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Students' Learning Styles and Performance in Mathematics: Basis for the Development of Teaching Materials

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Abstract:- This study employs Design Research that aims to develop teaching material in Mathematics in the Modern World (GECMAT) based on the students' learning styles and mathematics performance during the midterm period of the first semester of the school year 2018 – 2019. The participants of study were the 216 First Year Students taking Bachelor of Science in Industrial Technology of CHMSC major in Architectural and Drafting, Automotive, Fashion & Apparel, Food & Trades, Electronics, Electrical, Refrigeration & Air conditioning and Mechanical Technology, who are officially enrolled in Mathematics in the Modern World. The gathering of data for the study was through the use of two researcher-made questionnaires, namely, the Learning Style Questionnaire (LSQ) and the Performance in Mathematics Questionnaire (PMQ), which underwent validity and reliability. The study reveals that the dominant learning style of the students is visual; however, the second dominant learning style, which is auditory, has the highest mean performance in mathematics. Generally, the student's performance in mathematics was Average when taken as a whole and to the topics Nature of Mathematics, Language of Mathematics, and Data Analysis. However, students' performance in Problem Solving was Low. The audio-video presentation, practice sheets, and PowerPoint presentation are the teaching materials developed based on the findings. The teaching materials mean values gained excellent acceptability as perceived by the teachers and students. School administrators may influence teachers in promoting an environment favorable for learning and encourage teachers to pay attention to students' diverse learning styles and mathematical performance since these directly impact their mathematical knowledge.

Keywords:- *Learning Styles, Mathematics Performance and Teaching Materials.*

I. INTRODUCTION

According to Gloria (2015), students have low performance in mathematics due to a lack of concept, mathematical skills, or understanding of the fundamental manipulation and loving mathematics. They may create a negative outlook toward the subject.

Stevenson and Dunn (2001) stated that learners could learn further effectively and promptly based on their learning preferences. Brown (2003) suggests that teaching learners with their preferred learning style can help them develop the adeptness necessary to handle a different range of learning requirements.

Conversely, Ogden (2003) found out that learners learn independently by engaging them with different learning styles. Students also know their strengths when opportunities allow them to develop associated strengths in other areas.

The teaching methods and learning environment enhance the learners' educational experience, providing an improved connection to the teaching materials, according to Brodsky (2017). Furthermore, presenting information to the learners in various ways gives a more significant learning experience.

The statement of Abrahams (2015), in an article entitled "Understanding Generation Z learning styles in order to deliver quality learning experiences" states: *"As generations go, the latest-referred to as Generation Z – has completely revolutionized learning styles as we know them. This generation, born between 1995 – 2009, comprises children who are true digital natives. Children who epitomize the definition ' tech–savvy', children who do not use technology as a tool but as a way of life."*

Moreover, this generation investigates information and makes sound judgments reflecting poor critical thinking skills. Since generation Z learning takes place outside the classroom, the teacher will facilitate the discussion and application of the content within the school.

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Teachers should challenge the learners to build their concepts toward mathematics (Ozarka, 2016). Furthermore, teaching mathematics with videos and audiovisuals is an excellent alternative to lecturing. It provides an exceptional medium for learners to apply self-pacing of learning, providing a deeper understanding of the learners toward the concepts in mathematics that challenge them at their own pace.

Mathematics in the Modern World is one of the general education subjects which given the slightest interest and time, and maybe also influenced by their perceived skills in this subject, their negative behaviors, and readiness to address the demands of their Mathematics teachers. The Mathematics in the Modern World (GECMAT) this Academic Year 2018 – 2019 has no existing teaching materials. The results of this study will be the basis of the researcher framing a teaching material for Mathematics in the Modern World.

II. RESEARCH OBJECTIVES / PROBLEM STATEMENTS

The primary purpose of this study is to develop teaching material for Mathematics in the Modern World based on the learning styles and performance in mathematics of the first-year student's Bachelor of Science in Industrial Technology students of Carlos Hilado State College, Negros Occidental.

Specifically, this study will seek an answer to the following questions:

- What is the dominant learning style of the students?
- What is the level of performance of the students?
- What teaching material can be developed based on the results of the study?
- What evaluation procedures used by teachers and students to evaluate the developed teaching materials in teaching math?

III. FRAMEWORK

This study is anchored on the Experiential Learning Theory of Dave A. Kolb (1984), which is described as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combinations of grasping and transforming the experience" (Cherry, 2018).

Furthermore, the experiential learning theory was used to complement a comprehensive understanding of learning theory based on experience, perception, cognition, and behavior (AgriFutures, 2016). In addition, learning is best comprehended as development, not as an outcome, since concepts are not permanent and thoughts about experiences are molded and refabricated over time.

According to Vega and Prieto (2006), learners process information in diverse ways by seeing and hearing, reflecting and acting, reasoning logically and intuitively, analyzing and visualizing. A learner's learning style has to do with the way he processes information to learn and then apply it. Felder (1994) identified learning preferences that can help the learners comprehend and select strategies that soughed them.

Specific learning inventories include visual, auditory, and kinesthetic learning preferences when working in groups or individually. Furthermore, learners may be visual learners, aural learners, verbal learners, sensing learners, and kinesthetic learners.

The concept of Kilpatrick, et.al (2009) entitled Conceptual Understanding states that the learner understands the importance of the mathematical idea and the kinds of contexts in which it is valuable. The learner organizes their knowledge into a coherent whole, enabling them to learn new ideas by connecting those ideas to what they already know. Likewise, the significant indicator of conceptual understanding is being able to represent mathematical situations in different ways and knowing how different representations can be helpful for different purposes and is also essential to see how the various representations connect, how they are similar, and how they are different. The learners' conceptual understanding degree is related to the richness and extent of the connections they have made.

Furthermore, the knowledge that the learners have learned with understanding provides the basis for generating new knowledge and for solving new and unfamiliar problems. The learners also acquired conceptual understanding in the area of mathematics. They saw the connections among concepts and procedures and gained confidence that led the learner's move to another level of understanding. Lastly, Kilpatrick et al. (2009); define the following as the components of conceptual understanding: mathematical concepts, operations, and relations.

IV. RESEARCH PARADIGM

Figure 1 shows the paradigm illustrating the relationship between the independent variable and dependent variable of the study.

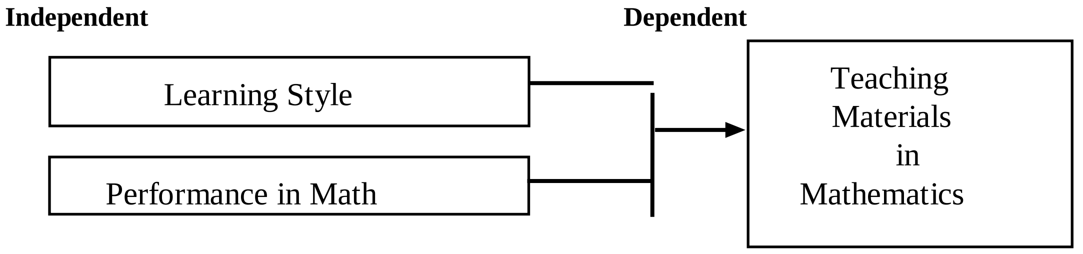

Fig. 1: The paradigm of the study shows the relationship of the different variables used in the study

Based on the scenarios mentioned above, the researcher is inspired to conduct the study on the students' learning styles and performance in mathematics. Based on the results, the researcher will develop a teaching material.

V. SCOPE AND LIMITATIONS

The concern of the study employed the Type 1 Developmental Research study aims at determining the students' learning styles and performance in mathematics. The Type 1 Developmental Research involved the first year Bachelor Science in Industrial Technology students majoring in; Architectural Drafting (Section O), Automotive (Section B), Fashion & Apparel (Section F), Food & Trades (Section D), Electronics (Section I), Electrical (Section J), Refrigeration & Air-conditioning (Section F), and Mechanical Technology (Section Q). They are officially enrolled in Mathematics in the Modern World in First Semester Academic Year 2018 – 2019.

The sections involved in the study were carefully chosen, utilizing simple random sampling from each program from the first-year Bachelor of Science in Industrial Technology students at the College of Industrial Technology, Talisay Campus. During the actual conduct of the study, two hundred sixteen (216) students participated in the gathering of the data instead of two hundred fortytwo (242) due to seventeen (17) drop-outs and ten (10) absent.

To determine the learning styles of the students, a twenty-four (24) statement question cycle through four receptive learning styles of the participants. The participants were advised to rank the statement's questions in terms of their usefulness in learning approaches. The participants rate their personal experiences and preferences using the 5 scale: 1 (Absolutely not useful), 2 (Little useful), 3 (Neutral), 4 (Fairly useful) and 5 (Absolutely useful). four receptive learning styles of the participants. The participants were advised to rank the statement's questions in terms of their usefulness in learning approaches. The participants rated their personal experiences and preferences using the 5 scale: 1 (Absolutely not useful), 2 (Little useful), 3 (Neutral), 4 (Fairly useful) and 5 (Absolutely useful).

The procedure of the study utilizes the ADDIE model. According to Aldoobie (2015) ADDIE model stands for Analysis, Design, Development, Implementation, and Evaluation, which is one of the most common models for instructional design to produce a practical design. In addition, the model helps teachers to construct effective and efficient teaching designs.

The researcher modified the checklist questionnaire Evelyn C. Torrefranca (2017) developed in her study Development and Validation of Instructional Modules on Rational Expressions and Variations for the teacher's and student's evaluation of the developed teaching materials. Furthermore, the criterion of the checklist questionnaire covers the following areas, namely: Objectives, Content, Format and Language, Presentation, and Usefulness of the teaching materials.

VI. MATERIALS AND METHODS

This Type 1 Developmental Research study aims to determine the students' learning styles and performance in mathematics. In addition, this study aims to develop teaching material on Mathematics in the Modern World.

According to Seels & Richey (1994), developmental research is "the systematic study of designing, developing and evaluating instructional programs, processes, and products that must meet the criteria of internal consistency and effectiveness."Developmental research seeks to generate information grounded in data systematically resulting from run-through. It is a pragmatic type of research that offers a way to test "theory" that has been only hypothesized and to validate practice that has been perpetuated essentially through unchallenged tradition. In addition, it is a way to establish new procedures, techniques, and tools based upon a methodical analysis of specific cases. As such, developmental research can either create generalizable conclusions or statements of law or produce context-specific knowledge that serves a problem-solving function.

Specifically, this research is a Type 1 developmental Research Design. This research design focuses upon a given instructional product, program, process, or tool. They reflect an interest in identifying either general development principles or situation-specific recommendations (Richey, Klein, & Nelson, 2004). Usually, Type 1 Development Research was defined as a research design that involves conditions in which the design and development process used in a particular condition was described, analyzed, and the final product was evaluated.

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According to Driscoll (1984), Type 1 developmental Research Design utilized the term "systems-based evaluation" to describe a similar research paradigm, whereas van den Akker (1999) considered it as "formative research." In addition, it refers to the "research activities performed during the complete development process of a specific involvement, from exploratory studies through (formative and summative) evaluation studies".

Instruments. To determine the Learning Styles and Performance in mathematics in the first year of Bachelor of Science in Industrial Technology at Carlos Hilado Memorial State College, the researcher utilized a researcher made survey questionnaire.

The Learning Styles instrument underwent face-and-content validity, was pilot tested to determine its administer ability, and has an alpha value of 0.867 utilizing Cronbach's Alpha. According to Breen, R. & Lindsay, R. (2002), the internal reliability utilizing Cronbach's Alpha with a coefficient between 0.74 and 0.87 has high reliability. As stated by MacMillan & Schumacher (2006), the goal of developing reliable scores is to minimize the influence on the scores of chance and other variables unrelated to the intent of the measure.

While for the participants' performance in mathematics, a (40) forty-point multiple-choice test questionnaire will be prepared by the researcher based on the Midterm Scope and Sequence. For the performances in mathematics of the First Years BSIT students, the researcher utilized the CMO No. 20, series of 2013. A table of s the pecification was developed that includes the topics, number of hours taught, percentage, and number of points for the performance in mathematics instrument.

There are 10 items from each topic: Nature of Mathematics (25%), Mathematics Language and Symbols (25%), Problem Solving (25%) and Data Management (25%). According to McMillan (2007), the multiple-choice tests are exceptional for objectively and efficiently evaluating information of a large content domain. In addition, this type of test can provide a broad sampling of knowledge and typically more reliable, and they are free from response set and much less of a guessing factor.

Moreover, this instrument was tested for both administrability and reliability. This test underwent content validation, item analysis, and reliability testing through Kuder-Richardson Formula 20 *(KR – 20)* and obtained a reliability coefficient of 0.852. The Kuder-Richardson reliability is used to determine from a single administration of an instrument, according to McMillan & Schumacher (2006).

VII. RESULTS AND DISCUSSIONS

Dominant Learning Style of the Students. Table 1 shows the dominant learning style of the students. The highest number of learning styles on unimodal was visual learning style with a frequency of 76, while on bimodal learning style was visual-tactile learning style with a frequency of 8, whereas on trimodal learning styles visual-auditory-kinesthetic learning style with a frequency of 7. The finding also shows that 176 participants with the dominant learning style were unimodal, followed by 33 participants with bimodal learning styles and 9 with trimodal learning styles.

Kozinsky (2017) mentioned in an article that the preferred learning environment of the learners of generation Z is collaborative since they refuse to be passive learners and expect to be fully engaged in the learning process. In addition, the dominant learning style of this generation was visual and tactile above auditory learning styles. Malat (2018) believed that generation Z has different learning style preferences from the other generation. They are DIYL or do-it-yourself-learning, they like better peer-to-peer learning with friends or classmates where the element of leadership is present, and this gives them a perfect way to exchange concepts that reflects new perceptions.

	f	Percentage (%)
Unimodal Learning Styles		
Visual	76	35.2
Auditory	40	18.5
Tactile	31	14.4
Kinesthetic	27	12.5
Bimodal Learning Styles		
Auditory/Kinesthetic	4	1.9
Auditory/Tactile	5	2.3
Tactile/Kinesthetic	5	2.3
Visual/Auditory	6	2.8
Visual/Kinesthetic	5	2.3
Visual/Tactile	8	3.7
Trimodal Learning Styles		
Auditory/Tactile/Kinesthetic	1	0.5
Visual/Auditory/Kinesthetic	7	3.2
Visual/Tactile/Kinesthetic	1	0.5
Whole	**216**	**100.0**

Table 1: Dominant Learning Style of the Students

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Table 1 presents the dominant learning styles of first-year BSIT students. On the unimodal learning styles the students are more visual (n = 76) in learning mathematics, followed by auditory (n = 40), tactile (n = 31) and kinesthetic (n = 27) styles in learning. Implies that the participant of the study shows that they are more visual learners in learning mathematics; findings show that the learners comprehend mathematics if they read the instruction and highlight important facts or passages in their readings/notes. Furthermore, the second dominant learning style was auditory in learning mathematics. Findings demonstrate that the learners learn better in class when the teacher delivers the lecture and gives the instruction orally. Whereas the third dominant learning style was tactile, results show that participants learn and remember the concept better in mathematics if they create something in the class. Lastly, the fourth dominant learning style was kinesthetic. Participants like to learn mathematics and learn better if they do something in class.

Whereas, on the bimodal learning styles the participants are more visualtactile (n = 8) in learning mathematics, followed by visual-auditory (n = 6), auditory-tactile (n = 5), tactile-kinesthetic (n = 5), visual-kinesthetic (n = 5) and auditory-kinesthetic (n = 4) in learning mathematics. The participants who are visual-tactile learners comprehend the lesson better if they read the instruction and remember it if they do something in the classification task. At the same time, the participants who are auditory-tactile learners learn better if the instructor delivers the instructions and creates something for the classification task.

Where on the Trimodal learning styles, the participants are more visualauditory-kinesthetic (n = 7) in learning mathematics, followed by auditorytactile-kinesthetic (n = 1), and visual-tactile-kinesthetic (n = 1) styles in learning mathematics. Implies that the participants who are visual-auditory-kinesthetic learners learn better if the instructor delivers the instructions to create something for the classification task and doing something in class to remember the lesson.

Level of Performance of the Students. According to Willingham (2009), practice is not enough to improve the working memory size for mathematics performance. Mathematics performance can improve through effort, ability, and intelligence (Jauŝovec and Jauŝovec, 2012). Challenging the students on their capability to improve their mathematical skills in solving problems should first master the basic facts about mathematics, according to Ediger (2012).

Table 2 shows the results of the students' level of performance in learning mathematics and in terms of the nature of mathematics, mathematics language, problem-solving, and data management.

Performance	M	SD	Interpretation
Performance in Mathematics	17.97	5.525	Average level of performance
Nature of Mathematics	5.08	1.851	Average level of performance
Mathematics Language	5.01	2.162	Average level of performance
Problem Solving	3.58	2.060	Low level of performance
Data Management	4.29	2.008	Average level of performance

Table 2: Level of Performance of the Students

Note: Mean Scale for 10-items; 0.00-2.00 Very low, 2.01-4.00 Low, 4.01-6.00 Average, 6.01-8.00 High and 8.01-10.00 Very high. Mean Scale for 40-items; 0.00-8.00 Very low, 8.01-16.00 Low, 16.01-24.00 Average, 24.01-34.00 High and 34.01-40.00 Very high

Table 2 shows that the level of performance in mathematics of the firstyear BSIT students was "Average" when taken as a whole (M = 17.97, SD = 5.525). The "Average" level of performance in mathematics indicates that student at this level has developed the fundamental knowledge, skills, and understandings and, with little guidance from the teacher and with assistance from peers, can apply these understandings. According to Ediger (2012), teachers must focus on the students acquiring a deep knowledge of the subject and mastering the context comprehension.

On the following topics, the students have “Average” level of performance on Nature of Mathematics (M = 5.08, SD=1.851), Mathematics Language (M = 5.01, SD=2.162) and Data Management (M = 4.29, SD = 2.008). However, the students have "Low" performance in Problem Solving (M = 3.58, SD = 2.060). A "Low" level of performance indicates that the student at this level possesses the minimum knowledge, skills, and understanding but needs help applying the concept. To overcome the poor mathematical performance of the learner, the learners should overcome the history of poor learning techniques and self-perception related to their mathematical concepts, according to Frodsham (2015).

VIII. TEACHING MATERIALS BASED ON THE RESULTS

According to Kharb et al. (2013), the understanding of the learners' learning styles implies both instructors and learners. In addition, learners classify the learning preferences that can be of help them employ suitable learning strategies. As a product, it is possible to become lifetime self-directed learners and to maximize the learner’s true potential. Moreover, the instructors developed awareness of the learners' learning styles and integrated teachinglearning strategies that meet the learners' learning preferences. It would not only create an efficient learning environment, but it would also motivate the students to achieve academic success.

As stated in an article published by the Ministry of Education of Guyana (2016), materials utilized in instructions are an essential factor in any classroom. It helps improve the reading comprehension skills, illustrating or reinforcing a skill or concept, and distinguishing instruction of the learners. Likewise, the teaching materials also help the learners engage in other senses since there are no limits to what the teaching materials can be used when enhancing learning.

According to the Republic Act 8293, "encourage full-time faculty members to develop textbook/instructional materials that will develop competencies as required by the subject." Furthermore, Presidential Decree No. 6-A, known as the Educational Development Act of 1972, stated, "Develop the high-level professions that will provide leadership for the nation, enhance knowledge through research, and apply new knowledge for improving the quality of instruction."

Learning Styles	**Performance**	**Interpretation**
Visual	17.43 (5.047)	Average
Auditory	19.10 (5.821)	Average
Tactile	17.68 (4.578)	Average
Kinesthetic	18.63 (6.052)	Average
Auditory-Kinesthetic	14.50 (6.608)	Low
Auditory-Tactile	20.80 (7.225)	Average
Tactile-Kinesthetic	14.40 (2.408)	Low
Visual-Auditory	19.83 (6.014)	Average
Visual-Kinesthetic	19.40 (7.503)	Average
Visual-Tactile	17.38 (6.163)	Average
Auditory-Tactile-Kinesthetic	29.00 (0.000)	High
Visual-Auditory-Kinesthetic	15.14 (6.619)	Low
Visual-Tactile-Kinesthetic	18.00 (0.000)	Average
Whole	17.97 (5.525)	Average

Table 3: Teaching Materials Based on the Results

Mean Scale for 40-items; 0.00-8.00 Very low, 8.01-16.00 Low, 16.01-24.00 Average, 24.01-34.00 High and 34.01-40.00 Very high

Table 3 shows that the students with higher mean performance on unimodal learning styles were Auditory (M=19.10, SD=5.821) followed by Kinesthetic (M=18.63, SD=6.052), Tactile (M=17.68, SD=4.578) and Visual (M=17.43, SD=5.047). Established from the results, students with auditory learning styles have a higher mean value on performance, followed by kinesthetic, tactile, and visual learning styles.

The findings refute the study of Alde and Ogbo (2014), that students with visual learning styles have higher performance than those with auditory and kinesthetic learning styles. Also, Moayyeri's (2015) study showed that the students with visual learning styles perform better than those with auditory and kinesthetic learning styles. Like the study of Bosman and Schulze (2018), students with visual learning styles have a higher performance in mathematics, followed by auditory and kinesthetic learning styles.

Meanwhile, on bimodal learning style, the students with Auditory-Tactile (M = 20.80, SD = 7.225) learning style have the highest mean performance, followed by students with Visual-Auditory (M = 19.83, SD = 6.014), VisualKinesthetic (M = 19.40, SD = 7.503), and Visual-Tactile (M = 17.38, SD = 6.163) learning styles. Furthermore, the least mean performance is students with Auditory-Kinesthetic (M = 14.50, SD = 6.608) and Tactile-Kinesthetic (M = 14.40, SD = 2.408) learning styles. Based on the findings, the students with bimodal learning style auditory – tactile perform better in mathematics than those with bimodal learning style visual – auditory, visual – kinesthetic, and visual-tactile.

Lastly, on the Trimodal learning styles, the students with Auditory Tactile-Kinesthetic (M = 29.00, SD = 0.000) learning styles have a higher performance than the students with Visual-Tactile-Kinesthetic (M = 18.00, SD = 0.000) and Visual-Auditory-Kinesthetic (M = 15.14, SD = 6.619) learning styles. Students with auditory – tactile-kinesthetic learning styles perform better in mathematics than those with visual – tactile-kinesthetic and visual – auditory – kinesthetic learning styles.

Learners with auditory learning styles love music and remember the words to songs they hear, according to Mead (2018). Auditory learners can effortlessly follow spoken directions and understand something. They read out loud rather than silently. Moreover, auditory learners understand that the teacher explains the concept to the class rather than reading assignments.

Robledo (2017) confers that indulging the interest of an auditory learner should be provided with materials to help them learn. In addition, talking about the subject or asking the learner with an auditory learning style can help the learner to understand the new concept of the lesson.

Pecha (2018) mentioned that mathematics is a creative and visual subject, not just a repetition of computation and drills or disconnected procedures. Making learning visible to the learners supports and connects to the deep conceptual understanding of mathematics.

IX. DEVELOPMENT OF TEACHING MATERIALS

Rationale. Many teachers will conclude that many students lack a good foundation in mathematics since the latter often fail to understand the significance of the basic concepts and principles of the subject. It is on this premise that the researcher is encouraged to formulate this set of teaching materials.

The presentation of lessons and exercises in this set of teaching materials in a gradually progressing, meaningful, and simplified approach. Illustrative examples were carefully arranged, selected, and graded in difficulty. Exercises had been carefully evaluated and tested in classroom discussions. At the end of every topic, semi-programmed activity sheets containing exercises and a mastery test are on hand to determine the students' achievement.

As regarded by Heinich (2001), learning materials significantly to master definite skills and obtain knowledge. Moreover, the design of the instructional materials are not a substitute for effective teachers or to supplement the reference book but to enhancement the instructional process. Selected contents of these teaching materials, based on the results and findings, the researcher focuses on the dominant learning styles and the performance in mathematics of the learners. The researcher used simple language to explain the step-by-step methods of solving problems to facilitate comprehension with multimedia and computer presentation.

Learning materials in instruction are essential to the performance of the learners' accomplishment, according to Right (2018). Specifically, the instructional components of lesson planning the instruction will be determined by the selection of teaching materials, "Teaching materials" is a common term used to describe the properties of the instructors' used to deliver instruction. Teaching materials can support student learning and increase student success. Preferably, the materials utilized in instruction were designed based on the topic's content, and teaching materials originate in various forms and extents. However, they all can support learners' learning.

The influence of matched teaching and learning style on learning performance is still provocative, and researchers found that the theoretical exploration and practice that one way to overcome the style mismatch is to introduce a consistent teaching style, according to Lu et al. (2009). In addition, this cannot only reflect the significant role of the instructor but also adapt to different learning styles and will make the instructions accepted by most students.

According to Gill (2013), instructors are accountable for the learner's various learning abilities. The instructors do not have the amenity of leaving the learners with low performance to experts specializing in behavioral concerns or learning disorders. In addition, the instructor must develop instructional styles that effort well in different classrooms. The practical instruction methods engage gifted and slow-learning learners and those with attention deficit tendencies.

The understanding of the learners' learning styles implies both instructors and learners, according to Kharb et al. (2013). Learners classify the learning styles that can be of help them employ suitable learning strategies. As a product, this is probable to become lifetime self-directed learners and maximize the learner's true potential. Moreover, the instructors developed awareness of the learners' learning styles and integrated teaching-learning strategies that meet the learners' learning styles; this would create an efficient learning environment and motivate the students to achieve academic success.

To improve the students' mathematical performance, mathematics teachers should search for environmental and personal variables to influence students' performance in the subject (West Africa Examination Council Report, 2009). The effectiveness of teaching-learning progression depends not only on the instructor but likewise upon the different types of tools accessible in the classroom, according to Malik & Pandith (2013).

Objectives. Preparing a teaching material is an essential component of the teaching-learning procedure. The better equipped the instructor is, the more possible he/she will be able to handle whatever unexpectedly happens in the lesson. The following are the main goals of the teacher materials:

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- Provide a comprehensive outline for smooth resourceful teaching employing teaching materials.
- Give a sense of direction to the teacher concerning the topic (Problem Solving) in GECMAT – Mathematics in the Modern World.
- Help the teacher to be more systematic and assertive when delivering the lessons; mathematical creativity and process skills of the students; and
- Provide an opportunity for teachers to improve their expertise in handling the instruction and teaching materials in delivering the subject matter.

Level of Acceptability of Teachers. The teachers evaluated the teaching materials to determine the level of their acceptability in the areas of Objectives, Content, Format & Language, Presentation, and Usefulness. Utilizing the modified checklist questionnaire developed by Torrefranca E. (2017) in her study Development and Validation of Instructional Modules on Rational Expressions and Variations. In this study, the teachers evaluated the teaching materials on the subject matter: Inductive & Deductive Reasoning, Polya's 4 – steps of Problem Solving, and Problem-Solving Strategies.

Subject Matter	M	SD	Interpretation
Whole	3.20	0.78	Very Good Acceptability
Inductive and Deductive Reasoning			
Objectives	2.86	0.73	Very Good Acceptability
Content	3.02	0.82	Very Good Acceptability
Format and Language	3.20	0.70	Very Good Acceptability
Presentation	2.86	0.81	Very Good Acceptability
Usefulness	2.68	0.68	Very Good Acceptability
Polya's 4-steps of Problem Solving			
Objectives	3.40	0.67	Very Good Acceptability
Content	3.48	0.79	Very Good Acceptability
Format and Language	3.42	0.67	Very Good Acceptability
Presentation	3.38	0.75	Very Good Acceptability
Usefulness	3.32	0.68	Very Good Acceptability
Problem Solving Strategies			
Objectives	3.24	0.77	Very Good Acceptability
Content	3.34	0.87	Very Good Acceptability
Format and Language	3.34	0.69	Very Good Acceptability
Presentation	3.24	0.87	Very Good Acceptability
Usefulness	3.24	0.80	Very Good Acceptability

Table 4: Teachers Acceptability

Note: Mean Scale: 1.00-1.49 Poor, 1.50-2.49 Good, 2.50-3.49 Very Good, and 3.50-4.00 Excellent

Table 4 presents the computed weighted mean on the acceptability of the developed teaching materials as evaluated by the teachers. The table reflects that, as perceived by the teachers, they evaluated the subject matter as excellent acceptability of the teaching material (M = 3.20, SD = 0.78). The teachers likewise evaluated each subject matter, Inductive & Deductive Reasoning, Polya's 4-steps of Problem Solving, and Problem-Solving Strategies, as excellent acceptability of the teaching material in the areas of Objective, Content, Format & Language, Presentation, and Usefulness.

In the subject matter Inductive and Deductive Reasoning, the areas Format and Language (M = 3.20, SD = 0.70) has the highest mean value on acceptability, followed by the areas Content (M = 3.02, SD = 0.82), Objectives (M = 2.86, SD = 0.73) and Presentation (M = 2.86, SD = 0.81), while the area Usefulness (M = 2.68, SD = 0.68) has the lowest mean value of acceptability. Right (2018) cited that distinction of instruction is the modifying of instructions to the diverse learning styles and capabilities within the interaction of the instructors and learners. Mayer (2005) cited that learners learn better from words and pictures than from words alone, and words involve writing. Spoken manuscripts and pictures comprise static graphic images, animation, and video that both words and pictures are more effective than words in processing information.

Whereas on the subject matter Polya's 4-steps of Problem Solving, the areas Content (M = 3.48, SD = 0.79) has the highest mean value of acceptability followed by Format and Language (M = 3.42, SD = 0.67), Objectives (M = 3.40, SD = 0.67), and Presentation (M = 3.38, SD = 0.75), while the area Usefulness (M = 3.32, SD = 0.68) has lowest mean value of acceptability. According to the Ministry of Education of Guyana (2016) teaching materials proved to be a tough enhancement for instructors when the strengthening of a skill or concept is essential. It also allows learners to provide more time to practice and present information in a way that offers learners a diverse approach to employ with the material.

The subject matter Problem-Solving Strategies, the areas of Content (M = 3.34, SD = 0.87) and Format & Language (M = 3.34, SD = 0.69) have the same highest mean value of acceptability; however, the standard deviation of the area Content was more spread than the area Format & Language. Lastly, the mean values of the areas Objectives (M = 3.24, SD = 0.77), Presentation (M = 3.24, SD = 0.87) and Usefulness (M = 3.24, SD = 0.80) are the same. Furthermore, among these areas, the standard deviation of the presentation was more spread than in the areas of Objectives and Usefulness. The teaching materials are significant since they can expressively upsurge the learners' performance by supporting their learning. Also, the teaching material in the learning process allows the learners to discover the information individually as well as provides repetition and has significant functions in the learners' learning, according to Right (2018).

Level of Acceptability of the Students. The students evaluated the teaching materials to determine the acceptability of the subject matters; Inductive and Deductive Reasoning, Polya's 4-steps of Problem Solving, and ProblemSolving Strategies in Format and Language, Presentation, and Usefulness of the teaching materials. Likewise, the students utilized the modified checklist questionnaire developed by Torrefranca E. (2017) in her study Development and Validation of Instructional Modules on Rational Expressions and Variations.

Table 5 presents that the students' level of acceptability, when taken as a whole (M = 3.23, SD = 0.56), was excellent. The table likewise shows that the students evaluated the teaching material in the subject matters, Inductive and Deductive Reasoning, Polya's 4-steps of Problem Solving, and ProblemSolving Strategies as excellent acceptability in the areas of Format and Language, Presentation, and Usefulness.

Subject Matter	M	SD	Interpretation
Whole	*3.23*	*0.56*	*Very Good Acceptability*
Inductive and Deductive Reasoning Format and Language	3.16	0.54	Very Good Acceptability
Presentation	3.18	0.56	Very Good Acceptability
Usefulness	3.13	0.51	Very Good Acceptability
Polya's 4 steps of Problem Solving Format and Language	3.19	0.54	Very Good Acceptability
Presentation	3.11	0.64	Very Good Acceptability
Usefulness	3.12	0.59	Very Good Acceptability
Problem Solving Strategies Format and Language	3.44	0.51	Very Good Acceptability
Presentation	3.41	0.51	Very Good Acceptability
Usefulness	3.33	0.56	Very Good Acceptability

Table 5: Students Acceptability

Note: Mean Scale: 1.00-1.49 Poor, 1.50-2.49 Good, 2.50-3.49 Very Good, and 3.50-4.00 Excellent

In the subject matter Inductive and Deductive Reasoning, the areas Presentation (M = 3.18, SD = 0.56) has the highest mean value of acceptability as perceived by the students, followed by the areas Formant and Language (M = 3.16, SD = 0.54) and Usefulness (M = 3.13, SD = 0.51). Chioran (2016) concluded that a learning environment that employs multimedia, where learners can classify and solve problems more easily compared to the traditional setting where teaching is made possible only by textbooks. While Right (2018) cited that teaching materials can support student learning and increase student achievement on a certain object lesson, the instruction is essential to the performance of the learners' accomplishment.

Moreover, on the subject matter Polya's 4-steps of Problem Solving, the areas Format & Language (M = 3.19, SD = 0.54) has the highest mean value as perceived by the students, followed by the areas Presentation (M = 3.11, SD = 0.64) and Usefulness (M = 3.12, SD = 0.59). Ediger (2012) stated that teachers must focus on the students acquiring a deep knowledge of the subject and mastering the context comprehension. Moreover, challenging the students on their capability to improve their mathematical skills in solving problems should master first the basic facts about mathematics.

Likewise, on the subject matter Problem Solving Strategies, the areas Format & Language (M = 3.44, SD = 0.51) has the highest mean value of acceptability as perceived by the students, followed by the areas Presentation (M = 3.41, SD = 0.51) and Usefulness (M = 3.33, SD = 0.56). Curtain-Phillips (2007) cited those learners master their skills and concepts towards mathematics more enthusiastically if the presentation of the instructions is actual, pictographic, and symbols. Furthermore, learners enjoy manipulatives, symbols, and pictures more than lectures and books. They were more motivated to discover with greater curiosity and interest in classwork.

X. CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn: The students comprehend mathematics if they read the written and presented instructions of the teacher. The students also acquire learning if they hear the instruction from the teacher that delivers the lessons orally. Whereas students may understand the lesson in mathematics if they can do something in class after the instruction is delivered.

Moreover, in bimodal learning styles, visual-tactile learners comprehend the lesson better if they read the instruction and remember the lesson if they do something in the school task. The students, who are auditory-tactile learners, learn better if the instructor delivers the instructions and creates something for the classification task.

Lastly, on trimodal learning styles, the students who are visual-auditory kinesthetic learners learn better if the instructor delivers the instructions to create something for classroom tasks and do something in class to remember the lesson.

The performance in mathematics in the topics Nature of Mathematics, Mathematics Language, and Data management indicates that student at this level has developed the fundamental knowledge, skills, and understandings and, with little guidance from the teacher and with peer assistance, can apply these understandings. The students in the topic Problem Solving indicate that the student at this level possesses the minimum knowledge, skills, and understandings but needs help applying the concept.

The PowerPoint presentation, video clips, and activity sheets can be effective teaching materials for teaching mathematics in the modern world, as revealed in the dominant learning styles and performance of the students. Indeed, the learning styles and performance in mathematics, to some extent, show how students learn and engage their selves in learning.

There is a seemingly great potential, and value in the use of teaching materials as an instrument used to deliver instruction in mathematics.

XI. RECOMMENDATIONS

In view of the data and findings generated and the conclusions drawn from the analysis and interpretation of data, the following recommendations are offered:

The students' dominant learning style and performance in GECMAT should be considered one vital part of the whole process of instruction, especially for those less self-directed students. Students who are still dependent on the teacher can be trained to be more independent. The researcher believes that the teachers must guide students to develop skills and learning strategies that match the learners' interests.

Curriculum developers and specialists play an essential role in designing the curricula in college based on the student's understanding of their personal learning styles. Likewise, they must spearhead innovative ways to strengthen classroom instruction, exclusively the awareness of the students' learning styles and performance in mathematics, which may enable curriculum developers to consider the utilization of teaching materials suited to the learners learning process.

The teaching materials are substantial since they can expressively increase learners' performance and support the students' learning. Teaching materials support the learning process by allowing the students to discover information individually and providing significant functions in the students' learning. To conclude, instructional variation is also a part of the learning involved in the classroom, where learning materials discern according to the types of learning styles.

It is also recommended that school administrators influence teachers in promoting an environment favorable for learning and encourage teachers to use varied approaches to enhance the teaching and learning process. They must plan out and create programs or include in-service training on different instructions and modify them to the diverse learning styles and capabilities within the interaction of the teachers and students.

Teachers who use multiple methods should allow students to build on their prior knowledge and make the exercise tangible and meaningful. Hence, teachers must pay attention to students' diverse learning styles and mathematical performance since these directly impact their mathematical learning.

Mathematics teachers are encouraged to utilize the teaching materials and learning plans developed in this study or create their own to ensure the enhancement of mathematical performance among their students in learning mathematics. By using the teaching materials, teachers may be able to facilitate more flexible, dynamic, challenging, and engaging learning situations, improving students' mathematics performance.

Students need to strive more to perform better in school. They must take responsibility for recognizing difficulties and knowing how to get their teacher to help them with what they do not understand. Results of the study may open the minds and hearts of students, improve their performance in mathematics and enhance their critical thinking and problem-solving skills not only in school but also in a real-life situation.

Develop among students the ability to solve a variety of problems in many different settings since, often, students lack success in mathematics because they do not have a way to approach and analyze a problem to understand it better.

Lastly, to validate this study's results, it is recommended that a similar study be conducted on other fields of specialization in the college. This study can be replicated using other subjects, methods, and time duration. The dominant learning styles in mathematics must be used for the whole school year to see their effect on the students' mathematical performance.

Future researchers may use dominant learning styles and performance in mathematics in junior and senior high, where students are well-thought-out experience different strategies employed by teachers that contribute involvement in learning and have low mathematics performance.

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