INVITATIONAL PAPER

Time Lapse Films In Crop Science Teaching

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Time laspe movies are not new (1, 4, 9, 11, 12, 13 and 14). However, their use in crop science teaching especially in super-8 mm. format appears to be all too rare. Excellent work in time lapse photography on plant growth has been done by several workers (2, 5, 6, 7, 8); and time lapse photography can be inexpensive, especially in super-8 mm. format (3, 10).

Seeing is believing; and plant growth motion in response to various environmental stimuli is difficult to demonstrate, excepting perhaps through the use of time lapse photography. For example, the geotropic and phototropic responses to auxin in the germination of corn has been demonstrated in eleven minutes of super-8 movie time, while the actual growth time of the seedlings is over 3 months. It is the objective of this paper to discuss a relatively simple but desirable setup for film production and to report on preliminary student evaluation of the use of time lapse films in crop science teaching.

Materials and Methods

Figure 1 shows the overall time lapse photographic setup in the basement of my home. Note from left to right, the camera, the wall shelf, laden with a mains unit, powerpak, aquarium pump; the corner shelf bearing a timer clock, which monitors the ceiling suspended floodlamp; a typical subject (soybean and corn plants) in black background; and the photographic quartz floodlamp unit. Figure 2 is a closeup view of the Leicina Super-8 camera mounted on a sturdy tripod. Notice that the camera lens is surrounded by a sunring which allows for making every frame a flash picture. In the lower right, note the intervalometer which measures the time internal (in a tropism film every 8 minutes) between each photograph in the time lapse sequence. Figure 3 is a closeup of (1) the mains unit, which permits powering the entire time lapse system from conventional 110-volt house current, (2) the powerpak which triggers the sunring, and (3) the aquarium pump, which provides aeration for plant subjects requiring growth in nutrient solutions for photographing purposes. Figure 4 is a view of the super-8 movie recorder chamber lined with accoustical tile. This chamber, vented and fitted with a plexiglass window, permits the recording of sound to sound-stripped film stock in a projector-recorder-motor noise-free environment while viewing the film.

In the production of the film, "Geotropic and Phototropic Responses to Auxin in the Germination of Corn" the corn seedlings were grown in: (a) petri dishes

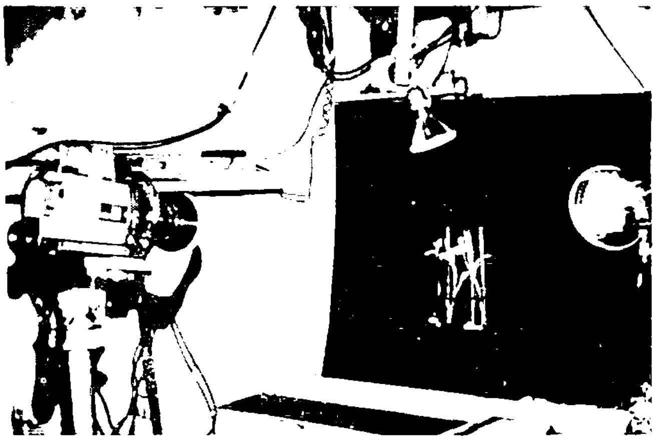

Figure 1. Overall time-lapse photographic setup in the basement of A. W. Burger home.

Figure 2. Closeup of Leicina Super-8 camera mounted on a sturdy tripod. The sun ring surrounds the lens and the intervalometer is shown at the lower left.

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The author expresses appreciation for the help of Dr. R. D. Seif, consultant on the statistical analysis phase of this paper and to Sandra Peyton of the biometry statistical staff for help in the data processing.

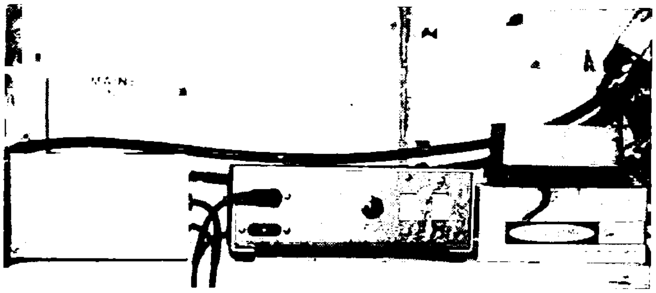

Figure 3. Closeup view of the Mains Unit (left) powerpak (center) and aquarium pump (right).

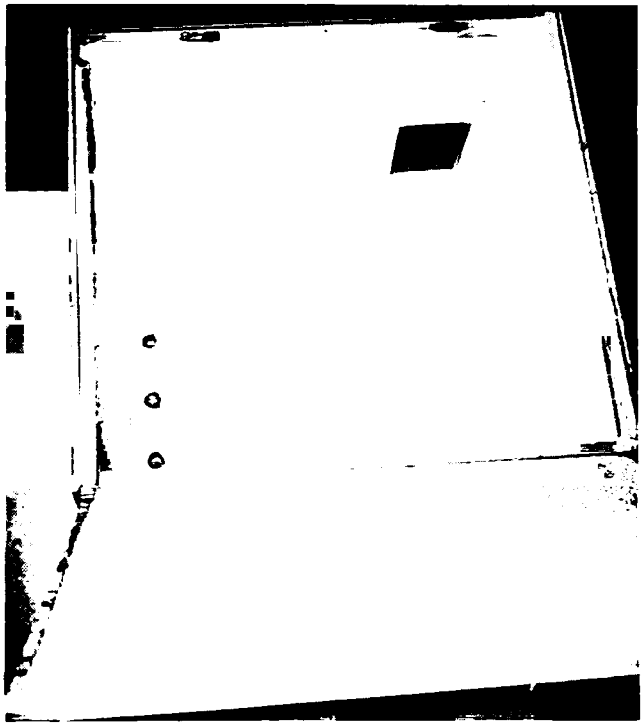

Figure 4. Super-8 movie-recorder chamber lined with accoustical tile. The chamber is vented and fitted with a plexiglass window.

laden with moistened paper hand towelling and/or kimpak and (b) a partially sand-filled plexiglass growing chamber 4" x 12" x 12".

Reaction data from 84 students in the crop science class, spring semester, 1976, were collected. Students were asked to score 23 items on a time-lapse movie critique form during the fifth week and again during the final week of the semester. The student's ratings, 1 = strongly disagree through 5 = strongly agree, were analyzed using standard analysis of variance. Differences noted are significant at the 5 percent level.

RESULTS AND DISCUSSION

"Geotropic and Phototropic Responses to Auxin in the Germination of Corn, **Zea mays L.**", the 11 minute time lapse film which was demonstrated at the NACTA Conference, June 18, 1976, Lubbock, Texas, shows:

(a) the radicle and coleoptile growth of corn seedlings as they respond to gravity and light, regardless of the original planting orientation of the seed;

(b) the change in direction of radicle and coleoptile growth after initial germination followed by inversion;

(c) the failure of response after tip excision; and

(d) the responses of excised coleoptile to unilateral light after treatment with indoleacetic acid-laden lanolin.

While the film is neither perfect nor professional, it is economical and accomplished the mission of teaching geotropism and phototropism movements in corn seedling germination to a college crop science class in 11 minutes.

Student reactions to the use of time lapse films in crop science teaching were considered necessary either to promote or reject their use in lecture or laboratory teaching. Thus in the spring of 1976, 84 introductory crop science students were asked to score the value of the time lapse film on phototropism and geotropism in corn, as well as 13 other time lapse films inserted into the AT crcp science laboratory and/or lecture program. The students scored the evaluation forms during the fifth (pretest) and again during the last (posttest) week of class in order that change in opinion could be monitored as more time lapse films were shown. Ideally the pretest should have been given at the beginning rather than at the fifth week of class, since 2 films had already been shown by week 5. However, as the following 4 figures (5a, 5b, 5c, and 5d) show, students appear to find time lapse movies desirable in college classroom teaching.

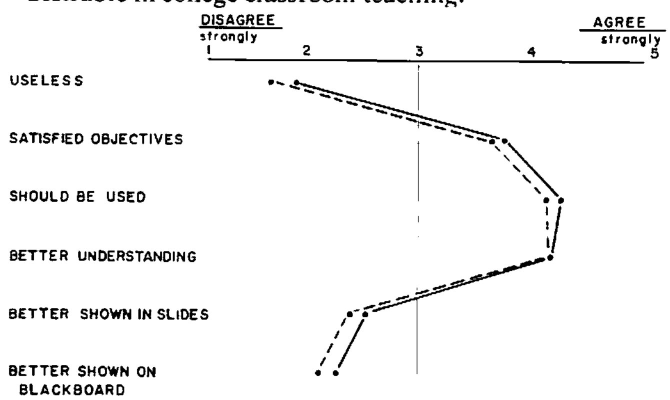

Figure 5a. Student reaction to the use of time lapse movies in crop science classroom and laboratory teaching. Pretest (solid line); Posttest (broken line).

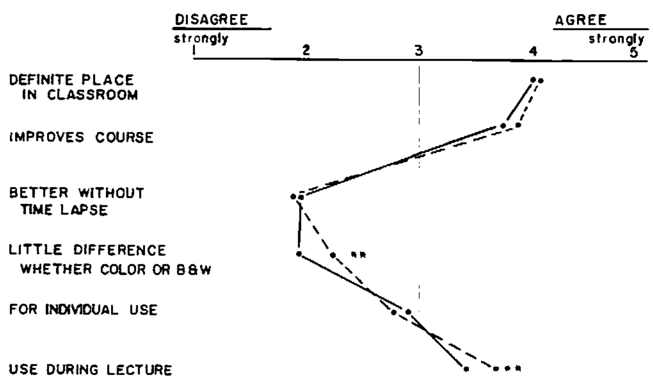

Figure 5b. Student reaction to the use of time lapse movies in crop science classroom and laboratory teaching. Pretest (solid line); Posttest (broken line).

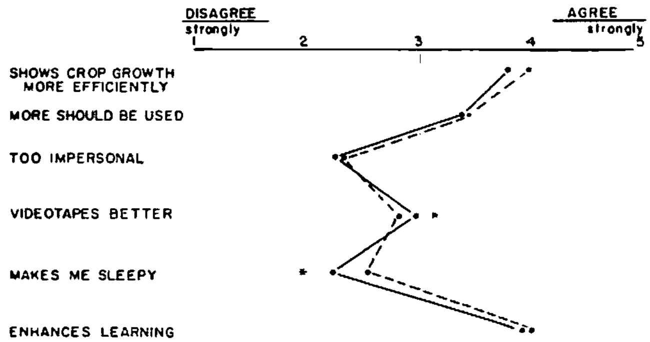

Figure 5c. Student reaction to the use of time lapse movies in crop science classroom and laboratory teaching. Pretest (solid line); Posttest (broken line).

Figure 5a shows that students agreed that time lapse movies (a) satisfied course objectives, (b) should be used in the course, and (c) lead to better understanding of the course. On the other hand, they disagreed that time lapse films are (a) useless and (b) that slides or blackboard drawings show plant growth principles better than do time lapse films. No significant changes occurred from pretest (solid line) to posttest (broken line).

Figure 5b shows that students agreed that time lapse movies (a) have a definite place in the classroom, (b) improved the course, and (c) should be used during the lecture; and they disagreed that (a) the course is better without time lapse, (b) it makes little difference whether color or B/W is used and, (c) the movies should be for individual use. Individual use has reference to placing short films into the autotutorial learning center so that any student has the opportunity for viewing the films for the first time or after premier showing during the lecture session. Ideally students prefer a lecture sound-synchronized explanation followed by review in the learning center. If allowed only one viewing, they prefer the lecture sound-synchronized explanation. However, when a synchronized sound explanation accompanies the movies, the preference is a toss-up. In the developing stage of the use of movies in crop science teaching, synchronized sound explanations accompanied the movies during the lecture followed by silent movie review. It was found that movie review must not be silent but sound-synchronized. Notice that there was a significant increase (a) in agreement that the films should be used during lecture time and (b) in disagreement that there is little difference whether movies are in color or black and white (B/W). The critique indicated that color films are superior to black and white movies; however, for some plant growth responses, black and white movies might do the job sufficiently well.

Figure 5c indicates that time lapse movies (a) show crop growth more efficiently than other media, (b) should be used more, and (c) enhance learning; however, students disagreed that (a) the movies are too impersonal, (b) videotapes are better, and (c) they made them sleepy. There was a significant increase in the disagreement that videotapes are better than movies from pre- to posttest. Further, there was significant decrease in the disagreement that time lapse movies made them sleepy. In private discussions with individual students, it was found that the latter trend was a response to the wish by students that all movies should have synchronized sound track (some of the time lapse short films in the AT laboratory were without sound or explanation; however, all movies will have synchronized sound for the fall semester, 1976).

Figure 5d shows that students agreed that (a) more time lapse movies should be produced, (b) they should be used in other courses, (c) their opinion on time lapse improved, (d) their opinion on time lapse has always been high, and (e) they never had time lapse movies until they had this crop science course. Most encouraging are the significant increases in agreement from the pretest to the posttest that this instructor should produce more time lapse films for crop science teaching and that their opinion of these movies improved as the course progressed. The only explanation for the significant increase in agreement that they never had time lapse movies until they had this crop science course is that students were not sure what time lapse movies were until several such films were shown: they confused time lapse movies with short films in other agriculture and life science courses. This was verified in their individual comments on the critique forms.

It should be emphasized that the data above are preliminary and that student reactions during several semesters will be sought. As was already indicated, all films will be incorporated with synchronized sound explanations as further evaluations are made to get a final reaction on the value of time lapse movies in crop science teaching.

CONCLUSION

A picture is worth more than a thousand words, and time lapse short films can put many months of plant growth time into a few minutes to enhance understanding by students of plant growth phenomena difficult to explain. Geotropic and phototropic responses to auxin in the germination of corn, over 3 months of actual growth time of seedlings, was shown in 11 minutes of time lapse movies.

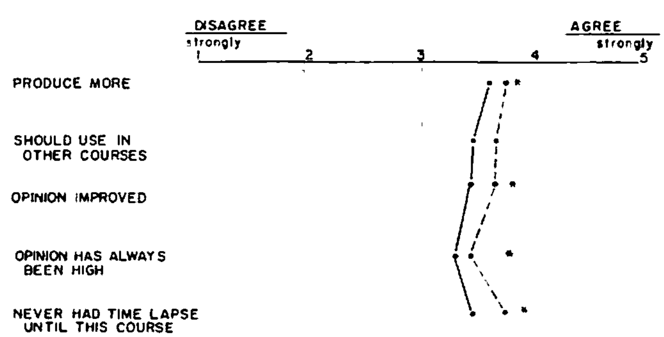

Figure 5d. Student reaction to the use of time lapse movies in crop science classroom and laboratory teaching. Pretest (solid line); Posttest (broken line).

Preliminary data on student reaction to the use of time lapse movies in crop science teaching indicate that students agreed that such movies (1) satisfied course objectives, (2) should be used in the course, (3) led to better understanding of the course, (4) have a definite place in the classroom, (5) improved the course, (6) should be used during course lectures, (7) show crop growth more efficiently than other media, (8) should be used more, (9) enhance learning, (10) should be increased in number, and (11) should be used in other courses; while they disagreed that time lapse movies are (1) useless, (2) less effective than slides or blackboard drawings, (3) too impersonal, (4) inferior to videotapes as a teaching medium, and (5) conducive to sleeping in the classroom or laboratory.

Students tend to increase their conviction that time lapse movies have a definite role and place in crop science teaching as more films are used.

REFERENCES

[1] Ariel, G. Method for Biochemical Analysis of Human Performance. *Research Quarterly of the Amer. Assoc. for Health, Physical Education and Recreation.* (AAHPER) 45:72-9, March, 1974.

[2] Boulton-Hawker Films Ltd. and Educational Foundation for Visual Aids. "The Looking at Plants Series" (5 films) International Film Bureau Inc. Chicago, Illinois. March, 1975.

[3] Grier, J. and R. C. Goss. Inexpensive Apparatus for Time Lapse Photography. *Am. Biol. Teach.* 26:198-201, March, 1964.

[4] Harlow, William M. *Exploring with the Time-lapse camera.* (A ten minute 16 mm. color sound film). International Film Bureau Inc. Chicago, Illinois. May, 1968.

[5] Ott, John. "You See Plants Grow by Time-lapse Photography." *Flower Grower.* XXXVI, January, 1949, pp. 40-41.

[6] Ott, John. "Some Responses of Plants and Animals to Variations in Wave Lengths of Light Energy." *Annals of the New York Academy of Sciences.* Vol. 117, Art. 1, September 10, 1964, pp. 624-635.

[7] Ott, John. *Exploring the Spectrum* (A 46 minute 16 mm. color sound film) International Film Bureau Inc. Chicago, Illinois, June, 1975.

[8] Ott, John. Health and Light: The Effects of Natural and Artificial Light on Man and other Living Things. Old Greenich CT: Devin Adair Co., 1973.

[9] Prior, T. and J. M. Cooper. Light Tracing Used as a Tool in Analysis of Human Movement. *Research Quarterly of the American Association for Health, Physical Education and Welfare.* 39:815-17. October, 1968.

[10] Rich, C. L. Super-8: Its Now a Real Consideration for Flimmakers. *Av. Instr.* 19:15-16, March, 1974.

[11] Smith, G. R. Time Lapse Camera Records Science Teaching. *Sch. Sci. and Math.* 63:573-5, October, 1963.

[12] Smith, G. R. Classroom Teaching in Memomation. *Peabody J. Ed.* 41:33-5, July, 1963.

[13] Walton, J. S. High Speed Timing Unit for Cinematography. *Research Quarterly of the American Association for Health, Physical Education, and Recreation.* 41:213-16, May, 1970.

[14] Zuckerman, Sir Solly. "Light and Living Matter." Trotter-Paterson Memorial Lecture, Transaction of Illuminating Engineering Society, London, Vol. 24, No. 3, 1959.

INVITATIONAL PAPER

The Lecture Method

Thomas M. Sutherland

Introduction

I consider it a great honor to be invited to present this paper, which I had in fact prepared originally for presentation to our own faculty at C.S.U. in one session of our continuing series called "Let's Talk Teaching." Our President Bill Thomas was at that session and suggested we might well present it to N.A.C.T.A. in view of our vital interest in teaching and the use we all still make of the lecture.

An old adage says that good teaching involves telling your audience what you are going to say, saying it, and then telling them what you said; I would like to bow to this saying today and start by giving you an idea of what you are about to hear. First it seems to me impossible to discuss intelligently the lecture method as a means of teaching without grappling somewhat with such questions as "What is education?", "When is a man educated?", "What is so-called 'good' teaching?", and "How do we evaluate teaching?". So I will throw out to you some ideas on this subject after which I will get to the heart of today's topic of the lecture method with a definition, some history, a discussion of the pros and cons and an analysis of the lecture method as it is used today. Finally I will try to set up a model of the "good lecture" and suggest some recommendations on how it can be put into effect!

Ideals of Education and Good Teaching

First then in a look at education in general, we can say and I hope agree that the fundamental aim of education is not just the training of a skilled technician or a competent professional—broadly stated, it is rather the furthering of good citizenship. Dewey says, "The aim of education is to further discipline, natural development, culture and social efficiency, which are the marks of a worthy member of society." Whitehead puts it even more loftily when he says, "The aim of education is understanding. . .in the sense that to understand all is to forgive all." The basic purpose of a university then is to prepare the nation's youth for a life in which they can contribute not only to the maintenance but also to the furthering of society. The university, through the education provided, should help students to discover and develop their capacities for self-realization; it does so by providing opportunities for contact between the minds of students and professors and in so doing presumably exposes them to the very loftiest ideals of our culture.

This invitational papers was presented by Dr. Thomas M. Sutherland, Professor of Animal Sciences, Colorado State University, during the 1976 NACTA Conference held at Texas Tech University, Lubbock, June 16-18.