Exploring Three-dimensional Shapes Using Student-Centred Approaches

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Introduction

Mathematics education is currently undergoing a paradigm shift. In the past, teachers stressed mastery of basic facts and mathematical algorithm. Today, educators advocate meaningful understanding of the underlying concepts rather than mastery. This understanding would be the building blocks towards constructing lifelong learning and the capability to use that learning to build new knowledge and apply them to "situations which are of significance to their private, social and professional lives" (Niss as cited in Ernest, 1991).

For pupils to become mathematically able, they should be open to mathematical experiences that promote critical thinking. The problem is, a great number of pupils either fear or dislike mathematics. Their fear of is rooted on failure in mathematics. Accordingly, mathematics failure can be attributed to a shallow understanding of mathematical concepts. Understanding of mathematical concepts is shallow when the teacher is the sole source of information and the learner is the passive receiver. McCombs (1997) contends that learning is most meaningful when topics are relevant to the pupils' lives, needs, interests, and when the pupils themselves are actively engaged in creating, understanding and connecting to knowledge. This is the true essence of ***student-centered approaches*** **–** pupils are put into the center of the learning process**.** Pupils become active participants of the learning process. The concepts to be learned are taken into the world in which they operate. The pupils are involved in deciding what they will learn and how they are going to learn it. In a student-centered classroom, pupils can be provided with opportunities to develop mathematical thinking and explore their own power to utilize mathematics in varied situations.

This exemplar shows teachers possible ways of facilitating learning in an opportunity-rich educational environment where pupils are free to explore learning and harness their mathematical thinking abilities.

TEACHING PLAN

Overview

The world we live in is a three-dimensional world. This is the world that a young child sees and explores everyday. The study of Geometry helps the child represent and

describe the things around him. It also develops the child's spatial abilities. However, most often primary mathematics lessons have concentrated on activities on naming and visualizing only. These types of activities have not helped children develop a deeper understanding of the properties of the objects or the relationships among different geometric objects (Reys, R.E., et.al, 2001).

The activities included in this exemplar emphasize the geometric processes such as describing and classifying, constructing, exploring and discovering, and relating three-dimensional shapes to two dimensional shapes. These are focused on helping children build understanding of properties and encouraging teachers to provide opportunities for children to give reasons or mathematical arguments to justify their thinking.

Throughout the lesson, pupils are either grouped or asked to work individually. They are grouped together to facilitate communications and exchange of ideas which can help them construct their own knowledge. Then they are asked to work individually for accountability and assessment.

ICT materials, the everyday tools of today's pupils are also used extensively in the plan. Manipulatives, posters and activity sheets are also used to give each pupil an active participation in the construction of the new knowledge on prisms.

A. Scope of Geometry Lessons in Grade 3

1. Identify various types of three-dimensional shapes
2. Describes and classifies three-dimensional shapes
3. Build three-dimensional shapes.

B. Description of Lessons in the Sample Lesson Plans

Lesson 1: Identify the different types of three-dimensional shapes.

Pupils identify the different types of prisms and use the words cube, cuboid, triangular prism, square prism and rectangular prism to name the different prisms. Through questioning pupils will be able to conclude that a prism is named after the shape of its base.

Lesson 2: Describe the features of a prism.

This is the topic of the second sample lesson. To translate this objective into one that connotes 'doing' mathematics as is the goal of student-centered approaches, the objective will be stated as: explore and discover the relationships among the different features that make up a prism.

Lesson 3: Build three-dimensional shapes using suitable materials.

Pupils visualize the features of a three-dimensional shape and explore different kinds of materials that can be used to construct the three-

dimensional figures that they see. They work in groups to build or construct the three-dimensional figure that they choose.

C. Sample Lessons:

Lesson 1: Identifying the different types of prisms

Time Allotment: 40 minutes
Grade Level: 3

Objective:

At the end of the lesson, the pupils will be able to identify and differentiate among the different types of prisms.

Major Skills/Processes Involved

Thinking skills: Observing and classifying the different types of prisms

Materials:

Real objects (spatial figures), models of prisms, activity sheets, charts, posters, PowerPoint Presentation.

Instructional Procedure

I. Motivation and Review

- Let pupils play a guessing game. (Materials to be used are; toblerone chocolates, bath soap, a paperweight in the shape of a cube and candies for the treats). A pupil gets one of the objects from the box and describes it without showing to his classmates. The other pupils try to guess the object described.

Note: *After all the contents of the box have been shown, teacher directs pupils into conjecturing in which box each object will fit in.*

II. Developmental Activities

Activity 1

- Pupils are grouped into eight groups. Each group is given a tray with four name cards (a triangular prism, a square prism, a rectangular prism, and a cube). Pupils work on Activity Sheet No. 1 (Lesson1).
- The pupils put together in one tray the entire prism models with the same attributes (e.g. same base). They then give a name to each group of prism models.
- Each group shows the grouping of the prism models and the group leader/reporter explains how the grouping was made.
- *Note: The teacher may point out that square prisms are also called cuboid. The teacher may direct pupils to conclude that the bases of the prisms give a clue on the name of the prism.*

Activity 2

- The different types of prism are shown using PowerPoint. The presentation focuses on what make up each of the prism.
- Teacher directs the pupils into concluding that all the prisms are made up of lines and surfaces and that there are one or two faces that has a different shape. Most of the other faces are rectangular.

Activity 3

- Interactive activities on identifying the different kinds of prisms are done using the PowerPoint and if available, the ActiveStudio.

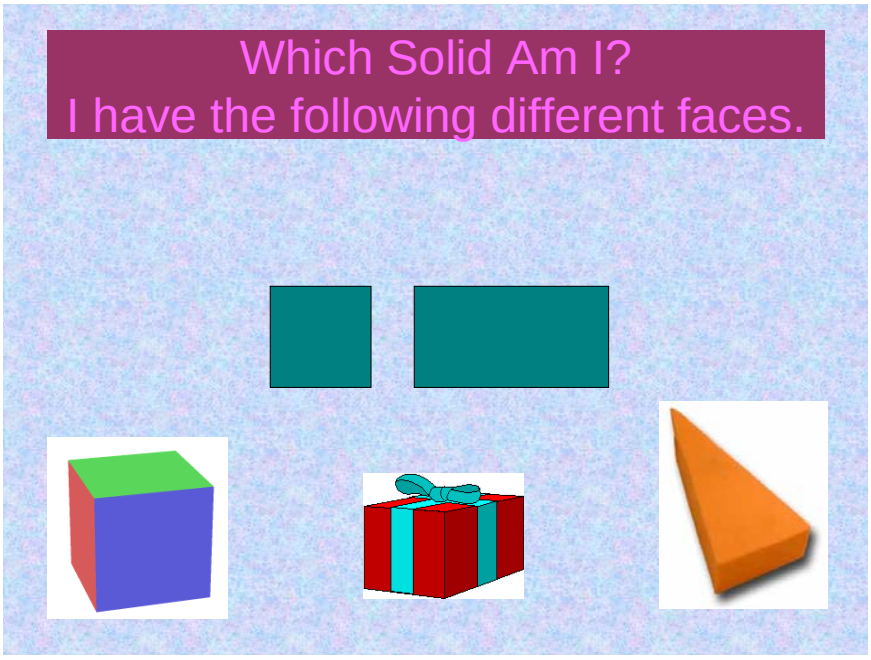

Figure 1: Sample slide