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# USING DISSECTED PYRAMIDS TO TEACH THREE-DIMENSIONAL PROBLEMS

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One of the latest trends in the teaching of mathematics is the use of manipulative materials to help learners conceptualise concepts. The use of three-dimensional models helps learners to reduce excessive imaginary representation of three-dimensional structures. Current research has indicated favourable relationship between the use of manipulative materials and the pupils' achievement in mathematics. The usefulness of using manipulative teaching aids in teaching has been supported by many educationists. Piaget (1971) indicated that concepts could be formed only through the reconstruction of ideas to the learner's level of understanding. Dienes (1969) suggested that mathematical concepts can be reconstructed through experiencing manipulative materials. These suggest that mathematical concepts can be effectively assimilated through a media known as teaching aid. The concept of using teaching aid can be represented below:

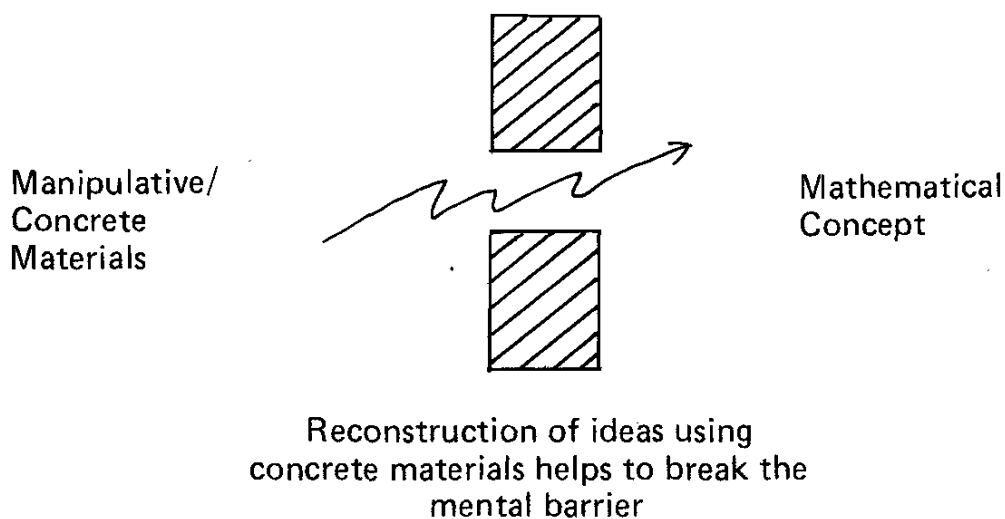


Figure 1

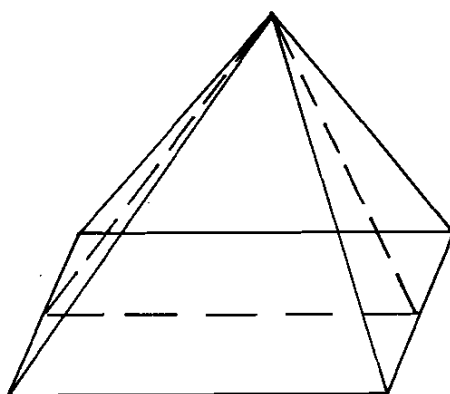
Relationship between manipulative/concrete  
materials and mathematical concepts

Teachers generally view that teaching the topic on three-dimensional problems is not an easy task. This problem becomes more severe in schools which do not have appropriate three-dimensional models to help pupils in mathematics lessons. Owing to the importance of concrete or manipulative materials to help teachers conceptualise mathematical concepts, this article attempts to show some methods of constructing dissected square-base pyramids for presentation of lessons on three-dimensional problems.

### Construction of Models

- (A) *Dissecting pyramid from the vertex to the central base where the dissecting plane is parallel to the side of the base.*

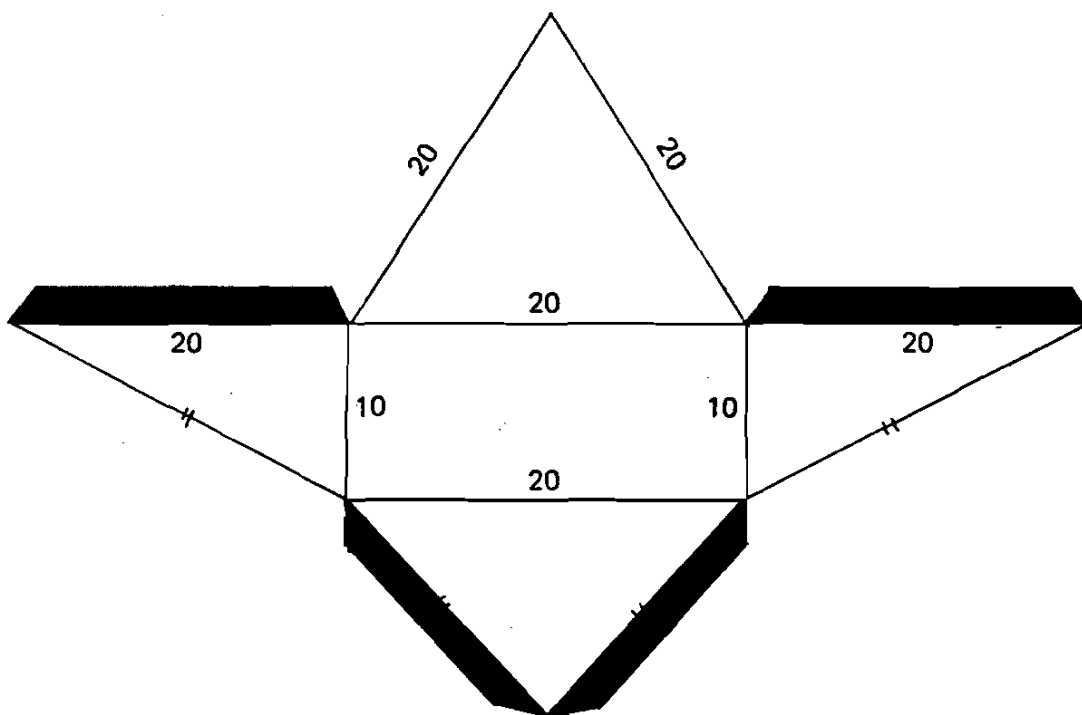
The dotted triangle below shows the plane of dissection.



**Figure 2**

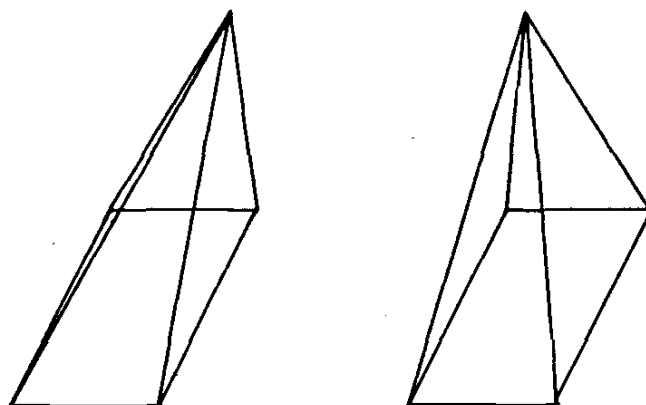
**A square-base pyramid**

To construct one of the two dissected halves, draw the figure below on a vanguard sheet. All measurements shown are in cm.

**Figure 3**

**An open-up half square-base pyramid**

Cut out the shapes along the edges. The outlines of the figure are folded and glue is applied to the shaded edges to fix the right-pyramid. Two completed solid shapes are shown below:

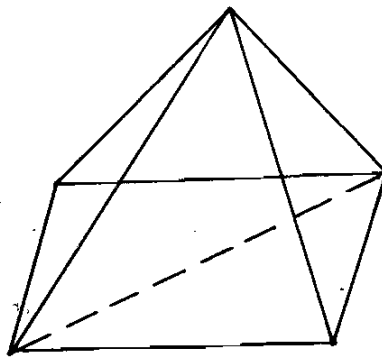
**Figure 4**

**Two half square-base pyramids**

When these 2 solid pyramids are arranged with dissected sides close together, a square-base right pyramid is formed.

- (B) *Dissecting pyramid from the vertex to the central base parallel to the diagonal of the base.*

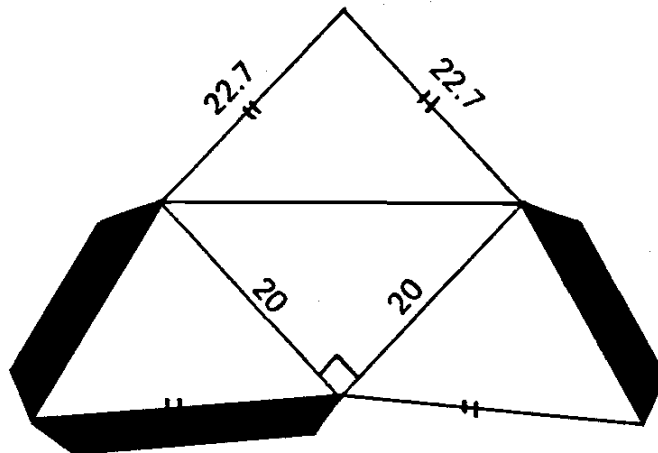
The dotted triangle below shows the plane of dissection.



**Figure 5**

**A square-base pyramid**

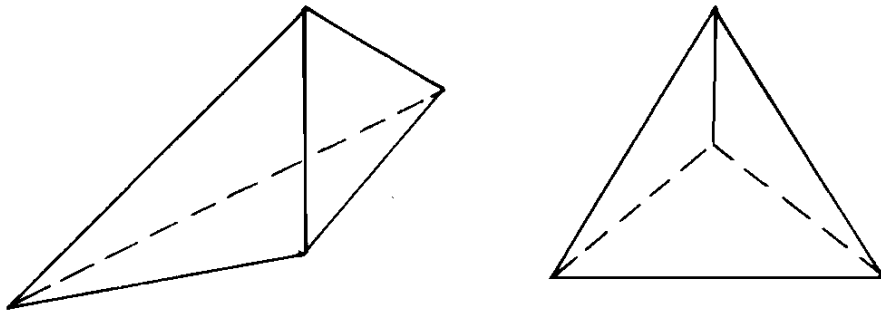
To construct one of the dissected halves, draw the figure below on a vanguard sheet. All measurements shown are in cm.



**Figure 6**

**An open-up half square-base pyramid**

Cut out the shapes along the edges. The outlines are folded and glue is applied to the shaded edges to fix the right pyramid. Two completed solid pyramids are shown below:

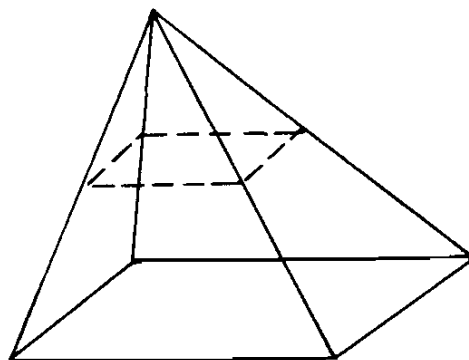


**Figure 7**

**Two half square-base pyramids**

When the 2 solid shapes are arranged with dissected shapes close together, a square-base right pyramid is formed.

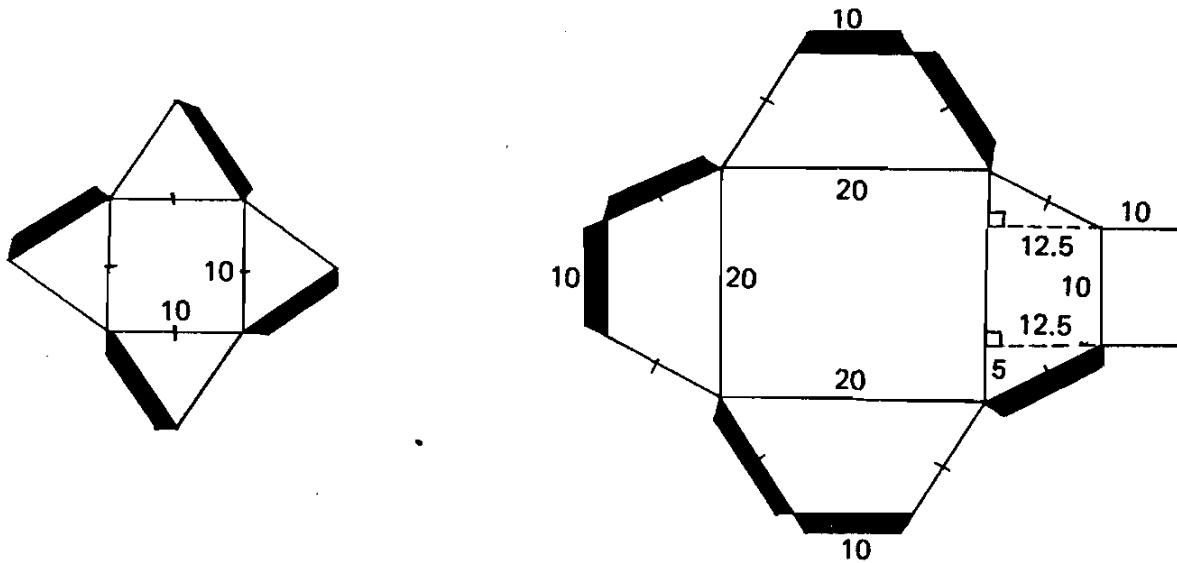
(C) *Dissecting pyramid across the slanting sides parallel to the base.*



**Figure 8**

**A square-base pyramid**

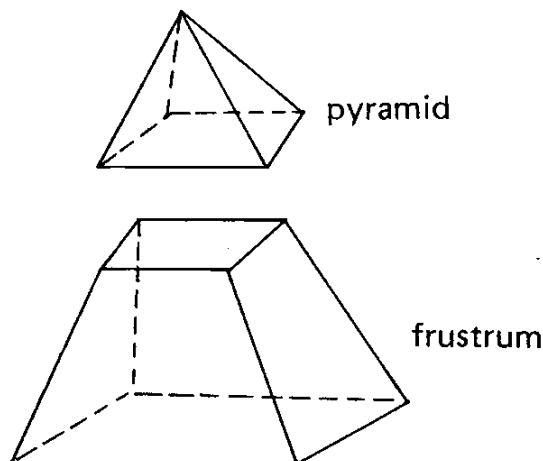
To construct the two dissected figures draw the figures below on a vanguard sheet. All measurements shown are in cm.



**Figure 9**  
**Open-up pyramid and frustrum**

Cut out the shapes along the edges. The outlines are folded and glue is applied to the shaded edges to fix the right pyramid and the frustrum.

The completed solids are shown below



**Figure 10**  
**Pyramid and frustrum**

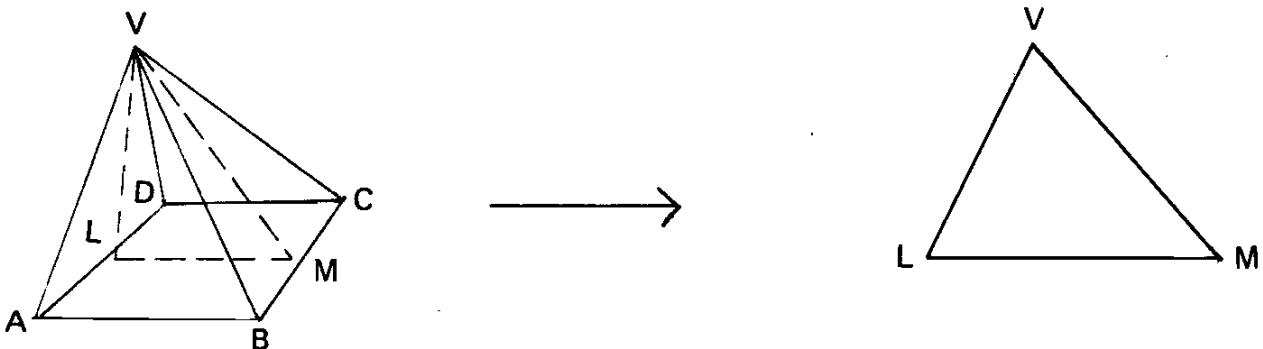
When the 2 solid shapes are arranged with the dissected shapes close together, a square-base right pyramid is formed.

### Presentation in classroom

- (A) *Model showing pyramid dissected from the vertex to the central base where the dissecting plane is parallel to the sides of the base.*

A square-base pyramid is shown to the pupils. They are asked to sketch the dissected plane they would see if the pyramid is dissected vertically down right from the vertex to the central base where the dissecting plane is parallel to the side of the base.

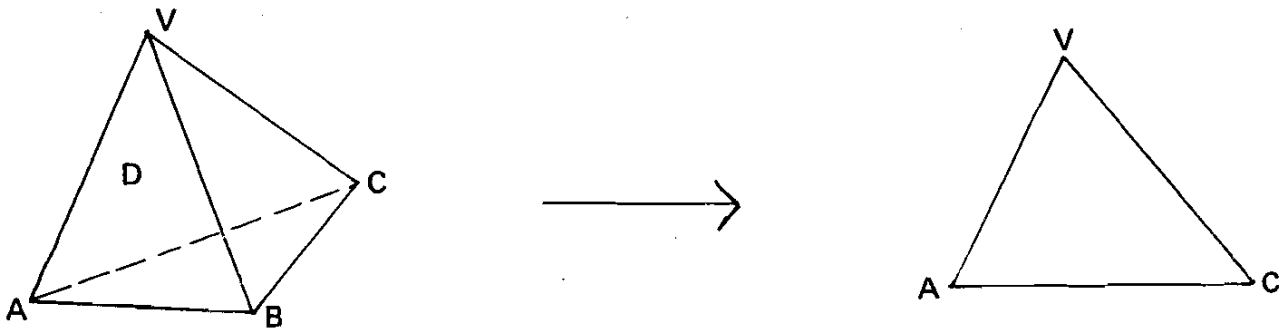
After the pupils have sketched the shape, one half of the pyramid is removed to show the dissected plane below:



- (B) *Model showing pyramid dissected from the vertex to the central base parallel to the diagonal of the base.*

The presentation is similar to (A). However, pupils are asked to sketch the dissected plane they would see if the pyramid is dissected vertically down right from the vertex to the base parallel to the diagonal.





(C) *Model showing pyramid dissected across the slant sides of pyramid.*

The model is shown to the pupils to show that a smaller pyramid and a frustrum are formed when the right pyramid is dissected across the slant sides parallel to the base.

In the presentation of this lesson on 3-dimensional problems, teachers are advised to ask pupils to construct their own models. These models could be useful to pupils who find difficulty in solving 3-dimensional problems.

## References

- Dienes, Z P (1969). *Building up Mathematics*. London: Hutchinson Educational.
- Piaget, J (1971). *The Psychology of Intelligence*. London: Rowlledge & Kegan Paul.