

Gallery Walk as Instructional Strategy in Trigonometry

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Abstract— To prepare students for advanced mathematics including trigonometry, an instructional holistic strategy that highlights the 4Cs – Critical thinking, Communication, Collaboration and Creativity is needed as they work on teacher-devised questions, problems, and activities. One of the engaging instructional strategies having these features is the gallery walk. This study aimed to develop and validate lessons in grade 9 trigonometry using gallery walk instructional strategy in Gabao National High School, Division of Sorsogon Province, for the school year 2022-2023. The descriptive - developmental research as a general approach in the collection and analysis of the data gathered in this investigation. The instruments used were the Evaluation Rating Sheet of the Learning Resources Management and Development System (LRMDS) of the Department of Education, utilized by the 5 mathematics experts as validators of the three (3) developed lessons in trigonometry using gallery walk instructional strategy. The data that was presented included observations, an in-depth interview using unstructured interview guide in Key Informants Interview (KII) and Focus Group Discussions (FGD) among the forty (40) student respondents, and a document analysis that gave a concise and clear description of the students' experiences. Findings revealed that the developed lessons in grade 9 trigonometry using the gallery walk instructional strategy were valid as rated by the experts and recommendable instructional materials in terms of content, format, presentation, and organization. The students became more engaged with their peers, teachers and lessons/activity when exposed to gallery walk instructional strategy in trigonometry lessons.

Keywords— Gallery walk, Instructional Strategy, Skills, Trigonometry, Validation, Learning experiences

INTRODUCTION

In crafting objectives for a lesson plan, particularly in mathematics, highly effective teachers ensure that the three domains of learning namely cognitive, affective, and psychomotor skills are fully achieved. Students learn in different ways, thus requiring educators to establish varied teaching techniques that will usher into a more holistic approach to learning. There is no perfect classroom setup, however, whenever students are encouraged to think critically, explore, make wise decisions, communicate well, show creativity, and collaborate actively with others, a high standard of quality education is somehow achieved.

Qualities such as the power of reasoning, creative thinking, and problem-solving ability in realizing the goal of preparing the youth of becoming socially efficient members, are fostered by teaching mathematics. Mathematical understanding is crucial as it can be applied in all facets of life (Preciado, 2016). However, the abstract nature of mathematics primarily leads to its being misunderstood and an unappreciated subject. Factors contributing even more to its complexities include students' attitudes toward the subject, the instructional practices of teachers, and the school environment.

DepEd Order no.35 s. 2016 recognizes that the quality of learning is greatly influenced by the quality of teaching. Revising traditional beliefs and assumptions about education, community, teaching, and learning will suit the present needs of learners. In traditional to exploratory classroom, students are encouraged to practice the inquiry-based learning approach in mathematics, making it student-centered contrary to the traditional method with low cognitive demand and does not meet the expectations of today's students (Vale & Barbosa, 2020). Effective learning provides opportunities for students to actively find out their knowledge, not just sit still, listen then work on the questions, but are actively engaged in the learning process. (Winarni, 2018).

Problems in Mathematics concerning the remarkable declines in students' performances are said to be very apparent in the Mean Percentage Score (MPS) of students in mathematics of Gabao National High School alone, particularly in grade 9 level for the S.Y. 2020-2021 and 2021-2022. From 45.67 it goes down to 40.86. Based on the given data, there was a decrease of 4.81 in the last two years. One major contributor to this decline was the effect of the pandemic which undeniably affected the mental, emotional, and social aspects of the learners' personalities. To counteract this decline, there

is an urgent need for effective and efficient instructional strategies that will develop the critical thinking, communication skills, collaboration, and creativity of the students now that the modality of learning and the educational setup is gradually getting back to its normal state.

Specifically, to prepare students for advanced mathematics including calculus, Trigonometry is a crucial topic as it also contributes to many applications in fields such as architecture, civil engineering, cartography, geophysics, and other advanced fields (Galarza, 2017). This however is a burden to students since they find trigonometry abstract and more difficult compared to other mathematics subjects (Gur, 2009). This is because of the learning complexities of students in developing understanding of trigonometry concepts.

In learning trigonometry, there is a tendency that the students will only learn it by rote since this is the easiest way to put information into their brain. Ausubel in Bell (1978) says, "... if the learner's intention is to memorize it verbatim, i.e., as a series of arbitrarily related word, both the learning process and the learning outcome must necessarily be rote and meaningless". Students who learn things that aren't "memorable" will find it easy to forget what they learned (Ishartono, N., Juniati, D., & Lukito, A., 2016).

Therefore, to make learning meaningful, we need an instructional strategy that reduces students' propensity to memorize the material they have learned. This is when the concept of the gallery walk instructional strategy comes in. It promotes teamwork, encourages higher order thinking abilities like analysis, evaluation, and synthesis, and reassures students that their opinions, ideas, and experiences are appreciated since they are more inclined to express their thoughts with others in a non-threatening environment (Leonard, N.C., & Nwanekezi, A.U., 2018). The gallery walk is one of the most flexible practices focused on learning. It links learners to each other with fun and engaging ways to the training subject according to Bowman (2005).

Perez (2014) stated that the gallery walk is an activity that allows the students to actively generate and display their ideas around the classroom in an interactive way. This discussion technique gets students out of their seats and into a mode of active engagement.

To fulfill the demands of internalization and globalization, it can be beneficial to study mathematics while simultaneously enhancing communication and social skills. The mentioned literatures discussed the significant ways on how to facilitate student learning in trigonometry through the stated learning models such as the critical thinking, collaboration, communication, creativity, differentiation, and contextualization. The instructional strategy that incorporates all these learning models is called the gallery walk.

METHODOLOGY

The study aimed to develop and validate lessons in grade 9 trigonometry using gallery walk instructional strategy in Gabao National High School, Irosin, Division of Sorsogon Province, school year 2022-2023. The descriptive -developmental research was used as a general approach in the collection and analysis of the data gathered in this investigation.

Developmental research is a systematic study of designing, developing, and evaluating instructional programs, processes, and products. (Richey and Klein, 2005). Moreover, this study utilized the ADDIE (Analysis- Design- Development- Implementation- Evaluation) model of instructional development (McGriff, 2000) in the designing and implementation of the gallery walk instructional strategy.

The instruments used were the Evaluation Rating Sheet of the Learning Resources Management and Development System (LRMDS) of the Department of Education, utilized by the mathematics experts as validators of the three (3) developed lessons in trigonometry using gallery walk instructional strategy. The data were treated using descriptive statics such as frequency count, range, weighted mean with their corresponding interpretation.

The data that was presented included observations, an in-depth interview using unstructured interview guide in Key Informants Interview (KII) and Focus Group Discussions (FGD) among the forty (40) student respondents, and a document analysis that gave a concise and clear description of the students' experiences. This research design helped unravel the experiences of the learners as informants of the study in utilizing the gallery walk instructional strategy in teaching trigonometry.

Three lessons were developed applying the suited formats. To measure the level of validity of the developed lessons, 5 math experts served as validators. The Expert's Validation Checklist (EVC), adapted from DepEd Learning Resources Management and Development System (LRMDS) was utilized in this study to get expert opinions on every aspect of the trigonometry learning lessons that were created for students in Grade 9 using the gallery walk instructional strategy. It is composed of four factors: 1. Content, 2. Format, 3. Presentation and Organization, and 4. Accuracy and Up-to-date datedness of Information. The math experts as validators of the lessons were requested with a one- week period to give enough time for

The collected data was statistically treated. These were addressed in a methodical manner according to the problem statement of the study. The following rating, which was taken from the DepEd LRMDS, was used to validate the developed lessons in this study by mathematics experts in terms of content, format, presentation and organization, accuracy, and up-to-datedness of information. The numerical rating scale ranges from 1.00 to 4.00. Ratings falling between 3.50 and 4.00 are classified as "Very Satisfactory," indicating the highest validity. A rating between 2.50 and 3.49 is considered "Satisfactory," denoting solid validity. Ratings ranging from 1.50 to 2.49 are labeled as "Poor," suggesting unsatisfactory level that needs improvement. Finally, a rating falling between 1.00 and 1.49 is categorized as "Not Satisfactory," indicating validity that falls significantly below expectations and requires immediate attention.

Similarly, the experts verified accuracy with the same instrument and scale to wit. The validity assessment utilizes a numerical rating scale ranging from 1.00 to 4.00, with corresponding descriptive ratings. A rating falling within the range of 3.50 to 4.00 is not present in this context, implying a lack of significant issues warranting attention. Ratings between 2.50 and 3.49 indicate the presence of minor issues, though they are of minimal concern and can be addressed easily. A numerical rating falling between 1.50 and 2.49 suggests the presence of more substantial issues that require significant redevelopment efforts to rectify. Finally, a rating between 1.00 and 1.49 warrants the label "Poor/Do not evaluate further," indicating severe deficiencies that render further evaluation unnecessary.

The LRMDS Evaluation Rating Sheet readily reflected the validity of the lessons using the gallery walk instructional strategy. Revisions were made based on the given feedback, comments, and recommendations of the mathematics experts as validators.

Based on the guidelines and processes for LRMDS Assessment and Evaluation, the resource must reach certain points to be considered passed and approved for recommendation. Moreover, the learning experiences of the student participants exposed to the gallery walk instructional strategy were collected through an unstructured interview. These were treated thematically for the data analysis.

The researcher read the transcripts several times for data familiarization. Identification of initial codes followed. The procedure involved methodically labeling or coding data segments that reflected concepts, ideas, or patterns. Then, codes that were connected to one another were put together until a theme was developed. Further, this was examined to make sure every theme is independent of the others and internally consistent. This was done until themes were clearly defined and were organized chronologically. A table was created with the themes and sub themes organized in a logical order. The themes were turned into narrative accounts

RESULTS AND DISCUSSION

Developed lessons in trigonometry using gallery walk instructional strategy

This study developed lessons in trigonometry which focused on the identified learning competencies that need to be enhanced by the grade 9 students in mathematics for the fourth quarter lessons. The topics include: 1) The Six Trigonometric Ratios: sine, cosine, tangent, cosecant, secant, and cotangent; 2) Trigonometric Ratios for Special Angles; and 3) Angles of Elevation and Angles of Depression. The teaching models or framework used were the 7Es (for lesson 1) and 6As (for lessons 2 and 3) showing how gallery walk instructional strategy was employed on certain parts of the model.

Validity of the developed lessons based on DepEd LRMDS

Table 1 shows the points gained by each individual lesson developed using the gallery walk instructional strategy. As shown, the materials have passed the required points and are qualified to be recommended as valid learning material.

Table 1. Summary of Experts' Rating

Criteria	Points to pass	Mean Scores of Experts' Validation		
		L1	L2	L3
Content	At least 21 of 28	26	25	24
Format	At least 54 of 72	68	64	62
Presentation and Organization	At least 15 of 20	18	16	15
Accuracy and up-to-datedness of information	At least 18 of 24	23	22	22

Legend: L1, L2, L3 – Lessons Developed

This denotes that the contents of the developed lessons are suitable to the students' level of development. The scope, range and depth of content and topics are appropriate to the learning needs of the students. The level of difficulty of the developed lessons is appropriate to the target learners and their stage of learning. The material contributes to the achievement of specific objectives for which it is intended. Also, it provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing, inquiry, problem solving, etc (DepEd, 2016).

The findings show that the format of the developed lessons with regards to the prints, illustrations, design and layout were appropriate to the intended user, simple and easily recognizable, and easy to handle. The

presentation is engaging, interesting and understandable. There was a logical and smooth flow of ideas. Vocabulary used is suitable/appropriate to the target reader.

Minor errors such as conceptual, factual, grammatical, and computational, use of obsolete information and other errors were identified by the math experts as validators of the material and were constantly modified for the making the material mostly suited as recommendable for instruction. To sum up, to develop lessons that are interesting, educational, and successful in reaching their intended learning objectives, they must meet the requirements for content, format, presentation, organization, and accuracy

Learning experiences of the students in trigonometry using the gallery walk instructional strategy

Table 2. Learning Experiences

Category	Themes	Sub themes
A. Student-Student Engagement	A1. Collaborative exploration	Knowledge sharing
		Problem solving
		Group reflection
	A2. Active Engagement	Active listening
		Hands-on learning
		Peer Teaching
A3. Accountability	Reflection on learning	
	Goal setting	
	Time management	
B. Student-Teacher Engagement	B1. Monitoring and guidance	Prompt interventions
		Timely support
	B2. Facilitating discussions	Critical thinking
		Questioning techniques
C. Student-Lesson/Activity Engagement	B3. Interactive displays reflecting different learning styles	Feedback and reflection
		Visual designs
		Personalized learning
	C1. Clear learning objectives	Real-world applications
		Alignment with content
		Relevance to real-world situations

	C2. Higher engagement	Interactive learning activities Collaborative learning Active participation
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Multiple ideas are at play since the foundation of a collaborative mathematics classroom is investigation and conversation. Based on student informants' experiences, it may be concluded that working together as a group in accomplishing the given tasks creates fun and convenience to each of the members. They have varying levels of understanding and if they work together, stronger students can support those who may be struggling, creating a more inclusive and supportive learning environment. One of the student respondents elaborated these experiences as stated below:

We had fun because we helped each other. In the activity that was given to us, each one has something to do, like who will solve, report, measure the triangles, etc. It makes the task easier to accomplish.

The Gallery walk instructional strategy employed helped in creating a classroom where students feel seen and heard as mathematical thinkers. The students are allowed to make sense of problems, direct their work together, and each one has a role. In this instructional strategy, learners are involved in a variety of peer interactions such as asking questions, explaining ideas, expressing, and resolving disagreements, gaining attention, making decisions together and much more, as opposed to a classroom where students work on individual assignments or listen to a teacher's explanation. In this student-directed exploration, teachers put their trust that students are independent explorers accomplishing kinds of social interactions, trusting themselves, practicing collaborative works, boosting their critical thinking skills.

This is in accordance with the study of Wang, Y., & Wang (2022) which states that a strategy that respects, cultivates, and promotes mutual assistance among students and between teachers and students in the learning process and thus can greatly improve the quality of classroom teaching and the teamwork and learning efficiency of students is called collaborative learning.

According to student informants, moving around the classroom keeps them alert and focused during the class activities. Compared to merely listening to the teacher

giving lectures, where students sometimes fall asleep in their seats, the student informants prefer visiting other stations to check other's works and allowing other groups also to check on them. According to the given statement of one of the student respondents:

Hindi po ako nakaramdam ng antok nung ginagawa namin ang activity sa klase dahil umiikot kami at nagbibisita sa ibang station at nagbigay ng aming comments sa kanilang mga ginawa at natuto din kami dahil sa iba.

(I did not feel sleepy during the class activity because we keep on moving around visiting other stations and giving comments to their works and learning from other too.)

This not only adds a kinesthetic element but also helps maintain energy level and keeps students actively engaged in the learning process. Also, the exhibits which they display at their stations require hands-on interaction. The manipulatives, models or interactive elements are things that students can physically engage with to deepen their understanding of mathematical concepts.

According to the study of Ridwan (2019), gallery walk exercise effectively engaged students in the learning process. The students obtained knowledge effortlessly, utilized their skills in understanding the topic discussed and created a constructive attitude towards other students.

To accommodate different learning styles, it's essential to incorporate a variety of interactive displays in a gallery walk. By catering to visual, auditory, and kinesthetic learners, you create a more inclusive and engaging learning experience. As shown in the table therefore reflects on the student informants' experience in line with student-lesson/activity engagement, with the themes that have emerged: interactive displays reflecting different learning styles, clear learning objectives, and higher engagement.

The visual learners based on the shared experience were helped much with the visual diagrams the teacher

provided while they were solving the tasks given to them. This type of learners prefers visual materials, learn effectively through images, enjoy using color coding and highlighting to organize information and tend to recall information through mental images.

“I enjoyed working for our displays in our station. In our group, the visual learners, we showed creative displays of our work for other groups to see. The visual diagrams were a big help.”

On the other hand, the auditory group of student respondents showed in their experiences that they had fun repeatedly singing a song containing the formula so as they are doing such, it becomes familiar to them and can easily apply it in doing their tasks. Also, there is a certain activity wherein they are to solve task cards by sharing the process verbally with their groupmates. Auditory learners learn well through listening and participating in small groups, and they tend to remember information through spoken words and sounds.

“While we were answering the problems, it was fun memorizing the formulas by means of a song. We were able to create our displays listening to one another’s suggestions.”

The last group of learners prefer hands-on activities and physical movement. They enjoy engaging in activities that involve touch, movement and exploration and may struggle with sitting still for extended periods. These are the kinesthetic group of learners and according to them, during the performance of the tasks assigned to them, the teacher prepared measuring tools such as protractors and rulers in measuring the sides and angles of the triangles.

“We, the kinesthetic groups have successfully accomplished our tasks through helping each other in measuring the triangles, computing sides and angles.”

This concept brings in further challenge to the educators and deals with the diversity or individual differences of the learners. Tomlinson (2005) states that differentiated instruction is a philosophy of teaching that is based on the premise that students learn best when their teachers accommodate the differences in their readiness levels, interests, and learning profiles.

When asked about which instructional strategy they prefer, that is gallery walk compared to the traditional

way of learning, the student informants responded based on their experience that they prefer the latter more since it is inherently interactive and engaging. They actively participated by moving around, exploring exhibits, and discussing concepts with their peers. There will be no room for dull moments during the process and all are active participants rather than passive listeners to the teacher, thus involving a higher level of engagement.

“I prefer gallery walk more than just listening to lectures where sometimes I get bored in my seat. Working with my groupmates is enjoyable especially when we visit other stations, and we give comments to their works.”

The study revealed that the learners had positive feedback about the gallery walk instructional strategy in learning trigonometry. This strategy allowed the development of the 4Cs skills which implied making the students active agents in the learning process. This adheres to the study of Vale & Barbosa (2020) that the use of gallery walk implies the orchestration of productive discussions, giving learners opportunities to communicate, collaborate, reason, be creative, think critically, solve problems, make decisions, and understand mathematical ideas.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the study, it can be concluded that the developed lessons in grade 9 trigonometry using the gallery walk instructional strategy were valid as rated by the experts and recommendable instructional materials in terms of content, format, presentation, and organization. The students became more engaged with their peers, teachers and lessons/activity when exposed to gallery walk instructional strategy in trigonometry lessons. The themes under the student-student engagement category were collaborative exploration, active engagement, and accountability. For student-teacher engagement, there were two themes namely: monitoring and guidance and facilitating discussions. On the third category: student-lesson/activity engagement, three themes have emerged: interactive displays reflecting different learning styles, clear learning objectives, and higher engagement. The teachers may use the gallery walk instructional strategy in teaching. Incorporate a variety of visuals, audio explanations and hands-on activities to cater to the different learning styles. Continuous adjustments can be made based on feedback and the evolving needs of the learners. Implementing a combination of varied

strategies can contribute to a more engaging and effective learning environment. Constant modification and revision of the developed lessons may be done in teaching trigonometry to develop the desired learning competencies. Likewise, further validation using other tools and criteria are highly recommended.

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