Exemplar 10: Nets of a Cube
(Project Learning)

Learning Dimension: Measures, Shape and Space

Learning Unit: More about 3-D Figures

Key Stage: 3

Objectives: (i) To construct different nets of a cube
(ii) To make the cube of the largest volume by means of a net on an A4 paper

Prerequisite Knowledge: (i) Understanding square and its related properties
(ii) The volume of a cube

Teaching Resources: A4 papers, scissors, protractors, tapes, compasses, rulers and calculators

Description of the Activity:

1. The teacher introduces the net of a cube to students. Some nets of a cube are then shown.
2. Students are asked to divide themselves into groups of at most 5 to do a project on the nets of a cube. The guidelines given to students are shown in the Annex.
3. Students are required to
   (i) construct the nets of a cube with appropriate tools;
   (ii) find, by trial and error, as many different nets of cubes as they can and calculate the volume of each cube they make; and
   (iii) determine a way of making the cube of the largest volume given that the net is made on an A4 paper.
4. The teacher should always keep track of the progress of each group and provide guidance/assistance whenever necessary.
5. Students are required to present their findings to their classmates and submit a brief written report.

Notes for Teachers:

1. Students' performance in the project can be assessed using the following criteria:

Criteria	Description of the Criteria
Understanding the theme of the project	• Do students demonstrate a thorough understanding of the theme of the project? • Do students know how to carry out the project and what information they are expected to collect?
Using appropriate strategies and methods	• Do students construct the net of a cube with appropriate tools and methods? • Do students adopt feasible strategies to find the cube of the largest volume?
Accuracy	• Are the cubes and the corresponding nets accurate? • Is the final product really the cube of the largest volume?
Creativity	• Do members of the group design their own project? • Are the methods and strategies adopted innovative?
Presentation and communication	• Can students present their work in a systematic and logical way? • Is the report concise and relevant?
Collaboration	• Is the division of duties among students in the group appropriate? • Is there a good collaboration among members?

The criteria suggested are by no way exhaustive and each criterion above is not necessarily of the same importance.

2. Each group, after completing the project, will be invited to present their findings to their classmates. After that, there should be time for the group to respond to questions raised by classmates and the teacher.

3. It should be emphasized that the process of the project is considered to be more important than the corresponding results/findings in this activity. Encouragement should be rendered to the members of groups who participate in the project but end up with unsatisfactory/incorrect results.

4. Students should be discouraged from spending too much time on the art design of the report. For instance, sophisticated computer art-work in the report is not recommended. The teacher, after taking into consideration the nature of the project and the abilities of students, should determine whether the project should be completed in class or be done at home. In addition, the teacher should give students suggestions on the time schedule for the project and indicate by when they should have completed their work.

5. Students should be given sufficient time to complete the project.

This exemplar mainly involves the following generic skills:

1. Collaboration Skills
   - Share responsibilities and understand the role of each member in the project
   - Liaise, negotiate and compromise with others in selecting suitable strategies for constructing the nets and making the cube of the largest volume
   - Agree on suitable strategies for carrying out the project through discussion

2. Communication Skills
   - Discuss and exchange ideas openly with other members in making the nets of cubes and the cube of the largest volume
   - Put forward ideas in a systematic and logical way during discussion
   - Give a concise and relevant report after the completion of the project
   - Respond to questions raised by the teacher and classmates during the oral presentation sessions

3. Problem-solving and Critical Thinking Skills
   - Identify the problems associated with the project
   - Make use of appropriate tools to construct the nets of cubes
   - Choose the appropriate methods/strategies to construct the nets of cubes and the cube of the largest volume

4. Creativity
   - Students strengthen creative abilities through the process of designing and carrying out their own projects

Annex

Project Learning Guidelines

Project Title: Nets of a Cube

1. Procedures
   (a) Construct the nets of a cube using appropriate tools
   (b) Find, by trial and error, as many different nets of cubes as they can and calculate the volume of each cube they make
   (c) Determine a way of making the biggest possible cube given that the net is made on an A4 paper

2. Format of Report
   The content of the report should be relevant and concise. It is desirable to include the following items in the report:
   (a) Objectives of the project
   (b) An abstract of about 150 words
   (c) Methods and mathematical principles used
   (d) Interpretation of results
   (e) Discussions and sharing among members
   (f) Conclusion and references