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Development of an Interactive Contextualized Microlesson on Correlation for Grade 11 Learners

Juhaira A. Hadji-Daud[1], Hassan S. Gandamra[2], Douglas A. Salazar[3], Joan Rose T. Luib[4], Joy R. Magsayo[5], Sotero C. Malayao[6]
[1, 2, 3,4,5,6]Department of Science and Mathematics Education, Mindanao State University – Iligan Institute of Technology, Iligan City, Philippines - 9200

Abstract*—This study aimed to develop an interactive contextualized microlesson on Correlation for Grade 11 students, with a particular focus on the Maranao ethnic group in the Philippines. The study employed a quantitative research design, involving participants who engaged with the microlesson. The lesson integrated Maranao cultural elements into the teaching of Correlation to help students better relate to abstract concepts, thereby promoting deeper understanding and improved mathematical performance. A panel of experts evaluated the ICM's content quality, instructional design, and technical aspects, resulting in high marks for relevance, accuracy, clarity of learning objectives, engaging teaching strategies, and professional-level production. Initial assessments showed an average pre-test score of 10, falling under the "Did Not Meet Expectations" category, indicating a need for more effective instructional methods. After engaging with the microlesson, the average post-test score rose to 16, classified as "Satisfactory," reflecting significant learning improvement. Overall, the structured format supported their problem-solving skills and made the learning experience both clear and entertaining.*

***Keywords*—** *Contextualized learning, Correlation, Interactive Contextualized Microlesson (ICM), Maranao culture, Mathematics achievement.*

I. Introduction

The quality of Mathematics education has been a great concern in the Philippines. Difficulty in learning mathematics is one of the perceived problems happening in society. The National Achievement Test in mathematics for the academic year 2011– 2012 had an average high school score of 46.37, according to [9]. This result is below the 75.00 passing rate. This shows how poorly our students have done in math. In accordance with the 2024 National Achievement Test findings, [8] examined the correlation between academic achievement and NAT scores for Grade 12 students in Negros Oriental. Employing a descriptive-correlational approach, the study revealed that the Mean Percentage Score (MPS) in Mathematics was 30.95%, falling under the "Low Proficient" category.

Fortunately, studies claimed that technology enhances mathematics learning by providing interactive tools, personalized instruction, and real-time feedback, improving both achievement and engagement levels. As stated in the study of [10], it was revealed that with the use of modern equipment technology, and tools, the learning and interactivity of students increases. They also find it much more interactive, as well as full of interesting areas, when aided by technology. The microlesson is one example of instructional material that contains a story that has a problem which will help develop the learners' problem-solving skills. These instructional materials focus on student-centered learning and utilize computer-based elements like animations, graphics, sound, and interactive features [11].

Thus, the study aimed to develop an interactive contextualized microlesson (ICM) that contains interactive activities and discussions on Correlation that would provide learners a connection to their community while learning. This study specifically focuses on discussions about Correlation, as research indicates that students often struggle with this subject area. This study sought to bridge the gap between learners' difficulties in Correlation and their achievement level through interactive, culturally contextualized microlesson. By incorporating Maranao cultural elements into Correlation discussion, the study aimed to make abstract concepts more relatable, fostering deeper understanding and improved performance in mathematics. As research by [3] suggests, incorporating local cultural practices into educational content can lead to improved academic engagement and a deeper connection with the subject matter.

II. Methods

This study employed a quantitative approach, which involved a pre-test and post-test design to evaluate student performance following the implementation of the ICM. Participants were engaged with the developed ICM. Multiple instruments were utilized in this research. An achievement test, consisting of twenty (20) items, measured students' understanding of the topic. The interpretation of scores was based on the proficiency levels outlined in the Department of Education's guidelines (DepEd Order No. 73, s. 2012), with slight modifications to suit the study. An evaluation rating scale, adapted and revised from the work of [7], was utilized by a panel of evaluators to assess the ICM in terms of: a) Content Quality, b) Structure of Instructional Design and c) Appropriateness of Technical Design. The panel of evaluators included three high school Mathematics teachers and one ICT expert, who reviewed the ICM to improve its presentation and overall effectiveness. They also provided their comments and suggestions for the improvement of the developed ICM.

Table 1 below serves as the basis for interpreting the evaluators' assessments of the developed ICM.

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TABLE I. Evaluation Rating Scale

Scale	Interval	Description	Interpretation
1	1.00 – 1.74	Poor	Not Acceptable
2	1.75 – 2.49	Fair	Below Expectation
3	2.50 – 3.24	Satisfactory	Met Expectation
4	3.25 – 4.00	Very Satisfactory	Exceed Expectation

III. Results and Discussion

The ADDIE model was used to implement and make use of the development of interactive contextualized microlessons (ICM).

A. Analysis Phase

The ICM was developed to discuss topics on Correlation. The mentioned topic is one of the difficult lessons encountered by Grade 11 learners according to studies. [2] explored the difficulties students in the eleventh grade had with creating, comprehending, and contrasting scatter plots. The findings revealed that students struggled with understanding the direction, form, and strength of relationships in scatter plots, as well as with accurately plotting data points and interpreting scatter plots in context. Prior to the development of the ICM, the researcher ensured that the desired lesson and learning objectives were included and formulated based on the Most Essential Learning Competencies (MELCs).

The following table shows the Most Essential Learning Competencies that are covered in the lessons included in the ICM. The target skills have a two-week lifespan. Therefore, the researcher created two components of ICM, with Part I focusing on the following competencies: a) Illustrates the nature of bivariate data; b) Constructs a scatter plot; and c) Describes shape (form), trend (direction), and variation (strength) based on a scatter plot. Moreover, Part II of ICM covered the following competencies: d) Calculates the Pearson's sample correlation coefficient; and e) Solves problems involving correlation analysis.

TABLE II: Most Essential Learning Competencies on Correlation

Most Essential Learning Competencies	Duration	K to 12 CG Code
Illustrates the nature of bivariate data	Week 7	M11/12SP-IVg-2
Constructs a scatter plot.		M11/12SP-IVg-3
Describes shape (form), trend (direction), and variation (strength) based on a scatter plot		M11/12SP-IVg-4
Calculates the Pearson's sample correlation coefficient	Week 8	M11/12SP-IVh-2
Solves problems involving correlation analysis		M11/12SP-IVh-3

The goal of MELCs is to equip students with the knowledge and abilities they will need in the future. The purpose of MELCs is to make sure that students gain the vital skills and competencies they need to succeed in the future. MELCs help instructors create and deliver engaging learning experiences that are consistent with the demands and objectives of the curriculum. In the study of [13], results showed that MELCs were highly utilized in aligning lessons to content-area standards, providing flexible activities, congruent lesson planning, delivering assessment questions, and planning a learning process.

B. Design Phase

The ICM covered lessons on Correlation as concluded in the analysis phase of the study. The target competencies are discussed on the seventh and eighth week of fourth quarter. Hence, the developed ICM was implemented for two weeks. Learning objectives were formulated based on the K-12 Most Essential Learning Competencies (see Table III). The learning objectives were articulated through the utilization of higher order thinking skills (HOTS) and lower thinking skills (LOTS) of Bloom's Taxonomy.

The following table contains the learning objectives formulated based on the K-12 Most Essential Learning Competencies:

TABLE III: K-12 MELCs and Learning Objectives

K-12 MELCs	Learning Objectives
Illustrates the nature of bivariate data	Define and give examples of bivariate data using real-world contexts.
Constructs a scatter plot.	Plot given pairs of data points on a Cartesian plane to form a scatter plot.
Describes shape (form), trend (direction), and variation (strength) based on a scatter plot	Describe the relationship shown in a scatter plot, mentioning its form, direction, and strength.
Calculates the Pearson's sample correlation coefficient	Interpret the meaning of a calculated Pearson's *r* in the context of a given real-life problem.
Solves problems involving correlation analysis	Solve problems involving the computation of correlation coefficients and interpret the result.

Bloom's Taxonomy is a framework that has been used in teaching by generations of college professors and K-12 educators. This framework was revised on 2011 and the authors of the revised taxonomy claim that using Bloom's Taxonomy can help to have an organized set of objectives that could support teachers to "plan and deliver appropriate instruction….design valid assessment tasks and strategies… and ensure that instruction and assessment are aligned with the objectives" [1].

Since the ICM was also intended to be developed in connecting the community to learning through interactive activities, some Maranao cultures are integrated into the lesson delivery of Correlation topics. The characters of the ICM were visualized as Maranaos since the majority of the population of Marawi City are the Maranao people and Marawi City is the location where the researcher conducted the present study.

With the intention of capturing the learners' interests, a brief introduction and motivation in a form of a scenario was presented. The scenario begins with a female character introducing the mission, which is to reach their desired destination. They can only reach their destination if they can earn a total of five (5) stars, and for each lesson objective they complete, they will earn one star. There are five lesson objectives in total. Topics on Correlation are the entire focus of the discussion. There are interactive exercises provided within the discussion from time to time. The interactive exercises were multiple-choice type and open-ended questions to monitor the users' understanding.

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Multiple-choice testing has the additional advantage of generally enhancing students' performance on subsequent exams [6]. [4] in their study, mentioned that the use of open-ended questions is widely considered as an important tool in educational settings: it allows teachers to effectively evaluate the learner's skills and the achieved cognitive level.

C. Development Phase

During the development phase, two key activities were carried out: the creation of the interactive contextualized microlesson (ICM) and its subsequent evaluation by a panel of experts.

i. Development of an Interactive Contextualized Microlesson

Microsoft PowerPoint Office was utilized in designing the ICM as it is the most convenient software that the researcher can use in developing the microlesson. The characters are generated using Artificial Intelligence (AI). In order to correspond with the cultural values of the intended audience, the ICM intentionally employed characters in modest attire. Animations and background music were also included upon designing the ICM while various sounds were attached to particular slides only.

Among the main factors that can stimulate learners' interests are the elements of the ICM. The use of animations, sounds, video, and audio clips makes the lessons attractive and affective [12]. With these elements present in the ICM, learners can perceive the lessons with higher motivation.

A sample slide of the developed ICM is presented below to showcase some of the design applied in the ICM.

Fig. I. Sample Slide of the Developed ICM

The developed ICM contained two parts since there are five (5) learning competencies, which are the target competencies to be covered in the ICM. The first part of the developed ICM contained the first three (3) competencies which are: a) illustrates the nature of bivariate data; b) constructs a scatter plot; c) describes shape (form), trend (direction), and variation (strength) based on a scatter plot; while the second part of the ICM contained the last two (2) target competencies which are: d) calculates the Pearson's sample correlation coefficient; and e) solves problems involving correlation analysis.

ii. Evaluation of Developed ICM

The evaluation phase of the ICM was conducted through an evaluation by the panel of evaluators using the adapted rating scale from the study of [7] and was revised to fit the needs and formatting of the developed ICM. The rating scale consisted of three (3) factors such as a) Content Quality, b) Structure of Instructional Design, and c) Appropriateness of Technical Design. It also consisted of four (4) rating scores, such as poor, fair, satisfactory, and very satisfactory. The developed ICM was evaluated by three (3) in-service secondary mathematics teachers and one (1) ICT expert. The result of the evaluation was presented in a table form.

Table IV shows the mean score of the evaluation made by the panel of evaluators regarding the ICM Part 1.

TABLE IV: ICM Part 1 Ratings and Interpretation

Factor	Weighted Mean	Description	Interpretation
Content Quality	3.83	Very Satisfactory	Exceed Expectation
Structure of Instructional Design	3.67	Very Satisfactory	Exceed Expectation
Appropriateness of Technical Design	3.68	Very Satisfactory	Exceed Expectation

Based on the reference rating scale—where a weighted mean between 3.25 and 4.00 is interpreted as "Very Satisfactory" and indicates that the performance exceeds expectations—Table IV shows that ICM Part 1 is highly rated. Its Content Quality scored 3.83, suggesting that the lesson content is both comprehensive and well-developed. The Structure of Instructional Design received a score of 3.67, which reflects a clear, logical, and engaging organization of material. Additionally, the Appropriateness of Technical Design scored 3.68, indicating that the technical elements effectively support the learning process.

Table V shows the mean score of the evaluation made by the panel of evaluators regarding the ICM Part 2.

TABLE V: ICM Part 2 Ratings and Interpretation

Factor	Weighted Mean	Description	Interpretation
Content Quality	3.79	Very Satisfactory	Exceed Expectation
Structure of Instructional Design	3.72	Very Satisfactory	Exceed Expectation
Appropriateness of Technical Design	3.68	Very Satisfactory	Exceed Expectation

Similarly, Table V evaluates ICM Part 2 using the same reference criteria, with all scores falling within the "Very Satisfactory" range. In this table, Content Quality achieved a score of 3.79, indicating robust and clear instructional content. The Structure of Instructional Design scored slightly higher at 3.72, reflecting a well-organized and coherent delivery of the lesson. The Appropriateness of Technical Design, with a score of 3.68, shows that the technical aspects are appropriately integrated to enhance the learning experience.

D. Implementation Phase

The ICM, which is developed using Microsoft PowerPoint Presentation, was utilized by the participants in the computer laboratory of the target school where the ICM has been implemented. The ICM has been saved on the desktop of the computer laboratory before the arrival of the participants in the venue. Each participant utilized the ICM individually, where they were given the chance to use the ICM interactively at their own pace.

Learners showed a great desire to use the ICM, as can be seen through their energetic performances while using the

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ICM, showing curiosity and motivation. The reason why they utilized ICM individually is that ICM is designed for individual use to promote a learner-centered approach and for each learner to learn at their own pace.

The first part of the ICM was more on the introduction of concepts, which mainly focuses on foundational knowledge on Correlation. At first, the participants were having difficulty using the ICM on their own since there are hyperlinks implicated in the ICM, but later on, they became more confident using it with the assistance of their classmates. The participants did not need to be assisted by the teacher, as it didn't take them long to master how to use the ICM. Exposure to this made it clear that most learners were beginning to build their skills and confidence toward undertaking independent activities.

Most of the students found the ICM helpful to them as a learning material. When asked how did the ICM helped them understand the lessons on Correlation, a learner said:

"*Yes, naiintindihan ko siya ng maayos at isa pa doon ay habang may knowledge ka na nakukuha ay excited ka pang mag-aral dahil sa teknolohiya na ginagamit. At isa pa kung hindi mo naintindihan o may gusto kang itanong pwedeng balikan mo ito para mas maintindihan. kumbaga di ka na mahihiya kong may tanong ka."* (Yes, I understand it well, and another thing is that while you are gaining knowledge, you also get more excited to study because of the technology being used. Also, if you didn't understand something or if you have a question, you can go back to it to understand it better. In short, you won't feel shy anymore if you have something to ask.) -L27

The learner expressed a clear understanding of the lesson or material. There was a growing sense of excitement to continue studying because technology makes the learning process easier and more engaging. The learner also appreciates the opportunity to revisit the material whenever something is unclear or when questions arise, without feeling embarrassed. In short, technology helps strengthen understanding and builds confidence to ask questions.

But some learners are not yet completely used to ICM. When they were asked if they would use the ICM as a way of learning based on their experience, a learner said:

"I'm neutral in this because sure ICM is fun and creative way to learn as to me I didn't get bored understanding it but due to lack of assistance to ask some complicated or hard questions I think this is a downside of it so I'm not sure whether to implement this or not..." -L18

The learner feels neutral about using ICM. While it is enjoyable, creative, and keeps learning interesting without causing boredom, the speaker notices a major weakness — the lack of available support when facing complicated questions. Because of this missing assistance, the learner is uncertain about whether ICM should be fully implemented. This indicates that there is still room for improvement in the activity. While L18 responded differently, the majority's answers clearly showed that the activity had a positive impact on their understanding of the triangle inequality topic. This confirms that even if some individuals struggled, the overall learning activity was effective. Many students were able to grasp and apply the concept successfully, demonstrating that the instructional approach was indeed beneficial. Such feedback highlights the importance of designing learning resources and materials that address diverse learner needs and shows the positive outcomes these efforts can have in helping students understand complex concepts.

At the end of the implementation, the learners showed interest in using the ICM. They expressed their amusement at being able to understand the lessons better when these were integrated with their culture.

"Yes, in a way na nirelate yung lesson on our culture or tradition. It makes easy to understand kase mismo yung culture yung pinagtutukuyan at nirelate sa lessons." (Yes, in a way that the lesson was related to our culture or tradition. It made it easier to understand because the lesson directly referred to and connected with our own culture.) -L28

The learner highlights that connecting the lesson to their own culture or tradition made learning much easier and more meaningful. By directly relating the concepts to familiar cultural practices, the learners found it easier to grasp the ideas being taught. This shows that the interactive contextualized microlesson played a significant role in enhancing learning progress. It not only made the lesson more relatable but also bridged the gap between abstract concepts and real-life experiences. As a result, students were more engaged, better able to understand the lesson, and could connect new knowledge to what they already knew from their cultural background. This approach clearly demonstrates the power of contextualized and interactive teaching in promoting deeper comprehension and retention.

E. Evaluation Phase

The researcher tried to determine the significant difference between the achievement level of the learners in the pretest and the posttest of the data gathered. The researchers used the statistical tool, paired t-test, to statistically confirm the positive impact of the intervention, which is presented in the next table.

TABLE VI: Paired t-test Summary for Pretest and Posttest Scores

t-value	Degrees of Freedom	p-value	Mean Difference	95% CI Lower	95% CI Upper
-14.895	34	0	-5.7143	-6.4939	-4.9346

H_1: There is a significant difference in the mean scores of the achievement level between the pretest and posttest.

Since the p-value is 0, there is enough evidence to accept the alternative hypothesis that there is a significant difference between the pretest and posttest scores. Furthermore, the 95% confidence interval for the mean difference, [-6.4939,-4.9346], does not include 0, providing strong evidence to confirm that the difference is statistically significant.

Therefore, the ICM has greatly contributed to their learning of the content. [5] mentions that, microlesson auxiliary teaching mode is conducive to improving students' learning enthusiasm, and it cultivates students' autonomous learning ability.

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IV. Conclusions And Recommendations

The main purpose of this study was to develop an Interactive Contextualized Microlesson (ICM) on Correlation for Grade 11 learners. Based on the findings of the quantitative research data, support and sustain the following conclusions:

1. The researcher used ADDIE model in developing the ICM. Certain processes were followed upon the development of ICM, such as: a) Analysis; b) Design; c) Development; d) Implementation; and e) Evaluation.
2. The rating scales for the two parts of the developed ICM yielded weighted means ranging from 3.25 to 4.00, interpreted as "Very Satisfactory," indicating performance beyond expectations. The three evaluation factors—content quality, structure of instructional design, and appropriateness of technical design—each received ratings within the same range of 3.25 to 4.00.
3. The learners' achievement level has significantly increased, and there is a difference between the mean of the pretest and that of the posttest based on the result of the paired t-test conducted. The learners' achievement level has improved from being classified as "Did Not Meet Expectation" to "Satisfactory" classification upon the utilization of the developed ICM.

Based on the findings and conclusions of the study, the following recommendations are suggested:

1. The researcher recommends the use of ICM in mathematics classes to make the lesson on Correlation visually attractive, enjoyable, interactive, and technology-inclined.
2. It is also recommended that the possible teacher-user may: change the manner, such as refining the approach by reducing the number of advanced competencies to prevent overwhelming learners, providing additional scaffolding—such as reviewing familiar graph types before introducing scatter plots— and incorporating reflective guide questions to foster deeper analytical thinking and participation;
3. Future researchers may use the present study as a reference to develop contextualized materials that would align with the New Curriculum.
4. Future researchers may investigate its effects on learners' conceptual understanding in Mathematics.
5. School administrators may consider the creation of a Contextualized Material that would support learners in their learning process, which could be made by the teachers themselves.
6. Further study may be conducted in developing ICM, particularly with activities that would focus on interactive learning, and other least mastered topics in Mathematics. This could be done extensively because teachers may adapt to the changes in the new curriculum.

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