

# A Five-Pronged Evaluation In The Crafting Of A Self-Learning Module In General Mathematics: A Case In The Philippines

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## ABSTRACT

Many scientific investigations dealt with the use and effectiveness of a self-learning module (SLM) during the Covid-19 pandemic. However, so meager an inventory of research there is yet, if not scarce, which focused on how the curriculum contents and scholastic exercises embedded in the learning modules are being appraised as to their contributory influences on academic performance. Hence, this current study shall respond to some unanswered hypotheses in such a regard. Results revealed that the identified Grade 11 Filipino students, who have well-assessed the contents and integrative tasks to be generally effective in such SLM, are faring well in General Mathematics. Additionally, the correlation between SLM use and academic performance shows no significant relationship. However, such an outcome could capture the attention of all concerned educators and stakeholders within the academic community to hopefully address the matter on quality education during the new normal and beyond it.

**Keywords:** Self Learning Modules, Academic Performance, General Mathematics, Distance Learning Modality, Quality Education

## I. INTRODUCTION

The Philippines had already embraced the new normal form of education. The most common sort of modality utilized by public schools is Modular Distance Learning (MDL). A survey done by the Department of Education (DepEd) last academic year 2020-2021 yielded the result of printed and

digital modules as the most preferred distance learning methods of parents and students. However, with these types of modalities, teachers have no assurance that the students are the ones answering the modules. Another concern was the vast number of activities that the DepEd considered reducing the activities and eliminating

unnecessary topics to achieve mastery as much as possible.

Consequently, the delivery and management of the intended curriculum contents for these learners, who are into homeschooling, have since then been under-challenged. Similar issues were also observed in the three (3) highly populated public secondary schools on the Island of Mactan, Philippines. Prior studies pointed out that the outcomes differed from one location to another. Some findings support the successful use of a modular approach to learning, while others do not. However, recent empirical investigations mostly only dealt with the effectiveness of employing the modular approach, its benefits, and its drawbacks, but none of these studies profoundly exhausted the factors of the modules used. Consequently, the failure to address the latter has influenced the regressive performance of many students in such discipline based on experiences, records, observations, and reports.

Hence, a scientific investigation on the effectiveness of self-learning modules and their influence on the academic performance of students in General Mathematics through distant learning modality is imperative. Having this scientific undertaking pursued, it may offer additional insights as to the vitality of content choice and how its crafting must be categorically considered to allow the students to achieve the most essential competencies established in general by the education department.

## II. LITERATURE REVIEW

### Exigency of Distance Learning Modality

The upsurge of COVID-19 cases has brought the world a tragic loss of human life globally. Lockdowns, health protocols, travel restrictions, and closure of schools and other establishments have been implemented by the people in authority to contain and reduce the spread of COVID-19 virus. One of the affected sectors is the academe, where the widespread

disruptions have impacted the usual educational processes. The migration of instructional delivery from a face-to-face mode to modular distance learning was accelerated to mitigate interruptions (Mukhtar et al., 2020).

This paved the way for the emergence of different modalities such as Online Distance Learning (ODL), Modular Distance Learning (MDL), and TV/Radio-Based instruction in the school system which seemed to be an unprecedented challenge to most of the teachers, parents as well as the students. Yet some schools have considered a learning environment where synchronous and asynchronous meets are held for the delivery of intended instruction (Dhawan, 2020). An option allows the students to be more innovative and flexible as they utilize any digital media, the internet, and other technological devices or tools in carrying out their academic tasks (Usher & Barak, 2020; Huang, 2019).

In line with this articulation of various modalities, the utilization of MDL was most observed in the management of learning in the public and private school systems in the Philippines. However, one of the barriers in the implementations of distance learning is the adaptation difficulties (Acain et al., 2022). Such usage of this modality poses certain challenges to self-paced learning especially when the students are working out the scholastic tasks alone in a given period of time. Parents have expressed a few challenges in dealing with the academic needs of their respective kids who are engaging in an MDL since they have both their work and role as a tutor at home to balance (Labrado et al., 2020). Teachers were also having a tougher time executing their jobs remotely and students were falling behind as a result of learning at home. However, in some countries, the modular approach was observed to be better than the conventional method of teaching as students learn at their own pace. Few empirical studies have pointed out the positive aspect of independence that the students have gained while learning and

interacting with their teachers and classmates in these environments (Singh & Thurman, 2019).

### **Effectiveness of Self-Learning Modules**

The employment of a self-learning module was found to be helpful in the delivery of instruction during the Covid-19 pandemic. A previous study posited that critical thinking skills, performance tasks, and cognitive learning that drive the students to achieve while scholastically engaging are just a few of those identified parameters in gauging the effectiveness of any developed modules. Accordingly, it was found that those students who were exposed to such developed modules achieved better in terms of cognitive learning and attitudinal aspect. Moreover, their critical thinking skills and responses are found to be generally good (Angkowati & Badruzsaufari, 2018). This is so because the self-learning modules (SLM) provide Filipino students the opportunity to determine and budget their time in studying the intended lessons and acquiring the most essential competencies.

These Filipino students, who were exposed to this type of learning module, can maximize such opportunities in self-directed inquiries while having the scheduled lessons and eventually acquiring the content knowledge (Al Mamun et al., 2020). Some feedback from parents disclosed that their children have displayed such an ability to conceptualize various ways of approaching their engagement in the lessons. Many of these Filipino students from such research environments have reaffirmed this opportunity for them to enrich both their knowledge and skills through the utilization of an SLM. In another empirical investigation, it was found that the usage of similar teaching modules has indeed encouraged the students to actively perform the established tasks (Matanluk et al., 2013). Consequently, too, their exposure to such kind of learning materials has developed their critical thinking skills. Thus, it is imperative to know which components of SLM are vital during its

crafting to establish its effectiveness. For this part, there are five aspects that the recent scrutiny has deliberately looked into, namely: clarity of concepts; use of higher order thinking skills questions for assessments; provision of practical and convenient performance tasks; timely and relevant activities in connection to the content; and language used.

### **Clarity of concepts**

In particular, one of the identified matters that necessitated focus during conceptualization is the clarity of concepts presented in an SLM based on some observations and experiences. It was found that instructional clarity has positively influenced the mind and behavior of the students in dealing with boredom. In effect, such clarity of instruction has improved students' performance while delightfully engaging in their mathematics lessons and activities (Chen & Lu, 2022). There were students from these research environments who expressly narrated the advantages when concepts are discussed in that learning module. It was known that they learned better when the mathematical concepts are simplified as it helps them understand well the lessons. A scientific study explained that mathematical concepts, which were written and explained vividly, provided favorable conditions among students (Tong et al., 2021). Students can develop and even improve their basic competence in such discipline, which is a better foundation for good learning. This was supported by another empirical investigation which pointed out that clarity in instruction and teaching both have nonetheless facilitated such motivational patterns of the students in mathematics education (Lazarides et al., 2019). Correspondingly, a positive linear correlation has been statistically validated between the acquisition of content knowledge and how well-motivated the students (Schumm & Bogner, 2016). Practically, this is so especially when students can grasp the lesson

very well due to the clarity of inputs. In many instances, teachers who have pursued graduate studies showed such academic aptness in crafting an SLM with a higher level of conceptual clarity and focus, respectively (Lindvall et al., 2018). However, it was pointed out that this claim may have varying outcomes or impacts among students with diverse intelligence.

### **Use of high order thinking skills questions for assessments**

Another factor to consider in preparing an SLM is how the integrative assessments are outlined to measure the scholastic achievements of the students. One of those challenges is how these formative or summative assessments are being crafted to employ higher-order thinking skills questions. It was found that there is an influencing link between how the mind determined one's performance when confronted with complex against difficult items (Musso et al., 2019). However, the usual evaluative approaches used by these Mathematics teachers were multiple-choice and problem-solving during the pandemic. Although teachers are providing the students with these types of evaluative tests in the modules, however, there were instances also that some assessments are done and facilitated using the online platform.

Research revealed that there were essential features of such online assessment of learning brought about by the current technological innovations which provided a good form of measuring the students' cognitive and skills achievements (Pezzino, 2018). Indeed, such an online mode of assessment is appropriate during the pandemic yet it posed certain issues in addressing truly the latter. Although the degree of sophistication was observably noted when test items are fundamentally constructed in the built-in features of an online platform, somehow, there are few challenges encountered by the teachers. Reinforcement of such online assessment, aside

from the evaluations incorporated in the SLM, is an equally beneficial mode to appraise the students' academic achievements. There were many gains to learning when automated assessments are made to supplement those embedded evaluations in the modules (Barana & Marchisio, 2016). One apparent example is that teachers can save time when automated assessments are integrated into that SLM as it shall give the teachers more space to prepare the learning materials needed for the scheduled instruction. For this matter, there were positive outcomes when this scheme is maximized as the affective and cognitive engagement of the students in learning mathematics can be facilitated significantly when assessments are well-crafted (Lin et al., 2018). Such a condition if sustained could expedite a better assessment of the achievement of students in mathematics.

### **Provision of practical and convenient performance task**

There are academic activities that were given at the time the In-Person classes had been conducted that may not be expedient during the new normal when students engage in online sessions. Many of the class works in mathematics, however, can be suitably done in any given situation – including that condition when homeschooling is imperative due to the Covid-19 pandemic. This was pointed out from a previous scientific investigation that teachers were able to correspondingly respond to any pedagogical situations. Hence, appropriate inputs and performance tasks are well-considered when outlining their daily lesson plan (Weber et al., 2020). Thus, it can be observed that the SLM had been employed by many Filipino teachers to address the needed delivery of mathematical instruction in such circumstances. Incorporated in that module are tasks that impel students to independently carry out those practical works, conveniently. However, few empirical results

have found that the integration of collaborative works can further assist students to learn more about the lessons (Troussas et al., 2020). Accordingly, a study revealed that there were low achievers in class who finished the given learning tasks successfully when instructional materials were crafted to address both cognitive and skills-related concerns (Hwang et al., 2020). Thus, it is certainly essential that teachers must look into which contents and performance tasks shall be included when writing their lesson plan, particularly during those times when non-conventional classes are to be held.

During the new normal, interestingly, a study revealed that students who have frequently made references to their classmates' approaches in working out their academic tasks have their learning behavior improved to those students who are into self-regulated learning (Hwang et al., 2021). This issue can be traced from how the latter students only focus on what they have gained from the given scholastic tasks and some feedback relayed by the teachers. Research disclosed that there are students of such type who would not pay more attention in peeking into their resource materials or taking down notes. However, they still could develop meaningful learning behavior in mathematics when well driven by their academic tasks. How students engaged in their academic tasks over time had been recognized, by some authorities in such field, of its complexity (Rienties et al., 2019). Hence, this condition is vital information for all concerned educators to accordingly conceptualize and timely act on the learning dispositions of students in such discipline during the pandemic and even beyond it.

### **Timely and relevant activities in connection to the content**

Many activities in the SLM, which were provided by Filipino teachers to their students from such identified research environments, were written

works that are supplemented with digital media utilization. This circumstance is supported by a study which found that the use of online sites and youtube, for example, has positively contributed to the learning engagement of these students in geometry (Maningo et al., 2021). There are websites on the internet that offer interactive learning pertinent to geometry and other mathematics subjects. The GeoGebra, for instance, is an interactive tool that allows the students to learn the key concepts and graph those various functions. Some online calculators offer speedy computations of simple or compound interests as well as simple or general annuities. Likewise, there are available online applications that provide immediate inferences on propositional logic, solving inequalities, and other lessons in General Math.

Such integrative learning, an SLM supplemented with digital media, is certainly aligned with what the curriculum developers expect students to engage in such as relevant online activities that will enhance both knowledge and skills. Like in General Math, the utilization of various digital media or online educational packages could assist in the learning and holistic formation among Filipino students during the new normal. On the other hand, Math teachers shared how such usage of SLM with its contents oriented on problem-based learning (PBL) has enhanced the capability of the students' metacognition (Siagan et al., 2019). Truly, such adoption of PBL in such types of learning materials provided an avenue for these students to improve their mathematical skills while working out embedded activities alone at home. Other teachers, too, expose their students to engage in gamification as part of the SLM-embedded activities. In education, the incorporation of gamification in the learning module gains interest among teachers as it bestows students the capability to enhance their learning process (Hakak et al., 2019). During the pandemic, this type of academic activity showed

a contributory effect on the performance level of students in learning the intended lessons (Jagušt et al., 2018).

### **Language used**

In the Philippines, the usage of local dialect by the teachers was permitted in the discussion of lessons with the students. However, there are some concerns experienced by both teachers and students in the utilization of such dialect during lectures especially when mathematical terminologies do not have equivalent expressions. The preference to use the English language in writing the lessons and activities in the SLM was more beneficial based on some feedback from students and parents. Yet, there are few instances when students consulted their teachers about some special terms to convert them into plain dialects for them to comprehend the mathematical concepts. Hence, the language used in crafting the SLM is of vital matter in the recent investigation.

This case is also true in some developing countries where English is not the first language. Teachers are impelled to blend the native language and English when pursuing the discussions as the latter was not identified as the only language where mathematics revolves. For mathematical discourses to be more engaging, translanguaged is more enticing during such undertaking (Alhasnawi, 2021). Other studies collaborated on the assertion that students whose first language is not English showed lower achievement in mathematics than those who are so keen on such language (Kleemans & Segers, 2020). It was further found out that those students with linguistic skills within such articulated language were predicted to perform well in fractions and geometry. On the contrary, there is a study that posited that the non-native language spoken by the students at home or used for social interactions has been assessed to be a factor that causes educational regression, particularly in

many developing nations (Ramachandran, 2017). This is the reason why the language used, as a research variable under scrutiny in this recent study, had been vitally included as there seemed to be incoherent findings from one scrutiny to the other. Nonetheless, in the case of the Filipino students, the combined use of English and dialect was found to be of influencing factor when writing the contents in that SLM during the pandemic. Accordingly, one study pointed out that there is this specialized language of mathematics that teachers must consider in the facilitation of instruction (Wilkinson, 2018). Evidence showed that students are exposed to a lot of opportunities in understanding mathematical concepts and performing those various tasks particularly when teachers employ such specialized language. Thus, it is true that the right use of language discussing the necessitated mathematical concepts is truly vital in writing them in such learning materials to build the learning of students in such discipline.

### **Performance of Filipino Students in Mathematics**

The performance of Filipino students in the global arena, like in the Trends in International Mathematics and Science Study (TIMSS), sadly, has been so challenging on the part of the Department of Education and concerned stakeholders. In the most recent TIMSS result, the Filipino students were not faring very well, particularly in Mathematics and Science. This, in its simplest interpretation, is the failure to hone the basic knowledge and skills of students in such discipline which calls for a revisit of how the curriculum contents are written to address the most essential competencies. If such performance is not urgently intervened, there is a greater tendency that these students from basic education will face certain struggles as they pursue their tertiary education (Almerino et al., 2020).

One possible way to address the articulated issue is to strengthen not only the cognitive domain of Filipino students but also their affective aspect. It was posited that students who have a good perspective of their interest and motivation in mathematics shall have positive effects on their achievement (Peteros et al., 2019). It was indeed observed among the respondents of the recent study that those students, whose skills were truly formed from their joyful engagement of the lessons and activities in mathematics, have gained in getting better scores during their evaluative exams. This achievement can only happen when contents or concepts are outlined in the SLM by their teachers to correspondingly respond to their individual needs. Thus, teaching quality must be looked into when it comes to addressing the performance of Filipino students in such discipline (Mamites et al., 2022). Here, the study proceeded to aver that the institutional culture and psychological characteristics of the teachers are found to determine how teaching quality shall be enhanced. The administrative support in providing digital media and other educational technologies in school that is responsive to the pedagogical practices of the teachers could, at least, work out such teaching quality (Hardman, 2019). Once the latter is attained, there is a greater probability that such a condition could influence how students could progressively perform in usual exams and in local or international competitions (Roick & Ringeisen, 2018).

### III. METHODOLOGY

To infer the probable association between the established components of an SLM and academic performance, a descriptive correlation design was employed in the current study. Such research design suit the latter as it describes the variables and the relationships that occur naturally between and among them (Meyer et al., 2020). Using a complete enumeration, there were 180

Accountancy, Business, and Management (ABM) students from three (3) highly populated public schools on the Island of Mactan, Philippines who were taken in as respondents. With restrained mobility due to the pandemic, the selection criterion in the identification of respondents is hinged on such conditions. Cognizant of the aims of the current study, a researcher-made questionnaire that took minor and integrative references from a few sources has been utilized. Contents of such research instruments have been proportioned into two parts, namely: the academic performance profile and the five (5) main components to gauge the effectiveness of SLM. For each component, a set of survey items were established to spell out the intended indicators. All of the indicators were subjected to pilot tests following the usual evaluative scheme that later ascertained the content validity and reliability ( $\alpha=0.83$ ). Before the actual conduct of such a current study, consent was respectively requested from the authorities and concerned parties to satisfy the communicative protocol. Additionally, reviews were made by the local research ethics committee on the safety aspect, the well-being of the participants, and other matters pertinent to scientific and ethical principles. In administering the survey, the questionnaires were translated to google documents where the link is sent to the intended recipients, and retrieval of results follows almost a similar transmittal flow. From this trail, all raw data underwent statistical treatment and data analyses.

### IV. RESULTS AND DISCUSSIONS

Three (3) data sets are accordingly arranged here which answer the core intent of the current study. The first table exhibited the indicators of where the contents of SLM were assessed for their effectiveness while the second table displays the performance of students in general mathematics who are using such module. Also, the last table

offers a specific review of the associative state between the two formerly articulated research variables. Hence, the combined analyses of these scientific results are vital in the overall

comprehension and eventual appreciation of the recent empirical undertaking.

**Table 1. Level of effectiveness of the self-learning modules in teaching general mathematics**

Indicators	Babag NHS n=90			Bankal NHS n=60			Pajo NHS n=30		
	SD	□	VI	SD	□	VI	SD	□	VI
Clarity of concepts	0.59	3.03	EF	0.64	3.02	EF	0.66	3.00	EF
Use of high order thinking skills questions for assessments	0.60	3.02	EF	0.63	3.15	EF	0.60	3.01	EF
Provision of practical and convenient performance tasks	0.62	3.05	EF	0.64	3.13	EF	0.59	3.02	EF
Timely and relevant activities in connection to the content	0.65	3.11	EF	0.63	3.15	EF	0.66	3.09	EF
Language used	0.64	3.30	EF	0.63	3.32	EF	0.64	3.30	EF
<b>Aggregate Mean</b>	<b>0.62</b>	<b>3.10</b>	<b>EF</b>	<b>0.63</b>	<b>3.15</b>	<b>EF</b>	<b>0.63</b>	<b>3.08</b>	<b>EF</b>
Average Results (Combined)	<b>SD = 0.63</b>			<b>□ = 3.11</b>			<b>VI =EF</b>		

Legend: 3.25-4.00 Very Effective (VE), 2.50-3.24 Effective (EF) 1.80-2.49 Less Effective (LE), 1.00-1.75 Not Effective (NE)

The scientific results provided a positive appraisal of the manners of how the contents of SLM were effectively crafted in facilitating the lessons in general mathematics with its overall rating ( $x=3.11$ ;  $SD=0.63$ ). Put simply, this entails that the clarity of concepts written in that module using the appropriate language for instruction expedited a better acquirement of the intended knowledge. The provision of germane activities and employment of the most essential exercises in the SLM have also improved self-engagement in such learning materials. As an outcome, these student-respondents can capitalize on their critical thinking skills as confirmed by their performance during those periodic assessments.

Indeed, the calculated ways of writing the contents in the learning module during the

pandemic had been instrumental in how students can grasp the intended lessons in General Mathematics. Research expounded that mathematics has some specialized language to be considered by these knowledge facilitators when facilitating the curriculum contents among the learners (Wilkinson, 2018). This was supported, in fact, by another scientific investigation which pointed out an encouraging engagement of the SLM among the students particularly when a translanguage is considered (Alhasnawi, 2021). This case was made clear in a study where students have been found to proactively work on their learning materials while at home as the inputs and drills built therein are consciously written to address comprehension (Chen & Lu, 2022). It is reassuring to note how teachers spent



time presenting the concepts creatively in that module to merit appreciative engagement by the concerned students. This is certainly a factor to continually look into even beyond the pandemic. Previous scientific investigation has explained clearly that any mathematical concepts that were discussed thoroughly have provided favorable influences among students (Tong et al., 2021). Truly, this scenario had been noticed in the recent study when clarity of discussions of mathematical principles within the SLM has positively driven these Filipino students into homeschooling due to the Covid-19 pandemic.

Although there was a meager number of feedback at some points of their SLM engagement, these students have encountered a manageable setback in accomplishing the established tasks due to their degree of complexity. Yet, they pursued still and accomplished them. This is no unusual case as previous empirical scrutiny has established the fact that there is an influencing link between how the minds react and how these students behave when they are confronted with certain complicatedness in carrying out the written tasks in that learning module (Musso et al., 2019). Guided by the call to address the most vital competencies, these teachers see to it that the academic activities given to the students should impel them to optimize their critical thinking skills. Many teachers from such research environments preferred to let their students

engage in problem-based learning (PBL) where mathematical concepts challenged them to resolve the established cases. Verily, this approach has been reaffirmed by a previous study where a subscription to PBL has enhanced the capability of the students' metacognition (Siagan et al., 2019). There were teachers, too, who employed other strategies only to liven the engagements of these students in such SLM during the pandemic which turned out to be equally effective.

Another contributory influence on such regard was nonetheless traced to how students interact with their peers who also are working on their SLM. Many of these student-respondents revealed that their frequent references to some approaches made by their classmates in carrying out those written or performance tasks have enhanced their learning and engagement in such modality. This was reaffirmed in a more current scientific investigation which discussed that learning behavior was noted to have improved among those students who usually interacted with their peers against those who are single-handedly working out their scholastic tasks from such module (Hwang et al., 2021). Pondering all of these matters, the essentiality to design, plan, implement, monitor, evaluate and even review the crafting of SLM is apparent not only to address its efficacy of use but, more importantly, how knowledge and competencies are formed.

**Table 2. Level of performance of the student-respondents in general mathematics**

Level	Num	Bahag NHS		Bankal NHS		Pajo NHS	
		n=90		n=60		n=30	
	Range	F	%	F	%	F	%
Outstanding	90-100	12	13.33	23	38.34	11	36.67
Very Satisfactory	85-89	30	33.33	14	23.33	10	33.33
Satisfactory	80-84	34	37.78	15	25.00	7	23.33

Fair Satisfactory	75-79	14	15.56	8	13.33	2	6.67
Did not meet the Expectations	Below 75	–	–	–	–	–	–
Total		90	100.00	60	100.00	30	100.00
Mean (x)		84		87		87	
Std. Dev. (S.D )		4.27		6.48		4.46	
Average Results (Combined)		<b>S.D. = 5.07</b>		<b>x = 86</b>			

A summative of the entire data would show that 26% of the students have their academic performance obtained an outstanding level while 30% of them have landed at a very satisfactory level. In overall appreciation of the data, this can be simply interpreted as having performed scholastically better in General Mathematics. One possible influence can be attributed to their positive perceptions of SLM as shared. Since all of the respondents are taking up Accountancy, Business, and Management (ABM) strand, they are expected to perform well in Mathematics as factored out by their screened admission. A parallel review of such performance reveals that ABM students were also faring well in one of those empirical studies made to evaluate their scholastic competence (Almerino et al., 2020). A similar inference could be deduced from the students' cognitive ability that was formed earlier as a possible reason why such performance is better in such academic clustering.

However, some respondents have earned a "Fair Satisfactory" rating which could imply that something might have caused them to struggle when engaging in such SLM. Many of those disclosures offer dislikes and insufficient study hours as one of the reasons to cause their performance under-challenged. Research exposes that the students who have allocated adequate time to study their lessons beyond the usual call were performing better than those who only review as the exam nears (Guinocor et al., 2020). Another scientific result explains that students,

who exhibited a higher interest and motivation, tend to achieve better than those who only express something good in such discipline (Peteros et al., 2019). Both findings are observed to vividly mirror the same scenario from the chosen research environments where some of those respondents shared how tiring for them to work out the written tasks from such module. The volume of tasks established in the SLM and the complicatedness of math problems are the most pronounced causes for these students to perform less than the rest of their peers.

Reflecting on the latter, it is certainly imperative for teachers to be more cognizant of the appropriateness of contents, tasks, and evaluative schemes to purposively reach out to those students who are at risk. Hence, both institutional culture and teachers' psychological characteristics are fundamentally necessary to effectuate teaching quality to address such students' needs. Once the latter is fully achieved, this would positively translate into better content-crafting, delivery of instruction, and holistic assessment of students' performance (Mamites et al., 2022). Another factor that could significantly contribute to better performance and achievement among students in any academic undertaking is the support of their peers (Filade et al., 2019). This finding has been observed during the Covid-19 pandemic when students work individually on their modules. Their regular connectivity with friends and classmates has kept me scholastically afloat while carrying out the established tasks

from such learning materials. Some intellectually-gifted students even shared their knowledge and techniques with their colleagues on those items which challenged them. Indeed,

peer collaboration has a positive influence on how a student performs or achieves under such circumstances (Korir & Kipkemboi, 2014).

**Table 3. Test of Significance on the relationship between the Level of Performance of the Student-respondents and Level of Effectiveness of the Self-learning Modules used in General Mathematics**

<b>Three (3) Respondent-Schools Combined</b>							
<b>Variables in Association</b>	<b>X</b>	<b>SD</b>	<b>Comp. value</b>	<b>p-value</b>	<b>Result</b>	<b>Decision</b>	
Level of performance and Clarity of concepts	86 3.02	5.07 0.63	0.0508	0.4983	Non-Significant	Accept H <sub>0</sub>	
Level of performance & Use of high order thinking skills questions for assessments	86 3.06	5.07 0.61	0.0030	0.9681	Non-Significant	Accept H <sub>0</sub>	
Level of performance and Provision of practical & convenient performance tasks	86 3.07	5.07 0.62	-0.0628	0.4008	Non-Significant	Accept H <sub>0</sub>	
Level of performance & Timely & relevant activities in connection to the content	86 3.12	5.07 0.65	0.0205	0.7847	Non-Significant	Accept H <sub>0</sub>	
Level of performance and the Language used	86 3.31	5.07 0.64	0.1432	0.0551	Non-Significant	Accept H <sub>0</sub>	

Tested at 0.05 level of significance

After the correlative probe between academic performance and identified SLM indicators, the results are non-significant with their p-values less than the 0.05 level. It entails that how the students achieve has no direct association with the manner that the contents and drills in the modules are designed. Agreeably, the completion of established tasks within the learning materials is not always predicated by well-crafted content and exercise. Some of those reasons were traced from the individual perspective of students towards mathematics. The previous study has statistically validated a positive linear correlation between well-motivated students and their engagement with the intended lessons (Schumm & Bogner, 2016). Actual experiences among the concerned subject teachers from the identified research locales agree with such finding that the acquirement of knowledge from the SLM is not solely concluded

by well-organized contents but must mull over how students perceive mathematics.

Thus, motivating SLM exposure has some contributory effects on how the students would think and behave when engaging with the established contents and exercises in such discipline. Learning modules, which adopted constructivism-based mathematics, were found to be an effective approach in getting the students to understand the given lessons in a such discipline (Anwar & Rahmawati, 2017). It was further noted from such a study that those students with higher proficiency display such tendency to engage more in the lessons. In particular, the interest of students has a vital bearing if one has to establish a direct relationship with their engagement in the academic drills that were fused in the SLM. Knowing how the recent generation students are digitally-exposed, the inclusion of exercises in such module which do not consider technological use could not establish associative

influence on their acquisition of content knowledge and skills. A related investigation has pointed out that reinforcement of mobile use during mathematical exercises was instrumental in learning the intended lessons and the acquisition of necessitated competencies (Sincuba & John, 2017). Hence, the scientific results indeed spoke well of the condition that there is no direct association between how the students achieve scholastically and their exposures to the contents and exercises built into that learning modules as there are other factors that dictate their link.

## V. CONCLUSION AND FUTURE WORK

With the empirical results and findings, there is enough evidence to conclude that how the contents and exercises were crafted in the SLM have given the Grade-11 Filipino students such educational advantage in acquiring the intended knowledge and most essential competencies as positively reflect by their academic achievement in General Mathematics. However, for future works, it is proposed that other interested researchers shall further peek into the survey indicators and appropriately increase the sample size with additional tracks to be included as participants to deepen such a quest for a better understanding of the case.

## VI. REFERENCES

- [1] Acain, B., Ortiz-Ocariza, A. G. C., Cabales, V. I., Matutinao, R. G., Rubin, J. L., Ancheta Jr, R. A., ... & Etcuban, J. O. (2022). Barriers of Distance Learning in Physical Education of Learners with Hearing Impairment. *Journal of Positive School Psychology*, 6(2), 1759-1768.
- [2] Al Mamun, M. A., Lawrie, G., & Wright, T. (2020). Instructional design of scaffolded online learning modules for self-directed and inquiry-based learning environments. *Computers & Education*, 144, 103695.
- [3] Almerino, P. M., Ocampo, L. A., Abellana, D. P. M., Almerino, J. G. F., Mamites, I. O., Pinili, L. C., ... & Peteros, E. D. (2020). Evaluating the academic performance of K-12 students in the philippines: A standardized evaluation approach. *Education Research International*, 2020.
- [4] Angkowitz, J., Zaini, M., & Badruzsaufari, B. (2018). The effectiveness of learning module to train critical thinking skill. *European Journal of Education Studies*.
- [5] Anwar, R. B., & Rahmawati, D. (2017). The use of mathematical module based on constructivism approach as media to implant the concept of algebra operation. *International Electronic Journal of Mathematics Education*, 12(3), 579-583.
- [6] Barana, A., & Marchisio, M. (2016). Ten good reasons to adopt an automated formative assessment model for learning and teaching Mathematics and scientific disciplines. *Procedia-Social and Behavioral Sciences*, 228, 608-613.
- [7] Chen, X., & Lu, L. (2022). How classroom management and instructional clarity relate to students' academic emotions in Hong Kong and England: A multi-group analysis based on the control-value theory. *Learning and Individual Differences*, 98, 102183.
- [8] Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of educational technology systems*, 49(1), 5-22.
- [9] Filade, B. A., Bello, A. A., Uwaoma, C. O., Anwanane, B. B., & Nwangburka, K. (2019). Peer Group Influence on Academic Performance of Undergraduate Students in

- Babcock University, Ogun State. *African Educational Research Journal*, 7(2), 81-87.
- [10] Guinocor, M., Almerino, P., Mamites, I., Lumayag, C., Villaganas, M. A., & Capuyan, M. (2020). Mathematics performance of students in a Philippine State University. *International Electronic Journal of Mathematics Education*, 15(3), em0586.
- [11] Hakak, S., Noor, N. F. M., Ayub, M. N., Affal, H., Hussin, N., & Imran, M. (2019). Cloud-assisted gamification for education and learning—Recent advances and challenges. *Computers & Electrical Engineering*, 74, 22-34.
- [12] Hardman, J. (2019). Towards a pedagogical model of teaching with ICTs for mathematics attainment in primary school: A review of studies 2008–2018. *Heliyon*, 5(5), e01726.
- [13] Huang, Q. (2019). Comparing teacher's roles of F2f learning and online learning in a blended English course. *Computer Assisted Language Learning*, 32(3), 190-209.
- [14] Hwang, G. J., Sung, H. Y., Chang, S. C., & Huang, X. C. (2020). A fuzzy expert system-based adaptive learning approach to improving students' learning performances by considering affective and cognitive factors. *Computers and Education: Artificial Intelligence*, 1, 100003.
- [15] Hwang, G. J., Wang, S. Y., & Lai, C. L. (2021). Effects of a social regulation-based online learning framework on students' learning achievements and behaviors in mathematics. *Computers & Education*, 160, 104031.
- [16] Jaguš, T., Botički, I., & So, H. J. (2018). Examining competitive, collaborative and adaptive gamification in young learners' math learning. *Computers & education*, 125, 444-457.
- [17] Kleemans, T., & Segers, E. (2020). Linguistic precursors of advanced math growth in first-language and second-language learners. *Research in Developmental Disabilities*, 103, 103661.
- [18] Korir, D. K., & Kipkemboi, F. (2014). The impact of school environment and peer influences on students' academic performance in Vihiga County, Kenya. *International Journal of Humanities and Social Science*, 4(5).
- [19] Labrado, M. G. L., Labrado, I. P. Q., Rosal, E. C., Layasan, A. B., & Salazar, E. S. (2020). Initial Implementation of Printed Modular Distance Learning in the City of Naga-Cebu during the COVID-19 Pandemic. *International Journal of Current Research*, 12(10), 14397-14402.
- [20] Lazarides, R., Dietrich, J., & Taskinen, P. H. (2019). Stability and change in students' motivational profiles in mathematics classrooms: The role of perceived teaching. *Teaching and Teacher Education*, 79, 164-175.
- [21] Lin, F. L., Wang, T. Y., & Yang, K. L. (2018). Description and evaluation of a large-scale project to facilitate student engagement in learning mathematics. *Studies in Educational Evaluation*, 58, 178-186.
- [22] Lindvall, J., Helenius, O., & Wiberg, M. (2018). Critical features of professional development programs: Comparing content focus and impact of two large-scale programs. *Teaching and Teacher Education*, 70, 121-131.
- [23] Mamites, I., Almerino, P., Sitoy, R., Atibing, N. M., Almerino, J. G., Cebe, D., ... & Ocampo, L. (2022). Factors Influencing Teaching Quality in Universities: Analyzing Causal Relationships Based on Neutrosophic DEMATEL. *Education Research International*, 2022.

- [24] Maningo, K. N., Almerino Jr, P. M., & Garciano, L. M. (2021). Gauging the educational efficacy of geometrical manipulatives in teaching the curriculum contents. *Cypriot Journal of Educational Sciences*, 16(3), 1279-1289.
- [25] Matanluk, O., Mohammad, B., Kiflee, D. N. 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.
- [26] Meyer, G., Shatto, B., Kuljeerung, O., Nuccio, L., Bergen, A., & Wilson, C. R. (2020). Exploring the relationship between resilience and grit among nursing students: a correlational research study. *Nurse Education Today*, 84, 104246.
- [27] Mukhtar, K., Javed, K., Arooj, M., & Sethi, A. (2020). Advantages, Limitations and Recommendations for online learning during COVID-19 pandemic era. *Pakistan journal of medical sciences*, 36(COVID19-S4), S27.
- [28] Musso, M. F., Boekaerts, M., Segers, M., & Cascallar, E. C. (2019). Individual differences in basic cognitive processes and self-regulated learning: Their interaction effects on math performance. *Learning and Individual Differences*, 71, 58-70.
- [29] Peteros, E., Gamboa, A., Etcuban, J. O., Dinauanao, A., Sitoy, R., & Arcadio, R. (2019). Factors affecting mathematics performance of junior high school students. *International Electronic Journal of Mathematics Education*, 15(1), em0556.
- [30] Pezzino, M. (2018). Online assessment, adaptive feedback and the importance of visual learning for students. The advantages, with a few caveats, of using MapleTA. *International Review of Economics Education*, 28, 11-28.
- [31] Ramachandran, R. (2017). Language use in education and human capital formation: Evidence from the Ethiopian educational reform. *World Development*, 98, 195-213.
- [32] Rienties, B., Tempelaar, D., Nguyen, Q., & Littlejohn, A. (2019). Unpacking the intertemporal impact of self-regulation in a blended mathematics environment. *Computers in Human Behavior*, 100, 345-357.
- [33] Roick, J., & Ringeisen, T. (2018). Students' math performance in higher education: Examining the role of self-regulated learning and self-efficacy. *Learning and Individual Differences*, 65, 148-158.
- [34] Schumm, M. F., & Bogner, F. X. (2016). The impact of science motivation on cognitive achievement within a 3-lesson unit about renewable energies. *Studies in Educational Evaluation*, 50, 14-21.
- [35] Siagan, M. V., Saragih, S., & Sinaga, B. (2019). Development of Learning Materials Oriented on Problem-Based Learning Model to Improve Students' Mathematical Problem Solving Ability and Metacognition Ability. *International electronic journal of mathematics education*, 14(2), 331-340.
- [36] Sincuba, M. C., & John, M. (2017). An Exploration of Learners' Attitudes towards Mobile Learning Technology-Based Instruction Module and its Use in Mathematics Education. *International Electronic Journal of Mathematics Education*, 12(3), 845-858.
- [37] Singh, V., & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning (1988-2018). *American Journal of Distance Education*, 33(4), 289-306.
- [38] Tong, D. H., Uyen, B. P., & Quoc, N. V. A. (2021). The improvement of 10th students' mathematical communication skills

- through learning ellipse topics. *Heliyon*, 7(11), e08282.
- [39] Troussas, C., Krouska, A., & Sgouropoulou, C. (2020). Collaboration and fuzzy-modeled personalization for mobile game-based learning in higher education. *Computers & Education*, 144, 103698.
- [40] Usher, M., & Barak, M. (2020). Team diversity as a predictor of innovation in team projects of face-to-face and online learners. *Computers & Education*, 144, 103702.
- [41] Weber, K., Mejía-Ramos, J. P., Fukawa-Connelly, T., & Wasserman, N. (2020). Connecting the learning of advanced mathematics with the teaching of secondary mathematics: Inverse functions, domain restrictions, and the arcsine function. *The Journal of Mathematical Behavior*, 57, 100752.
- [42] Wilkinson, L. C. (2018). Teaching the language of mathematics: What the research tells us teachers need to know and do. *The Journal of Mathematical Behavior*, 51, 167-174.