Series in Education, 3, 53-70. DOI-https://doi.org/10.20319/dv3.5370*
2. *Adebejo, O. A. (2023). Mode deactivation and emotion regulation therapies in the reduction of negative academic emotion among underachieving secondary school students in Ibadan, Nigeria (Doctoral dissertation). https://doi.org/10.1080/00940771.2019.1603801*
3. *Archer, M. O., & DeWitt, J. (2020). Thanks for helping me find my enthusiasm for physics! The lasting impacts research in schools projects can have on students, teachers, and schools. Geoscience Communication Discussions, 2020, 1–28. https://doi.org/10.5194/gc-4-169-2021*
4. *Bhandari, P. (2020). An introduction to quantitative research. Scribbr. https://www.scribbr.com/methodology/quantitative-research*
5. *Camacho-Morles, J., Slemp, G. R., Pekrun, R., Loderer, K., Hou, H., & Oades, L. G. (2021). Activity achievement emotions and academic performance: A meta-analysis. Educational Psychology Review, 33(3), 1051-1095. https://doi.org/10.1007/s10648-020-09585-3*
6. *Chan, S. H., & Lay, Y. F. (2021). Effects of attitude, self-efficacy beliefs, and motivation on behavioural intention in teaching science. Eurasian Journal of Educational Research, 93, 219-262. https://doi.org/10.14689/ejer.2021.93.11*
7. *Derakhshan, A., & Zare, J. (2024). Self-regulated learning and task engagement: A SEM analysis. International Review of Applied Linguistics in Language Teaching. https://doi.org/10.1515/iral-2024-0009*
8. *Doyle, L., McCabe, C., Keogh, B., Brady, A., & McCann, M. (2020). An overview of the qualitative descriptive design within nursing research. Journal of Research in Nursing, 25(5), 443–455. https://doi.org/10.1177/1744987119880234*
9. *Fulmer, G. W. (2019). Middle school student attitudes toward science and their relationships with instructional practices: A survey of Chinese students' preferred versus actual instruction. Asia-Pacific Science Education, 5(1). https://doi.org/10.1186/s41029-019-0037-8*
10. *Jia, M. O. Y. I., Zhang, H. A. I. Y. A. N., & Li, L. I. (2020). The power of teacher supportive communication: Effects on students' positive emotions and engagement in learning. Northwest Journal of Communication, 48(1). https://www.researchgate.net/publication/353026949*
11. *Kao, S., & Shimizu, K. (2020). Factors affecting Cambodian upper secondary school students' choice of science track. International Journal of Sociology of Education, 9(3), 262–292. https://doi.org/10.17583/rise.2020.4823*
12. *Lam, B. H. (2023). Empowering student teachers' autonomy through an innovative formative feedback schedule at the time of a global pandemic. In Educating teachers online in challenging times (pp. 177–204). Routledge. https://doi.org/10.4324/9781003288978-14*
13. *Liu, C., & Yu, C. (2019). Understanding students' motivation in translation learning: A case study from the self-concept perspective. Asian-Pacific Journal of Second and Foreign Language Education, 4(1), 4. https://doi.org/10.1186/s40862-019-0066-6*
14. *Maison, D., Aatalini, K., Kurniawan, D. A., Haryanto, & Kurniawan, W. (2020). Science process skills in science programs in higher education. Universal Journal of Educational Research, 8(2), 652–661. https://doi.org/10.13189/ujer.2020.080238*
15. *McCombes, S. (2019). Correlational research. Scribbr. https://www.scribbr.com/methodology/correlational-research*
16. *McCombes, S. (2022, May 5). Descriptive research design, definition, methods & examples. Scribbr. https://www.scribbr.com/methodology/descriptiveresearch/?fbclid=IwAR0xm32T3i1Uh8SsoppCrLHS4ARZAMbygMQV1p_JT6xaO5v4B I2xw5XQEiE*
17. *Membiela, P., Acosta, K., Yebra, M. A., & González, A. (2023). Motivation to learn science, emotions in science classes, and engagement towards science studies in Chilean and Spanish compulsory secondary education students. Science Education, 107(4), 939–963. https://doi.org/10.1002/sce.21793*
18. *Mirana, A. (2019). Physics content knowledge of junior high schools in HEI-supervised and DepEd schools in the Philippines. Asia Pacific Journal of Multidisciplinary Research, 7(2). Retrieved from https://www.apjmr.com*
19. *Nguyen, T. Q., Schmid, I., & Stuart, E. A. (2021). Clarifying causal mediation analysis for the applied researcher: Defining effects based on what we want to learn. Psychological Methods, 26(2), 255–271. https://doi.org/10.1037/met0000299*
20. *Osborne, J. (2019). Attitudes toward science: What we know and what we need to know. Studies in Science Education, 55(2), 121–136. https://doi.org/10.1080/03057267.2019.1667303*
21. *Pedrona, L. M. L. (2020). Science-related factors affecting students' attitudes toward science and their academic performance. Academia. https://www.academia.edu/44317132*
22. *Pekrun, R., Vogl, E., & Perry, R. P. (2020). The role of teacher communication in students' achievement emotions and engagement in science education. Educational Psychology Review, 32(2), 385–406. https://doi.org/10.1007/s10648-020-09542-0*
23. *Pekrun, R., Vogl, E., & Perry, R. P. (2020). The role of teacher communication in students' achievement emotions and engagement in science education. Educational Psychology Review, 32(2), 385–406. https://doi.org/10.1007/s10648-020-09542-0*
24. *Robledo, R. (2020). Student's attitude towards science in relation to student's achievement. International Journal of Science and Research (IJSR), 9(5), 1209–1219. https://doi.org/10.21275/ART2019804*
25. *Rui, L., Mohamad Nasri, N. U. R. F. A. R. A. D. I. L. L. A., & Mahmud, S. N. D. (2024). The role of self-directed learning in promoting deep learning processes: A systematic literature review. F1000Research, 13, 761. https://doi.org/10.12688/f1000research.150612.1*
26. *Sahin, D., & Yilmaz, R. M. (2020). The effect of augmented reality technology on middle school students' achievements and attitudes towards science education. Computers & Education, 144, 103710. https://doi.org/10.1016/j.compedu.2019.103710*
27. *Saleem, M. S., Isha, A. S. N., Awan, M. I., Yusop, Y. B., & Naji, G. M. A. (2022). Fostering academic engagement in post-graduate students: Assessing the role of positive emotions, positive psychology, and stress. Frontiers in Psychology, 13, 920395. https://doi.org/10.3389/fpsyg.2022.920395*

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28. *Santiago, P. (2022). Impact of COVID-19 on students' attitudes toward STEM education. Journal of Science Education and Technology, 31(3), 453–465. https://doi.org/10.1007/s10956-022-10039-1*
29. *Sierto, M. E. (2023). The science teachers' communication behavior in relation to students' attitude and performance. International Journal of Multidisciplinary: Applied Business and Education Research, 4(9), 3386–3402. https://doi.org/10.11594/ijmaber.04.09.18*
30. *Susilana, R., & Pribadi, B. A. (2021). Constructive online feedback to enhance learning achievement of open and distance students. World Journal on Educational Technology: Current Issues, 13(3), 514–528. https://doi.org/10.18844/wjet.v13i3.5959*
31. *Xie, F., & Derakhshan, A. (2021). A conceptual review of positive teacher interpersonal communication behaviors in the instructional context. Frontiers in Psychology, 12, 708490. https://doi.org/10.3389/fpsyg.2021.708490*
32. *Zhao, Y. (2019). Achievement emotions as mediators of teacher communication behavior and student participation: A model construction. Advances in Social Science, Education and Humanities Research, 286, 2352–5398. https://doi.org/10.2991/seiem-18.2019*
33.