

The Science Teacher Orders His Films

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It may be sacrilege—but it is nevertheless true—to say that there is among many teachers of science a waning of enthusiasm for the use of films in their classrooms. Film sales, in all probability, have in no way been affected; the validity of a visual instruction program has not been questioned.

Teacher dissatisfaction, of course, may arise from a variety of causes. It may be due to such external factors as difficulty in obtaining films or disruption of classroom routine when films are used. It may be occasioned by a lack of coordination between film and course of study or by pressure of overcrowded syllabi. Where rigid, uniform examination systems are in vogue, teachers may find films of little "value."

There is, however, something more basic to the dissatisfaction (a dissatisfaction, incidentally, that has also been expressed by students objective enough about study to overcome their enthusiasm for "movies"). The failure to make satisfactory use of so valuable an instrument of instruction has not been due to administrative details or even to faulty teaching technique. It has been due, rather, to a serious pedagogical flaw in the production of educational films.

There are several misconceptions which are affecting the production of pedagogical films. First of these is the belief (it may be a financial dictate) that one film on a subject can serve all the possible functions of an instrument of visual

instruction. Second is a notion readily accepted by companies and some teachers that a visual instruction program with the use of films is a pedagogical panacea. Exposure to adequate doses of V.I. was, and still is, believed to eliminate learning difficulties forthwith.

The third and most serious misconception is the belief that a film can and should replace the teacher. If only for brief periods, certain areas of learning could be wholly "imparted" to large groups of students without benefit of pedagogue. Administrators found in this conception of the use of films a "solution" for the many problems arising from the overcrowded building; teachers found in it an occasional much needed rest period; companies producing these films saw its possibilities.

These three ideas have led to the organization of educational films on the artistic-whole-complete-in-one basis. Originating in the "short-subject" film of the motion picture industry and subject, at least psychologically, to the dictates of the Hollywood masters, the educational film became the "complete presentation," however elementary. There was an implication that the film was a complete entity and, with the advent of sound, a complete "lesson" was made possible without much assistance from the teacher.

That this "service" failed to materialize is of secondary importance. What is of moment is that the misconceptions

mentioned persist and that because of them films are being produced that fail of their purpose in certain phases of a visual instruction program.

The belief that one film can serve all functions has led to the making of films that serve none. Where arousing interest or inculcating attitudes is the aim of the film the "artistic-whole" or "short-subject" technique is most valuable and let there be no mistake, this type of film is of vital importance. But there are direct instructional phases of a visual instruction program where this technique may be extremely harmful. A complete dependence on this technique produces films that are hodge-podges from an instructional point of view. In films for this purpose, emphasis on dramatic unity and coherence brings about excess treatment of subject matter that needs little visual "treatment" while it neglects to give sufficient treatment of those phases that need it most. In this way, a valuable function of films is being ignored and it is with this function—not those of arousing interest, training in attitudes, giving over-views, or presenting problems—that we are concerned here.

The panacea and teacher-substitute conceptions of visual instruction are, of course, open to criticism from many angles, but what is important here is to substitute the proper conception of the place of photography in a plan of instruction. It should be considered as part and parcel of the established principle in education that we learn by experiencing. Direct, first-hand experience with a place, a process or a phenomenon is most satisfactory. If this first-hand experience is impossible, secondary experience—photography—is next best. Both types are preferable to verbal explanation where children without a back-

ground of first or second hand experience cannot translate the verbalizations into concepts. In the last twenty-five years, films have become an additional and more effective means of putting into practice this principle of learning by experiencing where—and especially where—the possibility of direct experience is of necessity remote from the classroom. Outside of its possible functions of arousing interest, providing an over-view, or presenting problems, the film is a pedagogical instrument for providing secondary experiences in much the same way that microscopes or experiments are means for providing direct experiences.

There is no doubt that film producers and teachers have realized the immense possibilities for providing experiences not otherwise obtainable but there has been no full exploitation of this realization. This is the crux of the failure.

Based on the previously mentioned misconceptions and inspired by the "short-subject" technique, films have not contributed their fullest to those phases of instruction where they are in reality the only proper means of learning. Where first hand experiences are available films are of little value. Why use a secondary experience when first-hand ones are obtainable? Other secondary experiences, like a still photograph, may even be more valuable for close study as well as more practicable for efficient classroom use than a "moving picture" of the same object. There is nothing inherently valuable in a motion picture. It must not trespass upon the field of other experience-providing devices because (1) there is great value in those other devices, and (2) especially because there is so much for the film to do in its own particular field where there is nothing that can compare with it in effectiveness.

A case in point. There is a widely used film (considered "pretty good" by most biology teachers) that attempts to trace the development of the fruit from its beginnings in the flower. This film is of considerable help in the learning process because it does provide experiences that cannot well be given in any other way to students of city high schools. However, laboring under the short-subject-logical-whole psychology the makers of this film have made it practically impossible, even with varied teaching techniques, to get over the maximum number of needed experiences that a motion picture on this subject could provide. Pedagogically there are phases of this topic that are of considerable difficulty for the teacher since direct experiences are not available. The teacher is, in these cases, completely dependent upon the motion picture, but as has been indicated, these particular phases do not get adequate treatment. Phases that can easily be covered by other devices—especially direct experiences—receive as much treatment, if not more. The pedagogic inefficiency of such an arrangement should be evident.

The entire plan of the film is a product of the short-subject idea rather than of the experience-providing principle. Who, in a high school classroom, can cover the development of bud to fruit in twenty minutes, or with the "interrupted film technique" who can do it in one period? The result has been that the film has come to be used as a summary film to review concepts taught otherwise. The film has also been used to introduce the topic but for this purpose it has been found entirely too crowded with concepts. These are perfectly admissible functions of a film but surely they are secondary compared with the use of films as means for providing

experiences unobtainable elsewhere.

It might be argued that if it is possible to spread a twenty minute film over a full forty minute period, with the proper instructional technique it might be possible to extend it over the number of periods considered pedagogically adequate for teaching the topic. But, in the film under consideration as in all others of its kind, the short-subject psychology that dictated the scenario made it necessary, first, to include experiences that are better provided by other methods and secondly, to give such fleeting glances to experiences duly within the motion picture's scope that it becomes highly inefficient to set up the film for such short phases. This is not of small moment; efficiency in the modern crowded classroom is an essential. Besides, when the phases are so inadequately treated, it becomes necessary to repeat. Too much repetition of a part or the whole of a film produces a lag in interest and enthusiasm. When the phases are particularly short as they must be in the films conceived in the short-subject vein, the repetition is deadly, as well as highly inconvenient.

To illustrate: The film under consideration opens with a lengthy showing of the essential organs of several flowers. In the logic of the "complete-whole" film, this is quite satisfactory, but pedagogically there is at least this major criticism. Parts of the flower are much better studied from direct experiences and most schools—even city schools—provide these experiences. Certainly, the smaller rural schools have no difficulty in obtaining flowers.

Of course, it is quite conceivable that the intention was to give examples of flowers not likely to have been studied or to review what had already been learned. These aims are quite defensi-

ble. In fact it might be possible to make a short film on the essential parts of several different types of flowers, but here, the difficulty lies in the fact that there is so much to the topic of development of the fruit which the film undertakes that by putting in "extra" views of material easily shown by other and better means, the film must and does fail to do justice to those experiences for which we are so dependent upon the motion picture device.

Pollination, certain phases of which need the motion picture, is dealt with hastily. No indication of wind pollination is given when it would be perfectly possible to show the collection of pollen in "traps." The demonstration of pollination by hand is rapid; students without previous experience fail to understand the quick actions. It seems that the plan "to cover" the topic made for brevity even though vital experiences not easily obtainable otherwise might be omitted. The only item given sufficient attention is insect pollination and this, no doubt, is one of the facts that makes the film of some value.

There follows a good microscopic view of pollen grains but the view of pollen tubes and the sperm nucleus is hurried. Most schools are in great need of just these hurried views since many of them have few microscopes and high school laboratories are not always successful in growing pollen tubes while the few that do rarely show the sperm nucleus. Actual experience with the film has shown that even when students have been taught by means of chalk diagrams about the growth of the pollen tube before the showing of the film, they fail to grasp the meaning of the microphotographs, so fast do they pass before their eyes. They must be run again and again. But in this case, the film cannot

be run back with the illumination on since the tubes "grow" shorter. The result is that time is wasted in running it back blindly and estimating the time to start forward. There is an unpleasant break and a consequent let down in interest, not to mention the inability of so short a showing to hold interest in the first place. With the proper philosophy in film production, there should be no need for awkwardness in running or for lack of interest.

The growth of the pollen tube and the travelling of the sperm nucleus are realms of experience that must be made much of. After a series of microscopic views of different pollen grains, a diagrammatic view of a pollen grain growing is needed. This should be followed, if possible, by a single pollen grain actually growing its tube. The view of many grains growing tubes simultaneously should be followed by the sperm nucleus travelling down the tube. Repetition of a still of the sperm within the tube (much better than cutting off the illumination sufficiently to stop the film) should then be shown to "clinch" the concept.

Similar criticism and recommendations apply to the next sequence in the film. The growth of the pollen tube within the pistil and the process of fertilization are phases of this topic that make a film so valuable. To rush through the process is to fail to take advantage of the contribution that the motion picture can make toward the learning process.

But the most significant failure lies in what follows in this film. While students who come from farming communities have seen the development of a part of the flower into the fruit, few city children have experienced it. Every biology teacher knows that this concept is most difficult to establish. There is a world of pedagogic difference between the

static chalk diagram and the "living" device of time-lapse photography. But no! The film again rushes on. The petals fall and presto! the fruit. A long close up of a gorgeous apple follows. Beautifully ended but pedagogically of little value. Children in communities that can afford motion picture machines have seen apples or can be shown one if needed. But how, unless by motion picture device, can most children experience the development of that fruit?

This rather extended criticism of one film was undertaken to illustrate where films are failing to perform a necessary function in classroom teaching. Illustrations could, unfortunately, be repeated from numberless films that continue to be made under the short-subject-complete-in-one-performance psychology.

Mention, however, should be made of a type of film sequence which also disregards the fact that the film should specialize in those phases of a topic toward which they can make the greatest contribution. This is the type of film that spends a good deal of time on simple experiments that can easily be done in any classroom. The experiment is, of all things, material for direct experience. Ideally, each student should perform it; the teacher demonstration is about as near to his ideal as present school organization permits us to come. Putting it in a film cannot be condoned by claiming that the schools cannot afford the materials needed for the experiment. They can afford the simple materials long before they can buy motion picture equipment. If films are made of simple experiments to save the teacher's time, the practice is vicious. A teacher that does not make use of the inspiring device—classroom experiment—had better be denied the use of films since he will most

likely use it as a work saver rather than as a pedagogical device. If the experiments are put in the film to "round out" the "story," the makers are laboring under the misconceptions previously discussed. There is no reason why films and actual experiments cannot be used together, or why an experiment previously performed cannot be recalled by, or in connection with, an experience provided by a film.

When such simple experiments are included they naturally take time from other experiences. One more illustration: A film in common use shows a simple experiment on digestion that any teacher can perform, but gives a hurried view of peristalsis. It is safe to say that no high school in the United States has the means of demonstrating peristalsis. They must depend upon the film. Yet the possibilities are hardly touched, so much time is spent on the experiment.

There is no attempt here to deny that there is room for moving pictures on certain types of experiments. Those with expensive apparatus or experiments on diets which take several months and therefore are not very well adapted for performance in city schools are fit material for motion picture treatment. In such pictures, too, the Hollywood technique is not necessarily sound. Scenarios on lengthy experiments should follow the steps that would have been used had the class been able to perform it. Definite stopping places must be provided for classroom discussion on the progress of the experiment and particularly for "planning" the next step—which the film proceeds to show. Again the technique indicated here is that of using the film where direct experiences are not available but, also, of using it in such a manner that it is the next best thing to such experiences.

The fundamental bases for dissatisfaction and some suggestions for improvement have been indicated. By way of summary, it may be said that the science teacher is calling for:

1. Films that treat very short areas of experience.

(Incidentally there is nothing sacred about the 400-foot film. Two hundred feet may be better.)

2. Films that give adequate treatment to such short areas.

3. Films that specialize in areas of experience that cannot be more successfully taught by other devices at the command of the teacher.

4. And films that take into consideration the fact that the teacher is capable of providing direct experiences and that he expects all devices to supplement and complement each other.

There remains the possible objection to the criticism made throughout this discussion of the "artistically rounded out" film. Should, then, the film of pedagogic worth lack the artistry of composition? The simple point of the matter is that the art of the short-subject-lecture film is not necessarily the art of the pedagogically sound film and, what is more important, is that the art of the short-subject film is not the art of the pedagogically sound lesson. The type of film that has been called for does not require complete artistic composition in the Hollywood sense. It is, rather, that type of film that will provide an adequate experience in a limited field just as a microscope demonstration gives an experience. There will be art in the preparation of the microscopic slide (*cf.* photography in films), but the demonstration is not the "completely-rounded-out" lesson. It is only PART of the artistic lesson; it is the experience-providing device. Introduction, body, con-

clusion,—the unity and coherence of an artistic lesson are not supplied by the experience-providing device. The device can and must contribute to the artistry of the lesson, but it dare not disturb it by an artistry of its own which so often is pedagogically antagonistic.

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Then there is the question of who shall write the scenarios for the films of the type indicated. Of course, there need be no limitations, but it is very important that classroom teachers supply those scenarios that will fit in with the art of their lessons. There is probably something terrifying about the word "scenario" since it brings to mind that select, much heralded group of Hollywood artists. But it is just these artists or their imitators who have made no contribution to the pedagogy of the classroom. The classroom teacher who has no fear of ordering his microscope demonstrations, charts, experimental setups and the like, should have no fear of ordering films to fit in with the art of his teaching.

Such an order follows herewith. For years biology teachers have been teaching high school students the steps in mitotic cell division. For years they have relied on static illustrations to describe a process. An experience that has been extremely difficult to provide has been neglected by the only medium that is capable of providing it satisfactorily.

The following plan for a teaching film seeks to provide the necessary experience for the teaching of mitosis. It is neither a novel nor an original scenario. Its value pedagogically would lie in what it omits and in the possibilities it provides for student participation. The fact that it would become an experience-providing device rather than the "teacher" is most significant.

MITOSIS IN THE LIVING CELL

View

1. A living cell.
2. Stained cell—the same to be used throughout the film.
3. Diagram of cell with labels of essentials only—the same to be used throughout the film.
4. Formation of the twisted threads of chromatin matter.
 - a. A view of the living cell actually going through this process would be best.
 - b. An animated diagram would be second best.
 - c. If the living cell in process is not very clear but shows some changes, it might be used and followed by the animated diagram.
 - d. A clock to show the speed of the time-lapse device should be included.
5. Stained slide showing stage at which View 4 has stopped.

* * *
6. The emergence of the individual chromosomes and their splitting.
 - a., b., c., d., as of View 4.
7. Stained slide showing stage at which #6 has stopped.

* * *
8. The movement of the chromosomes to the "equator" of the formed spindle.
 - a., b., c., d., as of View 4.
9. Stained slide of chromosomes at "equator."

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10. The movement of the chromosomes toward the poles.
 - a., b., c., d., as of View 4.
11. Stained slide of stage where #10 stopped.
12. The reformation of the nuclei and the splitting of the cell.
 - a., b., c., d., as of View 4.
13. Holding the end of View 12 or stained slide of newly split cells.

By way of explanation. The introductory scenes, #1 and #2, provide opportunity for the students to recognize

parts of the cell they have presumably studied. It is quite inconceivable that mitosis should be taught without such a basis. View 3 gives opportunity for students to check their own answers.

The asterisks (* *) indicate suitable stopping places. The class summarizes verbally what has happened. With the room lights on, the last stage of each step may be drawn from memory or comparison can be made with previously prepared charts or diagrams. The students can then make the necessary distinction between static drawings and the "happenings" (*i.e.* process) depicted on the screen. Where the teacher uses microscope slides of mitosis, the film may precede or follow, but in either case pauses may be shorter since only the action would be summarized.

The significant point here is that the film will fit into a variety of lessons without breaking their continuity. It could hardly be used as the lesson itself; it simply provides an experience as directly as it is possible to do, without eliminating teacher, chart, discussion and (amazingly) the students' mind. Its omissions are important. It does not attempt to "teach" the entire problem of cell reproduction. No time is taken to give the "when" and "why" of cell reproduction. Explanation of surface problems is not made. No comparison is made with cells where mitotic figures are not clearly visible, nor is an attempt made to differentiate between the mitotic and meiotic processes. It is rather bold to say it but it might be ventured that the Hollywood, complete-in-one film would have included them all!

The scenario suggested would simply give the opportunity to students for experiencing mitosis. The art of using that experience is left to the teacher—and to the students.