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Triarchic intelligences and engagement: The erratic factors in mathematics achievement

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Abstract

This study determined the relationship between triarchic intelligences and engagement as factors in mathematics achievement of 1148 Grade 10 students in the Division of Davao del Norte, Philippines. It also investigated the relationship among the variables utilizing a descriptive-correlational and causal-comparative research design. Modified survey questionnaires were used for triarchic intelligence and engagement scales which were validated by the panel of experts. Standardized Division Unified Test was used to measure the mathematics achievement. Mean and Pearson product moment coefficient correlation were used to determine the proficiency level and the relationship between the variables while multiple linear regression was also used to derive the value and identify the predictor variable. The findings of the study showed that students did not meet the expectations on mathematics achievement; triarchic intelligences and engagement were at moderate level. Among the six indicators, only behavioral engagement was the predictor of the achievement. This indicates that the mathematics achievement of the students is best anchored on engagement. Thus, the result suggests that the more engaged the students are, the better and higher the achievement in mathematics.

Keywords: *triarchic intelligences, engagement, mathematics achievement, Davao del Norte, Philippines*

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1. Introduction

In a mathematical world, students who can do and understand mathematics have better opportunities that others do not have. Mathematics need not be tough for anyone, or even if it is difficult as experienced by many, it can still be enjoyed and appreciated as it should be so that an individual may reach a certain point of achievement. The enjoyment of the subject depends on how significant and dynamic the person's perception is. While the K to 12 curricula in the Philippines aims to uplift the quality of education and develop students to be well-prepared in emotional and cognitive aspects (Abad, 2016), the low achievement score on the National Achievement Test (NAT) shows otherwise. For instance, the Division of Davao del Norte has noted the poor performance of the students in mathematics during the Achievement Test. When the K to 12 started the NAT, the data revealed that in 2012-2013 was only 64.89. In the second year 2013-2014, the mean percentage score was only 67.39%. Moreover, the result disclosed a poor performance of students in Davao del Norte with 71.45% based on the data from DepEd NAT Result 2013.

Numerous studies showed that most of the students are afraid of mathematics (Sokolowski & Ansari, 2017; Costado & Piñero, 2024; Rozgonjuk et al., 2020; Khasawneh et al., 2021; Luttenberger et al., 2018) signified by scratching their heads whenever teachers start their lessons especially on word problem-solving. This is associated to several factors such as student-related factors (Ali et al., 2009; Honor, 2007; Elona, 2011) and school-related factors (Krishna-Reddy, 2009). However, majority of researchers associate low performance in mathematics to student engagement (Cevikbas & Kaiser, 2022; Maamin et al., 2022; Xia et al., 2022; Chand et al., 2021; Schnitzler et al., 2021; Joshi et al., 2022; Wong & Wong, 2019). While most of the studies proved student achievement through their analytic performance (Mayasari et al., 2021) in mathematics, studies suggest complete assessment through triarchic abilities (Grigorenko & Sternberg, 2001; Ekinci, 2014). However, there is limited research on triarchic intelligences of students in mathematics and there is no study associating student engagement and triarchic intelligences. Hence, this study tests the association between triarchic intelligences and engagement to reveal appropriate pedagogy that could lead to having a better teaching-learning process specifically in a mathematical perspective.

2. Literature Review

2.1. Factors affecting mathematical achievement

Achievement refers to the students' self-determination to accomplish something in an academic task. Because mathematics is challenging for the students (Abalde, 2023), their attitude towards the subject or the learning strategies affect their academic performance. Mazana (2019) specified that a number of factors have an impact of on learning and performance in Mathematics such as students' attitudes and confidence toward the subject, teachers' instructional practices, and school environment while Appiah et. al (2022) identified teacher-student relationship, self-efficacy, and student perception of mathematics. In spite of the role played by the teacher, the so-called self-concept, anxiety, self-efficacy, instructional design and attitude toward mathematics are pointed as factors to meet the expectation in mathematical success.

According to Mabena et al. (2021), poor performance in mathematics has been a global concern that has prompted developing countries to participate in initiatives to bring positive change in their communities. Mathematics excellence can bring positive change in developing countries to develop their education systems for shaping the future and prospects of young people; to develop infrastructure; and to improve economic knowledge, culture and morality, as well as the living standards of their people. However, mathematics underperformance has become a perennial concern which can prevent these developing countries from achieving their developmental goals.

2.2 Triarchic intelligences and mathematics achievement

Triarchic intelligence refers to the act of capitalizing on one's strengths and correcting or compensating for one's weaknesses to adapt, shape, and select environments through a combination of analytical, creative, and practical abilities (Sternberg, 1999). It is measured with indicators such as analytical intelligence, creative intelligence, and practical intelligence. *Analytical intelligence* is the ability to visualize, articulate, conceptualize or solve both complex and uncomplicated problems by making decisions that are sensible given the available information. *Creative intelligence* refers to as experiential intelligence which enables an individual to invent new ideas and solutions when dealing with new situations. *Practical intelligence* is defined as street-smart and the ability of a person to adapt to an environment, or change accordingly to best suit the personal needs. It was used in this study to help analyze,

explain difficult ideas, design and explore new ways, and apply the formula for computing worded problems.

Triarchic intelligence plays an important role inside the classroom since it involves formulating a meaningful and coherent set of goals for the students to reach them. Individuals coordinate those goals so that they form a coherent story in seeking life and moving a substantial distance along the path toward reaching the goals (Sternberg, 1999). Moreover, intelligence is directed towards behavioral goals relevant to the life of the individual like the adaptation of the environment and selection and shaping of an environment that leads to favorable academic performance. This intelligence involves practical, creative and analytical that embodied in tacit knowledge, increases with experience, and it is how one profit or learns from experience (Sternberg et al., 2000).

According to Dandagal et al. (2017) and Hendriyanto (2022), when student's mathematics achievement increases, their IQ will increase. Intelligence has a strong correlation with individual cognitive abilities such as thinking, remembering, reading, learning, problem-solving and language use. Hence, Natsir and Munfarikhatin (2021) argue that mathematical literacy is also essential in developing children's mathematical intelligence. However, Kullar et al. (2019) revealed that students with low IQ have significantly lower academic achievements compared to those with normal IQs. This shows that the students' IQ levels affect their academic achievement. Syafi'i et al. (2018) explain that this condition is caused by psychological factors which are one of the causes of fluctuations in learning achievement.

While many studies have suggested that performance equates to the academic achievement of the students, such as class performance, test performance and composite performance as an aggregated result, academic achievement is not itself a determiner of students' performance. This cannot be individually evaluated without going into the exploration of contributors to academic achievement (Madigan & Curran, 2021). For example, deep learning agility in many settings can provide new experiences (Murphy, 2021), which can be best predictor of future performance. Similarly, many researchers have shown interest in finding the relationship between intelligence and engagement leading to have a good academic achievement. Dandagal et al. (2017) studied the interrelationship between creativity, intelligence and academic achievement of 11th grade boys and found out that relationship between creativity and intelligence was low but positive and the relationship between intelligence and academic achievement was linear. Furthermore, these abilities reflect together

to form a successful intelligence that needs to be developed in a balance, help students to capitalize on their strengths, and at the same teach them that correcting or compensating for their weaknesses will lead them to achieve success. According to Purpura et al. (2017), a person's intelligence is not only measured in solving calculation questions but it is necessary to have good mathematical problem-solving skills for concrete certain problems.

2.3 Engagement and mathematics achievement

Aside from intelligence, engagement gives assurance to the student performance. This is the complex construct influenced by multiple factors (Fredericks et al., 2004). The students engage in classroom activities like talking to others around them, sharing different ideas about their performance and helping others in school involvements. It encompasses students' effort, persistence, participation, and compliance with school structures like daily/weekly grades for classroom, homework completion and task persistence. Its multifaceted constructs operate at three levels: cognitive, affective and behavioral. *Cognitive engagement* is the investment in his/her learning environment like motivation and self-regulation, *affective engagement* is the emotional reactions in the classroom and in the school, which is a sense of belongingness or connectedness to the school, and *behavioral engagement* is the students' participation in education, including the academic, social and extracurricular activities of the school.

Student engagement is a multi-faced concept and should be examined holistically, rather than in isolation. Through the course design, syllabus, activities, content, and assessment, instructors have a strong influence on how our students think, feel, and act. According to Zepke (2018), student engagement as a construct identifies what students do, think about, and feel when learning, and how teachers can improve that doing, thinking, and feeling in instructional settings. Li (2023) argues that student engagement plays an important role in the relationship between learner interaction and instructor presence in terms of both perceived student learning and student satisfaction. It includes a sense of belonging and valuing, cognitive, emotional, and behavioral engagement, peer relationships, and relationships with faculty members. Ultimately, student engagement promotes learning quality and performance.

Studies proved that engagement improves academic performance and has been repeatedly demonstrated to be a string predictor of achievement and behavior in schools. For instance, Jian (2023) found that students are more engaged in classrooms in which they have good relationships with their peers and teachers. They expect instructors promote students'

independence, provide clear and consistent feedback and give varied, daunting, fascinating and impactful tasks (Groccia, 2018). In this note, Peng (2021) suggests academic motivation and sustainable student engagement as the two of the most important examples that play a key role in students' academic achievement.

Student engagement is justified as malleable which means that through their actions, teachers can affect the engagement of the student's ether positively or negatively. According to Hasanov et al. (2021), students' engagement depends on the teachers' behavior, which may produce the most fruitful outcomes on academic achievement. Studies found positive relationship between behavioral engagement and achievement. For instance, Brallier (2020) found student engagement associated with learning, academic performance, persistence, retention, and academic achievement. Similarly, Ketonen et al. (2016) found that engaged students were more certain of their career choice, while disengaged students lacked interest or had uncertainty about their career path. However, Konold et al. (2018) found no link between student academic achievement and engagement.

3. Methodology

This study used descriptive quantitative research design to measure the association between triarchic intelligence and student engagement. It measured the three indicators of triarchic intelligence such as practical, analytical and creative, and three levels of student engagement such as cognitive, affective and behavioural.

The cluster sampling method was used in selecting the participants to ensure equal representation. This technique was employed since the Division of Davao del Norte has four (4) clusters and each cluster comprised of seven (7) to ten (10) different schools with a total of 4454 Grade 10 students. Of the total sample, Cluster 1 has 353 participants included, Cluster 2 has only 160 respondents, Cluster 3 has 405 respondents and Cluster 4 has 230 respondents. Only 1148 students from the different secondary public schools were coming from the different clusters and were enrolled for the school year 2017-2018. These students also belonged to the K to 12 curricula, although most of the students were not part of top or performing students but they were considered to be active participants in both academic and school-related activities. Considering the K to 12 curricula, the division supports the implementation of the different training programs for teachers who handled the mathematics subject like Regional Mass Training for Teachers, Mathematics Teachers Association of the Philippines (MTAP),

even Science and Mathematics Enhancement Program (SMEP) created and the making of Strategic Intervention Materials (SIM) to be used by other teachers.

The mathematics achievement level of students under K to 12 programs was measured using the Division Unified Test. A Table of Specification was laid and used to identify the achievement domain being measured and to ensure that a fair representative of questions of test. The guidelines in DepEd Order No. 8 series 2015 were the basis in plotting the five favorable gradations: outstanding (90-100), very satisfactory (85-89), satisfactory (80-84), fairly satisfactory (75-79) and did not meet expectations (74 and below). All grades were based on weighted raw score of the learners. The minimum grade needed to pass a specific learning area is 60 which is transmuted to 75 to the report card. The result of the said division examination during the first quarter of the School Year 2017-2018 was utilized with 40 competency-based items.

To establish an accurate measurement of the level of triarchic intelligence as perceived by the Grade 10 students in every indicator, the study adopted and developed an instrument based on Sternberg Triarchic Intelligence Test with Cronbach's Alpha of 0.910, which has acceptable internal consistency. The ratings were based on the five (5) point scales. Moreover, engagement survey questionnaire was a researcher-made type of questionnaire with a Cronbach's Alpha of 0.880, acceptable internal consistency. The rating was based on five (5) point scales.

The weighted mean was used to determine the proficiency level of the students and Pearson Product Moment Coefficient Correlation was used to determine the relationship between the variables. Positive correlation indicates the extent to which those variables increase to which one variable increases as the other decreases. On the other hand, multiple linear regression was also used to derive the value of a criterion from several other independents or predictor variables to determine which variable predicts the mathematics achievement.

4. Findings and Discussions

Using the Division Unified Test result, the participants belong to the lowest level of proficiency, *did not meet expectation*. This means that the students do not possess the minimum knowledge, skills, and understanding and they struggle to understand the prerequisite to learn the concepts. The over-all mathematics performance of Grade 10 students falls at the 74 and

below bracket. This implies that students undergo remedial classes for learning areas and comply all the requirements set by the K to 12 Curriculum Guide. A similar result was found in the study of Capuno et al. (2019) about the performance involving Grade 9 students in Mandaue City Division, Cebu.

Table 1

Level of students' mathematics achievement

Transmuted Grade	Frequency	Percentage	Level of Proficiency
90 -100 (84.00 - 100)	0	0%	Outstanding
85 – 89 (76.00- 83.99)	0	0%	Very Satisfactory
80 – 84 (68.00-75.99)	3	0.2%	Satisfactory
75 – 79 (60.00 – 67.99)	51	4.4%	Fairly Satisfactory
74 and Below (0 – 59.99)	1115	95.4%	Did not meet Expectations

Note: Mean = 39.09; SD=10.46; Description: Did not meet expectations

Moreover, the result signifies that there is difficulty among students in mastering the content area of the topics in the first quarter of the school year. This calls for an immediate response from teachers and other stakeholders. This confirms the study of Gafoor et al. (2015) that mathematics subject causes many negative emotions and challenges mathematics teachers to develop positive attitude in students toward learning mathematics. Therefore, teachers should be aware of students' affective beliefs and inter-relations of those in learning mathematics so as to employ more effective strategies in teaching. Similarly, Alingay (2017) stressed that the observed poor performance in mathematics test has been a matter of serious concern to all well-meaning education. The schools and teachers must take steps to address such issues like implementing differentiated instructions and providing additional support to struggling students (Aguhayon et al., 2023). This could be enough for methods and approaches be considered to provide a rich, meaningful environment that would arouse their interest and challenge them to think higher levels of learning mathematics concepts.

Table 2 shows the assessment of the different aspects of the intelligence. This presents a summary of the level of triarchic intelligence. The descriptive analysis shows that the level of the students in triarchic intelligence is moderate. This means that the activities of the students in analytical, creative and practical aspects were established inside the classroom.

Table 2

Level of triarchic intelligences

Indicators	Mean	Standard Deviation	Qualitative Description
Practical	3.36	1.14	Moderate
Analytical	3.34	1.16	Moderate
Creative	3.33	1.17	Moderate
Overall	**3.34**	**1.16**	**Moderate**

The result also reveals that practical intelligence got the highest mean. This signifies that the students acquire doing everyday activities through various activities like solving different logical problems, composing and creating new songs in mathematics and trying to resolve mathematical problems in ways and manners. Students help in navigating tough negotiations and embracing challenges on the fly. They are also adaptive and reflexive and they can change their approach to suit the requirements of the environment and situation echoing the idea of Flynn (2018). This further means that students should be encouraged to use their ideas gained inside the classroom. As stated by Sternberg et al. (2007), classrooms should not create a gap between real life and book learning. Lessons learned from books should find an implementation in the field, workshops, laboratories and playground. There must be a maximum opportunity given to work in stimulated settings which would provide hands-on experiences and more practical wisdom.

On the other hand, creative intelligence got the lowest mean, which means that the students hardly understand the activities, affirming the finding of Goetz et al., (2005) that the absence of enjoyment is one foundational reason for young people failing to achieve their potential. The result further supports Drebin (2014) that students should be aware of their capabilities and see how to connect the skills from one area to another. This is very evident because one of the students agreed that they experienced these kinds of activities inside the classroom especially the activities in practical intelligence like applying the formula during computation of worded problems, enjoying solving together with their friends and practicing every now and then so they will not forget the process or steps in solving mathematical problems. This also reflects the findings of Mai (2021) that the more intelligence is practiced by the learner through applying thinking skills the more thinking patterns are updated. Hence, as suggested by Hussein (2018), helping teachers to improve their performance in the education process and the possibility of adopting multiple intelligences as an input in teaching

styles will take into consideration the nature of the learners in the classroom. These would be the guide to all learners that suits their abilities and tendencies, improves students' achievement levels and raises their levels of interest towards educational content.

The level of student engagement with its three indicators is shown in the table 3. It can be gleaned from the table that the students' level of engagement is at a moderate level. This means that students have enough involvement in the classroom and extracurricular activities; they have a sense of belongingness and a general sense of liking toward school. Throughout the result, Wang and Peck (2013) emerged with the notion that students' perceptions of the school environment influence their motivation for academic achievement which can be influenced by these three types of engagement.

Table 3

Level of student engagement

Indicators	Mean	Standard Deviation	Qualitative Description
Behavioral	3.39	1.21	Moderate
Affective	3.39	1.17	Moderate
Cognitive	3.32	1.19	Moderate
Overall	**3.37**	**1.19**	**Moderate**

The table also shows that both behavioral and affective engagements got the same mean. This is an indication that students are attentive in learning activities and they have a sense of belongingness. As Fredricks et al. (2004) emphasized, having these engagements help correspond to the developmental needs of the students for competency, autonomy, and relatedness in school. Students have positive feelings of belongingness to school because they enjoy interacting with their peers or their teachers. Moreover, it was reflected that these engagements were referred to as participation in school activities and considered as being loyal to school rules and not getting into trouble in school. This concurs with the idea of Abla et al. (2019) that school is not merely a place where knowledge is transferred from one generation to the next but is also a place for emotional connections, which can be either negative or positive.

On the other hand, cognitive engagement got the lowest overall mean. This shows that cognitive engagement may hardly be developed. Blondal and Adalbjarnardottir (2012) stated that assessing the level of student engagement within a school is essential because school

failure and dropout are often the outcomes for these students. To minimize student failure and dropout, it is crucial to assess the engagement of the students. Wentzel (2003) stressed that engagement as a matter of student's will to feel about their works, their skills, and the strategies they employ to master their works. This means that students put into thinking about their tasks and incorporate the required thoughts to comprehend their ideas, and to master the content which is presented inside the classroom.

Although students might be disengaged, they might be succeeding academically. Such disengagement includes the feelings toward school and behaviors while at school. This is evident to the class because some of the students agreed that sometimes they were not paying attention to the teacher especially during instruction, that is why they always ask questions to the teacher on what they are going to do, and they always seek help from their classmates. This scenario is similar to the idea of Ginting (2021) that students are engaged in meaningful learning activities when they connect with other learners and complete substantial tasks. In spite of the fact that the students have different study techniques, they still find difficulty in learning mathematics. They must develop the best study techniques that will suit their capabilities to learn math. Therefore, it is desirable that the students be motivated toward developing study habits for a better attitude and understanding of the subject matter. Engagement may be aptly summed up with contention of Ali et al. (2018) that teachers play an important role in promoting positive relationships with students by understanding the students' background and building a learning environment that focuses on relevant and meaningful learning experiences to enhance student involvement in their learning process.

Table 4 shows the correlation between triarchic intelligence, engagement and mathematics achievement of the students. It is evident that there is a positive correlation between the two variables. The significant relationship shows that triarchic intelligences and engagement has a p-value results ($p < 0.05$) correlated to mathematics achievement. This implies that students' engagement contributed to their mathematics achievement as reflected in the p-value results ($p<0.01$) while triarchic intelligences also contributed to mathematics achievement as shown in the p-value ($p<0.05$).

The result on triarchic intelligences conforms to the findings of Parveen (2014) that there is a positive high relationship between intelligences and achievement. The data imply that teachers should balance the use of these intelligences in teaching and assessment which is

fruitful for all the students. The maximum use of different teaching aids will lead the students to understand, select, shape and even change the environment.

Table 4

Relationship between variables and mathematics achievement

Variables	Mathematics Achievement	
	r	p-value
Triarchic Intelligences	.072	.014*
Analytical	057	.049*
Creative	.073	.012*
Practical	.063	.014*
Engagement	.139	.000**
Behavioral Engagement	.159	.000**
Affective Engagement	.094	.001**
Cognitive Engagement	.116	.000**

Legend: **Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Moreover, the findings on engagement is consistent with Lee (2014) that there is a positive relationship between student engagement and learning achievement. This indicates that a student's engagement is considered essential for learning and achievement. Similarly, it is congruent with Mysore et al. (2020) that successful intelligence was positively related to the academic engagement and Bodovski and Youn (2012) that students accepted by their peers and with social skills often do better in school. Students who demonstrate active involvement in school have high academic achievement and positive attitudes while disengaged students usually face the opposite situation demonstrating low academic achievement and negative attitudes and behaviors (Ali et al., 2018).

Table 5 shows the multiple regression analysis to identify the predictor of mathematics achievement. Among the six variables, only behavioral engagement *(B=1.401, t=4.051, p<0.001)* was found to be a meaningful, significant predictor of mathematics achievement. The R^2 value (0.034) means that at most 3.4% of the variance of the mathematics achievement is explained by behavioral engagement. It can be concluded that for increase in the engagement, there is a corresponding increase in mathematics achievement as evidenced by the beta value of 0.124. This means that the high levels of behavioral engagement resulted in

a good classroom climate for learning of the students. Meanwhile, the rest of the variables such as analytical, creative, and practical intelligences, as well as affective and cognitive engagements were not significant predictors of mathematics achievement ($p>0.05$).

Table 5

Multiple regression analysis

Independent Variables	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	**Std.Error**	**Beta**	**t**	
Constant	**29.471**	**1.596**	**18.462**	**.000**	
Triarchic Intelligences					
Analytical	-0.2853	.235		-1.210	.226
Creative	0.2256	.234		0.960	.335
Practical	-0.1213	.231		-0.520	.601
Engagement					
Behavioral	1.4060	.347	.124	4.051	.000
Affective	0.8170	.233		3.490	.236
Cognitive	-0.1592	.223		-0.712	.476

Note: $r=0.183$, $r^2=0.034$, F-ratio=20.227, p-value=.000

Dependent: Mathematics Achievement

The result explains the findings of Böheim et al. (2020) that more engaged students may take form in raising a hand to contribute verbally, respond to a question, make suggestions, and ask a question if called by the teacher. Engagement of students is often associated with academic achievement and it can be a tool in addressing disciplinary problems in schools. Similarly, Lee (2014) concluded a positive relationship between behavioral engagement and academic performance, there is a possibility that emotional engagement influences academic performance through behavioral engagement. The findings of the study coincide with the studies of Jian (2022) that more engaged students in classrooms have good relationships with their peers and teachers, but refutes Albarico et al. (2023) on triarchic intelligences predicting mathematics achievement. For this, Chi et al. (2018) suggest students deep processing to link and organize new information with their prior knowledge and Parsons et al. (2014) for teachers to understand student engagement to understand their achievement.

5. Conclusion and Recommendation

Among the six indicators, only behavioral engagement influences mathematics achievement *(B=1.401, t=4.051, p<0.001)*. It can be concluded that for an increase in engagement, there is a corresponding increase in mathematics achievement. This means that the high levels of behavioral engagement results to a good classroom climate for learning. The more they engage, they maintain positive attitudes towards learning which results to higher achievement.

The results suggest teachers to conduct a competency-based diagnostic test to increase the engagement of the students. This will help them decide on appropriate pedagogy during the teaching-learning process. They are also encouraged to spend time crafting teaching matrices with the inclusion of affective, cognitive and behavioral engagement. They may provide different activities that will let the students appreciate usefulness and significance of mathematics, extend their interest and improve positive attitude. Additionally, they need to provide instructional initiative that allows students to master, experience, persuade and express understanding in their own manner.

References

Abad, M. I (2016). *Academic performance and attitude towards science of grade 9 students in differentiated instruction*. Central Mindanao University, Bukidnon. Unpublished Thesis.

Abalde, G. & Oco, R. (2023). *Factors associated with mathematics performance*. Southern de Oro Philippines College-Graduate School, Cagayan de Oro City, Philippines.

Abla, C., & Fraumeni, B. R. (2019). *Student engagement: Evidence-based strategies to boost academic and socialemotional results*. McREL International.

Aguhayon, H., Tingson, R. & Pentang, J. (2023). Addressing students learning gaps in mathematics through differentiated instruction. *International Journal of Educational Management and Development Studies*, 4 (1), 69-87. https://doi.org/10.53378/352967

Albarico, A., Blas, R. Cruz, A. & Enriquez, G. (2023). Factors affecting senior high school students' poor academic performance. *International Research Journal of Modernization in Engineering Technology and Science*, 5(4).

Ali, M. & Hassan, N. (2018). Defining concepts of student engagement and factors contributing to their engagement in schools. *Creative Education*, 9, 2161-2170. https://doi.org/10.4236/ce.2018.914157

Alingay, A. S. (2017). *Mathematical competencies, psychological attitudes, teaching characteristics and students' achievement*. Unpublished MAT Thesis. Central Mindanao University, Musuan, Bukidnon.

Blondal, K. S., & Adalbjarnardottir, S. (2012). Student disengagement in relation to expected and unexpected educational pathways. *Scandinavian Journal of Education Research*, 56(1), 85-100.

Bodovski, K., & Youn, M.J. (2012). Students' Mathematics Learning from Kindergarten through 8th Grade. *International Journal of Sociology of Education,* 1(2), 97-122.

Böheim, R., Knogler, M., Kosel, C., & Seidel, T. (2020). Exploring student hand-raising across two school subjects using mixed methods: An investigation of an everyday classroom behavior from a motivational perspective. *Learning and Instruction, 65*, 101250. https://doi.org/10.1016/j.learninstruc.2019.101250.

Brallier, C. (2020). *The effects of student engagement on academic achievement among college students*. Middle Tennessee State University.

Capuno, R., Necesario, R., Etcuban, J., Espina, R., Padillo, G., & Manguilimotan, R. (2019). Attitudes, study habits, and academic performance of junior high school students in mathematics. *International Electronic Journal of Mathematics Education,* 14(3), 547-561. https://doi.org/10.29333/iejme/5768

Carini, R.M., Kuh, G.D. & Klein, S.P. (2006) Student engagement and student learning: Testing the linkages. *Research in Higher Education*, 47, 1-24. https://doi.org/10.1007/s11162-005-8150-9

Cevikbas, M. & Kaiser, G. (2022). Student engagement in a flipped secondary mathematics classroom. *Int J of Sci and Math Educ,* 20, 1455–1480. https://doi.org/10.1007/s10763-021-10213-x

Chand, S., Chaudhary, K., Prasad, A. & Chand, V. (2021). Perceived causes of students' poor performance in mathematics: a case study at Ba and Tavua secondary schools. *Front. Appl. Math. Stat*. 7:614408. https://doi.org/10.3389/fams.2021.614408

Chi, M. T. H., Adams, J., Bogusch, E. B., Bruchok, C., Kang, S., Lancaster, M., Levy, R., Li, N., McEldoon, K. L., Stump, G. S., Wylie, R., Xu, D., & Yaghmourian, D. L. (2018).

Translating the ICAP theory of cognitive engagement into practice. *Cognitive Science: A Multidisciplinary Journal, 43*(6), 1777–1832. https://doi.org/10.1111/cogs.12626

Costado Dios, M.T. & Piñero Charlo, J.C. (2024). Mathematical anxiety among primary education degree students in the post-pandemic era: a case study. *Education Sciences*, 14(2), 171. https://doi.org/10.3390/educsci14020171

Dandagal, S. N & Yarriswami, M. C. (2017). *A study of intelligence in relation to academic achievement of secondary school students*. Research Scholar, School of Education, Rani Channamma University

Department of Education (2012). *Discussion paper on the enhanced K to 12 education program*. Pasig City: CEAP.

Department of Education (2015). *Policy guidelines on classroom assessment for the K to 12 basic Education Program*.

Drebin, C. (2014). *What is creative intelligence?* The Globe and Mail Inc. Toronto, Canada.

Ekinci, B. (2014). The relationships among Sternberg's Triarchic abilities, gardner's multiple intelligences, and academic achievement. Social Behavior and Personality: an international journal, 42(4), 625-633. https://doi.org/10.2224/sbp.2014.42.4.625

Flynn, R. (2018). What is practical intelligence? And how you can improve it? https://blog.mindvalley.com/practical-intelligence/

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74, 59–109.

Gafoor, K. A. and Kurukkan, A. (2015). *Why high school students feel mathematics difficult? An exploration of affective beliefs*. Presented in Pedagogy of Teacher Education: Trends and Challenges Farook Training College, Kozhikode, Kerala

Ginting, D. (2021). Student engagement, factors, and methods affecting active learning in english language teaching. *Veles Voices of English Language Education Society*, 5(2), 215- 228. http://dx.doi.org/10.29408/veles.v5i2.3968

Goetz, T., Nathan C., Hall, B., Anne, C., Frenzel, A., & Pekrun, R. (2005). A hierarchical conceptualization of enjoyment in students. *Learning and Instruction*, 16, 323-338.

Gozum, J.L. & Cura J.M. (2011). *Mathematics achievement and adversity quotient*. College of Engineering and Technology. Manila.

Grigorenko, E.L. & Sternberg, R.J. (2001). Analytical, creative, and practical intelligence as predictors of self-reported adaptive functioning: a case study in Russia. *Intelligence*, 29(1), 57-73. https://doi.org/10.1016/S0160-2896(00)00043-X

Groccia, J, E. (2018). What is student engagement? *New Dir. Teach. Learn*, 11-20. https://doi.org/10.1002/tl.20287

Hasanov, Z., Antoniou, P., Garayev, V., & Suleymanov, E. (2021). The impact of behavioural, cognitive and emotional dimensions of student engagement on student learning: The case of Azerbaijani higher education institutions. *International Journal of Knowledge and Learning*, 14(1), 10. https://doi.org/10.1504/ijkl.2021.10037816

Hendriyanto, A (2022) Mathematics achievement - intelligence quotient (IQ): A study of simple relations in class 10 high school students. *Journal of Mathematics and Mathematics Education*, 12(2).

Hussein, T. (2018). *The comprehensive guide to thinking skills* (4th ed.). Amman: DeBono Thinking Center.

Jian, Z (2023). Sustainable engagement and academic achievement under impact of academic self-efficacy through mediation of learning agility—evidence from music education students. *Front. Psychol*, 13:899706. https://doi.org/10.3389/fpsyg.2022.899706

Joshi, D. R., Adhikari, K. P., Khanal, B., Khadka, J., & Belbase, S. (2022). Behavioral, cognitive, emotional and social engagement in mathematics learning during COVID-19 pandemic. *PloS one*, 17(11), e0278052. https://doi.org/10.1371/journal.pone.0278052

Ketonen, E. E., Haarala-Muhonen, A., Hirsto, L., Hänninen, J. J., Wähälä, K., & Lonka, K. (2016). Am I in the right place? Academic engagement and study success during the first year at university. *Learning and Individual Differences*, 51, 141- 148. https://doi.org/10.1016/j.lindif.2016.08.017

Khasawneh, E., Gosling, C. & Williams, B. (2021). What impact does maths anxiety have on university students? *BMC Psychol*, 9, 37. https://doi.org/10.1186/s40359-021-00537-2

Konold, T., Cornell, D., Jia, Y., & Malone, M. (2018). School climate, student engagement, and academic achievement. *AERA Open*, 4(4). https://doi.org/10.1177/2332858418815661

Kullar, S. S., Shao, K., Surette, C., Foucher, D., Mergler, D., Cormier, P., Bellinger, D. C., Barbeau, B., Sauvé, S., & Bouchard, M. F. (2019). A benchmark concentration analysis

for manganese in drinking water and IQ deficits in children. *Environment International*, 130, 104889. https://doi.org/10.1016/j.envint.2019.05.083

Lee, J. (2014). The relationship between student engagement and academic performance: is it a myth or reality? *The Journal of Educational Research*, 107(3), 177–185. https://doi.org/10.1080/00220671.2013.807491

Li, J. & Xue, E. (2023). Dynamic interaction between student learning behaviour and learning environment: meta-analysis of student engagement and its influencing factors. *Behavioral Sciences*, 13(1), 59. https://doi.org/10.3390/bs13010059

Luttenberger, S., Wimmer, S., & Paechter, M. (2018). Spotlight on math anxiety. *Psychology Research and Behavior Management*, 11, 311–322. https://doi.org/10.2147/PRBM.S141421

Maamin, M., Maat, S.M. & H. Iksan, Z. (2022). The influence of student engagement on mathematical achievement among secondary school students. *Mathematics*.10(1), 41. https://doi.org/10.3390/math10010041

Mabena, N. Mokgosi, N. & Ramapela, S. (2021). Factors contributing to poor learner performance in mathematics: a case of selected schools in Mpumalanga Province, South Africa. Tshwane University of Technology, South Africa. *Problems of Education in the 21st Century*, 79(3), 451-466. https://doi.org/10.33225/pec/21.79.451

Madigan, D. J., & Curran, T. (2021). Does burnout affect academic achievement? a meta-analysis of over 100,000 students. *Educ Psychol Rev*, 33, 387–405. https://doi.org/10.1007/s10648-020-09533-1

Mai, M. & Dawahdeh, A. M. (2021). The mediating effect of creative thinking on multiple intelligence and thinking patterns among 10th-grade students in Abu Dhabi Private Schools. *European Journal of Education*, 4(2), 107-124. https://doi.org/10.26417/317ubz15f

Mayasari, D., Natsir, I., & Taufik, A. (2021). Analysis of students' mathematical problem-solving ability in term of multiple intelligence. *Jurnal Didaktik Matematika*, 8(2), 250-266. https://doi.org/10.24815/jdm.v8i2.20369

Mazana, M.Y., Montero, C.S., & Casmir, R.O. (2019). Investigating students' attitude towards learning mathematics. *Int Electron J Math Educ*.14(1), 207-31. https://doi.org/10.29333/iejme/3997

Murphy, S. M. (2021). *Learning agility and its applicability to higher education*. Ph.D Thesis. USA: Columbia University.

Mysore, L. & Vijayalaxmi, A.H.M. (2020). Relationship between successful intelligence and academic engagement among adolescents. *IOSR Journal of Research & Method in Education*, 10(4), 22-26.

Natsir, I., & Munfarikhatin, A. (2021). Analisis kemampuan literasi matematika siswa berdasarkan multiple intelligence dalam menyelesaikan soal matematika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 10(1), 273–283. https://doi.org/doi.org/10.24127/ajpm.v10i1.3384

Parsons, S. A., Nuland, L. R., & Parsons, A. W. (2014). The ABCs of student engagement: Teachers can increase all-important student engagement by being aware of its affective, behavioral, and cognitive dimensions. *Phi delta kappan*, 95(8), 23.

Parveen, D. (2014). Relationship between Intelligence and Academic Achievement of Secondary Level Students. *Global Journal for Research Analysis*, 3(3), 35-36.

Peng, C. (2021). The academic motivation and engagement of students in english as a foreign language classes: does teacher praise matter? *Front. Psychol*, 12, 778174. https://doi.org/10.3389/fpsyg.2021.778174

Purpura, D. J., Schmitt, S. A., & Ganley, C. M. (2017). Foundations of mathematics and literacy: The role of executive functioning components. *Journal of Experimental Child Psychology*, 153, 15–34. https://doi.org/10.1016/j.jecp.2016.08.010

Rozgonjuk, D., Kraav, T., Mikkor, K. Kerli Orav-Puurand & Karin Täht (2020). Mathematics anxiety among STEM and social sciences students: the roles of mathematics self-efficacy, and deep and surface approach to learning. *IJ STEM Ed*, 7, 46. https://doi.org/10.1186/s40594-020-00246-z

Schnitzler, K., Holzberger, D. & Seidel, T. (2021). All better than being disengaged: Student engagement patterns and their relations to academic self-concept and achievement. *Eur J Psychol Educ*, 36, 627–652. https://doi.org/10.1007/s10212-020-00500-6

Sokolowski, H.M. & Ansari, D. (2017). Who is afraid of math? what is math anxiety? and what can you do about it? *Front. Young Minds*, 5(57). https://doi.org/10.3389/frym.2017.00057

Sternberg, R. J. & Grigorenko, E. L. (2007) *Teaching for Successful Intelligence: To Increase Student Learning and Achievement 2nd Edition.* Corwin Press.

Sternberg, R. J. (1999). The theory of successful intelligence. *Review of General Psychology*, 3, 292–316.

Sternberg, R. J., Forsythe, G. B., Hedlund, J., Horvath, J, Snook, S, Williams, W. M., Wagner, R. K. & Grigorenko, E. L. (2000). *Practical Intelligence in Everyday Life.* New York: Cambridge University Press.

Syafi'i, A., Marfiyanto, T., & Rodiyah S. K (2018). Studi tintang prestasi belajar siswa dalam berbagai aspek dan faktor yang mempengaruhi. *Jurnal Komunikasi Pendidikan*, 2(2), 115. https://doi.org/10.32585/jkp.v2i2.114

Wang, M. T. & Peck, S. (2013). Adolescent educational success and mental health vary across school engagement profiles. *Dev Psychol.* 49(7), 1266-76. https://doi.org/10.1037/a0030028

Wentzel, K. R. (2003). Motivating students to behave in socially competent ways. *Theory Into Practice*, 42, 319–326.

Wong, S.L. & Wong, S.L. (2019). Relationship between interest and mathematics performance in a technology-enhanced learning context in Malaysia. *RPTEL*, 14, 21. https://doi.org/10.1186/s41039-019-0114-3

Xia, Q., Yin, H., Hu, R., Li, X., & Shang, J. (2022). Motivation, engagement, and mathematics achievement: an exploratory study among Chinese primary students. *Sage Open*, 12(4). https://doi.org/10.1177/21582440221134609

Zepke N. (2018) Student engagement in neo-liberal times: What is missing? *High. Educ. Res. Dev.*37, 433–446. https://doi.org/10.1080/07294360.2017.1370440