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ABSTRACT

This review considers two major areas--research on educational media and research on school media centers (learning resource centers). Research reviewed in this report is limited to studies carried out in public school settings or that deal with issues of concern in public education. An introduction discusses the changing definition of instructional technology. More than half of the review is devoted to summarizing conclusions and discussing the history, directions, and limitations of research on educational media. The review emphasizes comparative media studies, focusing on motion pictures, television, still pictures, audio materials, programmed and computer-assisted instruction, multimedia instruction, and problems with comparative media studies. The economic evaluation of educational media and research on media attributes are also reviewed. Research on school media centers is divided into several topics for discussion: descriptive research, experimental research, media staffing studies, national standards for media programs, planning and evaluation of programs, and needed research. Finally, the paper briefly summarizes conclusions from media research reviews and ends with a 5-page list of references. (LMM)

MEDIA IN INSTRUCTION: 60 YEARS OF RESEARCH

by

Gene L. Wilkinson

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Perspective, Definition, and Limits

The field of educational media is eclectic, reflecting the diversity of background and interests of the individuals who work in the field and the trends exhibited in its growth. Coming from such areas as mass communications, education, library science, military and business training, psychology and learning theory, engineering, sociology, information science and cybernetics, and the fine arts, professionals in the field of educational media share a common interest in the tools of teaching and learning and a common concern with the role and function of technology in education. With such diversity, the problem of field definition is both vital and complex.

In its monumental report to the Congress, the Commission on Instructional Technology (Tickton, 1970) noted two different ways of defining instructional technology. One of these definitions, "the media born of the communication revolution which can be used for instructional purposes alongside the teacher, textbook, and blackboard" (p. 21), is the traditional definition of educational media. Such a definition implies a consideration of machines and materials—the things, such as television, films, overhead projectors, computers—that are considered part of educational media. Because such an approach is expected by those outside of the field, it will be followed, to a degree, in this paper. However, such a definition of the field is too narrow. It excludes a number of issues which are, or should be, of concern to individuals looking at the quality of public education.

The Commission's second definition goes beyond specific devices or media. Under this definition, instructional technology is "a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and nonhuman resources to bring about more effective instruction" (p. 21).

The growing acceptance of this second definition is one of the factors that led the major professional organization in the media field to change its name from the Department of Audiovisual Instruction to the Association for Educational Communications and Technology, and led to the initiation of the work of the AECT Task Force on Definition and Terminology (AECT, 1977). The definitions developed by the Task Force are based on a number of assumptions concerning technology in education:

- Modern society is characterized by a high degree of technological sophistication. . .
- A technological culture, by definition, is one that finds technological solutions to its problems. . .
- A new technology for instruction has been developed and proved through basic research and practice. . .
- The new educational technology is capable of meeting and solving certain of the school's major problems in instruction, organization, and administration.
- Application of the new technology will result in major changes affecting the administration, organization and physical facilities of the public schools.
- Methods of instruction will be modified to a major degree, particularly in the presentation of information (and management of contingencies of reinforcement).
- Teachers and learners will have changed roles and new activities as a result of this technological change.
- A new kind of professional will be required to provide leadership in design, implementation and evaluation of programs in education which make the fullest use of [educational technology]. . . (Morris, 1963, p. 10, 11).

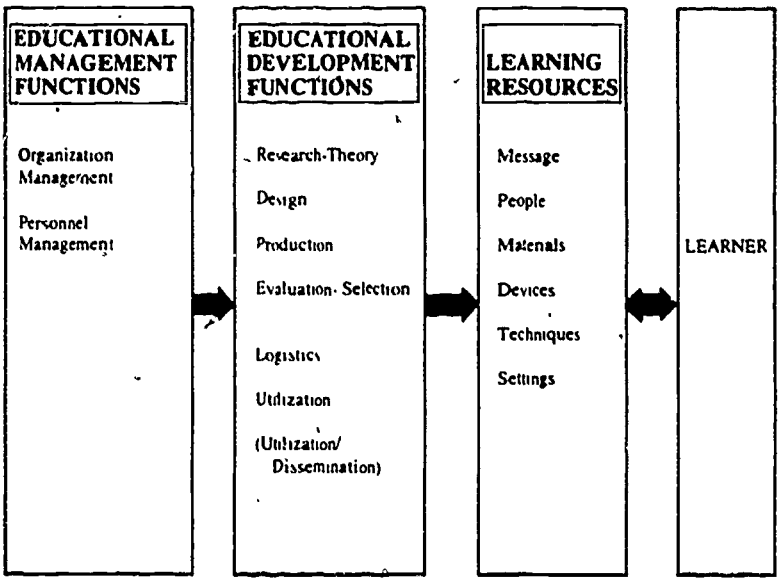
The definition, as proposed by the Task Force and accepted by AECT, states. . .

> *Educational Technology* is a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems, and devising, implementing, evaluating and managing solutions to those problems, involved in all aspects of human learning. In educational technology, the solutions to problems take the form of all the *Learning Resources* that are designed and/or selected as Messages, People, Materials, Devices, Techniques, and Settings. The processes for analyzing problems, and devising, implementing and evaluating solutions are identified by the *Educational Development Functions* of Re-

search-Theory, Design, Production, Evaluation-Selection, Logistics, and Utilization. The processes of directing or coordinating one or more of these functions are identified by the *Educational Management Functions* of Organization Management and Personnel Management. ("The Definition of Educational Technology," AECT, 1977, p. 59)

The relationship of the various elements mentioned in the definition are illustrated in Figure 1.

FIGURE ONE: *Domain of Educational Technology* (adapted from "The Definition of Educational Technology," AECT, 1977, p. 59)



The narrow term "educational media" is concerned primarily with just two elements of the total domain model—materials and devices. The concern in schools is with not just the materials and devices but also with the people who provide and operate them; the design, production, logistics, and utilization of them; their organization and management; and how they interact with learners.

This broader concern with technology as process rather than as things is reflected in the current research literature. The major educational media

research journal, in the process of redefining its publication policies, states that. . .

> Inquiry in educational technology may be associated with the planning, implementing, and/or evaluation of the management-of-learning process, where that process employs systematic technological analysis and synthesis. The definition is the same as the definition of educational inquiry except for the phrase [dealing with] "systematic technological process." Following authors such as Finn (1960), Hoban (1965), and Heinich (1970), it is argued that an appropriate definition of educational technology must include reference to a process. That is, technology defined with hardware or software attributes is too transitory to build useful philosophic distinctions and, therefore, too restrictive. (Schwen, 1977, p. 9)

This same concern with process and the broader aspects of instructional technology will be reflected in this review.

It will, however, be necessary to exclude a number of possible areas of interest that might be suggested by a broad definition of technology. For example, literature dealing with instructional design and development will be excluded, except as it applies specifically to the design of media materials. This is because, as Diamond (1978) points out, the theories and models in this area have not been field tested, research studies are scarce, and the existing reports are often incomplete and misleading. Other areas that will be omitted include facilities for media utilization, mass communications, information theory, and strategies for media utilization in specific subject areas. As much as possible, the paper will be limited to studies that were carried out in a public school setting or that deal with issues of concern in public education.

Two major areas will be considered in the paper—research on educational media and research on school media centers. The concern will be with the tools of instruction and how they should be organized for the most effective use. The term "educational media" will be used to refer to those devices and materials, other than textbooks, that can be used to convey information in a teaching/learning situation. "Media centers" will refer to the organizational unit that provides educational media and media services within the school.

Research on Educational Media

Anyone seeking to do a comprehensive survey of the research dealing with educational media is faced with a frustrating task. From one point of view, the field of educational media is one of the newest and most comprehensively documented aspects of education—reaching maturity along with the methodology of educational research and evaluation during the forced growth of World War II and the expansion of graduate training programs during the 1950s and 1960s. From another point of view, educational media is as old as the first primitive that scratched a crude drawing in the dust, and is an area rich in advocacy but poor in evidence. Many of the studies in the field were set up to demonstrate prior convictions rather than to examine carefully drawn hypotheses. The results of several decades of research, as will be seen in a later section, can be summed up as "no significant difference."

A number of reviewers have attempted to give cohesion and direction to research in educational media. Saettler (1968b), in his book, *A History of Instructional Technology*, traces developments from 1918 to 1965. Other authors have focused on research dealing with specific types of media, such as films (Hoban & VanOrmer, 1950; May & Lumsdaine, 1958), programed instruction (Lumsdaine & Glaser, 1960), and television (Reid & MacLennan, 1967; Chu & Schramm, 1967), or on specific aspects of media, such as Briggs' (1968) review of media and learner variables, Travers' (1967) publication on information transmission, and the work of Fleming and Levie (1978) on instructional message design. The 1956, 1962, and 1968 April issues of the *Review of Educational Research* were devoted to instructional materials (Allen, 1956; Wendt & Butts, 1962; Saettler, 1968a) and the *Review* continues to publish major reviews of media research (Jamison, et al, 1974). Another source of regular reviews (Allen, 1974; Meierhenry, 1978), as well as reports of research in progress, is the *Educational Media Yearbook* series edited by James W Brown, and the *AV Communication Review*, now titled *Educational Communications and Technology. A Journal of Theory, Research, and Development* (see for example, Moldstad, 1974). One of the most important research reviews, in terms of giving direction to the field, was that by Lumsdaine (1963) in Gage's *Handbook of Research in Teaching* and the subsequent review by Levie and Dickie (1973) in the *Second Handbook*.

Historical Development of Educational Media Research

Experiments dealing with the instructional use of media began near the end of World War I and grew with the development of commercial films and radio. One of the first major studies to look at the use of motion pictures in a public school setting was conducted at the University of Chicago (Freeman, 1924). This series of experiments, which ran over a period of three years in eight different school systems, produced a number of conclusions that still warrant attention:

1. The relative effectiveness of verbal instruction as contrasted with the various forms of concrete or realistic material in visual media depends on the nature of the instruction to be given and the character of the learner's previous experience with objective materials.

2. The comparison of the film with other visual media (slides, stereographs, still pictures) as a means of instruction when the medium variable is motion (e.g., a film showing the motion of a steamboat was compared with a still picture of the same object) indicates that the film is superior within a restricted range and type of content, but that outside of this range the other media are as effective or more effective.

3. The peculiar value of a film lies not in its generally stimulating effect, but in its ability to furnish a particular type of experience.

4. It is inefficient to put into films actions that can be demonstrated readily by the teacher.

5. In teaching science and how to do or make something, demonstration is superior to the film.

6. Films should be so designed as to furnish to the teacher otherwise inaccessible raw material for instruction but should leave the organization of the complete teaching unit largely to the teacher.

7. The teacher has been found superior to all visual media in gaining and sustaining attention.

8. Each of the so-called concentional forms of instruction that employ visual media has some advantage and some disadvantage, and there are circumstances under which each is the best form to use. (Saettler, 1968a, p. 116)

The Chicago film studies could have provided a solid foundation for media research; however, they were neglected in favor of a more limited experimental design that still persists today—the comparative media study. Following the lead of early studies conducted by Eastman Kodak Company (Wood & Freeman, 1929) and Yale University (Knowlton & Tilton, 1929), investigators compared the effectiveness of this medium, to that medium, to "conventional" instruction. As early as 1930, Weber was pointing out that no further experiments on the comparative value of media were needed and that other questions should be examined. Weber's advice was ignored, however, and there was no major shift in the type of media research being conducted until the end of World War II.

Major military studies on the use of film in training during and after World War II (Hovland, et al, 1949; Carpenter & Greenhill, 1956), the exploration of television as a training tool by the Navy and by Pennsylvania State University, and the stimulation for research and innovation caused by the National Defense Education Act of 1958, led to both an expansion and an intensification of media research during the 1950s and 1960s. At the same time, there was great dissatisfaction with both the common designs being employed in media research and the questions being examined. Knowlton (1964), among others, pointed out that much of the research on media was based on false assumptions—that assuming the key variable to be the means of information transmission rather than some aspect of the message, content, or the learner would lead to false or contradictory conclusions. The realization that motion is motion, whether presented in film, over television, or in a live demonstration, and that a unit of instruction that requires perception of motion will be more effectively taught if motion is employed, goes a long way toward clearing up some of the confusion and conflicting results of the comparative media studies. Chu and Schramm (1967), for example, concluded that there is no difference between learning from film and learning from television if they are used in the same manner.

A new direction for media research was provided by Lumsdaine (1963) and others. The approach that has dominated media research during the

past 20 years has focused primarily on the "attributes" of media rather than the media themselves. As stated by Levie and Dickie (1973), media attributes are. . .

> properties of stimulus materials which are manifest in the physical parameters of media. The attributes of a medium, then, are the capabilities of that medium—to show objects in motion, objects in color, objects in three dimensions; to provide printed words, spoken words, simultaneous visual and auditory stimuli; to allow for overt learner responses or random access to information. Some attributes, such as the capacity to show objects in three dimensions, are properties of relatively few media. (p. 860)

Research on media attributes, as summarized by Lumsdaine (1963), Briggs (1968), and Levie and Dickie (1973), continued to show the same conflicting results characteristic of comparative media studies. Levie and Dickie suggest. . .

> Early research dealing with media attributes sought main effects—spoken versus printed words, color versus black and white, overt versus covert responding, and so forth. Invariably the emerging generalization has been that no single level of the independent variable is consistently superior and that often the variable is, in fact, inoperative. The question then turns to the more complex problem of discovering the conditions under which different levels of attributes are differentially effective. What media attributes will facilitate learning for what kinds of learners in what kinds of tasks? The shift of focus from main effects to interactions is typically accompanied by a shift of focus from the physical parameters of stimulus attributes to concern with inferences about the internal human processes that may be aroused or facilitated by media attributes. Researchers cease to be satisfied with discovering what happens but seek to explain why it happens in varying contexts. (p. 877)

A number of individuals have suggested designs for generating and testing hypotheses about the interaction of media attributes and learner aptitudes (Snow & Salomon, 1968; Snow, 1970; Clark, 1975) and much work has been conducted in the area (Cronbach & Snow, 1977; Winn, 1978) but problems still persist. As Salomon and Clark (1977) point out. . .

Experimental work (on aptitude treatment interactions) has recently gained increasing prominence in the field of media and technology. However, the more it moved into the deeper layers of *understanding* media, the farther away it went from the world of education. And in spite of its improved quality, it nevertheless fell short of accomplishing the objective of improving educational practice.

There is a major reason for this failure. The research. . . .is by *necessity* highly analytic and detached, and thus it is—by its very nature—unrepresentative of the real world of education.

One of the major purposes of media research is to deepen the understanding of what functions media attributes can accomplish for different learners and different tasks. It must emphasize, first and foremost, *internal validity*. If the researcher wishes to ascribe a particular effect or function to a particular attribute, neatness of experimental comparison is necessarily called for. This calls for carefully arranged experiments in which *only* the desired variables are allowed to vary according to the researcher's rationale. However, when such is carefully done according to the canons of methodology, something of utmost importance is lost—namely, representativeness, or external validity. (p. 106)

A number of researchers have suggested possible solutions to these problems (Salomon & Clark, 1977; Clark, 1978), which should, from the point of view of the public schools, lead to more useful research in future years

On a pessimistic note, Clark (1978), until recently the Director of the ERIC Clearinghouse on Instructional Technology, states that. . .

> Despite claims to the contrary, there has been little educational media research conducted for at least the past ten years and there are serious questions about the usefulness of the research that was conducted from 1958 to 1968. It appears that much of what has passed for media research in the past 20 years has, in fact, been local evaluations of media programs that do not generalize beyond the use of a certain program in a specific setting or a large number of so-called experiments that contained methodological errors sufficiently serious to question results. In other words, the systematic, carefully planned and conducted media research project has been a rare event. (p. 99)

There is much that could be said to support Clark's view; however, there is also much that can be learned from looking at the studies conducted during the past six decades.

Comparative Media Studies

As each new medium—films, radio, television, programed instruction, computers—has been introduced into the classroom, the natural question is "Can students learn from this medium?" and if so, "Can they learn *better* from it than from some other medium?" As a result, the most common type of media research has been the study that compares a specific medium of instruction against one or more other media– most often "conventional" instruction.

The most common problem with research that purports to examine the effectiveness of instructional media is that the results are not consistent from one study to the next. At one point there is significant evidence for the use of media, then for conventional instruction, but most often the result has been no significant difference. For example, Hartley (1966) examined 112 studies that compared programed instruction with conventional instruction and found that on measures of achievement 41 showed programed instruction significantly superior, 6 showed programed instruction significantly worse, and 37 showed no significant difference between the two treatments.

Part of the problem can be explained by problems in the research design (Lumsdaine, 1963; Greenhill, 1967). When Hartley applied minimal acceptance criteria to the studies that he was considering, he was left with only 8 acceptable studies. In a similar way, Stickell (1963) examined 250 experiments that compared television to conventional instruction. When he applied criteria to determine if the research could be interpreted—(a) experimental and control groups of at least 25 subjects, (b) that had been randomly assigned from the same population, (c) were taught by the same instructor, (d) measured by a testing instrument judged to be reliable and valid, and (e) evaluated by acceptable statistical procedures—he was left with only 10 studies that met the full standards and 23 studies that were acceptable with minor problems. All 10 of the interpretable studies showed no significant difference. Among the acceptable studies, 3 favored television and none favored conventional instruction.

Moldstad (1974) states that a number of problems relating to current media research exist—the need for better designs, more insightful questions, more adequate sampling, and better integration of technology into instructional programs—but that "many educational decisions must be

made by administrators and school board members on information that might be considered somewhat incomplete by educational researchers" (p. 404). Generalizing from a number of studies, he concluded that when instructional technology is carefully selected and used:

1. Significantly greater learning often results when media are integrated into the traditional instructional program.

2. Equal amounts of learning are often accomplished in significantly less time using instructional technology.

3. Multimedia instructional programs based upon a "systems approach" frequently facilitate student learning more effectively than traditional instruction.

4. Multimedia and/or audiotutorial instructional programs are usually preferred by students when compared with traditional instruction. (p. 390)

In 1973, Schramm reviewed the media research literature in order to examine the contention of Gagné (1967) that "the required conditions of learning can be put into effect. . .by each medium" (p. 28). Schramm (1973) concluded that. . .

> Motivated students learn from any medium if it is competently used and adapted to their needs. Within its physical limits, any medium can perform any educational task. Whether a student learns more from one medium than from another is at least as likely to depend on *how* the medium is used as on *what* medium is used. (p. iv)

These contentions can be supported by a quick examination of just a few of the media research studies that *do* show a significant difference

Research on Motion Pictures

In one of the few studies that shows the advantages of films in aiding students to apply conceptual understanding to new problem situations, Rulon (1933) used specially designed films in a comparison of text-plus-film to text-only instruction in science. On factual items, the text-plus-

film group scored 14.8% better on the initial test and 33.4% better on a recall test. On items that measured application, the experimental group scored 24.1% and 41% better than the text-only group.

Nelson (1952) experimented with the use of films to teach a specific unit on sulfur. Two sections were taught with a combination of lecture and discussion plus film. Eight sections were taught with lecture and discussion only. On the comprehensive examination at the end of the unit, the plus film groups performed significantly better than the control groups. The experimental groups also did significantly better on a retention test given five weeks after the unit.

In a study focused on tenth grade history, Wendt and Butts (1960) assigned 315 students from seven schools to one of two different treatments. The control was a traditional two-semester course. The experimental treatment consisted of a one-semester course plus 54 carefully selected history films. The experimental group learned 86% as much history as the control group, in half the time, as measured by mean scores on the Midwest High School Achievement Examination, Form A for World History. In another study that examined learning efficiency from films, Stein (1959) found that students who had access to film loops learned to type significantly faster than students who did not have access to film loops.

One study that looks at attributes of film (Craig, 1956) can be used as evidence in support of adapting materials to local school needs. The sample consisted of 124 students, aged 9 through 15, compared with 136 students that were matched on a common entrance examination. The first group had sound films on a variety of informational subjects. The second group saw the visual track of the films, but heard commentary by their own classroom teachers. The group that saw the silent film with the local commentary performed significantly better than the sound film group on a posttest.

The vast majority of studies seeking to evaluate the effectiveness of motion pictures have shown conflicting results. Carpenter and Greenhill (1955), however, in summarizing the results of film research for the Navy, were able to reach the following conclusions: (1) well-produced films, used either singly or in a series, can be employed as the sole means of teaching some types of performance skills and conveying some kinds of factual data, (2) postviewing tests will increase learning when students

have been told what to look for in the film and that a test on the film content would be given; (3) students will learn more if they are given study guides for each film used, (4) note-taking by students during the showing of a film should be discouraged because it distracts from the film itself; (5) successive showings of a given film can increase learning; (6) short films can be spliced end-to-end in a loop and are beneficial in practice or drill situations, (7) students can watch motion pictures for one hour without reduction in training effectiveness, (8) the effectiveness of film learning should be evaluated by tests, (9) after a film has been shown, its major points should be summarized and discussed least students form misconceptions, and (10) follow-up activities should be encouraged to provide carryover of generalizations.

Research on Television

Almstead and Graf (1960) reported on tenth grade students taught geometry solely by television and fourth and sixth grade students taught reading by television with access to a talkback unit when needed. Eighty-five percent of the tenth graders passed the New York Regents Examination—30% with scores over 90. This record compared favorably with classroom students. The fourth and sixth graders gained an average of ten months on a standardized test in nine months of study.

The Anaheim School Board (1963) has reported a series of studies dealing with 1,157 fifth graders over a nine-month period and 1,016 fourth graders over a 26-month period. They found that. (1) of 48 comparisons on the Califomia Achievement Tests of pre and post television achievement on basic skills, 32 comparisons favored the television groups, no comparisons favored the non-television groups, and the television groups showed an overall mean advantage of four months over other groups, (2) of 23 comparisons between television plus regular instruction and regular instruction in conventional classrooms, 11 favored television enriched, at the .05 level of confidence, while none favored regular instruction, and (3) of 14 comparisons of large groups (75 students) plus television with small groups (25 or less) without television, 7 favored television in large classrooms, and two favored small classes without television.

One of the first school systems to integrate television fully into the total instructional program was Hagerstown, Maryland. Wade (1967) summa-

rized the significant gains from the experience: (1) In grades three through six, rural students, who were averaging half a grade below the national norm in arithmetic (on the Iowa Test of Basic Skills) before television, all came to exceed the norm: grades 3 and 4, after one year of television, the others after two years. In grade 5 arithmetic, the pupils gained an average of 1.9 years in knowledge of arithmetic concepts in one school year. (2) In junior-high general mathematics, the average achievement level of urban students, on a standardized test of concepts, rose in four years of televised instruction from the 31st percentile to the 84th percentile, and on a standardized test of problem solving from the 33rd to the 68th percentile. Rural schools on the same tests rose from the 14th to the 38th percentile on concepts but made very slight overall gains in problem solving. (3) In tenth grade mathematics, urban schools rose from the 34th percentile before television to the 51st percentile after television. (4) Analysis of sixth grade science achievement showed television students improving more than conventionally taught students at all ability levels. (5) In both city and rural Hagerstown schools, grade 8 general science achievement on standardized tests was two years higher after several years of television than it had been before television was introduced into the system. (6) When television was introduced as an additional resource in the teaching of U.S. History in outlying Hagerstown schools, the percentile ranks on national norms increased from 28 in 1958 before television, to 45 in 1959, 46 in 1960, and 50 in 1961.

Questions can be raised about the results of the Hagerstown experiments. Were the reported results due to the effects of television or were they due to the systematic curriculum and instructional design and development that the integration of television into the system required? One of the most recent examples of systematic design and development of instructional television has been *Sesame Street*. Ball and Bogatz (1970) have reported the results of learning measures from *Sesame Street* based on a large sample of young children in four U.S. geographical areas. They found that the more that children watched the program, the more they learned of what it was intended to teach—letters, numbers, forms, sorting, classification, etc.

Chu and Schramm (1967) in their major study, *Learning from Television*, make the following observation concerning the results of research on instructional television:

There can no longer be any doubt that children and adults learn a great amount from instructional television, just as they do from any other experience that can be made to seem relevant to them—experiences as different as watching someone rotate a hula hoop or reading the encyclopedia. The effectiveness of television has now been demonstrated in well over 100 experiments, and several hundred separate comparisons, performed in many parts of the world, in developing as well as industrialized countries, at every level from pre-school through adult education, and with a great variety of subject matter and method. (p. 1)

Research on Still Pictures

There has been a large number of research studies on the effectiveness of still pictures in instruction, in both their projected (slides, filmstrips, transparencies) and non-projected (photographs, study prints, charts) forms—particularly with the growth of interest in visual literacy (Levie, 1978). Some of the studies focus on aspects of the visual illustration (see for example, Dwyer, 1970), others look at presentation format (see for example, Popham, 1969). A few studies have demonstrated the effectiveness of projected visuals.

Kelly (1961) reported on the use of filmstrips to teach first grade reading in Michigan City, Indiana, public schools. He found that on the Gates Primary Reading Tests, the experimental group did significantly better in word recognition, at the .01 level of confidence, and sentence reading, at the .05 level of confidence.

In a comparison of lecture and discussion against lecture and discussion plus 200 transparencies over identical content in engineering descriptive geometry, Chance (1960) found: (1) the groups having the added use of the transparencies did significantly better on the mean final examination scores and final course grades, at the .05 level of confidence; (2) the three faculty members unanimously agreed on the desirability of using transparencies in their teaching: (3) use of the transparencies resulted in an average savings of 15 minutes per class period; and (4) students reported overwhelming preference for instruction using transparencies.

Brown (1977) has stated that the "research findings on the value of still pictures suggest the following implications for teaching:

- Pictures stimulate student interest.

- Properly selected and adapted, pictures help readers to understand and remember the content of accompanying verbal materials.

- Simple line drawings can often be more effective as information transmitters than either shaded drawings or real life photographs; full realism pictures that flood the viewer with too much visual information are less good as learning stimuli than simplified pictures or drawings.

- Color in still pictures usually poses a problem. Although colored pictures appear to interest students more than black-and-white ones, they may not always be the best choice for teaching or learning. One study suggests that if color is used, it should be realistic—not just color for its own sake. If only one color is to be added to an otherwise black-and-white picture, the teaching value may be reduced. But if what is to be taught actually involves color concepts, pictures in realistic color are preferred.

- When attempting to teach concepts involving motion, a single still picture (including those in filmstrips) is likely to be considerably less effective than motion picture footage of the same action. Yet a sequence of still pictures, such as might be shot with an automatic 35mm still camera, might reduce flooding brought about by the too-fast flow of live action portrayed in some motion pictures and thus improve the viewer's grasp of concepts involved.

- Verbal and/or symbolic cueing of still pictures through use of arrows or other marks can clarify—or possibly change—the message intended to be communicated by them. (p. 178–179)

Research on Audio Materials

Few current studies exist that are concerned with audio instructional media. As Allen (1974) states, "less is known about techniques for designing audio recordings to enhance learning than the other media. . . This fact is disturbing, especially because of the recent phenomenal growth of recorded instructional materials offerings, as evidenced by widespread

use of audiocassettes both as self-instructional materials and as sound accompaniments for filmstrips or printed materials" (p. 86).

Much of the existing research dates back to the early days of instructional radio (Woelfel & Tyler, 1945). The studies that have been conducted on tape recordings have largely resulted in no significant difference (see for example, Gibson, 1960; Popham, 1961). One area that has shown significant results is the teaching of foreign languages. Lorge (1963), reporting on a comprehensive, two-year study that involved ten schools and 17 classes in New York City, found that if language labs were used at least twice a week for a minimum of twenty minutes: (1) ninth graders using the language lab were significantly superior to non-lab students in French speech fluency; (2) tenth grade lab groups were significantly superior in both speech fluency and intonation; and (3) eleventh grade lab groups were significantly superior on French speech comprehension at both slow and fast speeds.

Research on Programed and Computer-Assisted Instruction

Goldbeck (1963) examined 150 high school government students who were in six different sections. One group of students learned from programed texts, a second group from regular classroom instruction, and a third from a combination of regular classroom instruction and programed texts. The third group performed significantly better than the other two groups.

The efficiency of programed instruction was demonstrated by Price (1963) in an experiment with 36 mentally retarded students. The students, who had an IQ range from 42 to 66, were taught the 12-factor table in addition and subtraction by means of two different programs and by conventional instruction. Although there was no significant difference on the posttest, the conventional group took 130 class periods to learn the material while the programed groups averaged 86 class periods.

In an experiment with normal students, Fincher and Fillmer (1965) taught the addition and substraction of fractions to 309 fifth grade arithmetic students. Those students who learned from programed textbooks were found to be superior to students who were taught by means of lecture/discussion, at the .05 level of confidence.

A variation of programed instruction that makes use of a computer rather than a textbook to present the material is referred to as computer-assisted instruction. In a study of computer-assisted instruction conducted by Atkinson (1968), first grade students were given 20 minutes of reading tutorial daily on a computer terminal. On nine of ten comparisons, on standardized posttest scores, the experimental groups were significantly better than the control groups.

Suppes and Morningstar (1972) have reported a number of studies on the effectiveness of computer-assisted instruction. In one study, a large sample of first through sixth grade students in Mississippi were given 10 minutes of arithmetic drill per day on a CAI terminal. On seven of seven comparisons, the experimental group was significantly favored over the control group. In another study, dealing with Russian language students, they demonstrated the effect of CAI on student attitude. The control group received five hours of instruction in written and spoken Russian per week. The experimental group received the same amount of instruction by means of a CAI terminal. Both groups made use of language laboratories and homework. Seventy-three percent of the CAI students finished the full year-long course, while only 32% of the control students lasted the full year. The average number of errors on quarterly exams was lower for the experimental group—significantly for one of the three exams.

Moldstad (1974), in summarizing the findings of three different surveys of programed instruction research, states that research on programed instruction confirms:

> (a) that student can learn effectively, often more effectively, from all types of programed materials, whether in the form of linear or branching programs, and from programs on machines or programs in texts, than from more conventional instructional stimuli; and (b) that frequently, students learn equal amounts in far less time. (p. 396)

Research on Multimedia Instruction

Louis Romano (1955) examined the effect of various projected media (both still and motion) on learning of fifth, sixth, and seventh grade science vocabulary. The control group received conventional instruction, which included the use of blackboards, charts, models, flat pictures, and field trips. The experimental group received the same instruction plus the use

of motion pictures, filmstrips, 2X2 and 3¼X4 slides, and opaque projection. The instruction consisted of six units dealing with electricity, rocks, astronomy, sound, air, and soil. The control and experimental conditions were rotated from unit to unit. Measures were 50-item vocabulary tests for each unit, based on textbooks, which were given as a posttest at the end of each unit and as a retention test after six months. Romano found: (1) that all experimental groups showed larger gains, from 26.2% to 63.9%, in vocabulary in all units, (2) that only two experimental groups, as compared to all of the control groups, showed a decrease in vocabulary on the retention test, and (3) that both teachers and students expressed the opinion that motion pictures and projected still pictures enhanced the learning experience.

Edwards, Williams, and Roderick (1968) have explored the use of multimedia in beginning typing and business machine operation courses. The control group was taught by means of traditional instruction. The experimental group was taught in an open lab consisting of programed materials, printed instruction sheets, continuous-loop sound films, tape/slide sets, and drill tapes. The experimental group learned significantly more, at the .05 level of confidence, on the end of term exams. Students generally preferred the experimental approach.

Schramm (1973) examined the literature dealing with the effect on instruction of adding one or more audiovisual or programed media, and found that "such research as there is on this question almost invariably indicates that the addition of one or more supplementary or complementary channels of instruction makes a difference" (p. 67). This conclusion contradicts the findings of Travers (1966; 1967) and others that there is little or no advantage to redundant materials in two channels, audio and visual, over a single-channel presentation. The assumptions and procedures of Travers have been criticized as being specific to redundant materials (Severin, 1967) and on other grounds (Conway, 1967). Fleming and Levie (1978) have suggested the following guidelines in regard to multiple channel presentations:

> Where an audiovisual presentation is too rapid, the perceiver must choose between the two channels. S/he will report separate strings of auditory information from one channel or visual information from the other channel. Only at slower rates can s/he interrelate information from both channels.

When information is received simultaneously from several sources, one source can degrade, accentuate, or bias other sources. There is an interaction.

Capacity appears to be larger where two modalities are utilized (audition and vision) rather than one. Two tasks involving the visual modality, for instance, will interfere more than where one involves the visual and one the auditory modality. (p. 60–61)

One must take into consideration whether the information being presented in the various channels is related or unrelated. As Severin (1967) suggests:

(a) Multi-channel communications which combine words with related or relevant illustrations will provide the greatest gain because of the summation of cues between channels.

(b) Multi-channel communications which combine words in two channels (words aurally and visually in print) will not result in significantly greater gain than single-channel communications since the added channel does not provide additional cues.

(c) Multi-channel communications which contain unrelated cues in two channels will cause interference between channels and result in less information gain than if one channel were presented alone.

(d) Single-channel communication will be superior to condition *c* (above), equal to condition *b*, and inferior to condition *a*. . . All of these predictions assume that testing for gain from the communications will be in the channel or channels of presentation. . . (p.243)

Residue of Comparative Media Studies

Schramm (1973) points out that students can learn from media, but. .

We cannot say that teaching by media is necessarily as effective as, or more effective than, conventional classroom teaching because it is almost impossible to measure all the outcomes of instruction. Most of the research studies measure achievement, defined in terms of criterion-

reference or standardized tests. A few measure some of the affective results, and a few others measure the time required to complete the work. But the total product of education is more than any of these; it is a changed person, with a set of values and abilities, a concept of culture and his place within it, and a living personality that governs his interactions with people and his internal life. No instructional research measures all that. However, there is ample reason for confidence that what instructional media can do, they can do well. This includes taking over the bulk of teaching in many subjects in the absence of direct teaching, supplementing classroom teaching with additional learning experience, providing directed and interactive practice, and in certain cases offering new opportunities to individualize learning and instruction. (p. 61)

Problem with Comparative Media Studies

Two major problems recur in media research studies: deficient experimental design and a lack of significant findings.

The problems of educational media research design have been discussed by a number of reviewers (Lumsdaine, 1963; Calomon & Clark, 1977). For example, Greenhill (1967) suggests that "the most common of these problems has been the use of nonrandom groups and the confounding (uncontrolled) mixing of variables. In addition, some studies used very short tests, and some studies provided no evidence of test reliability. This situation makes interpretation of results difficult indeed" (p. 16). The need to eliminate studies with design difficulties so that the research could be interpreted was the basis for the criteria applied by Strickell (1963) and Hartley (1966) to their classifications of media research, which were mentioned earlier in this paper.

In commenting on the second characteristic of media research, the lack of significant findings, Greenhill (1967) states that. . .

> It is interesting to speculate on the reasons for the failure to find large and significant differences. Some people have suggested that the measuring instruments are not sharp enough to detect differences which may exist; others suggest that the use of predominantly verbal tests with

visual media is the reason. Another hypothesis is that many studies have dealt with comparisons of complexes of variables which tend to cancel each other, while still other experiments were concerned only with single variables which in many cases are not sufficiently potent to produce significant differences in learning.

Another hypothesis is that the "law of compensatory effort" is operating in many learning situations. This law asserts that students have certain levels of aspiration and that they strive for a particular grade. If the instruction is improved in a course which is the subject of an experiment, many students will put less effort into that course and will work harder in other courses which are not being taught as well and where more effort is needed to achieve the desired grade. (p. 16)

A more likely cause might be problems of definition, as suggested by Levie and Dickie (1973):

Consider the question, "Are motion pictures more effective than textbooks?" One matter that must be considered before the question can be approached is, "What is a motion picture?" Clearly the things called "motion pictures" are not all of one sort They may or may not employ high-speed or time-lapse photography or they may not depict motion at all. Motion pictures are usually regarded as being fixed-pace and fixed-sequence presentations, but even these characteristics are only artifacts of traditional utilizations and standard projection equipment. Thus, for research purposes, the concept "motion picture" is far too inexact to be useful as an experimental construct. (p. 860)

Imprecise definition of terms often leads to imprecise, or contradictory, results.

Others, such as Knowlton (1964), Mielke (1968), and Salomon and Clark (1977), have argued that the original question was invalid, leading automatically to uninterpretable results, if results were obtained at all.

Methodologically, a comparison between two media calls for a well-controlled experiment in which all variables, except a media variable, are held constant. The content, mode of presentation, structure, didactics, situation, and the like need to be equalized between the experimental conditions. In the typical ITV vs. face-to-face comparison, the design would be as follows: A teacher presents the material in the face-

to-face condition (no interaction with students is permitted in order to avoid a new variable from entering), and another group of learners watches the *same* presentation on a TV monitor. Conditions, indeed, are equal, and only the medium of presentation is allowed to vary.

However, as Mielke (1968) has shown, if *all* other variables have been controlled for, what was left to vary? What, then, was the independent variable whose effects were studied? All that remained to vary in such a study was the *delivery device*, since, indeed, other things *were* equal. "The only reasonable conclusion [of such a study] would be that the mediation, and the mediation alone, caused the significant differences in [say] achievement" (Mielkie, 1968, p. 6)

But such differences were rarely found. An if found, how could they be interpreted? The answer is offered by Gordon (1969):

> Most research in this area has been designed merely to measure the influence of technology (not mediums) upon academic grades, rather than determine the real difference between the mediums themselves. That these experiments have shown that the *same kind of teaching* operates more or less the same way with and without technological aid . . . might have been anticipated before experimentation began. (p. 118)

In short, when only the least significant aspects of instruction are allowed to vary, nothing of interest could, and did, result. (Salomon & Clark, 1977, p. 101–102)

The finding of no significant difference is not necessarily a problem. Greenhill (1967) points out that. . .

> Although a finding of no significant difference does not prove that no differences exist, there is a practical value in such results in that consistent findings of nonsignificant differences in learning from different instructional methods give educational administrators some confidence that several alternative methods of instruction are available for use, and allows them to choose which one should be used in a specific situation on the basis of considerations other than relative instructional merits. (p. 4)

Economic Evaluation of Educational Media

A number of authors (Scanlon & Weinberger, 1973; Jamison, et al, 1978) have made use of the no significant difference findings in comparative media studies to suggest that technology might be a means of improving the productivity of education. As Jamison (1977) states:

> The key to productivity improvement in every economic sector has been through the augmentation of human efforts by technology, and we see no reason to expect a different pattern in education. We use the term *augmentation* deliberately here to set aside the notion of technology's replacing teachers; the purpose of the technology must be to make teachers more productive, not to replace them completely. The problem is not that of replacing teachers but of *successfully* using the technology to improve productivity. The overwhelming majority of the efforts devoted to developing educational technology have been directed toward improving quality with little regard for cost. We have learned much from these efforts, primarily in ITV and CAI, and now have a background of experience, program material, and evaluation that is quite substantial. Yet there has been widespread disillusionment with where educational technology is today that results, by and large, from the pattern of no significant difference findings. . . Furthermore, because technology has been primarily an add-on input to enrich the individual student's experience, there are few, if any, examples one can point to where it has improved system productivity. . . Technology has not yet proved that it can play an important role in American schools. (p. 57–58)

A number of cost studies dealing with the use of media in public schools have been conducted. These fall into three main categories—descriptive, predictive, and comparative (Wilkinson, 1973). Comparative studies are often referred to as cost-effectiveness or cost-benefit studies. The central purpose of a cost-effectiveness study is the evaluation of, and choice between, alternative means to achieve a given objective. The analysis can proceed from either of two orientations—the achievement of the most output for a set dollar cost, or the achievement of the least dollar cost for a set level of output. No matter which of these approaches is employed, there are certain fundamental operations that need to be carried out in the

study: (a) determination of objectives, (b) determination of feasible alternatives, (c) determination of relevant costs, and (d) presentation and interpretation of results.

Examples of media cost studies include a study by Carter and Walker (1969), which predicted and compared the cost of the wide-spread adoption of ITV and CAI by public schools; a General Learning Corporation (1968) study for the Department of Health, Education, and Welfare, which sought to compare a number of different media strategies under different conditions; and Kiesling's (1979) recent study of the University of Mid America.

One of the major problems with the economic comparison of media systems is the same problem of definition alluded to by Levie and Dickie (1973) in regard to the more traditional comparative media studies. As Wilkinson (1976) pointed out in regard to the use of CAI in special education:

> The need for a clearly defined CAI configuration is even more important when it comes to determining the alternatives against which it is to be compared. The comparison is to be with "viable" alternatives. What are viable alternatives to CAI? This would be determined by both the objectives and the constraints under which the project is operating. If the program is primarily one of rote drill and practice, an altemative could be a linear programed text or a simple workbook. And, given the almost constant research results of no significant difference, CAI would probably be a poor choice from a cost-effectiveness point of view. However, if the constraints called for taking advantage of the flexibility, memory capacity, and fast response capabilities of the computer in order to produce "infinitely" branching programs to provide individually shaped, corrected/reinforced programs which take into consideration the needs, knowledge, prejudices, etc., of each learner, clearly alternatives other than workbooks need to be considered. Traditional instruction—the self-contained classroom of one teacher, 20–35 students, and various textbooks, aids, etc.—does not provide this sort of flexibility and, therefore, should not be one of the altematives considered (in spite of the fact that this is the most commonly evaluated alternative to CAI in existing studies). Possibly a tutor, working on a one-to-one basis (provided that this tutor has the same grasp of the subject field and the various ways in which it can be misunderstood and mastered as the team of design and subject field specialists who developed the CAI program) would be able to provide such an alternative.

> Another possible alternative would be a paper and pencil (or other media), test, teach, and retest approach such as in Individually Prescribed Instruction programs. (p. 84–85)

The approach to defining alternative media for cost-effectiveness studies is based on an analysis of the attributes or characteristics of the media to be compared. Such attributes are a major theme of recent media research.

Research on Media Attributes

The inadequacies of comparative media studies have led to a new approach to media research. Levie and Dickie (1973) have suggested that "understanding media may be furthered by (a) specifying media in terms of attributes, (b) defining these attributes in terms which relate to the ways in which information is processed internally, and (c) discovering relationships between these attributes and other important instructional variables" (p. 877). Much of the research in this area is tentative and of interest primarily to other researchers or to media designers; it will not be reviewed in this paper beyond the aspects that have already been discussed. Those who wish to explore this area are referred to the reviews of Lumsdaine (1963), Levie and Dickie (1973), and Fleming and Levie (1978). A few points, however, need to be raised.

Schramm (1973) has stated that "there is almost a complete lack of studies intended to ascertain *under what conditions* and *for what purposes* one medium may be superior to another" (p. 62). One approach to this problem has been proposed by Allen (1967) when he attempted to define the appropriateness of various instructional media to different types of learning tasks.

Another aspect of the interaction problem is individual student differences. The effects of such individual differences are most often felt through teaching strategy, rather than through the medium that conveys that strategy. For example, some studies indicate that students with low IQs will learn more effectively from programed instruction if the program requires active response from the student (McNeill, 1962); that students with high anxiety learn significantly better when given immediate feedback

on the correctness of their responses (Campeau, 1965); and, that although high-ability students learn equally well from two different versions of a multi-media presentation, low-ability students perform significantly better when given a presentation based on their specific abilities (Monahan, 1966).

The identification of interactions among student, task, and media attributes is characteristic of some of the earliest (Freeman, 1924) and some of the best (Carpenter & Greenhill, 1956) research on educational media. The new interest in this type of research will in some ways restrict the sorts of generalizations that can be drawn from the research (Salomon & Clark, 1977). Researchers will not be able to continue to search for the "best" medium. Rather, they will need to focus on more limited types of generalizations of the kind formulated by Allen (1975) as a result of his extensive study of the research literature on media and intellectual abilities.

Interaction studies also call for large numbers of subjects and task levels for generalizations of any kind to be developed. A study by Allen and Weintraub (1968) is an example of this. In the study. . .

> three types of learning tasks were studied, and 582 learners, differing in age, sex, ability, and specific knowledge, were tested. The researchers reached the conclusion that motion in films facilitates learning more than still pictures. This generalization appears to be warranted since this was the case *regardless* of learner or task differences. More often, interactions are found with either learners, tasks, or both, demonstrating that generalizations on the basis of restricted samples of learners or tasks are unwarranted. (Salomon & Snow, 1977, p. 105)

Another common research problem is that too often researchers fail to consider the importance of their findings to subsequent practice. For example, Sego (1974), in a study of different types of programed instruction materials, found a significant aptitude treatment interaction between students' level of cognitive style and types of materials. However, analysis of the interaction indicated that only two percent of the population would benefit from the use of different forms. His conclusions suggested interesting and potentially significantly useful theoretical relationships, but the improvement in learning from the development and use of different forms of similar materials could not be justified economically.

Research on School Media Centers

A review of the research literature on the organization, services, and management of school media centers is complicated by the recent development of the unified media program, which combines all print and nonprint media within a single operational unit (AASL, 1969; 1975), under the influence of such professional organizations as the American Library Association and the Association for Educational Communications and Technology, and funding programs under the National Defense Education Act and the Elementary and Secondary Education Act. Previously, nonprint materials had developed within the schools under audiovisual programs, separate from the school library, which was responsible for all nontext, print materials. Thus, these two areas represent two different research strains which have not yet been fully integrated.

Other educational research areas are also of interest in the planning and management of school media programs. For example, Gaver (1969) points out that . . .

> The research that is focused on the school environment frequently has as much, if not more, significance for school libraries as the research focused on school libraries *per se*. Some examples from the past few years would certainly include the following: John Flanagan's [1962] identification, in his five-year study "Project Talent," of the quantitative provision for high school libraries as one of five determinants of a quality education for American youth; Merle E. Landerholm's [1960] analysis of the characteristics of quality education, in which he found the highest correlation between a quality criterion and the provision of specialists per thousand students to be with the provision of the school librarian, while guidance specialists ranked fourth and reading specialists sixth; and the Harvard study of *Reading in the Elementary School* [Austin & Morrison, 1963], which analyzed the teaching of reading in more than one thousand elementary schools in the United States and cited high among its forty-five recommendations a centralized library with a full-time teacher-librarian and provisions meeting with the ALA standards. (p. 764)

Unfortunately, space limitations will not allow for an adequate exploration of the research from outside the area of school media programs that might provide additional support for program standards.

Nelson Associates (1967), in their report to the National Advisory Commission on Libraries, identified the lack of research as one of the ten major problems facing school libraries. Other major problems were the absence of libraries in many schools, the gap between standards and current resources, the need to implement rapidly new materials and techniques, difficulties in establishing rural and inner-city library programs, high capital costs of facilities, staffing needs, copyright, inadequate statistics, and the need for centralized processing and district materials centers.

In order to determine the research needed by school librarians, Woodworth (1967) conducted a survey of school library leaders and found that the items of greatest concern were (a) the contributions of the library to the teaching/learning process, (b) teacher education and the library, (c) attitudes of the school staff, (d) evaluation of libraries, (e) personnel studies, and (f) the education of school librarians. A number of these items (for example, the contributions of the library to the teaching/learning process and the evaluation of libraries) are, or should be, of major concern in the development of standards for public schools and will be dealt with in separate sections of this paper.

Despite the perceived need for additional research on school media programs, many studies have been conducted and a number of major research reviews have been produced. Lowrie (1968) reviewed the school library research from the end of World War II to the mid 1960s. This review was brought up to 1971 by Aaron (1972a; 1972b) and continued by Barron (1977) for the period of 1972–1976. Other reviewers have focused on such topics as performance measures and evaluation (Daniel, 1976) and practical applications of research findings (Gaver, 1969). Research dealing with the organization and development of school audiovisual programs was being reviewed on a regular basis in *Review of Educational Research* (Bristow & Simon, 1956; Brown & Moldstad, 1962; Torkelson & Driscoll, 1968). However, changes in the editorial policies of the *Review* have led to the discontinuation of this service.

The major reason for the dissatisfaction with media center research has been the limited nature of the research that has been conducted. Lowrie (1968), in reviewing the research on school media programs, pointed out that "these studies are almost without question designed to show growth patterns or trends or to present the current status in a specific locale" (p.

52). There are, however, some studies of this type that can give direction to the planning of school media programs.

Descriptive Research on School Media Centers

A number of studies have attempted to provide a foundation for the evaluation and comparison of school media programs. Although many of these have been at the individual state or local level (for example, Loertscher and Land's [1975] survey of media services in Indiana elementary schools), a few studies have had national significance. The National Center for Educational Statistics has developed standard terminology for educational technology (National Center, 1975) and has begun the development of a national data base dealing with school libraries and media centers (National Center, 1977). The American Association of School Librarians has sponsored a survey of school instructional materials centers (Lohrer, 1970) which has had an impact on the development of both media program standards and guidelines for the training of media specialists.

An extensive review of the descriptive research literature that has addressed aspects of the problems and questions identified by Nelson Associates and by Woodworth is not possible within the limits of this paper. Lowrie (1968) summarizes the research as follows:

> From the group of doctoral studies presented, it may be concluded first that the majority are survey studies, often of local significance; second, that there are a few studies which present hypothesis followed by a controlled experiment, with devices for measuring which substantiate or disprove the hypothesis; and third, that more experiments need to be conducted which will develop a body of knowledge which may be used in solving future problems in the expansion of school librarianship. Almost all the studies draw the following conclusions, and thus fundamentally substantiate facts known: (a) collections assembled or selected by persons not qualified in book selection are inadequate; (b) better direction by local, regional and state consultants or supervisors is needed; (c) educational institutions should make a greater effort to coordinate the efforts of teachers and administrators and to improve

> their understanding of their role in relationship to the school library and utilization of its materials; (d) national standards now play a significant role in the development of criteria for most status studies; (e) in-service training programs for teachers should be developed in some form in all libraries or materials centers, since the role of the classroom teacher is crucial in promoting and expanding library services; and (f) lack of adequate personnel and insufficent funds are continuing hindrances to developing services. (p. 60)

These general conclusions were also found by Aaron (1972a) in her review of the literature from the period 1967–71, with the following exception:

> Two additional conclusions not reached by Lowrie are evident in a large number of the studies. . . These are the increasing acceptance of the IMC concept by educators in general, and the great impact made on school libraries by federal funds. (p. 44)

These conclusions, of Lowrie and Aaron, are also endorsed by Barron (1977).

Experimental Research on School Media Centers

The primary area of concern identified by Woodworth (1967) was for research that established the contribution of the library to the school program. This area shows the fewest studies in the literature. In her review of the school librarianship research covering the period of World War II to the mid 1960s, Lowrie (1968) found only one doctoral study, out of 50, that could be classified as a controlled research study. Only six of the over 100 studies cited by Barron (1977) attempted to measure the influence of the school media program on any other aspect of the school's program or on student achievement. Reviewers in the audiovisual field (Bristow & Simon, 1956) have noted the same problem.

A few studies do look at the effect of media programs. For example, Jenson (1970) found that media centers could influence teaching practice by supplying resources and services that helped to meet the individual needs of students. Yarling (1968) found that establishment of a centralized

library led to significant student improvement in reading expression and library skills as compared to students in a control school. Greve (1974) used the Iowa Tests of Educational Development and an index of library service levels to determine if there were relationships between the academic achievement of high school seniors and the library services offered in their schools. Based on a sample of 232 high schools in Iowa, he found a direct, positive correlation between the two variables.

In a major study, which Lowrie (1968) cites as significant both for its direct influence and as a pattern for further research which makes use of good statistical analysis, Gaver (1963) found that by most measures of effectiveness—such as amount of reading, quality of collections, and educational gain between the fourth and sixth grades—the elementary school library was favored over other provisions for providing materials to students and teachers. She concluded that "definite advantages accrue in schools that have school libraries manned by professional library staff" (p. 127). Other studies that show the effect of a full-time media specialist in the school will be discussed in the section dealing with staffing studies.

In one of the few controlled research experiments reported in the literature, Barrileaux (1965) compared the effects of instruction employing different combinations of library resources and textbooks on the achievement in science, critical thinking, science attitudes, writing in science, and library utilization of eighth and ninth grade students. Fifty-six eighth grade students were divided into two instructional groups, which were matched in mental ability and attitudes toward science. A single instructor, working from a prepared content outline, taught both groups. The control group was issued a textbook. The experimental group employed a variety of different reading and reference materials. Both groups were encouraged to use additional library materials. The study was continued for a second year with forty-two of the subjects who were enrolled in the ninth grade. Measures employed were the Iowa Test of Educational Development (ITED), the Sequential Tests of Educational Progress (STEP), the Watson-Glaser Critical Thinking Appraisal, and the Test on Understanding Science, as well as evaluation of writing on science problems and observational measures of library utilization. The findings of the study were:

(1) Science achievement, as measured on Test 2 (Background in Natural Sciences) and test 6 (Ability to Interpret Reading Materials in the Natural Sciences) of the ITED, there was, on the average, no differ-

ence between the groups. Within the experimental (nontext) group, however, students with high ability (on Test 2) and students with average ability (on Test 6) achieved significantly higher mean scores than the control group students after two years. On the STEP science test, the experimental group was statistically superior in overall effectiveness to the control group.

(2) Critical thinking: as measured on the Watson-Glaser test, the experimental group showed superior achievement, but not at a significant level.

(3) Science attitudes: the experimental group achieved significantly higher scores than the control group at the end of each of the two years of the experiment.

(4) Writing in science: evaluation of writing on science problems during the second year of the study showed that the experimental group had significantly higher mean scores than the control group. Analysis of interactions revealed that average ability students profited more from the experimental approach.

(5) Library utilization: the experimental group scored significantly higher than the control group on such measures of library use as total number of library visits, time devoted to science related library activities, and time devoted to all library activities. They also averaged higher on frequency of students pursuing unassigned related interest areas, free reading, locating and using materials, and checking out of materials.

A general conclusion from the study might be that the use of a wide variety of materials leads not only to increased skills in the use of the materials but to increased achievement in academic areas.

The limited number of controlled research studies that focus on the total effect of the media program is not surprising. Media programs are multifaceted, interacting entities, which affect and are affected in turn by all other aspects of the school program. In situations of this type, it is possible that the only effective research strategies might be surveys and questionnaires with, at best, correlational measures. Examples of this type of study can be found in the area of media personnel.

Media Staffing Studies

The growing interest in the application of educational media and technology to all aspects of education during the twenty years following World War II led to an awareness of the need to analyze the functions of professionals engaged in such operations, for the purposes of training program development and the design of certification guidelines. The period from 1961 to 1971 saw at least 18 major studies of staffing needs in the area of media and an equally large number of official statements by professional organizations (Brown, 1971). A number of these studies are of interest because they focus on specific aspects of the media profession such as Godfrey's (1967) study of the audiovisual coordinator and Clark and Hopkins' (1969) study of the emerging instructional development role—or because they develop methodology which was to be employed in subsequent studies—such as Martin and Stone's (1965) use of functional job analysis and critical incidents techniques in the first objective study of media staffing utilization and requirements.

Of the various media staffing studies, three are of primary significance—both because of the importance of the sponsoring agencies and because of their subsequent influence on the certification guidelines of such professional organizations as the American Association of School Librarians (AASL, 1976) and the Association for Educational Communications and Technology (Galey & Grady, 1977). These major projects are the Jobs in Instructional Media Study (JIMS), conducted by AECT under a grant from the U.S. Office of Education (Wallington, 1969); the Media Guidelines Project (Hamreus, 1970), conducted for the Leadership Training Institute of the Media Specialist Program of the U.S. Office of Education; and the School Library Manpower Project (Case & Lowrey, 1973), conducted by AASL under a grant from the Knapp Foundation.

The three studies have several things in common. They each sought to (a) objectively catalog specific tasks that are, or should be, performed by educational media personnel, (b) analyze the nature of these tasks, (c) to classify them as to the appropriate level of personnel, such as professional or clerical, for performing the task, (d) group tasks into job clusters, and (e) recommend training levels for each job cluster.

All three of the studies identified a large population of potential tasks that should be performed by the school media specialist. The School Li-

brary Manpower Project, for example, identified approximately 700 individual tasks that could be performed. These tasks were grouped under 74 functions, which were further grouped into the seven major areas of (a) human behavior, (b) learning and learning environment, (c) planning and evaluation, (d) management, (e) media, (f) research, and (g) professionalism. When developed into certification guidelines by AASL (1976), these tasks were consolidated into 52 skill statements, arranged into seven areas of competency: (a) relation of media to instructional systems, (b) administration of media programs, (c) selection of media, (d) utilization of media, (e) production of media, (f) research and evaluation, and (g) leadership and professionalism.

A few research studies have been conducted to determine if the presence of certified personnel has any major effect on the school media program and on the learning of students. A study by McCusker (1963) determined that elementary schools that do not have school libraries with professionally trained personnel do not have materials collections adequate to meet the needs of either the instructional program or the students. More recently, Wright and Grossman (1977), attempting to determine the effect of having a full-time elementary school librarian, found that students in such schools showed increases in basic skills, library skills, and achievement over students in schools without full-time librarians. Hodson (1978) found that educationally disadvantaged students expressed negative feelings about the part-time status of librarians, highlighting a need for full-time professionals in schools having disadvantaged students.

In spite of the number of existing studies, there is a need for studies that examine the effect of the new type of media specialist who is being trained as a result of the new certification guidelines. Do such professionals really make a difference in the schools?

National Standards for Media Programs

One outgrowth from the descriptive and staffing studies has been the development of joint standards for school media programs by AASL and AECT. Work on standards for school media was begun independently by the American Association of School Librarians (1960) and the Association

for Educational Communications and Technology (Hyer, 1961), then the Department of Audiovisual Instruction of NEA. The AASL standards were based on expert judgment, survey data and questionnaires sent to schools that had been identified as having very good library facilities.

The two associations came together to work on the joint standards, which were initially published in 1969 and then expanded and revised in 1975. The 1969 standards had a major effect on school media programs. As Daniel (1976) states, they. . .

> were the first to combine standards for school libraries with standards for audiovisual services in a unified media center program. . . A major contribution of this document was its movement to standardize terminology. The terms "media specialist" and "media center" were used throughout the work in an attempt to shift from the bookish connotation of "librarian" and "library." . . .[In the 1969 standards] there is a too heavy emphasis on the quantitative aspects of equipment and material necessary to create a media program. Still, as a first attempt at coordination by the two major professional associations dealing with learning resources in schools. . . it was successful.
>
> These two associations continued to collaborate to produce in the 1975 publication a smoothly coordinated document that provides the working school librarian with well-stated, integrated guidelines for creating a strong media program. An interesting feature of this new publication is the rejection of the term "standards" in favor of "guidelines" or "criteria." This action seems to reflect the general social movement away from rigid, prescriptive requirements to a more flexible, democratic approach based on choices.
>
> *Media Programs* focuses on qualitative goals, describing programs designed to respond to both district and school objectives. For each aspect of the total program, the document provides a definition, some guiding principles, and several criterion statements for programs on the district and on the school level. Quantitative statements follow and provide guidelines for the numbers and kinds of staff, collections, and facilities necessary to implement the programs. The guidelines recognize alternative choices that may better serve certain individual program needs. The work is impressive and every school librarian should become familiar with its provisions. It will be a powerful aid in articulating program requirements and in formulating goals and objectives. (p. 14–15)

Realizing that the national standards set goals to be strived for, rather than minimal criteria for all programs, a number of states have developed their own standards, often based on the joint AASL/AECT recommendations. Examples of such state standards include Maryland's *Criteria for Modern School Media Programs* (Maryland State Department of Education, 1971), Iowa's *Plan for Progress in the Media Center (Iowa Department of Public Education, 1969), and Pennsylvania's School Library Standards* (Pennsylvania Department of Education, 1972).

Planning and Evaluation of School Media Programs

The realization that an effective local media program must be planned to meet the needs of a specific location and curriculum and to remain effective must be constantly evaluated in terms of its goals and objectives, has lead to the development of a number of planning and evaluation tools (Daniel, 1976). Three of the most useful tools have been developed by the Association for Educational Communications and Technology (1976), Liesener (1976), and Loertscher and Stroud (1976).

AECT's publication *Evaluating Media Programs: District and School* is based on the joint AASL/AECT guidelines and on the assumption that "the purpose of evaluation is not to prove but to improve" (AECT, 1980, p. 1). The instrument allows the local school or system to adapt the recommendations of the joint standards and evaluates their progress toward meeting explicitly stated goals and objectives.

Liesener's (1976) *Systematic Process for Planning Media Programs* is a nine step—(a) definition of program output altematives, (b) survey of perceptions of current services, (c) determination of service preferences and priorities in relation to local needs, (d) assessment of resource and operational requirements of services, (e) determination of costs of preferred services and/or current services, (f) calculation of program capability, (g) communication of preferred services currently feasible to total client group, (h) reallocation of resources and implementation of changes in operations to provide the range and level of services selected, and (i) periodic evaluation of services offered and documentation of changing

needs—process that calls for a high degree of interaction between the media specialist and the client served by the media program.

The *Purdue Self-Evaluation System* (Loertscher & Stroud, 1967) is a computerized evaluation service that generates and analyzes evaluation instruments constructed from a large pool of items on the basis of local program objectives.

The widespread use of these evaluation and planning tools would go a long way toward improving the quality of local school media programs and toward the generation of a systematic data base of information on school media programs.

Needed Research on School Media Centers

A number of problems with the research on school media centers have been discussed or implied in this paper. In assessing the current status of research on the school media center, Stroud (1979) points out that. . .

> there remains an ongoing need for research studies that assess the learning that takes place, that attempt not only to identify services patrons view as desirable but to assess the outcomes or the benefits of those services, that measure the impact of the media center program on the students, the teachers, the community, and the curriculum. Studies are needed to identify those practices or activities that alter behavior patterns, that have the most influence, and that are the most effective.
>
> Research in the future must be conducted with the thought of producing measurable, positive, predictable, and reproductible results that may be used by professionals as justification for improvement and expansion of media center services. Evaluation research will also have to take into account the economics of change. Only those programs that can be proved cost-effective should count on continued support in a tight financial environment. (p. 278)

Conclusions From Media Research

It might be a temptation, at this point, to make a blanket indictment of the research on educational media. Countless studies have conducted ex-

haustive examinations of the wrong questions. Other studies have concentrated too much on status to the neglect of effect. There has been little research that seeks to relate the existence of a school media center directly to the academic achievement of students. Given the multifaceted nature of media and media centers and the difficulty of doing research on operating organizations, the lack of such research is not surprising.

In spite of the problems with existing research and the great number of studies needed to provide answers to specific questions, a number of general conclusions, which can provide guidance for the preparation of standards for public schools, can be drawn from the existing research. There is evidence to support the following propositions:

(1) When they are carefully selected and/or produced—taking into account both media attributes and student characteristics—and systematically integrated into the instructional program, educational media have a significant impact on student achievement and self image.

(2) Media are more effectively and efficiently used, and therefore have a greater impact on students, when teachers have received specific training in the utilization of media.

(3) Media are more effectively and efficiently used when the school provides an integrated media center based on the guidelines suggested by AECT and AASL.

(4) Media centers will have a greater impact on the use of media in instruction and on students when they are staffed by full-time, specifically trained media specialists.

(5) Media centers will have a greater impact when collections and services are based on and integrated into the curriculum and instructional program of the local school.

Media are the tools of teaching and learning. These tools must be available when and where they are needed to meet the needs of the teachers and students who must use them. In order to meet the needs of a varied curriculum and individual students, a wide variety and a large number of media are necessary. If the workman is not provided the tools necessary to do his job, he cannot be held accountable if the job is not completed properly.

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