International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

ARTICLE TITLE	MATHEMATICS LESSON DEMONSTRATION: "AMD" METHOD AND ITS APPLICATION
ARTICLE INFO	Munkhtaria Khayankhyarvaa. (2025) Mathematics Lesson Demonstration: "AMD" Method and Its Application. *International Journal of Innovative Technologies in Social Science*. 1(45). doi: 10.31435/ijitss.1(45).2025.3196
DOI	https://doi.org/10.31435/ijitss.1(45).2025.3196
RECEIVED	20 January 2025
ACCEPTED	21 March 2025
PUBLISHED	28 March 2025
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MATHEMATICS LESSON DEMONSTRATION: "AMD" METHOD AND ITS APPLICATION

Munkhtaria Khayankhyarvaa
Ph.D., National Defense University, Mongolia

ABSTRACT

A methodology was created and tested to design teaching materials for each subject that enhance children's engagement in math lessons, foster motivation and curiosity in learning math independently. This was achieved by converting study materials into educational activities rooted in the principles of mathematical anthropology, mathematics, and teaching methods, incorporating both theoretical and practical aspects.

In today's education landscape, teaching aids, presentation materials, and handouts are essential tools for teachers to effectively engage students and facilitate active and participatory learning in the classroom. While traditional mathematics instruction focused primarily on memorizing facts, there is now a greater emphasis on applying facts in different contexts and developing proficiency in mathematical methods.

Enhancing the importance of mathematical knowledge in general culture, broadening the objectives of mathematical education, enhancing and refining the quality of educational training, and enhancing the content, formats, and methodologies of organizing mathematical teaching materials. A fresh perspective is emerging on demonstration materials, with demonstration playing a crucial role in concept formation. Encouraging students' cognitive engagement, establishing a rapid "teacher-student" connection with personalized learning approaches, aiming to minimize unproductive time during lessons, and the practical integration of educational technology in all schools have greatly enhanced the methods of teaching mathematics.

The successful implementation of the teacher's planned methodology hinges on the use of teaching materials. Teachers typically view materials as encompassing blackboards, chalk, handouts, presentations, and textbooks. However, materials also encompass motivational strategies and tasks integrated into the lesson content. By preparing additional materials at the conclusion of each regular lesson, students can effectively utilize the provided scenarios to deepen their understanding and knowledge. The teacher's proficiency in facilitating discussions, lectures, and demonstrations, as well as organizing students' investigative activities, plays a crucial role in enhancing students' cognitive engagement.

KEYWORDS

Mathematical Anthropology, Mathematics, Foundations of Didactic, Applied Demonstration

CITATION

Munkhtaria Khayankhyarvaa. (2025) Mathematics Lesson Demonstration: "AMD" Method and Its Application. *International Journal of Innovative Technologies in Social Science*. 1(45). doi: 10.31435/ijitss.1(45).2025.3196

INTRODUCTION

In today's society, where human progress drives social advancement, educational activities are crucial for children's development. It is essential to adopt a new educational approach that focuses on nurturing children to become well-rounded individuals who are physically healthy, intellectually sharp, emotionally resilient, and morally upright citizens. One promising educational methodology is the management of children's knowledge creation activities. Various theoretical concepts underpin this methodology, including those outlined in the Mathematics Education Standards. By incorporating these principles, we can design and implement innovative educational approaches to support children's holistic development.

Principles derived from constructive theory:

- Knowledge is not merely transmitted from teacher to student; rather, it is constructed and acquired by the student through active engagement.

- Knowledge is present in the student's surroundings, ready to be created by the student.
- Knowledge becomes socially shared as individuals uncover and apply it.
- The teacher serves as the facilitator, supporter, guide, and overseer of the student's knowledge-building endeavors.
- The student is a knowledge creator.

Based on these principles, knowledge is always available in the learner's surroundings, and it is the teacher's duty to assist students in mastering the study methodology by connecting it to the issue at hand.

Key principles derived from the theory of application

According to the theoretical framework established by American scientist A. Maslow, individuals are constantly driven by various needs, which in turn motivate them to engage in specific actions. These actions ultimately lead to changes in human behavior, contributing to personal development and growth.

Connecting the lesson content with students' needs and sparking their interest and motivation is crucial. Methodology plays a key role in achieving educational goals by choosing and refining suitable methods and techniques to enhance students' analytical, recognition, and problem-solving skills. This involves tailoring the curriculum to consider students' age and cognitive abilities, the teacher's personal experience, and the learning environment. Constructive and cognitive theories in educational psychology emphasize that knowledge is not just passed from teacher to student but is constructed by students through their own active engagement.

The current focus in mathematics teaching methodology is on the idea that teachers should plan, guide, organize, and closely supervise students' active and creative engagement in knowledge creation. In essence, it emphasizes collaborative creative activities between teachers and students. As a result, contemporary educators must dedicate themselves to mastering didactic and management skills.

Drawing on the educational theories of L.V. Zankov and G.I. Schukina, as well as the principles of systems theory, the lesson content was structured to enhance students' observation, critical thinking, and cognitive development. The concepts of V.P. Bespalko, Z.A. Reshitova, I.T. Prolov, and V.I. Erdinev were also incorporated to ensure a comprehensive approach to students' knowledge and skills. By integrating ideas from prominent psychologists and educators worldwide, the lesson materials were designed to align with students' interests, needs, and motivation, fostering further intellectual growth and learning. This approach allowed for the creation of a scientifically grounded and practical framework for mathematics education.

Swiss psychologist and philosopher Jean Piaget emphasized the importance of demonstration materials that clearly present accurate information to help students understand.

Psychologist Arthur Robert Jensen demonstrated the effectiveness of such materials in learning. Renowned Czech educator J.A. Comenius highlighted the significant role of demonstration methods in enhancing children's attention, transferring language knowledge to memory, and fostering motivation for creative thinking. Comenius also stressed the importance of accurate demonstration materials for student comprehension.

The renowned Swiss educator I.G. Pestalozzi (1592-1670) emphasized the significance of teaching children how to count, comprehend numerical operations, and tell time. He advocated for straightforward teaching techniques, such as progressing from simple to complex knowledge acquisition and utilizing demonstration materials extensively. It is worth mentioning that demonstration can have both positive and negative impacts, as highlighted in the writings of A.N. Leontiev, E.N. Kabanova-Meller, and N.A. Menchinskaya.

Ts. Luvsandorj believes that humans are complex systems, with different components depending on the cultural perspective. In Eastern civilization, humans are seen as having a body, language, and soul, while in the West, they are viewed as having a body, mind, and spirit. Human learning involves both physical and mental aspects, which are interconnected and interdependent. Recent brain research has provided evidence for the integration of body and mind in learning, while the theory of mind and body further explores their interdependence.

Hence, learning can be seen as a system. The core principles of learning involve translating the learning material into the fundamental actions and tasks of the student, which is the essence of teaching. Teaching is the primary action and concept of guiding students in their learning journey. The art of teaching emerges when the teacher creatively applies the foundational wisdom of teaching. It is through the teacher's artistic efforts that the basic wisdom of teaching transforms into teaching expertise.

In many developed and developing countries, Information Communication Technology /ICT/ [1] education is not only a standalone subject but also a key tool to enhance learning activities. Across most European Union countries, ICT is integrated as a teaching aid, with a strong emphasis on equipping students with fundamental ICT skills to enhance learning and facilitate cross-curricular integration. In countries like the Czech Republic, Latvia, Poland, Slovakia, the United Kingdom, Iceland, and Turkey, ICT serves as a primary tool across all subjects in primary education. However, in Denmark, Ireland, the Netherlands, Finland, and Sweden, ICT is either taught as a separate subject or as part of technology lessons.

ANTHROPOLOGY, MATHEMATICS, AND THE DIDACTIC FOUNDATIONS AND METHODS OF DEMONSTRATING MATHEMATICS LESSON ACTIVITIES.

Our goal is to use a combination of anthropology, mathematics, and didactic (ADM)[2] to encourage and inspire children to independently explore and enjoy mathematics, making the learning process a joyful experience for students. By studying the anthropology of the subject, mastering mathematical concepts, and implementing effective teaching strategies, we aim to create a presentation that fosters a love for mathematics in every child.

Through anthropological study, the semantics, origin, related words, symbols, and explanations of key terms are uncovered, shaping the content of the demonstration. This recognition of the subject's anthropology is essential.

Similarly, by establishing the mathematical foundations of the subject matter, the teacher gains a deep understanding of the subject's history and development, leading to a profound appreciation of the essence and truth of mathematical knowledge. This understanding fosters a sense of connection for the teacher, ultimately determining the mathematics of the subject.

The presentation will outline an integrated approach to teaching mathematics, incorporating anthropology, mathematics, and didactic to engage students and encourage independent learning. This approach aims to make learning mathematics enjoyable and interactive for students.(Figure1)

The presentation will be structured as follows:

1. Anthropological Basis:

- Exploring the history, semantics, and practical applications of mathematics in the subject.
- Analyzing the historical context and significance of mathematical formulas and expressions.

2. Mathematical Basis

- Establishing a solid mathematical foundation within the subject matter.

3. Didactic Basis:

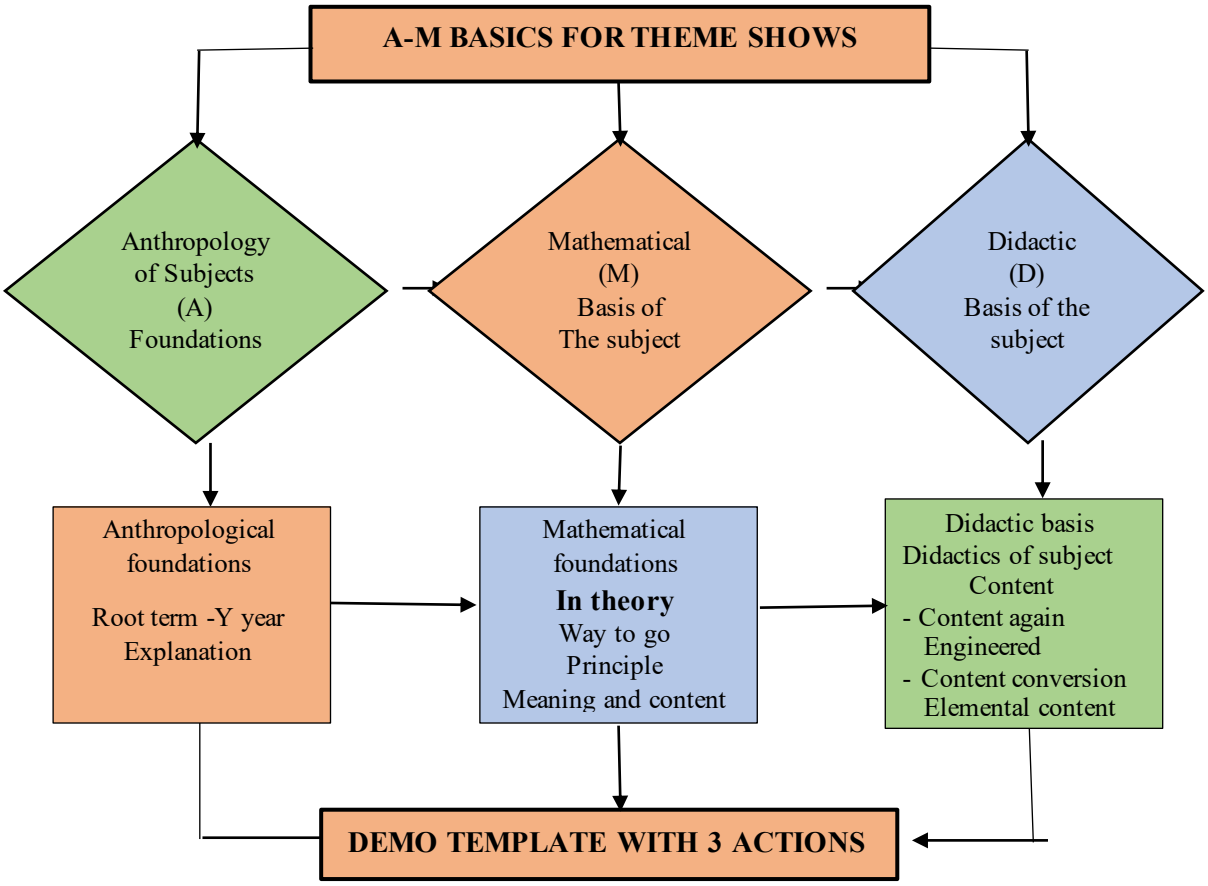
- Transforming the content into a teaching approach that promotes active learning and student engagement.

BASIS OF THE EXHIBITION “ANTHROPOLOGY - MATHEMATICS - DIDACTIC" (AMD)

At this point, the process involves learning from subject material, teaching, facilitating activities, subject methodology, and translating subject material into practical application. Following the principle of Mind + Action → Integration, the content of any mathematical subject is converted into a didactic transformation through the three activities mentioned above.

1. Portraying actual actions while maintaining the core of the material
2. Illustrating the mathematical essence of the material through sketches
3. Conveying the essence of the material in symbols (using mathematical language) through didactic conversion.
4. In this phase of showcasing the aforementioned didactic conversion (converting into a demonstration), it can be showcased in either physical or digital format.
5. Instances of showcasing the didactic resolution of the subject matter.

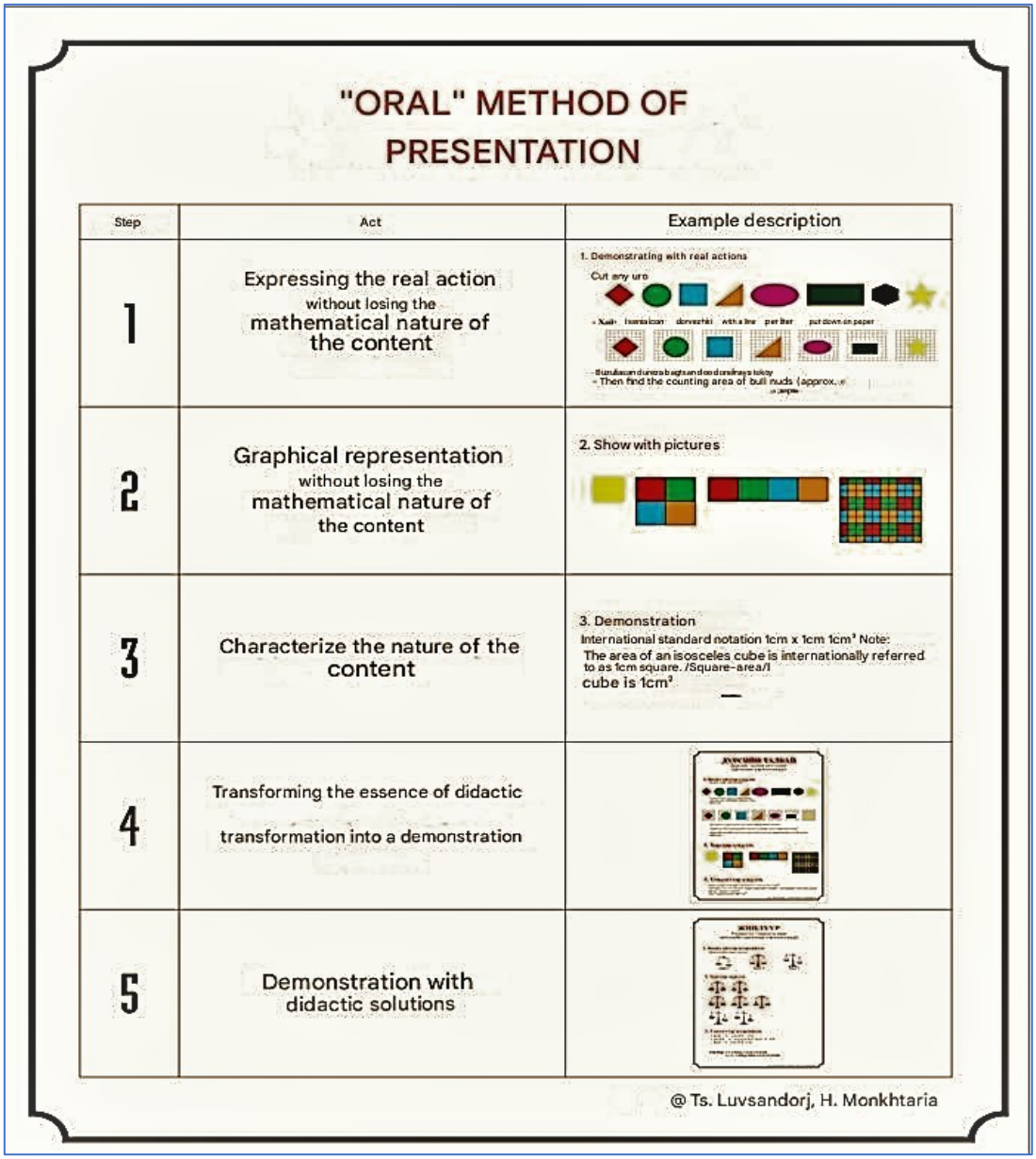
[1] ICT - Information Communication Technology
[2] ADM - anthropology, mathematics, and didactics



The second chapter showcases over 100 demonstrations of 63 topics using this approach. The initial three steps of the methodology outlined above lead to a didactic solution for the topic.

- The first step involves exploring the anthropological basis of the topic, allowing both the teacher and students to understand its historical origin and development.
- In the second step, the teacher thoroughly explains the mathematical foundation of the topic.
- The third step involves the teacher mapping the knowledge and skills from various disciplines such as education, psychology, philosophy, and education to the core of the topic, thereby creating a didactic solution for its development. These three steps collectively form a didactic solution for presenting any topic. (Figure2).

By following the four-step method outlined above, teachers develop their teaching materials, which are considered intellectual property. This approach differs from traditional presentations in that it involves a structured process where students actively participate in the lesson. It is not just a presentation but a systematic way of planning, designing, and implementing lesson programs through demonstrations, activities, and actions. While initially documented on paper, it ultimately serves as a practical method for delivering lessons, enhancing student engagement and participation.



"AMD" CURRICULUM DESIGN WITH PRACTICAL DEMONSTRATIONS

The process of creating a curriculum with practical demonstrations and experimenting with its design demonstrated that this approach is an innovative and effective model that saves time and resources, while guiding teachers towards developing effective teaching solutions and methodologies for their subject. Teachers who participated in this experiment experienced a significant shift in their mindset, realizing that lesson planning and implementation are interconnected activities, rather than separate tasks. This experiment also helped teachers recognize the close relationship between planning and implementing lessons with practical demonstrations, highlighting the importance of integration in teaching practices.

The lesson plan of the experimental teacher and the activities conducted based on ***Figure 1*** are presented.

Topic: Determining the total of the interior angles of a convex polygon

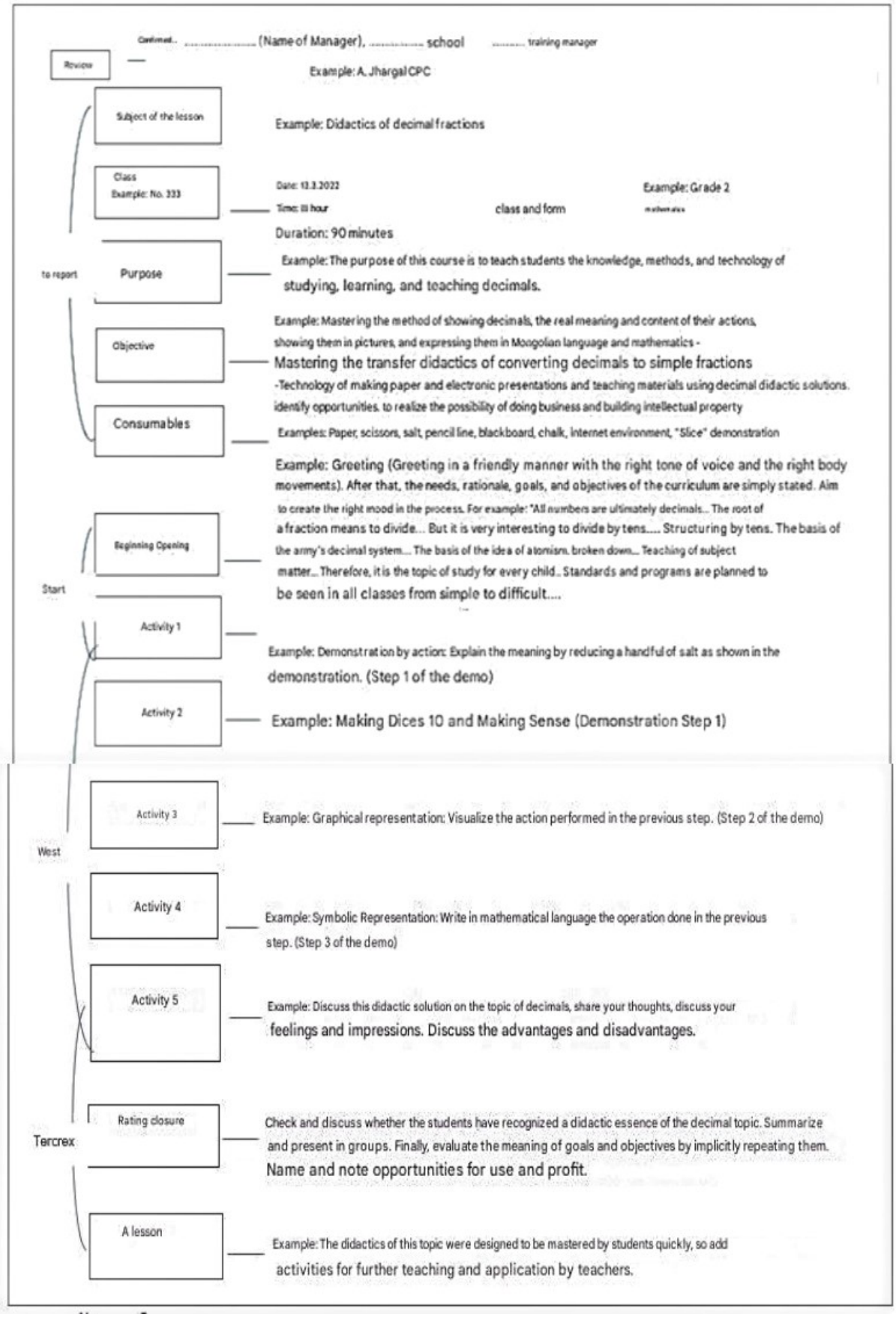
Activity 1: Students engaged in creating a triangle on paper.

Activity 2: Students sketched a polygon, segmented it into triangles, and deliberated the drawing with the teacher.

Activity 3: Students documented the process of determining the total of the interior angles of a convex polygon. They successfully calculated the sum of the convex polygon's angles and recorded the result.

A MATHEMATICS CURRICULUM DESIGN UTILIZING THE "AMD" METHODOLOGY.

Table 1



CONCLUSIONS

Mathematics teachers can fully master the AMD methodology for creating practical demonstrations within the framework of developing individual and group subject programs.

Utilizing the “AMD” methodology in preparing practical demonstrations results in a didactic resolution to the subject matter.

Many mathematics teachers require assistance and guidance in establishing the anthropological foundations of the subject.

The “AMD” design for practical demonstration programs is a creative and effective model that saves time and resources, guiding teachers towards the primary professional task of developing a didactic solution and methodology for the subject.

By planning and implementing lessons with practical demonstrations, teachers can recognize the interconnected nature of these two activities, enhancing their understanding and integration.

The practical demonstration-based methodology developed through the AMD approach encourages children's participation, making lessons and learning a source of joy for students.

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