Curriculum Research

Column Editor: Alexander Frazier
Contributor: Marvin D. English

Use of Color in Instructional Materials

RESEARCH evolves through a relationship which exists among people, ideas, and money. These three elements interacting in the proper environment produce energy. Action research is based on the energies of persons who are concerned with the outcomes of such research.

Anyone who has served on a curriculum committee to select instructional materials will testify to the fact that the controversies which arise seem numberless. One issue concerns the use of color. Many conclusions reached in the past have been subject to one weakness: their only basis was opinion. Good opinions are valuable, but something more substantial on which to base preference is generally welcomed.

While research studies in this area reveal some answers, the researchers themselves have called for additional studies. The writer, after studying such proposals, became interested in the study of color influences on pupil achievement. Colleagues were interested in this problem, a known school environment in which to conduct a research program was available, but how does one find funds to support such an endeavor?

A conference was arranged with Walter A. Wittich, professor of audio-visual instruction at the University of Wisconsin. What may be accomplished in this research is due, in a very large part, to the advising assistance rendered by Professor Wittich and the financial assistance of the McCormick-Mathers Publishing Company.

A series of conferences was scheduled. The possible types of research design were explored. The other various mechanical problems of a research program were discussed and the following program was put into action.

Color or Black and White?

The general question asked by the research study was stated as a null-hypothesis: "There is no significant difference in the acquisition of learning when children are influenced by colored as opposed to black and white instructional materials." The role of the null-hypothesis is a very simple one. The learning achievements of the students using colored materials are pitted against the learning achievements of the students using black and white materials. If no difference in scores is revealed, then the two media are equally effective. If, however, a difference does exist, then one or the other medium must be more favorable.

The research design employed was an extended Latin square. This means that one group used the colored materials while the other used the black and white

materials and they exchanged media on each successive unit. Six experimental instructional units were constructed. Thus, each pupil studied three colored units and three black and white units.

The units were paired, whenever possible, so that each pupil could be tested on both colored and black and white materials in each topic area. For example, units one and two in fifth grade science both dealt with simple machines. Thus, each pupil studied one unit in color and another in black and white, both units dealing with the same topic. By its rotating design, the Latin square technique yields a cancelling-out of individual differences because both the good and the bad elements in the groups involved contribute to the experimental (colored) materials and the control (black and white) materials on an alternating basis. Thus, the remaining variable is the one contributed by the style of the media.

The research was conducted at the McFarland Grade School, McFarland, near Madison, Wisconsin. The enrollment was 400, with thirteen teachers on the staff. The population of the school district was approximately 4100. Being near a large city, most of the employed were middle-low class industrial and sales personnel but 14 of the families operated full-time farms. This school was believed to represent adequately a "typical" Wisconsin grade school.

In an effort to be broad in coverage the study involved second, fifth and eighth grade classes. Changes which may evolve from maturation and scholastic growth could thus be uncovered. The two second grade classes totaled 43 pupils, the two fifth grade classes totaled 44 pupils, and the two sections of the eighth grade totaled 41 pupils. Each second and fifth grade class had its own teacher while both eighth grade sections were taught by the present writer. Thus, there were 128 pupils and five teachers involved in the project.

The research program involved two subject areas and two types of instructional materials. One of the areas employed what some writers refer to as the "realistic" use of color, science. In the other area, arithmetic, color was used for clarity or attention-getting. Textbooks were used in grades two and five, and sound films in grade eight.

Some of the science topics covered were: second grade—weather, the thermometer, the food we eat, winter coats and baby animals; fifth grade—simple machines, rocks and minerals and plants and animals; eighth grade—laws of motion, jet propulsion, how plants make seeds and classifications of animals. The arithmetic units dealt with combinations of numbers in the second grade; fundamental processes such as long division and decimals in the fifth grade; but funds could not be stretched to involve the eighth grade in this area.

Author style, format (type face, position of illustrations, etc.) and other characteristics of published materials influence greatly the effectiveness of instructional materials. An attempt was made to locate exemplary colored materials and then these were reproduced in black and white. In this way, the format was kept the same in every respect except the media of color or black and white.

The following value judgments were used as a guide in the selection of the instructional materials:

1. Only units usually taught by the teacher during the second semester were considered.
2. Color must be used effectively.
   a. Subjective appeal (to teachers)
   b. Enhancement of the text meanings

c. Non-decorative
d. Clarity
e. Appropriateness.

A total of 135 texts and 18 films were considered during the evaluation. Each teacher was given two months to independently evaluate the materials and then mutual agreement was arrived at during group meetings.

When making the black and white reproductions, the films offered no problem, for the producers made available black and white editions. However, the textbooks caused some additional work. Illustrations in textbooks are generally in half-tones. This means that photographs of the printed materials will produce hazy, grayish prints. An artist employing pen and ink sharpened and clarified contrasts in the textbook illustrations thereby enabling clear photonegatives to be taken. From these the black and white editions were made.

Individual booklets were made for each instructional unit. This eliminated the refinement presented by bound editions. One set of booklets contained the published materials cut out of the textbooks and reassembled into the standard experimental booklet format and the other set contained the reproductions. This aided in reducing the possible stigma of "home-made" materials. Neither set of booklets had the hard-cover "appeal" of the commercial publications.

Among the efforts made to remove the noticeable experimental characteristics of the research program were these:

1. The curriculum coordinator in charge of the research taught for a full year in the school so that he could best become acquainted with the capabilities of the teachers to be involved, accustom the pupils to his presence, and establish close liaison with the principal.

2. Considerable time was spent discussing materials with the teachers so that each experimental instructional unit could be absorbed very easily into the on-going curriculum.

3. The instructional units selected for the experiment were those intended for second semester use. This allowed each teacher one full semester to become familiar with her class and vice versa.

4. Many types of objective tests were used during the first semester and on the basis of these trials the types of questions to be asked during the experimental program were selected. Thus, every pupil became familiar with the testing procedures.

Before each unit was taught, the concepts to be identified and stressed were mutually agreed upon by the teachers involved. Care was taken to make provision for the same laboratory demonstrations in both the experimental and control groups (this function alternated, of course). The teachers also constructed the examinations together so that no unfair or unstandardized measures were obtained.

Each successive experimental unit was taught simultaneously in each of the two classes on each grade level. This eliminated the differences which may arise from scheduling difficulties, climatic conditions, lunch hour anxieties, and other variables indigenous to the classroom. The individual techniques employed by each of the teachers, questions raised by the pupils and ensuing discussions, environmental aids and other factors which may be unique to the individual classroom were assumed to cancel out due to the cross-over design of the Latin square. (Those unique factors which aid the color units this week will aid the black and white unit next week.)

On the objective tests which were administered only questions pertaining to the contents of the experimental booklets were asked. There was no attempt to check on other incidental learning. The attempt was made to have a question for each significant (agreed upon by the participating teachers) item in the instructional unit.

The statistical method of treating the data was the t-test of significance. The data was all converted to standard T-scores before attempts were made to identify differences at either the .01 or .05 level of confidence.

The effect of color was summarized by taking the sum of all the T-scores of a given grade (both classes) which were the results of instructional units presented in color. The effect of black and white was summarized by doing likewise with that style of media. The significance was then computed by comparing the two "total" results.

Questions arose before and during the research program. It is hoped that our study will provide additional information or even answers for some of these questions. When a researcher is concerned with the acquisition of knowledge through the use of instructional materials employing the medium of color or black and white, the following are some of the queries that come to mind:

1. Is the acquisition of knowledge especially influenced by one style of media?
2. Is the learning environment enhanced by a particular medium?
3. Are certain types of illustrations more effective?
4. As children mature, is there any noticeable change in their use of illustrations?
5. Does the placement of the illustration have any significance?
6. What uses of color are most effective?
7. What uses of black and white are most effective?

8. Do certain colors have more significance to pupils than others?

9. Are pupils aware of the characteristics of the illustrations employed?

10. Does the proportional increment of achievement as determined by the media differ between I.Q. levels?

11. Are there attitudes which can be evaluated as to the pupil and teacher reactions to given styles of media?

12. Is there a difference between the interest in a learning situation and the actual acquisition of knowledge?

13. Do any styles of media stand out as being significantly harmful?

Because of the controversial nature of the statistical results of this research study, it is felt that supplementary double-checking would be wise in order to prepare for criticisms which may arise. Extreme care must be taken by any group doing research in an area which is so strongly dominated by personal experience and opinion. Therefore, several more months must be devoted to careful scrutiny of all the procedures, experimental and statistical, before the results are made public.

—MARVIN D. ENGLISH, *research assistant, University of Wisconsin, Madison.*

Comparative Education

(Continued from page 402)

realization that no one form of organization, no one set of philosophical premises, no one system of instructional practices, no one arrangement of subject matter really makes any school system good or guarantees any type of outstanding product. All school systems have graduated those individuals who can take their places with the worthiest of mankind; all have turned out miserable failures. The real worth of a school is to be measured by the spirit that pervades it and this spirit depends in large part on the individuals who serve it. The value of stimulating the creativity and purpose of the individual is sharply focused in a recent excellent evaluation of American schools:

> Much of our present-day social achievement is manifested by group effort. It is our ability to marshal and unite the skills and abilities of thousands of individuals that makes possible the achievements of modern technology. It is a condition of modern society that we spend our lives in an atmosphere of collaborative effort.
>
> But while the strength of cooperative effort is impressive, there is danger that we may misunderstand the true source of that strength. The danger is that we may forget the individual behind a façade of huge and impersonal institutions. The risk is that we will glorify science and forget the scientists; magnify government and ignore the men and women who discharge its functions; pin our hopes on education, business or cultural institutions, and lose sight of the fact that these institutions are no more creative or purposeful than the individuals who endow them with creativity and purpose.[1]

Finally, a study of comparative education brings home to teachers everywhere that they are an important part of a global endeavor whose aspirations and problems have everywhere much that is common, despite the many outward differences. They realize anew, particularly for their profession, the truth of the words of the wise Confucius, "All within the four seas are brothers."

[1] Rockefeller Brothers Fund. *The Pursuit of Excellence: Education and the Future of America.* New York: Doubleday and Company, 1958. p. ix.