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Relationship of modular learning modality to the students' mathematics performance in the new normal environment

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ABSTRACT

This study was conducted to determine the relationship of modular learning modality on students' mathematics performance in the new normal environment in the secondary schools in Governor Generoso North District. The study applied a quantitative and descriptive causal-correlational research design. Complete enumeration was employed which comprised of 322 grade 11 students. Adapted and modified survey–questionnaire was utilized to gather information which was validated by the experts and had undergone pilot testing to assure validity and reliability. Results revealed that the respondents agreed to the extent of usage of the modular learning modality while their mathematics performance was described as satisfactory. Findings also revealed that there are differences in the usage level of modular learning modality across the demographic profiles of the respondents. Learning outcomes, capturing students' interest in learning and perceived solutions to learning difficulties were found to have a significant relationship to students' mathematics performance and modular learning modality is positively and significantly related to the students' mathematics performance. Furthermore, content format and optimal course to learn were the factors that can best predict students' mathematics performance. It is recommended to look for and study the best strategies that will answer the relationship presented in this study. It is also suggested to conduct comprehensive review of the modular learning materials, venture on the implementation of other learning modalities, and to do additional intervention activities in the learning process during this new normal environment.

Keywords: modular learning modality, mathematics performance

INTRODUCTION: RATIONALE

In this time of the pandemic, one of the sectors greatly affected by the coronavirus is education. Since face-to-face classes are still suspended, teaching mathematics in the traditional classroom now shifted into distance learning. This method of teaching is currently on the rise due to COVID-19 (Moreno-Guerrero et al., 2020). Even though the country battles the pandemic, learning remains unhampered through the different learning modalities. While most educational institutions in the country prepare for online classes, schools in rural areas like R. Sumambot Elementary School in Purok Banacabac, Barangay Del Pilar, Manay, Davao Oriental, the Internet connection remains inaccessible. The modular learning modality is the best option. In a news article entitled "Weighing modular learning" published in Sunstar Davao on July 20, 2020, it was emphasized that for this small and remote school in Manay town, the journey to modular learning seems to be difficult as 20 of their 68 students are still not able to read, write and understand on their own yet. Some of the parents and guardians of these struggling children are also illiterate, according to a teacher in that grade, which makes the situation more complicated.

This is a clear concern because despite this pandemic, learning should not be jeopardized. This research is therefore considered necessary to determine the relationship of modular learning modality on the mathematics performance of students.

OBJECTIVE/S

This study was proposed to determine the relationship of modular learning modality on students' mathematics performance in the new normal environment. It specifically aimed to:

1. Determine the extent of usage of modular learning modality in terms of
   1.1. Self-efficacy,
   1.2. Content format,

1.3. Optimal course to learn,
1.4. Learning difficulties,
1.5. Perceived solutions to learning difficulties,
1.6. Capturing students' interest in learning, and
1.7. Learning outcomes.

2. Determine the level of students' mathematics performance.
3. Determine the level of usage of modular learning modality across the demographic profile of the respondents.
4. Determine the significant relationship of modular learning modality on students' mathematics performance.
5. Determine the factors of modular learning modality that can best predict students' mathematics performance.

METHODOLOGY

This research utilized quantitative method using a causal-correlational analytical framework. The descriptive approach was employed as the researcher seeks to find answers to certain questions involving the relationship of modular learning modality, affecting the students' academic achievement in mathematics through the adapted and modified research questionnaire.

The study was conducted in the two public secondary schools of Governor Generoso North District which are Tibanban National High School and Sigaboy Agricultural Vocational High School from grade 11 of all strands offered by the two schools. The research instrument that was used for gathering data was adopted and modified which has three parts. The first part was the informed consent, while the second part asked for the demographic profile of the respondents. Lastly, the third part of the instrument was adopted and modified from the study entitled "Student evaluation of engineering modules for improved teaching-learning effectiveness" developed by Lim et al. (2010). The instrument used a Likert scale containing five items, each item showing the extent and the level of extent in the relationship of the use of modular learning modality to students' mathematics performance.

A complete enumeration of respondents was used with a total of 322 grade 11 students from both schools. The researcher used the complete enumeration method as it provides accuracy as every unit of the population is studied before drawing any conclusions from the research. It also increases the degree of correctness of the data. Respondents were informed that their response in the survey was voluntary. The confidentiality of the data from the respondents was also observed.

RESULTS AND DISCUSSION

Based on the data shown in the seven indicators, **Table 1** presents the summary of the extent of usage of modular learning modality in terms of these indicators among 322 grade 11 students who participated in the study. Among the seven indicators, five of them has a descriptive equivalent of *agree*. The indicator perceived solutions to learning difficulties got the highest mean value of 3.82 and a standard deviation of 0.66. It is followed by capturing students' interest in learning with a mean of 3.69 and a standard deviation of 1.04, optimal course to learn with a mean of 3.59 and a standard deviation of 0.65, learning difficulties with a mean of 3.57, and a standard deviation of 0.66, and the learning outcomes with a mean of 3.43 and a standard deviation of 0.65. This implies that the respondents agree on the extent of usage of modular learning in terms of these five variables.

Table 1. Extent of usage of modular learning modality in terms of self-efficacy, content-format, optimal course to learn, learning difficulties, perceived solutions to learning difficulties, capturing student's interest in learning, and learning outcomes

Indicators	Mean	Standard deviation	Descriptive equivalent
Self-efficacy	3.34	0.70	Not sure
Content format	3.35	0.90	Not sure
Optimal course to learn	3.59	0.65	Agree
Learning difficulties	3.57	0.66	Agree
Perceived solutions to learning difficulties	3.82	0.66	Agree
Capturing student's interest in learning	3.69	1.04	Agree
Learning outcomes	3.43	0.65	Agree
Extent of usage of modular learning modality	3.54	0.75	Agree

On the other hand, the indicators that have a descriptive equivalent of *not sure* are content format with a mean value of 3.35 and a standard deviation of 0.90 and self-efficacy with a mean value of 3.34 with a 0.70 standard deviation. The result showed that the respondents are not sure of these variables and their relationship to the extent of their usage of modular learning modality. Moreover, the results produced an overall mean of 3.54 and a standard deviation of 0.75, described as *agree.* This indicates that the respondents in general agree to the extent of usage of modular learning modality.

Presented in **Table 2** is the result of the respondents' level of mathematics performance based on their first quarter grade in general mathematics. In the DepEd Order No. 8, s. 2015, it was stipulated that the quarterly grading scale can be described as 90-100 which means outstanding, 85-89 which means very satisfactory, 80-84 which means satisfactory, 75-79 which means fairly satisfactory, and below 75, which means that learners did not meet expectations. It is shown in **Table 2** that the mean value of the first quarterly grade in general mathematics is 81.84 with a standard deviation of 4.65 which means satisfactory.

Table 2. The level of students' mathematics performance

Mean	81.84	**Standard deviation**	4.65

This implies that the students' mathematics performance in the new normal environment is satisfactory. It is supported by Shuja et al. (2020) that students who use wireless technologies for learning mark better grades than those who learned through conventional learning methods. This outcome of the improved scholastic performance of students can be articulated in terms of high efficacy of notetaking, higher retention of knowledge. Using mobiles and internet technology, learners personalize ways of receiving the required knowledge i.e., employing text, video, or audio.

The first identified demographic profile is the academic strand of the students. As shown in **Table 3**, it revealed that among the academic strands offered by the secondary schools, strands under the academic track, which are accounting, business and management attained a higher level of usage of modular learning modality compared to the strands under technical-vocational track, which are home economics, agri-fishery arts, information, communication and technology, and industrial arts. It is also notable that all the strands have a descriptive equivalent of agree which implies that the respondents from all academic strands agree to their extent of usage to modular learning modality. It is supported by the study of Cerbito (2020) that there is a significant link between attitudes toward mathematics and mathematical proficiency. Thus, teacher educators should be aware of the attitudes of senior high school students from many strands and work to improve them to favorably influence students' mathematics proficiency.

Table 3. The level of usage of modular learning modality across the demographic profile in terms of academic strand

Academic strand	**n**	**Mean**	**Standard deviation**	**Descriptive equivalent**
Accounting, business, &management	45	3.59	0.46	Agree
Humanities & social sciences	89	3.57	0.51	Agree
Agri-fishery arts	38	3.54	0.52	Agree
Industrial arts	77	3.47	0.50	Agree
Home economics	57	3.56	0.44	Agree
Information, communication, and technology	16	3.54	0.42	Agree

The second identified intervening variable is sex. The data shown in **Table 4** illustrates that female respondents have a higher usage level of modular learning modality compared to male respondents. Despite this difference in their level of usage, both males and females have a descriptive equivalent of agree. This means that both males and females agree to their level of usage of modular learning modality. It contradicts the findings of Rodríguez et al. (2020), which showed that girls had fewer positive attitudes toward mathematics than their male counterparts, with weaker motivation and a lower perception of competence.

Table 4. The level of usage of modular learning modality across the demographic profile in terms of sex

Sex	**n**	**Mean**	**Standard deviation**	**Descriptive equivalent**
Male	141	3.50	0.54	Agree
Female	181	3.57	0.43	Agree

The third identified demographic profile is the family income of the respondents. **Table 5** revealed the respondents with a family income that ranges between PHP 23,381 (USD 423.83)[1] to PHP 46,761 (USD 847.64) per month have the highest level of usage of modular learning modality, followed by between PHP 11,690 (USD 211.91) to PHP 23,381 per month, less than PHP 11,690 per month and at least PHP 233,807 (USD 4,238.25) per month. The result implied that high family income does not mean that they also have a high usage level of modular learning modality. Based on their descriptive equivalent, it can also be concluded that respondents whose family income ranges between PHP 23,381 to PHP 46,761, between PHP 11,690 to PHP 23,381 per month, and less than PHP 11,690 per month agree to their usage level of modular learning modality. On the other hand, respondents whose family income is at least PHP 233,807 per month are not sure of their level of usage to modular learning modality. It is supported by Machebe et al. (2017), which revealed that parents' involvement in their children's school activities is more important than their financial income in improving their children's academic achievement.

Table 5. The level of usage of modular learning modality across the demographic profile in terms of family income

Family income	**n**	**Mean**	**Standard deviation**	**Descriptive equivalent**
Less than PHP 11,690 per month	225	3.49	0.47	Agree
Between PHP 11,690 to PHP 23,381 per month	74	3.61	0.45	Agree
Between PHP 23,381 to PHP 46,761 per month	20	3.86	0.60	Agree
At least PHP 233,807 per month	3	3.23	0.21	Not sure

The fourth identified demographic profile is the school. This finding in **Table 6** showed that Tibanban National High School has a higher level of usage of modular learning modality compared to Sigaboy Agricultural Vocational High School. Nevertheless, both schools have a descriptive equivalent of agree. This means that the respondents enrolled in the two secondary schools in Governor Generoso North District agree to their level of usage of modular learning modality.

Table 6. The level of usage of modular learning modality across the demographic profile in terms of school

School	**n**	**Mean**	**Standard deviation**	**Descriptive equivalent**
Tibanban National High School	134	3.58	0.49	Agree
Sigaboy Agricultural Vocational High School	188	3.52	0.48	Agree

[1] At the time of the study, 1 USD (US dollars) was roughly equal to PHP 55.16 (Philippine pesos).

Table 7 presents the test of the level of significance between the factors of modular learning modality and students' mathematics performance of grade 11 learners of the secondary schools of Governor Generoso North District. The table provides statistical result for the significant relationships between the identified factors using Spearman's rho correlation.

Table 7. The significant relationship in the level of usage of modular learning modality on students' mathematics performance

Factors of modular learning modality	Spearman rho coefficient	p-value	Remarks
Self-efficacy	0.075	0.180	Not significant relationship
Learning difficulties	-0.030	0.591	Not significant relationship
Learning outcomes	0.18	0.001	Low positive and significant relationship
Optimal course to learn	0.004	0.937	Not significant relationship
Capturing student's interest in learning	0.146	0.009	Low positive and significant relationship
Content format	0.041	0.458	Not significant relationship
Perceived solutions to learning difficulties	0.13	0.020	Low positive and significant relationship
Modular learning modality	0.109	0.050	Low positive and significant relationship

The result revealed that the computed correlation coefficient for self-efficacy is 0.075, which is categorically described as low positive degree of relationship. Learning difficulties, on the other hand, has a correlation coefficient of -0.030, described as low negative degree of relationship while learning outcomes has a correlation coefficient of 0.18 which means that it has a low positive degree of relationship. The factor optimal course to learn has a 0.004 correlation coefficient which is categorically described as low positive degree of relationship. Consequently, capturing students' interest in learning resulted to a 0.146 correlation coefficient which means low positive degree of relationship. The factors content format and optimal course to learn are also described as low positive degree of relationships with correlation coefficient of 0.041 and 0.13, respectively. The modular learning modality in general has a correlation coefficient of 0.109, which is described as having a low positive degree of relationship to the level of students' mathematics performance.

Findings also showed that among the seven factors of modular learning modality, three of them has a significant relationship to students' mathematics performance. These implies that the factors learning outcomes with a p-value of (0.001) <0.05, capturing students' interest in learning with a p-value of (0.009) <0.05, and perceived solutions to learning difficulties with a p-value of (0.020) <0.05 has a significant relationship to the students' mathematics performance. Furthermore, the modular learning modality, in general, has a significant relationship to the students' mathematics performance. This implies that modular learning modality is positively and significantly related to the students' mathematics performance.

It is supported by the study of Paspasan (2015), which revealed that the self-paced modular approach in teaching Trigonometry allowed learners more independent of learning types since they tend to work at their speed. It allows students to improve their level of success particularly in their mathematical ability. The findings in the research conducted by Melad (2020) also supports the result as the study indicated that the use of the module as a remedial instructional material substantially improved the study group's level of achievement.

Upon modeling the result using a stepwise multiple regression model, it is shown in **Table 8** the factors of modular learning modality that can best predict students' mathematics performance. Among the seven factors of modular learning modality, two of them are significantly affecting students' mathematics performance. These factors include optimal course to learn and content format.

Table 8. Table on top of a column (font size: 9)

No	Model	Beta value	T-value	p-value	R^2	Remarks
1	(Constant)	77.196	53.698	.000	.032	3.2% can be explained by the model
	Optimal course to learn	1.292	3.277	.001		
2	(Constant)	78.064	52.214	.000	.044	4.4% can be explained by the model
	Optimal course to learn	1.627	3.813	.000		
	Content format	-0.618	-2.001	.046		

There are two separate models for the factors of modular learning modality. The first model is strictly with optimal course to learn. In this model, optimal course to learn has a beta coefficient value of 1.292, a t-value of 3.277 and a p-value of 0.0001, which means that is positively and significantly related to the students' mathematics performance. It can also be observed that it has an r-square value of 0.032. This implies that about 3.2% of the students' mathematics performance can be predicted by the model 1, which included the optimal course to learn only.

The second model consists of two factors, the optimal course to learn and content format. In this model, optimal course to learn has a beta coefficient value of 1.627, a t-value of -3.813 and a p-value of 0.000, which means that it is positively and significantly related to students' mathematics performance. Also, in this second model, content format has a beta coefficient value of -0.618, a t-value of -2.001 and a p-value of 0.046 which implies that this factor is negatively and significantly related to students' mathematics performance. In addition, the second model has an r-square value of 0.044. It can be implied that around 4.4% of the students' mathematics performance can be predicted by these two indicators.

Based on the r-square value of both models, it implies that the second model which includes the factors optimal course to learn and content format is the model that can best predict students' mathematics performance. In the model, content format has a beta coefficient of -0.618. This means that it has a negative or inverse relationship on the students' mathematics performance. This implies further that as the unit increases on the extent of usage for the content format, it decreases a 0.618 unit for the students' mathematics performance. It is supported by the study of Rienties and Toetenel (2016), which asserts that learning design activities strongly influence academic retention and learner satisfaction is strongly influenced by learning designs. On the other hand, the factor optimal course to learn has a positive or direct relationship on the students' mathematics

performance based on the beta coefficient, which is 1.627 which implies that as unit increase on the extent of usage for the optimal course to learn, it also means an increase of 1.627 unit for the students' mathematics performance. This only means that improving the pacing of modular learning including the courses, strategies, and techniques of the modality will optimize learning. In the lens of Constructivism, learners are knowledgeable and active, and so the process of learning should be active, recursive, and continuous construction (Shah, 2019). Individualized learning in the form of modular learning should promote students to independently build their knowledge, selective experiences which would contribute and forms the basis of their knowledge (Matanluk et al., 2013).

CONCLUSION/S AND RECOMMENDATIONS

It is concluded that the respondents agree to the extent of usage of modular learning modality. The indicators perceived solutions to learning difficulties, capturing students' interest in learning, optimal course to learn, learning difficulties, and learning outcomes were described as agree while self-efficacy and content format were described as not sure in terms of its extent of usage. The level of students' mathematics performance in the new normal environment is also found to be satisfactory.

It was also found out that strands under academic track have a higher usage level of modular learning modality than the strands under technical-vocational track. Also, female respondents have a higher level of usage of modular learning modality than males while respondents whose family income ranges between ₱23,381 to ₱46,761 per month have the highest level of usage of modular learning. It is also concluded that respondents who are enrolled in Tibanban National High School have a higher level of usage of modular learning than those respondents who were enrolled in Sigaboy Agricultural Vocational High School.

It can also be concluded that the factors learning outcomes, capturing students' interest in learning and perceived solutions to learning difficulties have a significant relationship to students' mathematics performance and that modular learning modality is positively and significantly related to the students' mathematics performance.

Moreover, as to the main objective of the study, the content format and optimal course to learn are the factors of modular learning modality that can best predict students' mathematics performance. It is also concluded that content format has a negative relationship with the mathematics performance of the respondents. Whereas optimal course to learn has a positive relationship with the mathematics performance of the students.

Based on the findings of the study and the conclusions arrived, since it is concluded in the study that there is a negative relationship on the extent of usage of content format to the students' mathematics performance in the new normal environment then the Department of Education should make a comprehensive review concerning the negative relationship of the content format in modular learning materials. Furthermore, since the mathematics performance of the respondents of the study are only described as satisfactory in the use of modular learning modality, then educational leaders should venture on the implementation of other learning delivery modalities and mathematics teachers should do additional intervention activities to achieve maximum student learning as it was revealed in the study that there are differences in the level of usage of modular learning across demographic profiles. Lasty, future researchers should look for and study the best strategies that will answer this influence. If done, all people involved in the learning process could benefit from the said study.

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Declaration of interest: No conflict of interest is declared by the author.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the author.

REFERENCES

Cerbito, A. F. (2020). Comparative analysis of mathematics proficiency and attitudes toward mathematics of senior high school student. *International Journal of Scientific and Research Publications, 10*(05), 211-222. https://doi.org/10.29322/ijsrp.10.05.2020.p10125

Lim, H., Gan, S., & Ng, H. K. (2010). Student evaluation of engineering modules for improved teaching-learning effectiveness. *Engineering Education, 5*(1), 52-63. https://doi.org/10.11120/ened.2010.05010052

Machebe, C. H., Ezegbe, B. N., & Onuoha, J. (2017). The impact of parental level of income on students' academic performance in high school in Japan. *Universal Journal of Educational Research, 5*(9), 1614-1620. https://doi.org/10.13189/ujer.2017.050919

Matanluk, O., Mohammad, B., Norizah, D., Kiflee, A., & Imbug, M. (2013). The effectiveness of using teaching module based on radical constructivism toward students learning process. *Procedia-Social and Behavioral Sciences, 90,* 607-615. https://doi.org/10.1016/j.sbspro.2013.07.132

Moreno-Guerrero, A. J., Aznar-Díaz, I., Cáceres-Reche, P., & Alonso-García, S. (2020). E-learning in the teaching of mathematics: An educational experience in adult high school. *Mathematics, 8*(5), 840. https://doi.org/10.3390/MATH8050840

Paspasan, R. M. (2015). Structured approach vs. self-paced modular approach in teaching trigonometry. *Asia Pacific Journal of Multidisciplinary Research, 3*(5), 51-58.

Melad, A. F. (2016). Modular approach in teaching mathematics: Quadratic function. *Scholars Journal of Physics, Mathematics and Statistics, 3*(3), 99-105.

Rienties, B., & Toetenel, L. (2016). The impact of learning design on student behaviour, satisfaction and performance: A cross-institutional comparison across 151 modules. *Computers in Human Behavior, 60*(July), 333-341. https://doi.org/10.1016/j.chb.2016.02.074

Rodríguez, S., Regueiro, B., Piñeiro, I., Estévez, I., & Valle, A. (2020). Gender differences in mathematics motivation: Differential effects on performance in primary education. *Frontiers in Psychology, 10*(May 2015), 1-8. https://doi.org/10.3389/fpsyg.2019.03050

Shuja, A., Qureshi, I. A., Schaeffer, D. M. & Zareen, M. (2020). Effect of m-learning on students' academic performance mediated by facilitation discourse and flexibility. *Knowledge Management and E-Learning, 11*(2), 158-200. https://doi.org/10.34105/j.kmel.2019.11.009