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Acceptability of Electronic Modulo Art Design (EMAD)

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ABSTRACT

Today's trend in education has opened various avenues for educators to explore, and arrive at strategic means for a successful transfer of knowledge among learners. This descriptive method of study assessed the use of Electronic Modulo Art Design (EMAD) in Sorsogon in terms of its perceived usefulness, ease of use, element of satisfaction, equity and accessibility. Data were generated through survey, unstructured interview and content analysis of the written responses of the students in the researcher made questionnaires. The respondents were the selected students and teachers from the public secondary and elementary schools of Bicol region. The study revealed that the students appreciated modulo art design through the use of computers for its attractiveness, speed and creativity. EMAD has the potential to develop the problem solving and thinking skills of the learner. Both students and teachers have high level of acceptability on EMAD when integrated to teaching and learning process. Teachers and students significantly agreed on the usefulness and equity and accessibility of EMAD which can provide high level of satisfaction when integrated to teaching and learning process. It is recommended that EMAD may be utilized in the teaching and learning processes in different learning areas as a way to arouse the interest and potentials of the learners in arts and information technology.

Keywords: Electronic Modulo Art Design (EMAD), Acceptability, Assessment

INTRODUCTION

Today's trend in education has opened various avenues for educators to explore, and arrive at strategic means for a successful transfer of knowledge among learners. Quality education has always been the goal. At the teacher's end, this ultimate goal can also be realized through acquiring teaching methods, strategies and approaches that would best fit his/her learners in many aspects. Likewise, conducting relevant educational research is said to reveal possible solutions for many classroom problems, and offer teachers with scientific approaches to utilize in his/her classroom for successful learning to take place. This learning is manifested through the skills generated from the knowledge instil to them.

In a global perspective, the UNESCO Institute of Education (UIE) is committed to continually seek for multiple ways of learning, knowing and producing knowledge to keep pace with rapid socio-economic and technological changes notably, globalization and the growth of information and communication technology [1]. Effective educational policy making and practical interventions are among the diverse areas that demand access to research, information, ideas, effective models and the possibility to form appropriate partnership. The general aim is for education to acquire the principles towards implementation and acquisition of lifelong learning. These principles of lifelong learning gain new relevance and pose challenges as it requires a fresh look at the concept of learning.

Together with UNESCO and being one member state, the Philippines EFA advocated the concept of lifelong learning [2]. Lifelong learning in the Philippines is directly linked with the EFA goals by way of the new concept of Quality of Education – Anchored on Functionality. Functionality is equated with the notions of lifelong learning rooted on four pillar of education: learning to know, learning to do, learning to life together and learning to be. These are translated with the five strands of indicators namely, communication skills, problem solving and critical thinking, sustainable use of resources/productivity, development of self and sense of community and expanding one's world vision.

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All these efforts are synchronized by the goal along quality education. In fact, Article XIV, section 1 of the Philippine Constitution mentions the role of quality education in human development and in the achievement of national goals. It states that:

"*The state shall protect and promote the right of its citizens to quality of education at all levels and shall take appropriate steps to make such education accessible to all."*

To attain this, the Department of Education (DepEd), being the government unit that takes charge of the education system of the country, continuously undergoes enhancing and upgrading of the basic education curriculum. It implements several innovations in attaining quality education. Specifically, the intervention of technology to teaching and learning environment is recognized to have a key role in improving the quality of education in the country.

The DepEd Vision for Information Communication Technology (ICT) in Education is "21st Century Education for All Filipinos, Anytime, Anywhere". This means that ICT enables education system to transform students into dynamic life-long learners and values-centered, productive and responsible citizens. To launch this, DepEd employs a project where all public schools in the country can connect to the internet [3]. Calleja continued that according to then DepEd Secretary Armin Luistro, it was not enough to build classrooms and toilets; the real revolution in education that has long-term effects can only be done through information technology.

Because education has seen the capacity of ICT in the school setting, DepEd is gearing towards a computer-centric learning environment. Teachers and students can yield positive results within the learning environment and true-to-life situations. Students' gadget, teachers' laptop, schools' computers and classrooms' ICT are more and more involved in 21st century education process. Teachers should learn to use computers and the corresponding programs and software for instructional use.

Information technology can assist students in the successful learning of different mathematical concepts. Teachers therefore should teach mathematics not only through classroom instruction but also through the different learning avenues so that students can fully understand the concepts from simplest to the most complicated ones. One of these is the integration of the use of technology to mathematics instruction.

Mathematics is the study of patterns. The graphical features in the computer can aid the teacher to present the ideas clearly among the students. These patterns created by numbers can create unique and artistically pleasing designs. Number theory as a branch of mathematics is a subject that enhances and develops the imaginative and artistic inclination of students through the patterns of designs from number pattern in Modular Arithmetic called Modulo Art.

Given the chance to discover what Modulo Art can do in teaching mathematical concepts, the researcher would like that this learning avenue be maximized to teachers and students alike. With computer application in Modulo Art, he believed that the aesthetic inclination and technical knowledge and skills of the students and teachers can be merged together to create an interesting and attractive outputs. With this, students may not have a struggling time doing difficult and boring mathematical tasks as observed when traditional way of teaching mathematics is employed. Also, with the ready instructional materials he has at hand out of Modulo Art, he would like that its acceptability among its users be as well investigated. This can be an initial and scientific step towards utilization of Electronic Modulo Art Design in classrooms. It is with these ideas that the researcher would like this study to be undertaken.

Objectives of the Study

This study assessed the use of Electronic Modulo Art Design (EMAD) in Bicol region. Specifically, the following are the specific objectives:

(1.) Determine the skills developed among teachers and students when exposed to Electronic Modulo Art Design. (2.) Assess the Electronic Modulo Art Design along: a. Attractiveness, b. Speed and c. Creativity. (3.)

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Determine the acceptability level of both students and teachers in using computer-based modulo art design along: a) usefulness b) content, c) accessibility and, d) ease of use (4.) Test whether there is a significant difference between the students and teachers' perception on the level of acceptability of EMAD along the identified variables.

Related Literature and Studies

There are learning theories and principles underlying the instructional design. The three learning schools, namely: the behaviorism, cognitivism and constructivism are the foremost theoretical foundation in education. Their principles are applied to education most especially when designing an instructional material.

The primary focus of the behavioral perspective is on behavior and the influence of the external environment in shaping the individual's behavior. Learning is inferred from behavior, so it is important to identify the goal behavior, this involves breaking that goal behavior into a set of simple behaviors and arranging them in a sequence of frames that will help students progress toward the goal [4]. Davidson-Shiver and Rasmussen [5] purport that there are several key concepts of behaviorism that have been applied to the educational environment and that you may find important in designing and implementing instructional materials. These are practice, modeling, reinforcement and active learning.

Cognitivism emphasizes information processing, the mental processes that a learner uses as they apply skills and knowledge [6]. In cognitive learning, the individual learns by listening, watching, touching, reading, or experiencing and then processing and remembering the information. Learning is described as a change in knowledge stored in memory. As a consequence, the instructional expert is challenged with organizing new information for presentation, carefully linking new information to previous knowledge and using a variety of techniques to guide and support the mental processes of the student.

The constructivist perspective describes learning as a change in the meaning constructed from experiences. Learning is constructed by the complex interplay among students´ existing knowledge, the social context and the problem to be solved. The instructional designer should be able to pose good problems, create group learning activities and guide the process of knowledge construction [7]. Some strategies to use with constructivism are scaffolding, reciprocal teaching and guided instruction.

In addition to these theories, the information processing theory is also essential to EMAD development. According to Zhou and Brown [8], information Processing Theory is concerned with how people view their environment, how they put that information into memory, and how they retrieve that information later on. It is an approach that is based on the idea that humans process information they receive instead of simply responding to external stimuli. The mind is often compared to a computer. The computer, like mind, analyzes information and determines how the information will be stored. There are three components of the Information Processing Theory: sensory memory, working memory, and long-term memory.

Sensory memory is all of the things that you experience through your five senses - hearing, vision, taste, smell, and touch. The capacity of sensory memory is great but the duration is very limited. Working memory is short term, often just seconds long, and includes the thinking part of applying what came out of the sensory memory. Long term memory is memory that can be accessed at a much later time, and is much longer lasting and can hold more information than working memory.

Higher order thinking skills include critical, logical, reflective, metacognitive, and creative thinking [9]. They are activated when individuals encounter unfamiliar problems, uncertainties, questions, or dilemmas. Successful applications of the skills result in explanations, decisions, performances, and products that are valid within the context of available knowledge and experience and that promote continued growth in these and other intellectual skills. Higher order thinking skills are grounded in lower order skills such as discriminations, simple application and analysis, and cognitive strategies and are linked to prior knowledge of subject matter content.

The famous and mostly used theory on learning and higher order thinking skill was that of Bloom's. Bloom's taxonomy is a multi-tiered model of classifying thinking according to six cognitive levels of complexity. It is

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hierarchical; each level is subsumed by the higher levels. The lowest three levels are: knowledge, comprehension and application. The highest three levels are: analysis, synthesis and evaluation. A student functioning at the 'application' level has also mastered the material at the 'knowledge' and 'comprehension' level. However, Bloom's taxonomy has undergone changes. From the six categories, it was changed from noun to verb forms.

Furthermore, the lowest level of original, knowledge was renamed and became remembering. Finally, comprehension and synthesis were retitled to understanding and creating. In summary, the following categories are now used for Bloom's Taxonomy: remembering, understanding, interpreting, applying, analyzing, evaluating and creating. Appropriate teaching strategies and learning environments facilitate their growth as do student persistence, self-monitoring, and open-minded, flexible attitudes

On assessing user acceptance of instructional material and technology, user acceptance is defined by Dillon as demonstrable willingness within a user of computer aided instructional material to employ it to learn practical skills [10]. According to Turner, et. Al [11], technology assistance model (TAM) was proposed by Fred Davis in 1989 as a means of predicting technology usage. TAM postulates that perceived ease of use and perceived usefulness of technology are predictors of user attitude toward using the technology, subsequent behavioural intentions, and actual usage [12].

Perceived usefulness is the degree to which the user believes that using the technology will improve his or her work performance, while perceived ease of use refers to how effortless he or she perceives using the technology will be [13]. Masrom further said both perceived usefulness and perceived ease of use are considered distinct factors influencing the user's attitude toward using the technology, though perceived ease of use is also hypothesized to influence perceived usefulness and attitude toward using the technology

There were reviewed local and foreign studies which were found relevant to the present study. Their similarities and differences were indicated in the succeeding discussion.

Casaig [13] conducted an investigation on the use of computer manipulative in building concrete understanding in statistic subjects. This quasi-experimental action research aimed to determine the effects of the use of Microsoft Power Point and Microsoft Excel as an approach in teaching Statistics. The respondents are the eighty second year students from two sections of BS in Business Administration. They were given a 30-item multiple choice pre-test and post-test. The experimental group was exposed to power point presentations and hands-on activities using the Microsoft Excel. The control group was exposed to the traditional method of lecture and chalkboard instruction.

Significant difference was observed in the pre-test and post-test level of performance of the two groups of respondents. But there is no significant difference in the level of performance of the controlled and experimental group in the pre-test, while a significant difference was observed in their post-test performance. This means the advantage of the intervention using Microsoft Excel and Microsoft Power Point in the study of Statistics.

Pelones conducted a study which tested several technological tools that shaped students to become compliant with the standard of a 21st century learner [14]. The researcher used a quasi-experimental, quantitative and qualitative methods of research in testing the effectiveness of these various tools. Descriptive statistics, correlation tool, test of significance and qualitative tools were used in the study.

In 2007, the use of computer-aided software using MathCad, Conics, Statistica and Algebrator did not significantly affect the performance in Math but imporved the attitude of the students at a great extent making them become independent learner, self-starters and collaborative. Using the qualitative research in 2010, blog has proven to improve communication and writing skills, increase global awareness and critical thinking skills. In 2011, a descriptive-correlative study revealed that social networking skills did influence neither increase nor decrease of their academic performance in math. The study conducted in 2014 revealed that students strongly agreed that Facebook is an effective vehicle as learning repository, helpful in connecting to new trends and ideas, promotes information sharing and crowd sourcing, heighten collaboration, encourage engagement and

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innovation.

Lapinid, et. al. [15] evaluated the effectiveness of CAI modules in mathematics for intermediate grade schools. developed by the Department of Science and Technology – Science Education Institute in collaboration with the Advanced Science and Technology Institute (ASTI) in terms of motivating pupils in Mathematics learning and improving their performance in an achievement test. The ratio of pupil to computer unit as pupils go through the CAI learning module during the conduct of this study was 1:1. Responses were analyzed using descriptive statistics. One-way Analysis of Variance (ANOVA) was used to determine if there is significant difference among the three grade level pupils' perception in each interactivity category. A paired samples t-test was used to see if there is a significant difference between pupils' pre-CAI and post-CAI achievement test scores in the selected CAI topics.

Findings include: only a limited number of schools have the capacity to facilitate the use of the Math and Science courseware modules in their instruction due to their physical facilities such as computer laboratories and internet access, as well as teachers' computer literacy skill. Surveyed teachers' reason for not using the CAI was due to the lack of orientation and training of the said modules. Teachers agree that the CAI has management interactivity. The pupils have greater control over their learning which makes them involved and motivated to proceed with the module.

Dio et. Al [16]. conducted policy research on the factors affecting the involvement of faculty members in the development of instructional materials (IM) as basis for policy recommendation. It was descriptive research design and involved 95 faculty members of Sorsogon State College. The study determined the profile of the respondents along IM preparation. Despite the fact the most of them did not have formal training of IM preparation, majority of them are developing IMs presently utilized in their own classroom. But very few applied for copyright of their developed IMs so that it can be sold for wider utilization. To increase engagement of the faculty in the development of quality and publishable instructional materials, a scheme on policy recommendation has been formulated which contains provisions on the formation of the IMs committee, the evaluation procedures, approval, copyrighting and patenting, reproduction, publication and utilization of IMs.

Dokor [17] conducted an assessment of learner acceptance and satisfaction with video-based instructional materials for teaching practical skills in a distance learning setting. This paper was the second part of a larger exploratory study that assessed the instructional effectiveness of video-based instructional materials for teaching distance learners practical skills in block-laying and concreting and how learners respond to these instructional materials.

Learners appeared positive about their learning experiences with the use of video-based instructional materials to learn practical skills at a distance as they rated highly all the items assessing their acceptance and satisfaction. Results of item-by-item ANOVA regarding learner acceptance indicated that the respondents, categorized according to study centers, exhibited similar levels of acceptance for nine of the ten items. For learner satisfaction, there were no statistically significant differences for six of the seven items. Thus, learners of different study centers exhibited about the same level of acceptance and satisfaction.

The researcher attributed the teachers' decisions to number of contextual and teacher factors, including their beliefs about teaching and learning and their opportunities to learn about the curriculum changes. More important than a particular textbook choice was how the teachers selected and implemented the materials to support the mathematical goals of the curriculum. The results of the study indicate that teacher educators must help practicing and prospective teachers develop their knowledge of curriculum standards and how to select and implement materials to support those standards.

MATERIALS AND METHOD

This study assessed the use of Electronic Modulo Art Design (EMAD) in Bicol region. Descriptive method of study was used in this study to describe the acceptability and the skills developed among students when exposed to EMAD. Pagano [18] emphasizes that if an analysis is done for the purpose of describing or

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characterizing the data, then descriptive method of research is used. Data were generated through survey, unstructured interview and content analysis of the written responses of the students.

The respondents were the selected students and teachers from public elementary and secondary schools of Bicol region. A researcher-made questionnaire was the main instrument used in data gathering. Frequency count, percentage, weighted mean and t-test were the statistical treatments employed.

RESULTS AND DISCUSSION

1. The problem solving and thinking skills developed among students when exposed to Electronic Modulo Art Design as perceived by the teachers and students

Table 1 presents the problem solving and thinking skills developed among students when exposed to Electronic Modulo Art Design as perceived by the teachers and students. Overall, both the teachers and the students strongly agreed that the enumerated skills were perceived to be developed among students when EMAD is used.

Table 1. The Problem Solving and Thinking Skills Developed among Students When Exposed to Electronic Modulo Art Design as Perceived by the Teachers and Students.

SKILLS	TEACHERS		STUDENTS		Ave.	I	Rank
	$\bar{x}$	I	$\bar{x}$	I			
Problem solving skills							
Creating mathematical models from real-life problems	3.43	SA	3.44	SA	3.44	SA	5
Being alert to the reasonableness of results	3.53	SA	3.54	SA	3.54	SA	3
Specifying relationships	3.53	SA	3.52	SA	3.53	SA	4
Observing, classifying, using space/time relationships	3.63	SA	3.58	SA	3.61	SA	2
Choosing appropriate computation	3.78	SA	3.70	SA	3.74	SA	1
Thinking skills							
Divergent thinking	3.62	SA	3.58	SA	3.64	SA	1
Critical thinking	3.66	SA	3.64	SA	3.62	SA	2
Reflective thinking	3.53	SA	3.50	SA	3.52	SA	3
Finding regularity in repeated reasoning	3.56	SA	3.52	SA	3.37	SA	5
Converging thinking	3.50	SA	3.48	SA	3.49	SA	4

Legend: $\bar{x}$ - mean; I – interpretation; SA – strongly agree; Ave. - average

While problem-solving skills, the top ranking among the skills was choosing the appropriate operation being the first, followed by observing, classifying, and using space/time relationships and being alert to the reasonableness of results being the third. They obtained a mean of 3.74, 3.61, 3.54, and 3.54, respectively, and were interpreted as strongly agree. While the least in the rank was the fifth was creating mathematical models

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from real-life problems, and the fourth was specifying relationships. They got a mean of 3.44, and 3.53, respectively, and were interpreted as strongly agree.

In addition, thinking skills' top ranking sub skills were divergent thinking being the first and critical thinking being the second, with a mean of 3.71 and 3.57, respectively and interpreted as *strongly agree*. In contrast, the lowest ranking skills were finding regularity in repeated reasoning was the eighth rank with a mean of 3.37, being followed by reasoning abstractly and quantitatively with a mean of 3.40. Both were interpreted as strongly agree.

Students and teachers alike perceived that creating mathematical models from the real-life problems was in same rank skill they can attain from using the EMAD. This may be brought about by the fact that when executing EMAD, all human senses are activated which made them associate it to reality. They thought that EMAD can help them find avenues to approach the different problems in life. With the patterns and designs elicited from EMAD, the user can create an artwork with the use of computer simultaneously solving a math problem. However, inferring and predicting skills can also be taught by EMAD because they are basic among the complicated skills to be learned.

Problem-solving is one of the most vital and basic skill which is required to students in the 21st century education. Technology supports problem-solving in a number of ways. It enables students to identify problems quicker and easier and helps better to analyze a complex problem. Technology students are especially encouraged to be innovative and to want to improve a current situation by encountering and solving problems, in an advanced way.

Critical thinking skill is the foremost goal of the K to 12 for its learner to achieve. This skill to manifest requires the mastery of other basic thinking skills. Critical thinking skill is essential at this time so that students can discriminate between right and wrong, logic and illogical or reasonable and not on the different overwhelming social and personal issues in the society. They can identify what is their stance on the issue and believe on it. These qualities of a critically minded person may be achieved through the use of EMAD.

According to Suh [19], technology can also stimulate students' interest. Because real-life problems often require complex computations, visualization and graphing for data analysis, technology must be used.

2. Students' assessment in Electronic Modulo Art Design in terms of attractiveness, speed and creativity

Attractiveness. Table 1 shows the Student's Assessment in EMAD in terms of attractiveness. It can be gleaned from the table the over-all students' assessment of 3.51 on the attractiveness of EMAD. This only shows that the students strongly agree that the output from the EMAD is attractive to them when its procedures are properly executed.

Table 2A. Students' Assessment in Electronic Modulo Art Design in terms of Attractiveness

INDICATORS	WM	I
1. It is very appealing to my sight.	3.83	SA
2. I am amazed at how design is produced through EMAD.	3.60	SA
3. I can easily get what is explained by the teacher.	3.54	SA
4. It suits my preferences in learning.	3.51	SA
5. I am very inspired to proceed with the next design.	3.49	SA
Over-all Mean	**3.51**	SA

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Legend: WM- Weighted Mean; I- Interpretation; *SA- Strongly Agree*

What makes an instructional material appealing among learners is its graphical representation which includes colors, design and uniqueness. When something is new to the sight of the students, they become more curious and interested especially at how that thing is being done. During the workshop of the introduction of EMAD among students and teachers, the researcher observed that these participants are so engaged. They were interested at how these designs are made when put together.

Illustration 1A shows one of the outputs during the EMAD Contest last 2021. The given design obtained the highest score in attractiveness. It further illustrates the patterns of design and color rendering made by EMAD which made the output very attractive for the students. Because it is visually attractive, the students are inspired to proceed with their work. They can understand better the mathematical concept being taught to them. It made them realize that out of learning Mathematics, they would be able to come up with such design. They are also excited about the output design of the present modulo they are working on. This element of emotion among learners is essential for them to grasp the essence of what they are learning.

Illustration1A. Sample Output of Student Showing Attractiveness

Villeres [20] restates that the emphasis of the content of education is moving from usual elements of knowledge and compliant learner-attitudes, to higher forms of problem solving and initiative that makes open learning and constructivist environments more appealing. Innovations in instructional design must be oriented with theories and metarules so that convention and content approaches are merging towards instructional interaction.

Speed. Student's Assessment in EMAD in terms of speed is shown in Table 2B. The table discloses that the students strongly agree that they can achieve speed in doing EMAD designs, with an overall weighted mean of 3.65.

The table further shows that "students can make design easily and quickly" at a mean of 3.70. "EMAD can be operated fast and efficiently," has garnered a mean of 3.63. "The EMAD can show the design quickly" has a mean of 3.59. "It has many designs and patterns to choose from", garnered a weighted mean of 3.65. Likewise, "it can correct and edit their work before they can have the final design" got a weighted mean of 3.70. All these indicators and their weighted means were interpreted as *strongly agree*.

Table 2B. Students' Assessment in Electronic Modulo Art Design in terms of Speed

INDICATOR	WM	I
1. I can make design easily and quickly	3.70	SA
2. It can be operated fast and efficiently	3.63	SA

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3. It can show the design quickly	3.59	SA
4. It has many designs and patterns to choose from	3.65	SA
5. It can correct and edit my work before I can have the final design	3.70	SA
Over-all Mean	**3.65**	SA

Computer technology has great advantages in art design. It makes art design more efficient, faster and more accurate and is a major innovation in the art design. It will not cause hassles to students when coming up with their designs. They offer quick output. The element of speed offered by EMAD is essential to learning too. Now that students are used to quick sources of information from what experienced from the internet, learning in the same manner would be satisfying to them. They can efficiently get what they wanted at a short period of time. When they are not achieved at certain short period of time, students become bored and might not continue with their potential learning.

Tao said that the application of computer technology in art design will speed up the development process of art and design [21]. It changes the manual activities such as graphic design, animation design, three-dimensional design, etc., which not only saves time and reduces the loss of labor, but also greatly improves the work efficiency of the art design.

Illustration 2 shows the artifact during the EMAD Contest last 2021 for speed. The given design was done ahead of a time given during the contest. It was the first design to finish. No matter how intricate the design is, the students were able to finish this output at a shorter period from the possible time it could be finished.

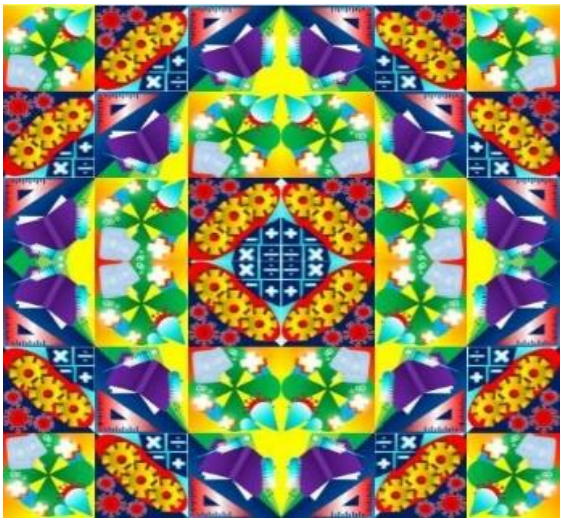

Illustration 1B. Sample Output of Student Showing Speed. This design was finished ahead of the given time

Creativity. Table 2C shows the mean of Student's Assessment in Electronic Modulo Art Design in terms of creativity. Creativity gained a weighted mean of 3.63 and interpreted as *strongly agree.*

Table 2C. Students' Assessment in Electronic Modulo Art Design in terms of Creativity

INDICATOR	W M	I
1. I can have the design I want which suits my personality and preferences	3.60	SA
2. I can explore other designs that I can put together to come up with a very unique design	3.67	SA
3. I am assured that the design is my own piece of art	3.59	SA

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4. It offers many ways to discover my imagination and creativity	3.67	SA
Over-all Mean	**3.63**	SA

The indicator, I can have the design I want which suits my personality and preferences gained a weighted mean of 3.60. I can explore other designs that I can put together to come up with very unique designs and I am assured that the design is my own piece of art had a weighted mean of 3.67 and 3.59, respectively. 40 Lastly, it offers many ways to discover my imagination and creativity got a weighted mean of 3.67. All these weighted means were interpreted as strongly agree.

As mentioned in the comments found in the Google form, the researcher was able to understand that students appreciated the EMAD because it gave them the freedom to express themselves. This avenue let them reveal their creativity. They have the choices of what designs they would want to create according to their personality, sense of design, and appropriateness of their designs.

The creativity of students can be identified by their teachers not only because they excel in Mathematics but they also possess the art inclination. This is essential in EMAD. The artistic side of the students is discovered even if they cannot actually draw. The computer will do that to them. But the thing here is that they were aided by the computer to come up with the design they preferred and created, and at the same time learn a mathematical concept.

Illustration 1C. Sample Output of Student Showing Creativity

Illustration 1C shows an EMAD design during the EMAD Contest last 2021. The given design obtained the highest score in creativity.

Harrell (2014) theorized that computers can be used to produce new forms of soulful expression and social change and can reach its potential as a medium by creating and revealing phantasms- mental images. Computer technology can also make students full of information. Computer technology in art design can impart knowledge to operation, which will strengthen the interaction with students, get rid of the traditional boring design methods, and provide a broader space for students' art creativity. Different from the attending mode in the past, students' creative ability, therefore, is improved.

Creativity is the ability to join ideas that apparently have no relation to each other together to create new forms of expression, and this makes math very much a creative pursuit. Math consists of all sorts of patterns and symmetries, some of which we're aware of and some of which are still waiting to be discovered. Mathematicians used what they know to find connections that weren't previously conceivable and thereby make new discoveries, both within the mathematical world itself and in applying it to the real world. And that is what EMAD has shown when Arts and Math were combined.

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3. Level of Acceptability of both students and teachers in using Electronic Modulo Art Design

Table 3 presents the level of acceptability to both students and teachers' perception in using EMAD along element of satisfaction, usefulness, ease of use, content and equity and accessibility. Overall, the mean was 3.47 and interpreted as *very much acceptable*.

Table 3. Level of Acceptability of both Students and Teachers in using EMAD along with the identified variables

Indicators	WM	I	R
a. Element of Satisfaction	3.54	VMA	1
b. Ease of Use	3.34	VMA	2
c. Content	3.38	VMA	3
d. Usefulness	3.34	VMA	4
e. Equity and Accessibility	3.29	VMA	5
Over-all	**3.47**	**VMA**	

Legend: VMA- Very Much Acceptable; I – Interpretation; WM- Weighted Mean; R- Rank

The element of satisfaction garnered the highest mean of 3.54 and ranked first, followed by ease of use with a mean of 3.34, usefulness with a mean of 3.38 which ranked 3, then followed by content with a mean of 3.34 which ranked fourth. And, equity and accessibility gained a mean of 3.29 which ranked fifth. All of the means were interpreted as *very much acceptable*

Both teachers and students have the highest reception about the use of EMAD in all of the indicators surveyed, namely: perceived usefulness, perceived ease of use, content, equity and accessibility, and element of satisfaction. It can be gleaned from the table that both teachers and students accepted well the EMAD.

The element of satisfaction was the highest among the indicator. This may be brought about by the instances when the respondents were amazed as also revealed in the interview and reflection in the previous discussion. They contended at the overall impact of the EMAD especially when they saw the output in various and unique designs. The perceived usefulness of the EMAD was also wellregarded by the respondents. They find EMAD to be practical to be used as an 46 instructional intervention. Also, the perceived ease of use has been perceived to be excellent because EMAD is operated with convenience and comfort.

Masrom described *perceived usefulness* as the degree to which the user believes that using the technology will improve his or her work performance, while *perceived ease of use* "refers to how effortless he or she perceives using the technology will be" [19]. Masrom added both perceived usefulness and perceived ease of use are considered distinct factors influencing the user's attitude toward using the technology, though perceived ease of use is also hypothesized to influence perceived usefulness and attitude toward using the technology. Finally, such attitude toward using the technology determines the behavioral intention to use EMAD.

4. Difference between the Students and Teachers' perception on the Level of Acceptability of Electronic Modulo Art Design(EMAD)

Table 4 presents the difference between the perceived level of acceptability of students and teachers in the use of Elecgtronic Modulo Art Design (EMAD). It was tested at the .05 level of significance.

About the element of satisfaction in the EMAD, both teachers and students agree that EMAD is enjoyable. It is very interesting learning material. Aside from the different skills that students may acquire, EMAD also offers

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them with affective components such as enjoyment and fulfillment of one's output from the EMAD. Teachers have found it to be an effective tool for learning.

Table 4. Test of Difference between the Students and Teachers' Perception on the Level of Acceptability of Electronic Modulo Art Design along the Identified Variables

Statistical Bases	**Statistical Analysis**				
	EOS	**U**	**EOU**	**C**	**EAA**
df	71	71	71	71	71
Level of sig.	.05	.05	.05	.05	.05
t-critical	1.994	1.994	1.994	1.994	1.994
t-computed	1.081	0.278	-0.553	0.071	-0.469
Decision on H_o	Accept	Accept	Accept	Accept	Accept
Interpretation	NS	NS	NS	NS	NS

Legend: U- Usefulness; EOU- Ease of Use; C-Content ; EAA- Equity and Accessibility ; EOS- Element of Satisfaction; NS-Not significant

On the practical side of EMAD, teachers and students perceived that EMAD may improve their performance and skill acquisition in Mathematics. The main purpose of EMAD is to make mathematics teaching interesting while students understand every concept art in Mathematics. Teaching and learning mathematics with EMAD may be effective and very useful

On the convenient side of EMAD, teachers and students experienced the operation of EMAD with ease and comfort. It is easy for them to operate especially those who are already competent in computers. Those who are just starting to learn to operate a computer may also be served by the EMAD with its ease and comfort.

The content of EMAD is very flexible. Teacher and students agreed that EMAD may be utilized to teach according to the curriculum and standards of education. It may serve the user with the needed higher order thinking skills. It can make a learner independent and responsible for his learning.

Lastly, equitability and accessibility of EMAD were found to be served by EMAD. This was agreed by teachers and students. With the use of computer, the material needed for EMAD is very accessible especially at this time that computers are everywhere. It is durable, easily stored, transported and universal.

In general, teachers and students alike accepted EMAD to be a useful tool for teaching different Mathematical concepts. They are one in saying that the student's skills in mathematics lessons may be further enhanced by this intervention. For them, it is worth sharing the knowledge and skills in EMAD with different teachers and students not only in Mathematics but in some other content areas. During the interview, some of them would like implementation to be done region-wide. Further dissemination of how EMAD is operated and taught may be done so that many teachers and students can experience the benefit that EMAD can offer them.

CONCLUSION AND RECOMMENDATION

The students appreciated electronic modulo art design through the use of computer along attractiveness, speed and creativity. EMAD has the potential to develop the problem solving and thinking skills of the learner. Both students and teachers have high level of acceptability on EMAD when integrated to teaching and learning process. Teachers and students significantly agreed on the usefulness and equity and accessibility of EMAD

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which can provide high level of satisfaction when integrated to teaching and learning process.

EMAD may be utilized in the teaching and learning processes as one way to arouse the interest and potentials of the learners in arts and information technology. EMAD may be integrated in different learning subjects to enhance the problem-solving skills and other thinking skills. ICT-intervened teaching and learning methods, strategies and approaches may be conducted so that learning become more fun and exciting among learners. EMAD may be included in a yearly Regional Math Skills competition. Further research on the use of EMAD to other content areas may be conducted as well as the conduct of other researchers that encourage the use of ICT-intervened teaching methods and strategies.

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