

added. When the student participates in the selection of the material he is to study, the purposes are clearer and more worthwhile to him and the work will be greatly motivated.

3. If more than one person checks the list the order numbers may be added for each item and the item with the lowest total given No. 1, the next lowest No. 2, etc. This will give a composite rating which might be weighted if desired but perhaps this suggestion should be omitted in the interest of prompt action.

4. Beginning with the objective judged most worthwhile estimate the time required to teach it. Next estimate the time required to teach the item of second highest desirability. Continue in this manner until enough items have been marked to occupy all available time. These then will be the things which it seems are most important for your students now. This might be a good time to contemplate the comment of an administrator, "What you biology people

ought to do is to teach fewer things better."

5. The selected items should be re-grouped into units for more efficient teaching. Many teachers may be shocked at the items they have thus decided are desirable for teaching in their courses. They may hesitate to trust their judgment and to proceed on it because of their previous ideas. But we should not permit ourselves to include extraneous material simply because it has always been placed with some unit. If it is felt that some omitted activities ought to be included it may be possible to cover a number of items of seemingly special value and interest as projects and extra assignments for those especially interested. However, the procedure here described seems fully justifiable in terms of the students' needs because it will produce a course in which both teacher and students can have faith. And faith in our purposes is the essence of supreme effort.

The Use of Miniature Dioramas as a Visual Aid in Biology

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Next to a first-hand experience the diorama probably provides the most objective proof of reality in its natural setting. Obviously the same perception cannot be obtained from a picture, a diagram, or even an occasional model since these devices do not show space relationships adequately. Pictures on flat surfaces do not bring the observer into proximity with the spacial factors of a setting which make the diorama possible. It is more difficult for the observer to

imagine himself as a part of a picture relationship, consequently it is less objective and much less real to him. The diorama supplies the third dimension to successful teaching.

Little successful teaching can be done among high school students without active school work of some kind. Without activity, reading, writing and reciting will finally become passive hum-drum which will lead to disorder in the end and little or no learning. High school

students are creatures of activity, and since they see to a large extent through their finger tips they should have the opportunity to do creative work with their hands. It is not enough for a teacher to insist that each student shall do something without offering some very definite suggestions as to what each may do. Suggestions should cover a wide range of activity so as to provide for the most gifted and the least gifted members of the class. Many of the projects may be worked out in groups in which case the mechanic, the architect and the artist may work together to turn out a worth while product.

MINIATURE DIORAMA CONSTRUCTION

The construction of a Miniature Diorama from plastic clay provides a variety of activities for a real group project. The diorama cases are about one foot square and eight inches wide. They are usually made by students interested in woodwork although many types of ordinary wooden boxes may be used. Many students may cooperate in this phase of the project since it involves cutting, fitting, sanding, painting, etc.

Those who are interested in art cooperate in modeling the figures and in painting the background. The figures are modeled about a wire frame or armature which passes directly into the baseboard of the case to provide ample support. Additional support is usually provided at inconspicuous points by wire nails which are nailed into the sturdy wooden parts of the setup. The plastic clay figures are pushed on to the wire nails to prevent them from falling forward because of their own weight. Plastic clay can be painted most successfully with oil paints, although ordinary poster colors may be used with some success if no water has been added to them. The background is usually done in water

colors on heavy cardboard which has been bent into a semi-circle. A thin veneer of clay is used on the base to blend the foreground into the background, and to form a substance into which artificial plants, etc., may be fastened.

Trees are made from small twigs which are forced on to small wire nails for support. Leaves and other types of vegetation may be made from artificial flowers obtained at the ten cent stores. Imitation rock formations are made by smearing ordinary screen wire with plastic clay. The screen wire can be bent into any shape desired and tacked into position on small blocks or strips of wood for support.

When the figures are properly supported and protected by glass in the diorama case, the exhibit becomes a permanent addition to the classroom. Each new addition creates new interest and spurs group activity towards the completion of a museum as the ultimate goal in the Biology Classroom.

TYPES OF MINIATURE DIORAMAS

The types of dioramas constructed by high school students in biology may be classified under three headings, namely:

1. Prehistoric Plant and Animal Life—including Prehistoric Man.
2. Nature Study.
3. Natural Formations—such as those found in a coal mine or an oil well.

Of the three types mentioned those which deal with Prehistoric Man seem to be the most popular among the students.

Since high school students, for the most part, are passing through a "dreamy" stage in their development they are highly imaginative, and receive a great deal of satisfaction from associating themselves with strength and power, because it is through such means that they hope to accomplish great

things. Not long ago every high school had its "Tarzans" who rushed about the corridors to fall upon some anemic classmate and to shake him by the neck until the victim's teeth rattled. Having accomplished his purpose Neanderthal Style "Tarzan" usually shoved his half-dazed friend aside, thumped his own chest with his fists, and let loose a petrifying war-whoop to demonstrate his superiority.

Much the same type of responses are manifested during the construction of miniature dioramas on Prehistoric Man. It is apparently much easier for a student with a good imagination to make himself a part of this type of diorama because it deals with primitive human beings with instincts much the same as his own. Since the student has something in common with the thing he is studying in this case he can fit himself into the picture more easily. Some dioramas constructed on the above plan are as follows, namely:

1. The Carboniferous Period.
2. The Age of Dinosaurs and Giant Lizards.
3. The Neanderthal Man and Family.
4. The Cave of Cro-Magnon Men.
5. Pottery Making.

Next to their own likeness high school students are most interested in animals closely related to Man, *i.e.*, small mammals, birds, etc. As in the case of the Cave Men, students are interested in where the animals live, what they eat, and how they build their homes. This is all very fruitful ground for diorama construction. The following titles represent a few of the dioramas that have been constructed on Nature Study,

1. The Mountain Goat.
2. The Mountain Lion.
3. The Home of the Beaver.
4. A Woodland Community.
5. The Prairie Dog.

In so far as most Natural Formations lie more directly in the special field of Geology this field has been little emphasized in our work, except for those formations that deal with coal and oil.

THE TEACHER'S PART

The successful teacher is a good strategist. His aim is to maintain enthusiasm among his students with all the art in his power. To maintain enthusiasm he must be the source of inspiration; he must be the "jack of all trades" who can help the student who gets stalled on "dead center"; he must be the driving force that insists that a thing once started shall be carried to completion, and he must be the source of those materials that may be difficult for most high school students to obtain. In addition a successful teacher must be "alive." He should be vitally interested in his subject, willing to work with the students and willing to set the example for hard work. Above all his procedure should be planned to anticipate possible difficulties so that action will continue undisturbed in a definite direction.

Unlimited suggestion on the part of the teacher is the secret of activity on the part of the students. Abundant suggestion creates a desire to do something by stimulating the imagination, but this initial momentum thus created will not usually carry a project through to completion. Care should be taken to fit a project to the ability of the student, but when this has been accomplished it is the teacher's job to help the student face the new situation so that he may not be discouraged at the outset. Cooperative planning will insure success at the start.

The construction of a diorama requires considerable study and planning on the part of students. It requires the exer-

cise of considerable judgment in the selection and arrangement of materials, and involves the use of many skills through manipulation. It places learning on an objective basis by making the subject matter concrete to all of the senses.

Among high school students learning words is useless without some experiences to give meaning to them.



Diorama construction requires the exercise of judgment in the selection and arrangement of materials.

ACID PROOFING TABLE TOPS

Steps for acid proofing hardwood table tops.

1. Clean and sand-paper the table top.
 - a. Fill in gouges in table top by using plastic wood.
 1. Use plenty of plastic wood.

2. Sand-paper down.

2. Apply #1 Solution hot to the table top and allow this coat to thoroughly dry. (Do not hurry the following processes.)

3. Apply #1 Solution hot the second time to the table top and allow this coat to thoroughly dry.

FORMULA FOR #1 SOLUTION

125 grams copper sulphate.

125 grams potassium chlorate.

1000 grams water.

4. Apply #2 Solution hot to the table top and allow this coat to thoroughly dry.

5. Apply #2 Solution hot the second time to the table top and allow this coat to thoroughly dry.

FORMULA FOR #2 SOLUTION

150 grams good fresh aniline oil.

180 grams concentrated hydrochloric acid.

1000 grams water.

6. Table top now looks mottled green. Scrub hard with a hot, gold dust solution; use a hard brush; wash off. Table top now black and mottled green. Dry thoroughly.

7. Apply to table top, hot raw linseed oil. Be certain the oil is hot. Use a cloth and rub oil in thoroughly. Don't put too much oil on, but rub thoroughly. Table top now is a very dark black color.

8. Table top may need a second coat of linseed oil. Allow to dry for two weeks.

9. Every six months wash the table top thoroughly and apply linseed oil. (This keeps table tops in excellent condition.)

10. This is a chemical process completed in wood; insoluble in water; and acid proof.

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