Effect of Modular Distance Learning Approach to Academic Performance in Mathematics of Students in Mindanao State University-Sulu Senior High School Amidst COVID-19 Pandemic

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A B S T R A C T

This study investigated the instructional competencies of teachers in The existence of COVID-19 pandemic brought extraordinary challenges to the stakeholders, teachers, parents, and students. Thus, the researcher believed that there is an effect of teaching-learning process in new normal education to students' performance most especially using modular type of learning in Mathematics. With this, the study sought to determine the perception of the students regarding modular distance learning approach (MDLA) in Mathematics, identify the challenges of the students, examine the effect of MDLA to academic performance of students in Mathematics, determine the level of academic performance of students, determine the significant difference on perceptions when they grouped according to their gender and age, and determine the relationship of students' perceptions regarding MDLA to their academic performance in Mathematics. The descriptive research design was utilized in this study. The researcher gathered one hundred seventy eight (178) grade 11 STEM students currently enrolled in MSU-Sulu Senior High School through the use of purposive random sampling. The survey questionnaire was applied in the study. Mean, frequency counts and percentage, t-test for independent samples, one-way analysis of variance (ANOVA), and person product-moment correlation were used to analyze and interpret the data. Based on the result, the study revealed that students' perceptions agreed on using modular distance learning approach (MDLA). It means the students had positive perceptions regarding MDLA in Mathematics. The study also revealed that students agreed on using modular distance learning approach (MDLA) in Math have little challenges. It had also a positive effect to students' performance in which students performed very satisfactory in Mathematics which means they had good quality performance. However, the study also revealed that it has no significant difference on their perceptions when they are grouped by gender and age which means the students had the same perceptions.

1. Introduction

COVID-19) pandemic; the schools were shutting down and no face-to-face interaction between teachers and students. To address these extraordinary challenges, the schools in the Philippines shifted traditional face-to-face way of teaching to distance learning approach. This is a learning delivery mode where interaction takes place between the teachers and students which they are geographically remote from each other during instruction and the lesson proper delivers outdoors the traditional face-to-face platform viewed of Bonz Magsambol (2020).

According to John Elflein (2021), Coronaviruses were a group of viruses that can be transmitted between animals and people, causing illnesses that may range from the common cold to more severe respiratory syndromes. Here are the top ten (10) most affected countries in the world: USA, India, Brazil,

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Russia, UK, France, Spain, Italy, Turkey, and Germany.

Merlina Hernando-Malipot (2020) reported that of all the alternative learning modalities offered by the Department of Education (DepEd) most students prefer to use the 'modular' distance learning options. She added that based on the partial results of the Learner Enrollment and Survey Forms (LESFs) distributed during the enrollment period, it showed 7.2 million enrollees prefer to use modular distance learning, TV & Radio based instruction and other modalities while only 2 million enrollees prefer online for school year 2020-2021. (Anthony, 2020) Modular distance learning is a learning form of individualized Instruction allows learners to utilize self-learning modules it's either in printed or digital format/electronic copy, learners access the copies of learning materials on a computer, tablet PC or Smartphone, CD'S, USB storage, computer-based including offline E-Books, with this learners may ask assistance from the teacher via E-mail, telephone, text message/instant messaging, messenger, etc.

Mathematics is often pointed as a difficult topic despite of its importance in daily life. Such perception is due to the abstract nature of Mathematics as said by Sufiana K. Malik (2012). If the students with negative perception towards Mathematics performed poorly and vice versa, that performance of mathematics can be improved through enhancing positive perception towards Mathematics (Wasike, Michael, & Joseph, 2013). According to Antony Charles that modular approach in Mathematics learning proved to be an effective and efficient tool to help students to learn mathematics themselves. (Jazim and Rahmawati, 2017) stated students improve the mathematical understanding on the material that is given to them. As they explained, the use of module in learning mathematics makes students with high academic ability tended to be more active in the discussion process. Moreover, this approach is also useful for students with a poor mathematical background and lack of motivation (Abramovits, Berezina, & Shvartsman).

Despite of this COVID-19 pandemic the Mindanao State University-Sulu, particularly in Senior High School Department opened the school year 2020-2021 using modular distance learning approach that was to adapt well in a new normal classroom or environment, and a new development in teaching-learning process. The modular approach placed students to learn in the comfort of their homes, limited contact to the teachers and their parents or guardians take place as their learners' model.

The purpose of this study was to examine the significant effect of modular distance learning approach in Mathematics to academic performance as perceived by grade 11 STEM strand students. To give significant plan to the educators to improve the teaching-learning process even this pandemic vanished and how it can be implemented effectively so the teachers embrace its use. This study was also to determine that using module can help and can be permanently used as teaching-learning material in mathematics subject.

2. Literature Review
Perception

Perception (from the Latin perceptio, meaning gathering or receiving) is the organization, identification, and interpretation of sensory information in order to represent and understand the presented information or environment (Schacter, 2011). It is not only the passive receipt of these signals, but it's also shaped by the recipient's learning, memory, expectation, and attention (WIKIPEDIA). William N. Dember (n.d.) said perception, in human, the process whereby sensory stimulation is translated into organized experience. That experience, or percept, is the joint product of stimulation and of the process itself.

Smart and Cappel (2006) mentioned if the students perceive some benefits to their learning (through either a personal interest in or an application of content) they will likely be more motivated to perform well. He cited McKeachie (2002, pp.19), accordingly students who are motivated to learn will choose tasks that enhance their learning, will work hard at those tasks, and will persist in the face of difficulty in order to attain their goals.

If the students with negative perception towards Mathematics performed poorly and vice versa, that performance of mathematics can be improved through enhancing positive perception towards Mathematics (Wasike, Michael, & Joseph, 2013).

Students' academic performance

According to Anthony Abaidoo (2018) as cited in Narah and Abdullah (2016), academic performance is the knowledge gained which is assessed by marks by a teacher and/or educational goals set by students and teachers to be achieved over a specific period of time and they added that these goals are measured by using continuous assessment or examinations results.

According to Shuja, Qureshi, Schaeffer, & Zareen (2019) in their study entitled "Effect of m-learning on student's academic performance mediated by facilitation discourse and flexibility", as they suggested that a multifaceted phenomenon, influenced by diverse factors such as meta-reflective learning and cognition, interest, motivation for learning, skills, engagement, quality of teaching and socio-economic status, characterized by enhance student's capability to perform at the desired level (Lewin & Mawoyo, 2014; Moseki & Schulze, 2010). Tinto (1987) defined students' academic performance as a longitudinal process that involves exchanges between students' characteristics such as resources, intentions, temperaments and commitments as well as characteristics of the academic institution. Academic performance is increased by positive students'

experiences that alter their commitments and intentions to positive encounters.

Don Elger (n.d.) claimed performance, as the adage goes, is a "journey not a destination." The location in the journey is labeled as the level of performance. Each level characterizes the effectiveness or quality of a performance.

Theories

James J. Gibson introduced the cognitive theories of perception that assumed there is a poverty of stimulus (Gibson, 2002). And from Gibson's early work derived an ecological understanding of perception known as perception-in-action, which argues that perception is a requisite property of animate action. It posited that, without perception, action would be unguided, and without action, perception would serve no purpose.

A mathematical theory of perception-in-action has been devised and investigated in many forms of controlled movement, and has been described in many different species of organism using the General Tau Theory (WIKIPEDIA).

Walberg's theory of academic achievement, cited by Dr. Rugutt and Chemosit, posited that psychological characteristics of individual students and their immediate psychological environments influence educational outcomes (cognitive, behavioral, and attitudinal).

Daryl Bem (1972) stated in his theory (Self-Perception Theory) that Individuals come to "know" their own attitudes, emotions, and other internal states partially by inferring them from observations of their own overt behavior and/or the circumstances in which this behavior occurs.

Dr. Friestad-Tate, Dr. Schubert and Dr. Mccoy (as cited in Biggs, 1999) claimed modular learning is the approach where the focus is on learning outcomes, and its success relies on connecting outcomes to student learning and course design. These areas

combine to make a course constructively aligned. In order for curriculum to be constructively aligned, it is important to defined learning outcomes, to determine learning and teaching outcomes that lead to successful realization of appropriately assessed student outcomes.

Guilhardi et al. (2007) developed the modular theory of learning and performance. This modular theory of learning and performance contains parts that may be labeled, perception, memory, and decision. This modular theory is a development of packet theory that adds a distinction between pattern and strength memories, as well as contributing closed-form equations. The name packet theory derives from a focus on the decision module, which provides the basis for bouts of responses. The perception and memory modules, however, are just as important as the decision module.

In the study of Botman, Van Rensburg, Coetzee, & Heyns (2015), "Conceptual Framework or Educational Design at Modular Level to PromoteTransfer of Learning", they mentioned learning theories have reshaped themselves from behaviourism to information processing to constructivism. Cognitive science and cognitive psychology confirm that the process of constructing knowledge is dependent on existing knowledge, the context or situation, and internalisation of information in an organised cognitive structure cited in (Bruce, Klopper, & Mellish, 2011). This constructivistic approach interrelates well with Kolb's experiential learning theory, which postulates that knowledge is created from understanding and transforming experience. Kolb's model postulates that observations and reflections occur upon concrete experiences. These reflections are internalised and abstract concepts are formed with associated possible consequences of action. The possible associated consequences can be actively tested for validity and inform future actions in similar situations cited in (Kolb & Boyatzis, 2000). On the basis of these viewpoints of learning it is clear that the

focus of learning outcomes has shifted from content to competence cited in (Braband, 2008; Brandon & All, 2010). With the constructivist approach the educator becomes a facilitator of learning. For this reason the responsibility of the educator-facilitator is to create learning opportunities for students to process new information and link it to existing mental frameworks through individual or social activity. However, prior knowledge needs to be retrieved before the student is able to link the new knowledge to it. Through this process the new information is comprehended and meaning making occurs or knowledge is constructed. Learning opportunities are created within a complex system that consists of the educator, student, teaching context, teaching and learning activities, outcomes, and student assessment tasks and should take the clinical environment into consideration. The starting point for creating learning opportunities is to clarify the learning outcome or competence cited in (Biggs, 1996) that the professional person must demonstrate. Kouwenhoven defined competence as the capacity to demonstrate up to a predetermined standard the key occupational tasks that characterise a profession cited in (Kouwenhoven, 2010.). According to Braband (2008) cited by (Botman, Van Rensburg, Coetzee, & Heyns, 2015), students are competent when they have the capacity to apply their knowledge and skills with an appropriate attitude in various environments and circumstances. In other words, when foundational knowledge (content), procedural knowledge (how to do), and conditional knowledge (when to do) become functional knowledge cited in (Biggs, 1996). The elements of learning opportunities that promote competence are activation of existing knowledge to serve as a foundation for new knowledge; application of knowledge in real-world settings; active engagement of students in real time and real-world situations; practicing of assessment, critical thinking, communication, and leadership skills through collaborative learning processes; multiple authentic formative assessments to ensure mastery of the

complete competence; and objective assessment measures that are clearly aligned with expected competencies cited in (Carraccio, Wolfsthal, Englander, Ferentz, & Martin, 2002; Merrill, 2002). It is the responsibility of the educator to ensure that all teaching and learning activities are aligned with the outcome, reality, and assessment tasks while it is students' responsibility to actively engage with the learning material in order to internalise the theory and skills and in this way construct new knowledge cited in (Reaburn & Strategy, 2009).

According to McIsaac & Gunawardena as they cited Moore's (1990) concept of "transactional distance" encompasses the distance that, he said, exists in all educational relationships. This distance is determined by the amount of dialogue that occurs between the learner and the instructor, and the amount of structure that exists in the design of the course. Greater transactional distance occurs when an educational program has more structure and less student-teacher dialogue, as might be found in some traditional distance education courses. Education offers a continuum of transactions from less distant, where there is greater interaction and less structure, to more distant, where there may be less interaction and more structure. This continuum blurs the distinctions between conventional and distance programs because of the variety of transactions that occur between teachers and learners in both settings. Thus distance is not determined by geography but by the relationship between dialogue and structure. He discussed three types of interaction essential in distance education. Learner-instructor interaction is that component of his model that provides motivation, feedback, and dialogue between the teacher and student. Learner-content interaction is the method by which students obtain intellectual information from the material. Learner-learner interaction is the exchange of information, ideas, and dialogue that occur between students about the course, whether this happens in a structured or nonstructured

manner. The concept of interaction is fundamental to the effectiveness of distance education programs as well as traditional ones. Learners who do not have the basic skills required to use a communication medium spend inordinate amounts of time learning to interact with the technology and have less time to learn the lesson.

Module

Alcantara (2015) claimed that education is very important in everyone's life thus, learning mathematics is very relevant in man's daily living, some students with this, teachers who facilitate learning should prepare and apply different strategies and techniques in order to help students to understand the lessons especially in Mathematics. She added that developing a learning module is a great effort a teacher will do in supporting students learning. Alcantara (2015) also mentioned that modules are the most widely accepted learning materials so it is important to prepare in intelligently. It has an impact in learning since using this material has already been spread in the whole and the use of it has an effect in the learning process of the students all over the world especially in the subject mathematics.

Based on the students' opinion they said that course modules are the alternative solution to provide effective education to all students and at levels in the present scenario under new education policy (Reddy, 2005).

In accordance with the idea of James D. Russell (1974), module is "an instructional package dealing with single conceptual units of subject matter." A module, as a self-contained unit, offers variety and adaptability to the instructional process. It can be used by an individual or small group of learners in a variety of situations. It cooperate multimedia learning experience so the learners can see or hear about the concept they're studying. A module may be several minutes or several hours long. Modules take into

account individual learning styles, are flexible to meet variable learner needs, and place maximum responsibility on the learner. Modules also provide for active participation by the learner, reinforcing the theorem that they learn by doing.

In the idea of Dr. Kardarp Sejpal (2013), the concept of "module" is strictly linked to the idea of flexible language curriculum, which should provide all those concerned with education framework to establish dear and realistic language learning objectives. In addition to Alelaimat & Ghoneem (2012) said that module contains specific objectives, experience, and certain teaching activities carried unit sequence and logical completion to help the learner to achieve the goals and develop sufficiency according to the speed of self-learning. As a result, the new teaching method (module) attention to learner who become the center of activities which aim achieving the objectives of the teaching process for the learners, this approach makes the teaching materials more understandable and increase the mental activities for the learner, strength then the motivation, consolidating the self-satisfaction and helps to keep what they learned, as they organize the Information in his way.

The role of the concept module is to provide students the opportunity to gain exposure and experience with a threshold concept by engaging with It from multiple perspective there behaving greater opportunity to recognize the implicit threshold nature of the associated concept (Parker & McGills). The modules include sections on motivation and assessment that serve as a complete guide of both teachers' and students' desired competencies. Teachers will monitor the learners' progress through home visits (following social distancing protocols) and feedback mechanisms, and guide those who need special attention. (Manlangit, Paglumotan, & Sapera)

In addition to, Dr. Sejpal (2013) enumerated the following advantages: learning become more effective; It establishes a system of assessment other than marks or grades user study the Modules in their own working environment; user can study without disturbing the normal duties and responsibilities; Modules are flexible so that implementation can be made by a variety of patterns; Modules can be administered to a single use small group or large group; It is more appropriate to mature students; It enables the learners to have a control over his learning; accept greater responsibility for learning; It already economical in their use; appropriate only for matured students and this method demands smart classroom. And he also enumerates the following disadvantages: Modules are economical in their use; Appropriate only for matured students; And this method demands smart classrooms. But modules are not substitutes for teachers (Estrada, 2021).

Modular distance learning approach

According to Bonz Magsambol (2020), to make sure that learning remains unhampered, DepEd will be implementing a distance learning approach a learning delivery mode where interaction takes place between the teacher and the students who are geographically remain from each other during instruction, this means lesson will be delivered outside the traditional face-to-face setup. Based on (Manlangit, Paglumotan, & Sapera) Modular learning is a form of distance learning that uses self-learning modules (SLM) based on the most essential learning competencies (MELCS) provided by DepEd. According to Mark Antony Llego (2020), modular distance learning is learning in the form of individualized instruction that allows learners to use self-learning modules (SLM) in print or digital format/electronic copy whichever is applicable in the context of the learner, and other learning resources like learners' materials, textbook, activity sheets, study guides and other study materials. Learners access electronic copies of learning materials on a computer, tablet PC, or Smartphone, CD'S /DVDs /USB storage and computer-based application can all be used to deliver e-learning materials, including

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offline E-Books. The learners may ask assistance from the teacher via E-mail telephone, text message/instant messaging etc.

Dr. Sejpal (2013) defined Modular learning as a unit of work that is virtually self-contained and a method of teaching that is based on the building up skills and knowledge on discrete units should be independent, self -contained, self-instructional, and well defined and have clearly defined objectives. He said, modular method of teaching is more effective, recent and more technology based teaching method in the present educational field. Modular approach provides more flexibility to distance teaching made as well to learners. Using modular approach, the students improve the mathematical understanding on the material that is given to them. The use of module in learning mathematics makes students with high academic ability tended to be more active in the discussion process (Jazim & Rahmawati, 2017).

Ma. Theresa Bringas Nardo (2017) claimed modular Instruction is an alternative instructional Design that uses developed instructional materials which are based on the needs of the students. Students are encouraged to work on various activities that are interesting and challenging to maintain focus and attention, thereby encouraging independent study. Students engaged themselves in learning concepts presented in the module. They developed a sense of responsibility in accomplishing the tasks provided in the module. With little or no assistance from the teacher, the learners progressed on their own, they learned how to learn; they were empowered.

Moreover, this approach is also useful for students with a poor mathematical background and lack of motivation (Abramovits, Berezina, & Shvartsman). They are used as enrichment or supplementary instructional materials for learning concepts and skills, or as remedial instruction is necessary for slow learners and as advance instruction for the fast and highly motivated ones (Balderas, 2012).

The limitations of the modular approach are mostly related to its short duration- there is only so much that can be accomplished with only one week of instruction. A modular approach would be more effective than only or the other (Martin & Furey, 2018).

(Abramovits, Berezina, & Shvartsman) self-learning method permits to overcome some challenges like the lack of student-teacher interaction. (Magsambol, 2020) Insufficient budget allocation and supplies of bond paper and he is also citing its expensive cost and negative impact to the environment, Education Secretary Leonor Briones hopes schools will eventually "reduce dependence" on modular learning as the country shifts to distance learning approach during the pandemic.

Despite of its effectiveness many families have experienced challenges because numerous parents have difficulties in terms of their abilities and availability to support their children in their learning (Deslandes-Martineau, Charland, Arvisais, & Vinuesa, 2020). According to Estrada (2021) modular learning might not work at all. Additionally, she said that there is a lack of feedback and there are a lot more challenges concerning modular learning, but because we're still in the middle of pandemic, it's not the students or the teachers fault. Even they will have a harder time adjusting to the new normal. She also mentioned that it's hard to absorb new information when no one is there to guide you (or at least empathize with you) when the lessons become too much. Learning is hard when done own our own (you are being left in the dark). This contribute to them the anxiety and depression.

Coronavirus disease (COVID-19)

According to John Elflein (2021), coronaviruses are a group of viruses that can be transmitted between animals and people, causing illnesses that may range from the common cold to more severe respiratory syndromes. In February 2020, the International

Committee on Taxonomy of Viruses and the World Health Organization announced official names for both the virus and the disease it causes: SARS-CoV-2 and COVID-19, respectively. He said that the name of the disease is derived from the words corona, virus, and disease, while the number 19 represents the year that it emerged.

Elflein (2021) added that COVID-19 is a novel coronavirus that had not previously been identified in humans. The first case was detected in the Hubei province of China at the end of December 2019. The virus is highly transmissible, and thousands of new cases are being reported around the world each day.

Coughing and sneezing are believed to be the most common forms of transmission, which is similar to the outbreak of the SARS coronavirus that began in 2002 and was thought to have spread via cough and sneeze droplets expelled into the air by infected persons.

In his article of COVID-19 cases worldwide as of March 11, 2021 by country, the outbreak of the coronavirus disease (COVID-19) had been confirmed in over 210 countries and territories. The virus had infected almost 119 million people worldwide, and the number of deaths had reached over 2.6 million. The most severely affected countries are below:

Table 1. Top ten affected countries: number of coronaviruses (COVID-19) cases and deaths worldwide

Country	Number of cases (March 11, 2021)	Number of deaths (April 12, 2021)
USA	29,862,124	575,829
India	11,285,561	170,209
Brazil	11,205,972	353,293
Russia	4,351,553	102,986
UK	4,234,924	127,087
France	3,963,165	98,750
Spain	3,178,442	76,328
Italy	3,123,368	114,254
Turkey	2,821,943	33,939
Germany	2,532,855	78, 964
World	**118,648,421**	**2,949,419**

Related studies

In the study of Dangle & Sumaoang (2020) in their title 'The Implementation of Modular Distance Learning in the Philippine Secondary Public Schools' the key purpose of the research was to find out the challenges encountered, opinions, and recommendations of teachers, parents, and students in the implementation of Modular Distance Learning. These challenges, opinions and recommendations were identified through a mixed quantitative and qualitative approach by conducting surveys to the 37 participants in the selected schools through quota and purposive sampling. The main challenges that emerged were lack of school funding in the production and delivery of modules; students struggle with self-studying, and parents' lack of knowledge to academically guide their child/children. In conclusion, the study was able to determine the prevailing challenges of the participants in terms of resources, preparedness, and communication.

According to Antony Charles in his article entitled "Modular approach of teaching mathematics for

selected topics at plus one level", Modular approach in Mathematics learning proved to be an effective and efficient tool to help students to learn mathematics themselves. He also defined that the modular approach is a self-contained package dealing with one specific subject convenient form, so that the learner can identify the objectives, select materials and method and evaluate his own accomplishment. This provided more flexibility to distance teaching mode as well as to learners. It was enable the learners to have a control over his learning and accept responsibility for learning. Since strategy demanded greater maturity on the part of learner, the modules are more appropriate for more mature students.

Edgar Julius A. Lim (2016), this study entitled "Effectiveness of Modular Instruction in Word Problem Solving of BEED Students", used Quasi-experimental design to the third year BEED students. Based on the findings cited, it concluded that modular instruction in teaching Math specifically word problem solving, it is effective teaching approach.

According to Dr. Padmapriya P.V. (2015), modules helped to develop self-learning capacity among the learners. The present study implied that this is self-learning style in which immediate reflection of the self is possible, which motivated the students to regulate and manage their own learning styles, and thereby to create an interest and attitude towards science among the students as they are free to learn at their own pace. With the help of modules students learned and interacted which boost their confidence in their own learning. The student's treated with modular approach achieved higher mean scores than those students teach through activity oriented method. The study revealed that effectiveness of self-instructional module on achievement among secondary school students and the administrators must take necessary steps to give special training to teacher in developing modular packages.

In the study of Edrian E. Gonzalez (2015) entitled "A Modular Approach Utilizing Decision Tree in Teaching IntegrationTechniques in Calculus" stated many students failed in Mathematics courses because they did not know on how to arrive at the correct decision when doing a mathematical task. This finding led to the conclusion that both modular and traditional instructions are equally effective in facilitating the learning of integration by parts. The other result revealed that the use of modular approach utilizing decision tree in teaching integration by trigonometric transformation was more effective than the traditional method.

Cristobal M. Ambayan (2020) as stated in his study entitled "Modular-Based Approacch and Stusents' Achievement in Literature" he used Comparative-Experimental research design. The third year Bachelor of Secondary Education students (BSED major in English students for school year 2015-2016) were the participants of the study. Based on the results, the performance of the college students in literature improved from poor to fair achievement. Hence it was recommended that the module is used in similar contexts particularly in learning mythology and folklore.

Dochy, F.J.C. and others (n.d.) entitled "Modularization and Students Learning in Modular Instruction in Relation with Prior Knowledge", the study found out the important of prior knowledge, suggesting that in a modular Education environment, according to the changing ideas in today's society on personal development, students requested a kind instruction more fully in accordance to their personal characteristics and their prior knowledge stated resulting in a more efficient and effective education for the learner. There was also the opportunity for students to ship a module or to work through it more quickly on the basis of prior knowledge.

In the study of Carmen L. Vedal Rodeiro and Rita Ñadas on "Effects of Modularisation", a modular specification was one in which the content divided into a member of units or modules, each of which examined separately. The study found out mathematics students

were more satisfied with their grade reports (most common/from of feedback) and gained more information from them. Furthermore, mathematics students found it easier. However, grade reports were not helpful in identifying student's learning needs and informing their learning strategies. Students reported messing the opportunity of going through their own marked paper or receiving suggestions about the areas they needed to improve on in order to change, it necessary, their focus of learning and strategies of exam preparation.

"Structured Module vs. Self-Paced Modular Approach in Teaching Trigonometry" by Rodin M. Paspasan (2015) based on the result it showed that self-passed modular approach helped them also improved their level of performance in relation to plane trigonometry and regardless of their mathematical abilities compared to the structured approach.

Ibyatova, Oparina, and Rakova (2018) on "Modular Approach to Teaching and Learning English Grammar in Technical University", the result of their study entitled "Modular Approach to Teaching and Learning English Grammar in Technical University" showed that the modular approach were found to be effective in teaching and enhance students' understanding and critical thinking.

According to Victorio B. Duyan (n.d.) in his study entitled " Effectiveness of Modular Approach in Teaching and Learning on Chemistry of GASES and their Application at University of Perpetual Help System Laguna (UPHSL)", modular approach should be applied to other subjects as well as other level of education and teachers would use modular teaching to improve the academic achievements of the students.

Based on the study of (Awodeyi, Akpan, & Udo, 2012) entitled "Enhancing Teaching and Learning of Mathematics: Adoption of Blended Learning Pedagogy in University of Uyo", it revealed that the using blended learning, improved students' learning outcome in Pre-algebra. Also gender did not have any statistically significant effect on the students' achievement in pre-algebra toward the use of blended learning.

There was a difference in learning outcomes in the Pharmaceutical Care Course between face-to-face and distance education in the study of (Gossenheimer, Bem, Carneiro, & Silveira de Castro, 2017). Therefore, the student performance was better in the distance education module.

3. Methods
Research design

This study used descriptive research design in order to test the hypothesis and systematically analyze the data about the perceived effect of modular approach to academic performance in Mathematics. According to Dr. Dela Cruz and Dr. Silverio (2019) Descriptive Research Design of research illustrates present characteristics, conditions, images, and the like based on impressions, perceptions or reactions of the respondents.

Locale of the Study

This study was conducted in the premises of Mindanao State University-Sulu (MSU-SULU) specifically in Senior High School Department. MSU-SULU was located at Capitol Hills, Patikul, Sulu near the Provincial Office of Sulu and approximately two kilometers away from the town of Jolo.

Respondents of the Study

The respondents of this research were 178 students, who were enrolled this school year 2020-2021 of grade 11 STEM strand students. The researcher chose three out of the five sections.

Table 2. Respondents of the study

Sections	Number of students
STEM 1- Freud	60
STEM 2- Jung	59
STEM 4-Adler	59
Total	178

Research instrument

The researcher used survey questionnaire in this study in order to collect facts and opinions of the respondents about the study because the researcher wanted to know the perceived effect of modular approach of the students. A questionnaire is a set of questions that measures every item by making the rating scale to check their level of agreement in various statements about on perception. The questionnaire made by researcher consist of four parts: the first part was demographic profile of respondents; second part was to determine the perception of the students regarding modular distance learning approach in Mathematics; and next part was the challenges of the students towards modular distance learning approach in Mathematics; and the last was the perceived effect of modular distance learning approach to academic performance of grade 11 STEM strand students in Mathematics.

Table 3. Rating scale and interval with the verbal description

Scale	Interval	Verbal Description
1	1.00 – 1.49	Strongly Disagree
2	1.50 – 2.49	Disagree
3	2.50 – 3.49	Agree
4	3.50 – 4.00	Strongly Agree

Sampling procedure

The researcher used the sampling design of non-random sampling which was purposive random sampling. The respondents were 178 students from three sections namely STEM 1-Freud, STEM 2- Jung, and STEM 4- Adler.

Data gathering procedure

In gathering all the data needed in this research, the first step was to validate the research questionnaire. Three (3) experts from the field were tapped to validate the questions. After which, the researcher secured a permission letter from the Director of MSU-Sulu Senior High School Department.

The advisers of each and every section helped in administering the questionnaire and in the retrieval.

The researcher collected the accomplished questionnaire from the advisers within one week after administering it.

Statistical treatment

The statistical tools that the researcher used in this study were the following: **Mean** for the research statements of "what is the perception of the students regarding modular distance learning approach in Mathematics?", "what are the challenges of the students towards modular distance learning approach in Mathematics?", and "what is the effect of modular distance learning approach to academic performance

as perceived by grade 11 STEM strand students in Mathematics?". **Frequency counts and percentage and also mean** was for answering in the statement of "what is the level of academic performance of students in Mathematics using modular distance learning approach?"

For the statement of "Is there a significant difference on perception of the students toward modular distance learning approach in Mathematics when grouped according to their gender?" the tool that being used was **t-test for independent samples**. The independent samples t-test compares the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different (https://libguides.library.kent.edu/spss/independenttest). For the statement of "Is there a significant difference on perception of the students toward modular distance learning approach in Mathematics when grouped according to their age?" the tool that being used was **one-way analysis of variance (ANOVA).** The one-way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of two or more independent (unrelated) groups (although you tend to only see it used when there are a minimum of three, rather than two groups).

And for "Is there a relationship of students' perception regarding modular distance learning approach to their academic performance in Mathematics?" **pearson product-moment correlation** was the tool to answer this. Pearson product-moment correlation coefficient (or pearson correlation coefficient, for short) is a measure of the strength of a linear association between two variables (https://statistics.laerd.com/statistical-guides/pearson-correlation-coefficient-statistical-guide.php)

With the assistance of the thesis adviser in the analysis and interpretation of data, the researcher after collecting the data utilized the computer programming called the SPSS to be easy for her to find the answers in a short period of time.

4. Results

Table 4. Perception of the respondents regarding modular distance learning approach

Statement	Mean	Description
1. In a modular teaching method I have a lot of time to answer the activities.	2.99	Agree
2. Students can be guided by friends, parents and relatives on their activities.	2.84	Agree
3. Students are more active and self-directed.	2.80	Agree
4. Modular distance learning approach helps to explore myself in mathematics.	2.77	Agree
5. It is flexible than other approaches in mathematics.	2.58	Agree
6. I am more comfortable to answer the activity in math on my own using modules.	2.48	Disagree
7. I prepare modular distance learning approach in learning mathematics.	2.47	Disagree
8. It is cheaper.	2.44	Disagree
9. Students can easily answer the problems in mathematics.	2.17	Disagree
10. I prefer modular distance learning approach rather than traditional face-to-face instruction.	2.06	Disagree
Grand Mean	**2.56**	**Agree**

Legend: 3.50-4.00 (strongly agree); 2.50-3.49(agree);1.50-2.49(disagree);1.00-1.49(strongly disagree)

The table 4 presented the perception of the students regarding modular distance learning approach in Mathematics. As shown in the table, the grand mean was 2.56 with description Agree. This implied that the respondents agreed with the views

cited along the perceptions regarding modular distance learning approach in Mathematics.

The respondents Agreed on the following statements that the modular distance learning approach helps to explore themselves in mathematics; they have a lot of time to answer their activities; it is flexible than other approaches; they are more active and self-directed; and they can be guided by friends, parents and relatives on their activities. However, the respondents disagreed on the following: they prepare modular distance learning approach in learning mathematics; they are more comfortable to answer the

activity in math on their own using modules; cheaper; they can easily answer the problems; and they prefer modular distance learning approach rather than traditional face-to-face instruction.

The highest perception was the statement of in a modular teaching method I have a lot of time to answer the activities which had mean of 2.99 indicated agree. And the weakest perception was I prefer modular distance learning approach rather than traditional face-to-face instruction. This had a mean of 2.06 that indicated disagree.

Table 5. Challenges towards modular distance learning approach

Statement	Mean	Description
1. Students require self-motivation in answering activities in math.	3.12	Agree
2. Students cannot easily access their teachers should they need explanation for a particular topic.	3.07	Agree
3. Have little support from teacher in learning math.	2.97	Agree
4. Modular distance learning approach is stressful.	2.97	Agree
5. Some parents cannot guide their children because some of them are illiterate.	2.96	Agree
6. Modular distance learning approach has minimal social interaction.	2.94	Agree
7. In Modular distance learning approach, there is a feeling of isolation on the part of the students.	2.92	Agree
8. This modular distance learning approach makes the students' brain drains.	2.85	Agree
9. Students can hardly understand of what they are reading in their modules.	2.83	Agree
10. Students can hardly comprehend the lecture and can hardly solve the activity in mathematics.	2.82	Agree
11. Students might be depressed to answer their activities.	2.78	Agree
12. Students are being mentally sick.	2.74	Agree
13. This approach affects the students' health.	2.70	Agree
14. Students are going to be lazy to solve math problems.	2.67	Agree
15. Students cannot cope up with the discussion.	2.65	Agree
16. Learning mathematics using modular distance learning approach is boring, painful and uninterested.	2.63	Agree
17. Students have much time to play games, surfing on the internet and others rather than to answer the math activities.	2.62	Agree
18. Parents must hire tutors to help their children.	2.57	Agree
19. Students can lose their self-confidence.	2.54	Agree
20. Students can rely on their parents, siblings, friends, and others to answer their activity.	2.49	Disagree
Grand Mean	**2.79**	**Agree**

Legend: 3.50-4.00 (strongly agree); 2.50-3.49(agree); 1.50-2.49(disagree);1.00-1.49(strongly disagree)

The table 5 showed the challenges of the students towards modular distance learning approach in Mathematics. As shown in the table the grand mean was 2.79 indicated Agree that implied the respondents agree with the statements cited.

The respondents agreed on the following challenges: modular distance learning approach has minimal social interaction; it is boring, painful and uninterested; it is stressful; it makes the students' brain drains; it affects the students' health; there is a

feeling of isolation; students have little support from teacher; they require self-motivation in answering activities in math; they cannot easily access their teachers should they need explanation for a particular topic; they cannot cope up with the discussion; they can hardly understand of what they are reading in their modules; they might be depressed to answer their activities; they are being mentally sick; they are going to be lazy to solve math problems; they can lose their self-confidence; students have much time to play games, surfing on the internet and others; they cannot cope up with the discussion; parents must hire tutors to help their children; Some parents cannot guide their children because some of them are illiterate.

On the other hand, the respondents disagreed on the statement that students can rely on their parents, siblings, friends, and others to answer their activity.

The most challengeable part of the students was students require self-motivation in answering activities in math that had mean of 3.12 with description Agree and the less challenge was students can rely on their parents, siblings, friends, and others to answer their activity with mean of 2.49 and description Disagree.

Table 6. Perceived effect of modular distance learning approach

Statement	Mean	Description
1. It helps the students to express with their ideas.	3.04	Agree
2. It saves money for the students that would be spent on travel, lodging and transportation.	3.01	Agree
3. This can help the students to read a lot about the topics in different source.	2.94	Agree
4. It allows students to progress their thinking ability in solving mathematics problems.	2.84	Agree
5. They can manage their time in answering all the activities, reading lectures and so on.	2.84	Agree
6. It saves time to answer the activities.	2.83	Agree
7. With this approach, the students have much time with self-meditation and self-reflection.	2.80	Agree
8. It builds the students' self-confidence.	2.73	Agree
9. The students have the possibility to get good grades in mathematics.	2.65	Agree
10. The students can answer well without pressure.	2.62	Agree
11. Modular distance learning approach improves my ability to learn Mathematics.	2.57	Agree
12. It helps me learn better.	2.53	Agree
13. It helps me understand mathematics concepts better.	2.52	Agree
14. Modular distance learning approach is effective in learning in Mathematics.	2.51	Agree
Grand mean	**2.75**	**Agree**

Legend: 3.50-4.00 (strongly agree); 2.50-3.49 (agree); 1.50-2.49(disagree); 1.00-1.49(strongly disagree)

The table 6 presented the perceived effect of modular distance learning approach to academic performance by grade 11 STEM strand students in Mathematics. As shown in table that the grand mean was 2.75 that indicated Agree. It means that the respondents agreed in all views cited along the effect of modular distance learning approach to academic performance in Mathematics.

With that the respondents agreed in all statements that researcher stated above.

Table 7. Cumulative grades in General Mathematics

	Frequency	Percent
85-89 (Very Satisfactory)	59	33.1
90-100 (Outstanding)	119	66.9
Total	178	100

The table 7 presented the frequency and percentage distribution values of the respondents' cumulative grades in General Mathematics. 33.1 percent of the STEM students achieved very satisfactory level of performance. And 66.9 percent of the respondents achieved outstanding level of performance.

Table 8. Cumulative grades in Pre-Calculus

	Frequency	Percent
75-79 (Fairly Satisfactory)	8	4.5
80-84 (Satisfactory)	40	22.5
85-89 (Very Satisfactory)	50	28.1
90-100 (Outstanding)	80	44.9
Total	178	100

The table 8 presented the frequency and percentage distribution values of the respondents' cumulative grades in pre-calculus. 4.5 percent of 8 students achieved Fairly Satisfactory level of performance. 22.5 percent of 40 students achieved a satisfactory level of performance. 28.1 percent of 50 students achieved very satisfactory level of performance. And 44.9 percent of 80 students performed outstanding in pre-calculus.

Table 9. Level of academic performance in Mathematics

	Mean	Std. Deviation	Description
Pre-Calculus	4.13	.917	Very Satisfactory
General Mathematics	4.67	.472	Outstanding
Rating Obtained	**4.4**	**0.695**	**Very Satisfactory**

Legend: 90-100(Outstanding); 85-89(Very Satisfactory); 80-84(Satisfactory); 75-79(Fairly Satisfactory); 75 below (Did Not Meet Expectation)

The table 9 showed the mean and standard deviation to determine the level of academic performance of students in Mathematics using modular distance learning approach based on the cumulative grades obtained. The academic grade mean of the respondents was 4.4 and standard deviation of 0.695 with the level of very satisfactory. This implied that the students' rating in Mathematics performed better using modular distance learning approach.

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The academic mean of the respondents in Pre-Calculus was 4.13 and standard deviation of .917 that indicated very satisfactory. This implied that the respondents' academic performances in Pre-Calculus classes were very satisfactory. And the data showed that the academic mean of the respondents in General Mathematics was 4.67 and standard deviation of .472 with the description level outstanding. This indicated that the respondents' academic performances in this subject performed excellently.

Table 10. Modular distance learning approach when grouped according to gender

Statements	Gender			
	Male (51)		Female (127)	
	Mean	Description	Mean	Description
1. Students can be guided by friends, parents and relatives on their activity.	2.84	Agree	2.83	Agree
2. It is cheaper.	2.47	Disagree	2.43	Disagree
3. I prefer modular distance learning approach rather than traditional face-to-face instruction.	2.12	Disagree	2.04	Disagree
4. In a modular teaching method I have a lot of time to answer the activities.	2.92	Agree	3.02	Agree
5. I am more comfortable to answer the activity in math on my own using modules.	2.82	Agree	2.53	Agree
6. I prepare modular distance learning approach in learning Mathematics.	2.33	Disagree	2.53	Agree
7. Modular distance learning approach helps to explore myself in mathematics.	2.65	Agree	2.82	Agree
8. Students can easily answer the problems in mathematics.	2.02	Disagree	2.23	Disagree
9. Students are more active and self-directed.	2.63	Agree	2.87	Agree
10. It is flexible than other approaches in Mathematics.	2.33	Disagree	2.69	Agree
Mean	**2.51**	**Agree**	**2.60**	**Agree**

Legend: 3.50-4.00 (strongly agree); 2.50-3.49 (agree); 1.50-2.49(disagree); 1.00-1.49(strongly disagree)

The table 10 showed that there is no significant difference on the perception of the students toward modular distance learning approach when they are grouped according to their gender. Both male and female have the same perception.

Table 11. t-test on modular distance learning approach when grouped according to gender

Statements	t-computed	Df	Sig. (2-tailed)	Decision
1. Students can be guided by friends, parents and relatives on their activity.	.067	176	.947	Accept H$_o$
2. It is cheaper.	.307	176	.760	Accept H$_o$
3. I prefer modular distance learning approach rather than traditional face-to-face instruction.	.549	176	.584	Accept H$_o$
4. In a modular teaching method I have a lot of time to answer the activities.	-.779	176	.437	Accept H$_o$
5. I am more comfortable to answer the activity in math on my own using modules.	-1.116	176	.266	Accept H$_o$
6. I prepare modular distance learning approach in learning Mathematics.	-1.348	176	.179	Accept H$_o$
7. Modular distance learning approach helps to explore myself in Mathematics.	-1.446	176	.150	Accept H$_o$
8. Students can easily answer the problems in mathematics.	-1.116	176	.102	Accept H$_o$
9. Students are more active and self-directed.	-2.081	176	.039	Reject H$_o$
10. It is flexible than other approaches in mathematics.	-3.094	176	.002	Reject H$_o$

The sig. (2-tailed) is the probability (p) value which referred to the smallest level of significance for which the observed sample statistic tells the researcher to reject HO. If p-value is less than or equal to α (alpha), then it rejects the null hypothesis. If p-value is greater than α, it accepts the null hypothesis.

The data on the table 11 showed the t-values of the independent sample test for comparison of means with equal variances on the perception of respondents toward modular distance learning approach if they are grouped by gender. In the statements that modular distance learning approach is flexible than other approaches in mathematics and students are more active and self-directed, the null hypotheses were rejected in favor of the alternative hypotheses. Since the t-values of -3.094 and -2.081 and sig-values of .002 and .039 were lesser than the .05 level of significant with degree of freedom 176. These indicated that there exist significant differences on the respondents' perceptions when they are grouped according to their gender.

The table 11 also presented that there are no significant differences among respondents' perceptions toward modular distance learning approach if they are grouped by gender along these statements: Respondents prepared modular distance learning approach in learning Mathematics; they had a lot of time to answer the activities; they were more comfortable to answer the activity in math on their own using modules; they could easily answer the problems in mathematics; they preferred modular distance learning approach rather than traditional face-to-face instruction; they were guided by friends, parents and relatives on their activity; modular distance learning approach helped to explore themselves in Mathematics; and it was cheaper. Hence, the null hypotheses are accepted since the t-values and sig-values were greater than the .05 level of significant with degree of freedom 176.

Table 12. Modular distance learning approach when grouped according to age

Statements	Age					
	15-16 yrs old (26)		17-18 yrs old (130)		19 above yrs old (22)	
	Mean	Description	Mean	Description	Mean	Description
1. I prefer Modular Distance Learning Approach rather than traditional face-to-face instruction.	1.96	Disagree	2.08	Disagree	2.09	Disagree
2. It is cheaper.						
3. In a modular teaching method I have a lot of time to answer the activities.	2.54	Agree	2.42	Disagree	2.45	Disagree
4. Students can be guided by friends, parents and relatives on their activity.	2.88	Agree	3.00	Agree	3.05	Agree
5. I prepare Modular Distance Learning Approach in learning mathematics.	2.96	Agree	2.82	Agree	2.82	Agree
6. I am more comfortable to answer the activity in math on my own using modules.	2.31	Disagree	2.48	Disagree	2.59	Agree
7. It is flexible than other approaches in mathematics.						
8. Students are more active and self-directed.	2.54	Agree	2.52	Agree	2.23	Disagree
9. Modular Distance Learning Approach helps to explore myself in mathematics.	2.46	Disagree	2.64	Agree	2.41	Disagree
10. Students can easily answer the problems in mathematics.						
Mean	2.77	Agree	2.85	Agree	2.55	Agree
	2.69	Agree	2.74	Agree	3.05	Agree
	2.00	Disagree	2.26	Disagree	1.82	Disagree
	2.51	**Agree**	**2.58**	**Agree**	**2.51**	**Agree**

Legend: 3.50-4.00 (strongly agree); 2.50-3.49 (agree); 1.50-2.49(disagree); 1.00-1.49(strongly disagree)

The table 12 presented the perception of respondents toward modular distance learning approach when they are grouped according to their age. It showed the weighted mean of 26 respondents under 15-16 yrs old was 2.51 with description of agree; the mean of 130 respondents at 17-18 yrs old was 2.58 as they are agree; and the mean of 22 respondents of 19 above yrs old was 2.51 with description agree. These implied that the respondents agreed on the following statements above cited and there is no significant difference on the perception of the students toward modular distance learning approach when they are grouped according to their age.

Table 13. ANOVA test on modular distance learning approach when grouped according to age

Statements	F-computed	Sig. (2-tailed)	Decision
1. I prefer Modular Distance Learning Approach rather than traditional face-to-face instruction.	.208	.812	Accept H_o
2. It is cheaper.	.267	.766	Accept H_o
3. In a modular teaching method I have a lot of time to answer the activities.	.345	.709	Accept H_o
4. Students can be guided by friends, parents and relatives on their activity.	.398	.672	Accept H_o
5. I prepare Modular Distance Learning Approach in learning mathematics.	.678	.509	Accept H_o
6. I am more comfortable to answer the activity in math on my own using modules.	1.179	.310	Accept H_o
7. It is flexible than other approaches in mathematics.	1.477	.231	Accept H_o
8. Students are more active and self-directed.			
9. Modular Distance Learning Approach helps to explore myself in mathematics.	1.769	.174	Accept H_o
10. Students can easily answer the problems in mathematics.	1.910	.151	Accept H_o
	3.978	.020	Reject H_o

The sig. (2-tailed) is the probability (p) value which referred to the smallest level of significance for which the observed sample statistic tells the researcher to reject HO. If p-value is less than or equal to α (alpha), then it rejects the null hypothesis. If p-value is greater than α, it accepts the null hypothesis.

The table 13 presents the ANOVA test to determine the significant differences on the perception of respondents toward modular distance learning approach when grouped according to their age. The significant values and f-values of all nine (9) statements cited above were all greater than .05 level of significant. These suggested that the null hypotheses for the variable age were accepted. This indicated that there is no significant difference on the respondents' perception toward modular distance learning approach when they are grouped according to their age. This implied that the respondents had the same perceptions with regards to their age.

But for the statement, students can easily answer the problems in mathematics the p-value was less than .05 level of significant. Hence, the null hypothesis was rejected. It indicated that there exist significant differences on the perception of respondents toward modular distance learning approach when grouped according to their age.

Table 14. Relationship of students' perception to academic performance

Parameters	Mean	Description	Correlation coefficient r	Sig. (2-tailed)	Decision
Perception	2.56	Agree	.017	.827	Accept H_o
Academic Performance in Mathematics	87.85	Very Satisfactory			

The sig. (2-tailed) is the probability (p) value which referred to the smallest level of significance for which the observed sample statistic tells the researcher to reject HO. If p-value is less than or equal to α (alpha), then it rejects the null hypothesis. If p-value is greater than α, it accepts the null hypothesis.

The table 14 above showed the relationship of students' perception regarding modular distance learning approach to the academic performance in Mathematics. Since the significant value of .827 is higher than the level of significant of .05, therefore, the null hypothesis was accepted. This implied that there is no a significant relationship of students perception regarding modular distance learning approach to their academic performance in Mathematics.

5. Discussion

This research study aimed to investigate the effect of students' perceptions in regards to modular distance learning approach and its relation to academic performance of the students in Mathematics. It explored further to identify the challenges of using modular distance learning approach, also to determine the level of academic performance and significant difference of students' perception according to their gender and age. This study used descriptive research design and utilized the research survey questionnaire to get the data. Purposive sampling was used in the selection of respondents. The data analyzed and interpreted using the SPSS computer programming. The perception, challenges and the perceived effect to academic performance of students regarding modular distance learning approach were used mean. The level of academic performance was also used frequency counts and percentage & mean. The hypotheses of significance difference of the students' perceptions when grouped by gender and age were tested using t-test for independence sample and one-way analysis of variance (ANOVA). The significance relationship of perceptions to academic performance was tested using Pearson correlation.

6. Conclusion

In this study, the academic grades in Mathematics of the STEM students treated by modular approach achieved very satisfactory in school year 2019-2020. The study revealed the effectiveness of modular distance learning approach in learning Math despite of its challenges amidst COVID-19 pandemic. The hypotheses were accepted on the differences of the perceptions of students regarding modular distance learning approach when they were group according to their gender and age. Hence, these were not the factors on the students' perceptions towards academic performance using modular approach. And also the study revealed that there is no significant relationship of their perceptions regarding about modular distance learning approach to academic performance in Mathematics. Therefore, the researcher concluded that the academic performance of the STEM students were not affected by their perceptions in regards to modular distance learning approach. This means that the quality of performance in getting high, average or low grades did not depend on their perceptions. And the researcher also concluded that this approach helped students to improve their math performance.

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