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SELECTIVE REVIEW OF LITERATURE

2.1   Purpose and Scope of Review

2.1.1   Purpose

The purpose of this chapter is:

1   To review research studies in the light of the objectives of the thesis namely "development of a multi-media package for teaching a course" for achieving given learning requirements.

2   To show the limitations of these studies and point out how the literature on media research are more directly useful in terms of the present study.

2.1.2   Scope of the Review

In focussing the review of research relevant to the development of instructional materials, comparative effectiveness studies, utilisation studies, and basic studies were the categories of research judged to be of the most potential usefulness in helping to determine which media to choose for a given instructional package and how to use each medium in the package most effectively.

2.2   Development of media materials and comparative effectiveness studies

Only a few studies are available on the development of "multi-media
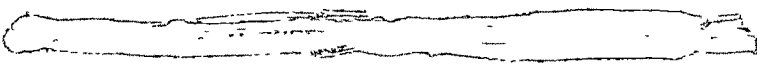
packages." Some studies compare the relative amounts of learning which result from instruction by a given medium as compared to instruction by conventional methods. Conventional media is referred to by the investigator to include traditional media such as textual materials and classroom presentation by the instructor (teacher). Comparative effectiveness studies pit one medium against another (e.g.) instructional film against instructional television; programmed learning material against instructional film; a combination of filmstrips or slides and sound against still pictures with or without captions, and so on.

2.3   Utilisation Studies

These studies go a step further by discovering how (not why) a given medium instructs best. Typically studies compare one method of using a medium against another method of using that medium to determine which utilisation produces the most learning (e.g., introduction by an instructor plus filmstrip versus instructional film plus classroom discussion).

2.4   Basic Studies

This label is used here to include analytical studies which seek to explore media and learner characteristics which may be related to achievement. For example what characteristics of the learner determine how effective instruction by a given medium will be for him? What behavioural process or learning conditions must be provided in order to learn a given instructional objective most effectively through a given medium? What particular

characteristics of a given medium render it most effective for achieving given ~~[illegible]~~ learning requirements? Most of the media reviewed here, with the exception of programmed learning materials, have not yet been subjected to much of this kind of analysis. Developmental studies on "multi-media packages" are negligible in our country.

2.5   Programmed Learning Materials

Ever since the introduction of programmed learning materials, also called programmed instructional materials into the educational scene, a large number of studies have been carried out in establishing their effectiveness and efficiency in achieving certain specified instructional objectives. Many studies have shown even contradictory results.

2.5.1   Comparative Effectiveness Studies

Feldhusen and his collaborators (1962) could not find any significant difference between programmed learning group and traditional group, but use of programmed materials, reduced the time for acquisition of skills to 14 weeks from a usual 12 months. Hughes and McNamara (1961) in their study with mechanical maintenance trainees found programmed instruction superior to the lecture method on both the post test and in time needed for completing the unit. Schramm (1964) found that out of 36 studies comparing programme with conventional instruction, half showed no significant differences, but 17 showed a significant difference in performance favouring

programme groups. Only one study showed a significant superiority for conventionally taught groups. Strong (1964) cites studies comparing programmed instruction with conventional instruction in a college statistics course using 128 college students (Smith, 1962); and a unit on use of the library (Wendt and Rust, 1962); no significant differences were found in these two studies.

Hartley (1966) comparing a number of programmed instruction and conventional instruction studies says that P.I. is superior to traditional methods of teaching. Hartley after reviewing 110 programmes, reported that 41 of the programmes were significantly more effective in terms of greater achievement and efficiency than traditional methods; 15 of the programmes found traditional teaching was more effective and 54 studies found no significant difference between them. In spite of large number of studies available in the literature, the studies have been limited to gross comparisons. Porter (1959) used a teaching machine to present programmed spelling to second-grade and sixth-grade children. Significant differences in achievement on standard tests favoured the programme groups at both levels. Evans, Glaser, and Homme (1960) used programmed materials to teach part of a course on music fundamentals, the programme group surpassed the control group by a significant difference.

Roe (1962) compared the performance of groups who learned elementary probability either from programmed text-books, teaching machines, programmed lectures, or conventional lectures-and-text books. Students who used the programmed materials in any form did significantly better on the final examination than those who were taught by the conventional

method. Furthermore there were no significant differences in learning achievement among the programme groups. Ripple (1963) taught university students principles of programmed instruction by one of four instructional methods; (a) programmed which supplied students with feedback as to the correctness of their written responses, (b) text book (this was the programme reproduced in text-book format -- no blanks to be filled in, (c) conventional lectures (based on reading the programmed material to students), or (d) programmed instruction which did not supply feedback. The two programme groups learned significantly more than the text book and lecture groups, with no significant difference between the programme treatments (feedback versus no feedback). Hughes and Reid (1975) reported that the classroom teacher did best by teaching the same topics covered by programmed text through conventional instruction.

2.5.2 Programmed instructional materials in India

Development of programmed instructional materials began around the year 1963 in our country. NCERT, Delhi started arranging workshop and training courses in this area and the Faculty of Education and Psychology of the M.S. UNIVERSITY of Baroda was the first to introduce the course on "Educational Technology and Programmed Learning" at the M.Ed., level in the year 1966. An Indian Association for Programmed Learning was formed in 1967. Since then, a good many programmes have been developed and tried out in various parts of India. Most of these programmes were developed by research scholars for a doctoral or a masters degree programme. Topics of these programmes varied from primary to college level. Most of the programmes developed can be categorised as under:

1   Programmed Approach vis-a-vis Traditional Approach to Teaching,

2   Different Forms of Programmed Learning Materials,

3   Different uses of Programmed Learning Materials,

4   Programmed Learning for different subjects,

5   Programmed Learning and Instructional Media, and

6   Programmed Learning and Individual Differences.

Shah (1969 a) conducted an intensive study, by using Programmed learning materials in teaching algebra to standard VIII students of schools in Gujarat. The findings revealed that the group taught through the P L M achieved higher on the post test than the group taught in the traditional way. Reddy (1975) compared the programmed learning with conventional learning in the instruction of language, and found that the teaching by P L M was definitely better than by conventional method. Shah (1964) found that P L M approach is effective, not only in terms of immediate and delayed achievement but also in terms of time to learn a particular topic. In her study she had three groups, one group taught through P L M only, another by traditional instruction only, and the third group was taught through programmed learning helped by a class room teacher. It was reported that the group taught through programmed learning with the teacher's help failed to do better. Shah's (1969 b) study established that auto instructional programmes are superior to the traditional methods of teaching.

Shah (1971) studied the effectiveness of four response modes using a programme on 'Additions and Subtraction of Directed Numbers'. The four response modes studied were (A) overt-answer not given, (B) overt-answer

given (response prompt), (C) covert-answer not given, and (D) covert-answer given (response prompt). The results revealed that the response mode (D) wherein the pupils had to read the answer already given in the blank, was the most effective as far as immediate scores were concerned. Response mode (B) was found to be superior in one school, when retention scores were analysed, whereas response mode (C) was found superior in another school. Response mode (D) seemed to consume the least time.

Kulkarni and Dewan (1967) applied principles of P L M to television lessons. The T V presentation of a question, followed by responding by the students and feedback enabled the students to score much higher. Sarkar (1969) found that P L M for industrial training at the Gujarat State Fertiliser Corporation was found to be quite effective. Kulkrni and Mullick (1967) found that correspondance lesson in Statistics in programmed format when compared with conventional way, was in favour of the programmed format. Krishnamurthy and Thiagarajan (1967) found that when the P L M technique was applied to teach a topic in family planning to health visitors, P L M technique was more fruitful and less time consuming. Sharma, M.M. (1968) and Kulkarni, (1968) reported that retention scores of the groups taught through P L M were better than those taught through the traditional approach.

Kulik and Jaksa (1977) reviewing nine studies that compared the effectiveness of programmed instruction and conventional teaching in college teaching, reported that, "In three of the nine courses, achievement was significantly higher in the programmed instruction groups, as indicated by final examinations performances." In the remaining six courses, there was no significant difference. Considering all the nine courses together, achieve-

ment was five percent higher in the courses taught by programmed instruction. Hough (1962) and Smith (1962) reported that there is a saving of time, when groups are taught via P I whereas in a study conducted by Himmel (1972), it was reported that the time taken by both the programmed group and conventional group were equal. It was reported by Desai (1966) that students preferred learning through P L M than traditional approach.

Hussain (1971) reported the effectiveness of linear and branching programmes in two situations - rural and urban, and under supervised and non-supervised situations - and reported that supervised linear programmes was superior to non-supervised programmes in the urban situation, while in the rural situation, supervised branching treatment was superior to all other treatments. Linear non-supervised treatment was significantly inferior to all other treatments in urban and rural situations. The report also indicates that linear programmes work well when given under the direct supervision of a teacher. Branching supervised and non-supervised treatments proved to be equally effective though the branching supervised treatment was slightly better than branching non-supervised treatment.

Sharma (1974) reviewing the research in programmed learning carried out at Meerut University, reports that about 35 programmes were developed in various subjects. Of these 2 were designed for primary classes, 16 for secondary classes and 7 for graduate level students and 10 for B.Ed. students. Yadav and Govinda (1974) provide a list of 16 programmes developed at the Centre for Advanced Study in Education at the Maharaja Sayajirao University of Baroda. These programmes were developed for primary and secondary school student population and often they covered only few individual units

and not a set of units covering the syllabus for a full course. Most of these programmes have been generally following linear programming style only with a few exceptions following branching style. Further these programmes were compared for its effectiveness with conventional teaching methods.

Krishnamurthy (1972) wrote a programme in Physics in seven forms including linear and branching styles, and found that there was no significant difference in the retention test given after six weeks. Bhushan (1973), developed a programme on "Educational Statistics" as a part of the B.Ed. programme in Educational Psychology. In that study he found that the mean of attainment scores on post-test was 76.8%. Govinda (1976) developed P L M for ja B.Ed. level course on "Educational Evaluation" at the M.S. University of Baroda and tried under real classroom situation of teaching and examination, to compare the effectiveness of the programme with structured lecture method. There was no significant difference between the achievement of students taught through P L M and those taught through the structured lecture method in respect of the four out of six units selected for the study. With regards to the remaining two units, the differences in achievement by students were in favour of programmed text.

Kuruvilla (1977) reported her findings after experimental study in the use of P L M in the classroom for VIII standard students to the effect that eighty percent of the students who had learned through four types of programmes - linear, overt, branching, skip and response prompt - scored eighty percent or above, and ,most of the students had positive attitude. There was positive significant relationship between performance of students and skip programme alone. Verma (1977 a) on a study of interaction effects of styles of programming, response mode and taxonomic categories in geography

for VIII class students found out that while branching programme was generally more effective than linear programme, at comprehension level, linear programme was more effective at knowledge level. Verma (1977 b) on the study of reinforcements and extroversion on P I, concluded that performance of extroverts was significantly higher than that of introverts through intermittant schedule of reinforcements and introverts learned better than extroverts through continuous reinforcements.

Patel (1977) found out that in the case of highly motivated students the P L M was working well with those who had good as well as poor study habits. More anxious students learned better through P L M than their counterparts. In his study of linear programme on Elementary Algebraic concepts in relation to size and the three levels of taxonomical classifications, Gosain (1977) reports that small step programme was more effective for knowledge, comprehension and application categories, with reference to student achievement. Sansanwal (1978) on his experimental study in programmed learning for teaching a research methodology course at M.Ed., level, at Maharaja Sayajirao University of Baroda, found that the instructional strategy adopted was effective in terms of student's achievement on criterion tests. Achievement of students through the instructional strategy was found to be significantly related with academic motivation and English language reading comprehension. The majority of the students had favourable reactions towards the instructional strategy as a whole.

Programmed learning materials have been developed and utilised as major instructional inputs in many other studies carried out at the Centre

for Advanced Study in Education, M.S. University of Baroda (Shah, 1978; Joseph, 1978; Seshadri, 1980; Ravindranath, 1982; and Vardhini, 1982; Menon, 1978; Menon, 1983).

2.6   P L M and Instructional Television

The first Indian study in which principles of programmed learning applied to televised instruction was that of Dewan (1966) to compare two modes of presentations, i.e., programmed televised learning and normal instructional television. The experimental group which was given programmed televised instruction was found superior to the control group which received television lessons in the normal way. Roy (1974) studied the cognitive effects of the Educational Television (E T V) programmes of the Delhi Television Centre. It was found that students were not having the overall cognitive effects out of the TV lessons and the most affected were the assimilation and utilisation bases.

2.6.1   Utilisation Studies

Klaus and Lumsdaine (1960, 1961) evaluated the effectiveness of supplementing instruction in high school physics with programmed textbooks. Students in both control and experimental classes read their standard textbooks, viewed televised films, watched and performed laboratory demonstrations, and heard classroom lectures. In addition, some of the experimental groups received programmed materials which provided additional coverage of topics already covered by other methods. As a means of measuring possible effects of additional study time spent on the programmes, other experimental groups

were given individual workbooks paralleling the coverage of the programmed text. Results of this study indicated that the programmed material made a significant contribution to the level of achievement of students. This study made it clear that even when students were already being taught physics by several integrated methods, coverage by programmed instruction was able to produce significant achievement gain. A second study by the same investigators indicated that the teacher did not add to the level of achievement produced by use of a programme alone, i.e., groups who learned exclusively from a programmed physics learned as well as groups taught by a teacher plus the programme. On the other hand, Goldbeck and his associates (1962) integrated the use of homework assignments in a programme with introductory or follow-up lectures by the teacher in a high school course. Introductory lectures previewed important points in programme topics which students found troublesome or which had not been covered in sufficient detail in the programme. An item analysis of test responses indicated that students performed significantly better on test items covered directly by both the programme and the teacher than on items covered by either the programme or teacher alone. These results are especially interesting because they provide statistically reliable evidence that programmed instructional techniques and conventional instruction can be mutually facilitating, where careful planning and preparation have been directed toward this end. In the same study, no teacher differences were found regarding the instructor's ability to use the integrated programmed instruction. In harmony with findings from Goldbeck study, Hatch and Flint (1962) found significant difference favouring the overall effectiveness of programmed-plus-conventional instruction in basic electronics at junior college level, as compared to using either instructional method alone. When results from the use of single methods

were evaluated, programme groups and conventional classroom groups achieved equally well.

In a series of studies with elementary school children conducted by Cambell (1964), achievement of students who were allowed to direct their own learning activities was compared with that of students who completed linear programmes. For several subject-matter areas, no significant differences were noted between linear programme groups and self-directed groups. However, in one study with mathematics material a significant difference was found favouring "coached" self-directed students, indicating that the effectiveness of self-direction may depend on coaching students how to direct their own learning activities. Also, a significant difference was obtained favouring self directed students in a history experiment, where achievement was measured by a transfer test in which students had to apply knowledge of history to hypothetical historical situations. In these experiments, materials for self-directed students were not conventional texts; they consisted of packets of statements of objectives, reading materials, maps, self test items, etc.,from among which each student chose what to use and when to use it.

Utilisation of programmed learning materials by educational institutions in our country in the classrooms or for other instructional purposes has remained a scene aspired for, rather than accomplished though research and develop- ment activities in the area of programmed learning have been going on for the past twenty years. The programmed learning materials are not u n - accounted. By and large, with few exceptions, the programmes that have been developed are fragmentary in nature covering only one or two topics of a complete course of study for a subject. On the same account, the

validation data can be less reliable. It is possible that the students would have considered the programme more as something additional or supplementary to the routine instructional work, than as an integral part of it.

2.6.2 Basic Studies

A great deal of research has been devoted to determining specific characteristics of programmed instructions which will increase its effectiveness. Additional effort has focussed on determining learner characteristics which may interact with programme characteristics in affecting achievement. In order to lend some structure to the several studies which will be reported here as examples of basic research, citations will be discussed under two sub-headings: Programme variables and learner variables.

Programme variables

a. **Knowledge of correct response.** Does providing the student with answers which he can check his responses increase learning? And if so, what form should this feedback take and how frequently should it be provided?

b. **Prompting versus confirmation.** Will prompting the student before he responds, or will confirming the correctness of his response, result in higher achievement?

c. **Response mode.** How should students respond to programmes items: write out answers, answer mentally, or simply read through a programme in which no blanks need to be filled in?

d. **Hardware versus software.** Will students learn best if programmed learning material is presented by a machine, by a projection device (e.g., T.V., Slides or filmstrip), by a printed textbook?

e.   Pacing. Will a student learn best at his own pace (as when he works through a programmedtext or perhaps his own teaching machine) or at some fixed pace (as when programmed material is presented by a device which controls the rate at which material is viewed, e.g. by T.V. or slide projection).

f.   Step size. Will students learn best if presented with smaller or larger bits of information before being asked to respond?

a   Knowledge of correct responses

Most studies have found that providing students with immediate knowledge of results at frequent intervals enhances learning (Schramm, 1964). Glaser and Taber (1961) and Moore and Smith (1962 a, 1962 b) have not supported this generally accepted finding. In the study by Glaser and Taber no significant differences was found between learning when feedback was provided after one-quarter to one-half of the response as compared to feedback after all responses. They suggested that knowledge of results is more important in a programme in which the probability of making wrong responses is high; their programme was evidently easy and receiving feedback consistently throughout was relatively unimportant. Moore and Smith (1962) found no significant difference between feedback and no-feedback groups using spelling and psychology programmes. In their studies, the spelling material was evaluated quite easy by the authors. There was a high degree of frame-to-frame redundancy which reduced the need for formal feedback. In the psychology programme, no precautions were taken to prevent students in the no-feedback groups from flipping back to previous frames for help. Ripple (1963), also attributed his failure to find a reliable difference between feedback and no-feedback groups to the use of a programme with a low error rate. These studies

emphasize the fact that there may be more sources of feedback in a programme than the formal feedback term supplied by the programmer. Only in programmes where other sources of feedback are minimized can the effects of formal feedback on learning, be minimized.

There are studies on the form of feedback. Krumboltz and Bonawitz (1962) found that providining feedback in the context of a complete sentence was significantly superior to presenting the feedback term alone, while measuring achievement with a test of ability to apply principles learned in the programme. A study frequently cited as evidence that accompanying feedback with an explanation enhances learning is the study by Bryan and Rigney (1956). College students in the group receiving feedback plus an explanation, scored higher than both a group receiving no feedback and a group receiving feedback without an explanation. A follow-up study was conducted to determine the relative effectiveness of three different types of feedback (Bryan, Regney, and VanHorne, 1957): (a) feedback which gave the correct definition or description of the chosen alternative; (b) feedback which indicated the reason why an alternative was correct; and (c) feedback which pointed out probable "operational consequences" of the course of action represented by the alternatives. No one type of explanatory feedback was found to be superior. No provision was made in the second study for groups receiving no feedback, or feedback without any explanation.

The only research discussed here on delay of feedback will be the quite comprehensive and analytic series of studies by Brackbill et al. (1964). Brackbill found that delaying feedback by a specified number of seconds during learning improved retention over a wide range of tasks which varied

In meaningfulness and difficulty. While the relative amounts of increments in retention resulting from delayed feedback varied as a function of subject-matter variables, the superiority of delayed feedback was consistent across tasks.

b   <u>Prompting versus confirmation</u>

Under the prompting condition, the stimulus material and the correct response are presented to the student simultaneously, after which the student may be required to repeat response. Programmed instruction typically employs cueing, which falls between prompting and confirmation. A cue is less direct than a prompt in the amount of guidance given to the learner, and is followed by confirmation. In the P I, under a confirmation condition, the student responds after the stimulus is presented, and then he is given correct response. Briggs and Hamilton (1964), reviewing studies of prompting and confirmation techniques, conclude that there is general agreement on the superiority of prompting over confirmation for meaningful serial learning, and for simple problem-solving tasks. Studies by Angel and Lumsdane (1960, 1961), using paired-associate tasks, have qualified the findings in favour of a mixture of prompting and confirmation by a study in whcih prompting on three-fourths of the trials and the confirmation on the other fourth, was more effective than either prompting or confirmation on all trials. Briggs and Hamilton (1964) note that there is other evidence suggesting that techniques combining prompting and confirmation are even more appropriate. Prompting and confirmation studies they cite include those by Angell and Lumsdaine (1961), Briggs (1961 a), Sidowski, Kopstein, and Shillestad (1961), and Goldbeck and Cambell (1962). These studies have to do with variables which, in the language of teachers, are known as 'didactic' teaching

(prompting) and 'guided discovery'(less prompting, as in the cueing in P I).
The findings from the above quoted studies appear to lend general support
to the notion that didactic methods may be best for memorizing, and a greater
degree of discovery best for learning to solve problems. However many
teaching procedures are really mixtures of these techniques, and the advantages
of either method are not very clear, except when analysed as instructional
events.

c   Response Mode

Briggs and Angell (1964) concluded in their review of programmed
instruction research involving 5 studies in Science and 14 in Mathematics
that "overt responding has not been shown to be a requirement for learning
from auto-instructional programmes". Evans, Glaser, and Homme (1962)
reported no significant differences in achievement as a result of learning
overt (written), covert (mental), and reading responses modes, using a pro-
gramme on symbolic logic. In a study by Alter and Silverman (1962), no
significant differences were found among groups who studied programme
on basic electricity requiring overt-written, covert, reading, overt-spoken,
or written-plus-spoken responses. Two additional studies failed to find differ-
ences in learning attributable to either overt or covert response modes;
one study used a programme in descriptive statistics (Stolurow and Walker,
1962), the other used a programme on sets, relations and functions (Lambert,
Miller, and Whiley, 1962). Schramm (1964) cited 16 studies to support
his conclusion that the majority of studies on overt-versus-covert responding
find no significant differences between response modes. On the other hand,

Deterline (1962) cites a study by Holland (1960) who found a significant difference in achievement favouring students who wrote down their responses (overt mode) over students who merely "thought" their responses (covert mode) and over students who read programme frames in which no words were left blank (reading mode).

Lumsdaine and May (1965) predict that overt responding will be more effective when: (a) the task is to learn responses, as opposed to learning the association between a new stimulus and an already learned response; (b) the task involves rote memorisation, as opposed to meaningful context learning; (c) the task is difficult, learners are very young, and conditions are distracting; (d) the learner makes appropriate implicit responses which he would not make unless required to give overt responses; (e) the learner responds more adequately to other portions of the instructional sequence as a function of the expectation that he may be called upon to respond overtly at unpredictable checkpoints. Research in response modes and prompting has been conducted for those types of tasks, those instructional events and those media (programmed instruction) which emphasise the importance of responding and the importance of ways to elicit and reinforce responses. For instructional events like goal setting, and recall and selection of relevant rather than irrelevant concepts, other factors appear to be important in the design of instruction. In a study reported by Briggs and his associates (1962), students who responded to multiple choice questions over large segments of reading material scored higher on tests phrased unlike the way study questions were phrased than did students who wrote in responses to a small step linear programme.

d   Hardware versus software

Comparisons between text and machine presentations of the programm-
ed material are typically inconclusive (Stolurow, 1963; Goldstein and Gotkin,
1962). The point is made that these studies compare relatively simple teach-
ing - machine presentation devices with current programmed texts and are
not relevant to future experiments which may have unique advantages over
programmed - textbook presentation. Carpenter and Greenhill (1963) used
students in a contemporary (college) algebra course to make comparisons
between presenting a programmed course by teaching machines, programmed
textbooks, and filmstrips. No significant differences in performance among
the three programmed treatments were shown. As part of the same series
of experiments, the same investigators conducted two more experiments,
with English grammer classes. One study found no differences in achieve-
ment among students taught by TV presentation of the programmed material
and students taught by teaching-machine presentation. The second also
failed to find any significant difference in performance of students taught
by lecture, discussion methods and students taught by a programmed course.

e   Pacing

Pacing studies seem to have been a logical next step from gross
comparisons of hardware and software presentation devices. Three studies
in a series of experiments by Carpenter and Greenhill (1963) compared effects
of self-pacing (programmed texts or teaching machines) with externally con-
trolled pacing - i.e., students viewed programmed texts or materials on
TV or films. Subject matter was either college mathematics or English.

They found no significant difference due to the pacing. Frye (1963) was able to demonstrate that external pacing of a programme less satisfactory - took longer to master -- if students were grouped heterogeneously; for the homogeneous ability groups external pacing took no longer than self pacing. In summary, Schramm (1964) notes that, although it seems learning should be enhanced by allowing students to proceed at their own pace, "the experimental literature has not been able to demonstrate as much advantage for individual pacing as might be expected."

Kress and Gropper (1964) in a study, projected programmed instruction on T V screen at various presentation rates. It was demonstrated that student performance under a given fixed-rate presentation was a function of the individual's own pace, as determined under self-paced conditions. That is, under fast, fixed-pace presentation of the programmed material, students who under self-paced conditions consistently and successfully -- as measured by achievement tests -- worked at a fast pace could readily adapt to the externally set fast presentation rate. On the contrary, under slow, fixed-pace presentation, the performance of characteristically fast students was actually inferior to that of slow students in the slow pace group and to that of fast students was actually inferior to that of slow students in the slow pace group and to that of fast students in the fast pace group. Comparisons between characteristically slow students were as expected: performance was much better under the slow fixed pace than under the fast fixed-pace presentation of the programmed material. These studies are in agreement with an earlier study by Briggs, reported first in 1951, reprinted later (Briggs, 1961 b), in which there was no significant difference between self-pacing and group-pacing at the average rate best for all students.

f   Step size

Step size has a number of different meanings and connotations,ranging from difficulty of responding to amount of reading material per response requested (Schramm, 1964; Lumsdaine, 1963; Briggs and Hamilton, 1964). In general however, when significant differences have been found, they usually have been in favour of programmes with relatively small step size, regardless of differences in procedure for measuring step size (Evans, Glaser, and Homme, 1960, 1962; Coulson and Silberman, 1960). On the other hand, Smith and Moore (1962) found no significant differences in rates of learning to spell with variations in step size.

Molstad (1964 a) cites a study by Keith Hall at Pennsylvania State University in which a spelling programme was rewritten in three versions varying in three sizes of step and three types of cue. He found that effects of these two variables varied with ability level, such that high I Q students did best if presented with large steps; low I Q students with small steps. Step size cannot be relied upon until a satisfactory definition of the terminology makes the results interpretable.

Learner variables

Briggs et al. (1967) reports that several investigators have found that individual differences among learners may be related to the effectiveness of sundry programme variables. The difference may be due to sex, age, grade, socioeconomic background, interests, motivation or other intellectual or personality characteristics. Campeau (1965) found a significant interaction between anxiety level and the presence or absence of feedback in

P I. High-anxious girls scored significantly higher on a test over a programme, when the programme the girls learned provided feedback as compared to no feedback. For low-anxious girls, the results were just the reverse, the girls scoring higher on a test if the programmes they learned did not provide them feedback, as compared to providing feedback. No significant differences were noted for boys.

Porter (1961) reported that the greatest gains for all IQ-method combinations were made by low-IQ students who were taught by P I, the least gains of all were made by low-IQ students receiving conventional instruction. McNeil (1962) found that for low-IQ students oral responding was effective. Campbell (1962) found that a bypass programme on set theory which enabled students to skip ahead based on correct responses to programme items resulted in significantly better performance than the linear format of the programme. For low ability students, the bypass and linear programmes worked equally well. Campbell also found that bypassing was most useful when the topic had a hierarchical structure. Stolurow (1965) summarises Campbell's study and suggests that grade level will be related to hierarchical structure, since older children will be possessing more prerequisite information and knowledge and it will be easier for them to learn subsequent material.

Classroom studies on multi-media are relatively scarce and with respect to three-dimensional models, radio and recordings, pictorial illustration. Combinations of these with other projected media such as transparencies, sound-slide systems, are almost completely confined to military/research. Therefore only descriptions of a few studies that are available, are described briefly.

2.7   NON PROJECTED MEDIA

2.7.1   Comparative Studies

Seymour (1970) working with the first year college students in a study on the order of fixation effects in classification of word-shape pairs to find the time required to match words and shapes, found out that the time will be less when the word is first than vice versa. He says that printed words tend to be noticed first and remembered longer. Thus in labelling anything, the words should be placed above the object. Duncan and Hartley (1969) in a study to compare the effects of different modes of presentation on recall, using forty undergraduate students as subjects, concluded that performance is related to methods of instruction, methods of learning and methods of testing. Laner (1965) in an experimental study of pictorial methods of instruction using R A F men reported that visual material is not necessarily more intelligible, nor more dependable than conventional media. The intelligibility appears to be largely determined by the adequacy of the accompanying verbal exposition, concludes Laner.

2.7.2   Basic Studies

It may fairly be claimed that even children can recognise pictorial representations of objects. Colborne (1966) and Colborne and Sargent (1971) found that if there was any story line embedded in the picture, pictorial statements could be understood easily. All have difficulty in grasping abstract visual statements and the ability to interpret such abstract visual diagrams is partly a function of maturation. Bayliss and Renwick (1966), Bedri (1961), Dutton and Leith (1967) found out that less able, i.e., less intellectually

mature children, need help in extracting information from abstract diagrams either by relating the statement to the concrete experience or prefacing the study of diagrams by more nearly iconic visual representation.

Vermon (1946) in a study to test the ability of adults, especially those who have not had a wide general education to understand and acquire information about problems of general social importance from charts and diagrams presented graphic information to 231 students, airmen, and soldiers. Vermon concluded that the essential factor in understanding and remembering such material is the production of continuous and coherent argument connecting together the isolated data. In another study on the value of graphical material, Vermon (1954) points out that graphical presentation may actually confuse the learner if he has not learnt to understand this type of presentation with facility. The grasp is determined by the intelligence and the amount of education of the learner.

2.8   Sound Media

2.8.1   Comparative studies

The sound media includes tapes, tapes with slides and tapes or discs with visuals. Here again, little research has been reported, though tape recorders and record players are available in plenty and many educational uses are advertised. Articles appear in such journals as Visual Education, Audio Visual Instruction, Instructional Innovator, Educational Television, Training Bulletin etc,. There is some evidence to suggest that tapes, with

or without visual support, have great teaching potential. This is especially the case with adult, highly motivated learners. Elton, Hills and O'Connel (1971) at the University of Surrey in a physics course investigated the provision of a series of prototypes of tape - slides as components of a teaching - learning system. The work was concentrated on situations connected with lectures and laboratories that had mainly a physics content. Self tests and lecture notes were provided in addition to:

1   A taped lecture to supplement the live lectures, mostly used for revision. 63% of students liked them.

2   Three of the lectures were replaced by tape-slide presentation. Examination results showed no measurable difference between the lectures and the tape - slide presentations.

3   Lecture-demonstration on video tape in conjunction with programmed strips led to an increase in retention.

4   A comparison of a conventional lecture with one presented in programmed form showed a marked gain in favour of the programmed form, but thestudents did not prefer the latter.

5   Experiments were tried using film loops and slides in a teaching booth.

For the purpose of tape-slide presentations, teaching booths in the library were used. The innovations were successful, reports the investigators. Different students preferred different methods to reach the given objective. But the authors concluded that staff and students liked lectures.

Amswych (1967) investigated into the use of tape recorded programmes for craft training. He worked through two groups one of 8 and the other

of 9 first year craft apprentices. One group was given a written version of a linear programme on the operation of a lathe and the second group worked on a taped version which included pauses during which the student carried out self instruction. This version involved responses on the machine itself. All were tested on performance after one session. Both groups showed a mean gain in performance of over 50%; the group using tapes were significantly better and completed the programme in lesser time. He concluded that the taped presentation was a more suitable method of presentation of programmes on machine tool operation than written programmes.

Engel and Wakeford (1971) in a study on the aspects of audio tapes for individual study in medical education came to a conclusion that careful preparation of material is more important than the medium through which it is presented to the student. Audio tapes with illustrative material are both acceptable and educationally effective. These experiments were done with tapes having illustrations and without illustrations. Students were given "self-tests" or "test-yourself" exercises.

Other combinations of media were 8 mm loop films with printed notes. The study was conducted at the post graduate level to teach clinical management. Orr(1968) studied the effectiveness of a taped lecture with the same kind of live lecture presented for Health Education at the Atomic Energy Research Establishment in England. He concluded that a taped recording illustrated with slides can be as effective in health education as a similarly illustrated live lecture.

Harden, Wayne and Donald (1968) in an experiment to report on the use of taped lectures and auto synchronised tape-slides, reports that the

maximum time for taped lectures should not exceed 45 minutes. The lecture with slides can be used repeatedly for different institutions by the students themselves. It is easy to make amendments to boththe tape and slide versions. In a similar study to investigate the effectiveness of group-paced presentation of medical programmes, with tape-slide audio visual programmed instruction Holroyd, Lever, Kennedy, Dunn and Harden (1970) conducted at the Department of Medicine and Education at the University of Glasgow, U.K., report that the group paced tape-slide programmed instruction was as effective as self-paced tape-slide sequence. The authors further reports that the group pacing was administratively more convenient and resulted in savings in cost. Students did not favour the tape-slide presentation. Reviews of research on radio and tape recordings (Allen, 1960; Wendt and Butts, 1962) also reveal that relatively little evidence on the instructional superiority ofthese media is available. This is due in part to the small number of relevant published classroom studies and in part to the inconclusive findings where evidence is available.

Allen (1960) states that, in general, radio and recordings have been found to be at least as effective as conventional instruction. He cites two studies (Barr, et al., 1942; Cook and Nemzek, 1939) which were inconclusive regarding the effectiveness of classroom radio instruction, and two studies (Wiles, 1940; Miles, 1940) in which radio instruction produced superior learning as compared to conventional learning methods. Wendt and Butts (1962 b) cite five studies indicating no significant differences in the instructional effectiveness of tape recordings when compared to conventional instruction, and one study with differences in favour of conventional over tape-recorded instruction. Again, the research reviewed in both cases covered a variety of subject matters and a large age range.

Popham (1961) taught a graduate level course in educational research by a series of tape recorded lectures combined with brief instructor-led discussions. When the experimental group was compared with a group taught by standard lecture and discussion methods, no significant differences were found. Similarly, results of later study (1962), in whichPopham used student-led discussions and tape-recorded lectures in the experimental group, again failed to show significant differences between achievement of experimental and control groups. This time the subject matter was a college course on Principles of Secondary Education. In his discussions of research on teaching foreign languages, Carroll (1963) notes that few experimental studies have investigated questions of "how much and in what ways the tape recorder may contribute" and "the degree to which the tape recorder may be expected to take over some of the functions of the instructor." He criticises the few studies available on the grounds that uncontrolled factors or other deficiencies from the stand point of "valid research methodology" prevent any reliance on their findings. Carroll goes on to point out a carefully controlled study by Pickrel, Neidt, and Gibson (1958) which evaluated the instructional benefits from using a regular classroom teachers without prior knowledge or training in Spanish. Control Students were taught by a trained Spanish teacher. A comparison of students randomly chosen from experimental and control classes indicated no significant differences between methods; however, when data from all students were used in the analysis, three of the four comparisons of control classes with experimental classes favoured the controls. In another study, using university language students (Antioch College, 1960), no significant differences in achievement were noted in comparisons between experimental classes (using a combination of conventional methods and a language laboratory) and control classes (using only conventional methods of instruction).

Molstad (1964 b) cites a study by Lorge, who compared achievement in French under two instructional conditions: one in which students used a language laboratory and another in which no language laboratory facilities were used. For ninth grades in beginning French, the laboratory group was significantly superior to the no-laboratory group on a measure of fluency. Tenth graders in second year French who had the laboratory experience were superior to no-laboratory students in both fluency and intonation. Eleventh graders in the laboratory group were significantly superior to no-laboratory students in ability to understand spoken French.

2.8.2 Other Studies

No experimental analysis of utilisation techniques or basic research reports on sound media of Indian origin were discovered during the search of literature.

2.9 STILL PROJECTED MEDIA

2.9.1 Comparative Effectiveness Studies

Considering how widely slide and filmstrips are used it is remarkable that so little research has been published in this field. What has happened appears to be inconclusive and contradictory. Haliwell (1962) found that a filmstrip compared unfavourably with a visit. Colborne (1971) found that the method of using slides proved more effective in teaching children the correct way of crossing a road between parked vehicles than manipulating small models. The latter activity one would suppose would be more nearly to a visit - a concrete experience - and yet the result was the opposite.

Hartley and Fuller (1971) found that the teaching points in a lecture that were supported by slides were less well remembered than points made on a blackboard. Vasishta (1958) found that using filmstrips was slightly better than not using filmstrips in an experimental and critical investigation into the efficacy of pictorial aids in education with differing age groups of children from working class families living in an industrial area in Britain.

It is clear that factors other than just using projected picture also work. One of these is the way in which each slide in a series or each frame of a filstrip has been designed. The next factor is the rate of presentation of the slides or filmstrip frames. The third is the environment and the nature of the tests used to determine if and how much learning has taken place. Rate of presentation is to be reckoned when a series of frames is involved. Except the study by Kinsbourne and Warrington (1962) no worthwhile research on this variable is reported. The results of the study by Kinsbourne and Warrington show that the length of presentation is attributed to the neural system subserving visual perception. Rate of presentation depends on many factors. Different learners and different types of material will doubtless yield different results. A uniform pattern is very difficult to be made for a heterogeneous class group.

Allen (1960) while reviewing audio visual communication devices, concluded that the research upto 1960, which compared filmstrips and slides with either silent or sound motion picture instruction, found in general that such projected still pictures were about as effective as silent or sound films in teaching factual information. Studies summarised in Allen's review include early studies by Brown (1928), James (1924), and McClusky (1924), Anderson et al. (1956), Jackson (1948), Stampolis and Sewell (1952), Slattery (1953),

Lasser (1954), Zuckerman (1954), and UNESCO (1951). These studies covered a wide range of subject matter areas including spelling, nursing, mechanics, economics, social studies, health education, and safety education and were used with various grade levels from elementary school to the University.

Allen (1959) suggested that filmstrips and slides have been found to be at least as effective as films because of special learning conditions for which they are especially suited, e.g., individual pacing and student participation. Wendt and Butts (1962) remark on the preponderence of findings of no significant differences in studies comparing filmstrips, slides and transparencies with other media (e.g., lecture, still pictures, motion pictures), and they cite studies by Dworkin and Holden (1960), Sprague (1955), and McBeath (1961). Chance, 1960, in a study comparing the use of transparencies to the use of chalkboard for teaching engineering drawing, did find significant differences in favour of transparencies. It seems likely that characteristics of the subject matter (engineering drawing) could have interacted with media in such a way that the clearer representation one would expect from a specially prepared transparency as compared to a chalkboard sketch would be especially crucial to instructional effectiveness: In a quite different subject-matter area, Slattery (1953) used informational and conceptual learning in fifth grade social studies to evaluate the relative effectiveness of silent filmstrips and sound motion pictures. The filmstrips, with or without student participation, were significantly superior to the motion pictures. Hoben and VanOrmer (1950) suggested that where filmstrips have been found to be superior to motion pictures, this was probably due to the slower rate of instruction used in actually presenting the filmstrip to the viewers. On the other hand, they continue, the superiority of motion picture to filmstrips

In other studies could result from the greater adaptability of movies for portraying interacting events.

Wendt and Butts (1962) cited a study by Weintraub (1960) in which second graders either read stories unaccompanied by pictures, read stories which were supplemented with pictures, or saw pictures unaccompanied by the textual material. He found that reading comprehension was best when no pictures accompanied the stories. Allen (1973) concludes in his extensive review of educational media that there is a dearth of research on educational value of pictorial illustration, and that what little evidence has been reported amounts to a few pro-confindings which contradict each other. He suggests there is a need to study factors within pictorial illustration that lead to increased learning, to identify the kinds of contents best communicated by still pictures, and to evaluate various techniques for implementing their use. In a study on pictorial presentation, Lumsdaine (1963) cited two studies by Vermon (1950, 1952) in which no reliable differences were found in the relative effectiveness of using pictorial charts, numerical tables, graphs, and words to convey factual information. The task in the 1950 study was for British grammer school students to grasp the results of comparisons in vital statistics when presented by pictorial chart, graph, or numerical table, with or without printed text material. Vermon (1953) while summarising a series of studies and articles in England on graphic presentation concluded that (a) special training in reading and interpretting graphs is required in order for them to be effective for instructional purposes, (b) certain types of data require certain types of diagrammes, and (c) accompanying diagrammes with explanatory text or comments generally enhances understanding.

2.9.2 OTHER STUDIES

A utilisation study by Vermon (1952) failed to reveal reliable gains from using pictorial charts to accompany, precede, or follow reading of the text material. In basic research by Lumsdaine (1958), various combinations of pictures and words were used in studies of paired associate learning. Lumsdaine concluded from the results he obtained that using pictures to represent the first object of a pair was significantly better than use of a printed word. On the other hand, using a printed word to represent the second (response) term of a pair was significantly better than using a picture. These results were confirmed by studies using college and grade school learners, individual and classroom presentation, and fast and slow learners. In this chapter on instruments and media of instruction, Lumsdaine (1961) cites studies by Kopstein and Roshal (1954) with Russian-English Vocabulary which lent additional support to his findings, Kale, Grosslight and McIntyre (1955) found that for teaching Russian Vocabulary, pictures contributed to learning, still pictures and motion pictures contributed equally, and regarding the use of sound, pronounciation of words by a narrator tended to interfere with learning to write words. VanderMeer (1950 a) using eighth and eleventh graders for teaching American History, studied the role of visuals in instruction. He assigned the students to a reading treatment and a treatment filmstrip. Although no significant differences in performances between the two groups, an item analysis of test responses, showed that while the reading group did significantly better on several items, the filmstrip group did significantly better on an equal number of other items. VanderMeer concluded that learning may have been impaired where picture (filmstrip) was deficient in detail, clarity, or definition. The filmstrip was less effective for teaching factual information. Where the filmstrip group was superior to reading group, he notes that this frequently was where the filmstrip

was used to define or illustrate an important term or concept; alternatively, the reading material covering these same test items may have been relatively weak (i.e., may have buried important information in descriptive phrases and clauses, or near the end of a paragraph).

Silberman (1958) used static or animated transparencies to teach facts about firearms to college students and found a significant difference in achievement in favour of the animated group on a performance test, but not on a pencil and paper test. Allen (1960) cites two case studies concerned with learning from slides (Butts, 1956; Vergis, 1954). Butts found that students who viewed slides with declarative or imperative viewing captions, performed significantly better on a test than a group viewing slides which were captioned with questions. Vergis concluded that three dimensional slide projections of pictures are most advantageous where certain spatial concepts are being taught. The basis for his belief was that three dimensional projections were ^no more effective than regular (two-dimensional) projection of slides for teaching fifth graders factual information, and yet three-dimensional slides were greatly superior where students were to interpret size and form in space.

The trend as reported by many investigators in learning and teaching is towards the use of a greater variety of materials and towards group teaching combined with self instruction. The problems that confront us will be access to equipment and information about the sources of material. Mee (1970) puts the matter succinctly in her book on Audio Visual Media and the disadvantaged child, "It might be concluded that some technological aids have over the years established their value beyond all question and that some recent innovations might not only prove useful in their own right

but extend the value of established aids. The conditions for successful use are that the apparatus itself, and above all the material which the apparatus mediates, should be designed, selected and used with regard to the ascertained needs of the teachers and children in education as it is and as it is developing. For financial and other reasons substantial extension of the use of techno-logical help in the education of young children is likely to be slow."

2.10   MULTI MEDIA PACKAGES

Development of multi-media packages for instruction as effective instructional strategy than any single medium or less systematic way of instruction is the outcome of many studies conducted both within and outside the country in the latter half of this Century. There has been a greatly increasing awareness, interest and activity involving the analysis of component behaviours and an attempt to design instructional strategies. While these are called different by different people, all have one common goal, namely, to enable the student to attain the desired terminal behaviour. The purpose of any instructional strategy is to enable the learner, to change his behaviour by learning faster and at his convenience and retain the changed behaviour over a considerable period of time. The process of learning is an individual experience for each person. The major purpose of any media is to effect behaviours that serve objectives. Terms like "objective," "behavioural objective," "instructional objective," "performance objective," and "learning objective" were not used by curriculum designers early in this Century. Ammons (1969) credits Charters and Bobbitt with formulating a method for determining educational objectives on a scientific basis.

Barnes (1971) reported on the use of multi-media materials with adult

education groups as follows: "There was almost universal satisfaction with the range of teaching and learning opportunities offered. A typical comment was that with such a variety of presentations the students can't help learning." Broadwell (1976) in a study conducted reports that students learn quickly and the use of individual methods results in more effective learning and simultaneously release teachers to use their time in tutorials and discussion. Coppen (1978) while surveying on the number of sources about learning from audio visual aids, reports that results of many experiments are inconclusive because of lack of precision in experimental design. The author has drawn on research published in Britain, Sweden, U.S., and South America, and adds that most teaching goes forward by audio and visual means operating simultaneously and we do not yet know clearly how the mind deals with these two channels at the same time.

Edwards (1966) in a survey to find out the use being made of A.V. aids by Colleges of Education in England and Wales, points out that there is a great variation in facilities and courses available, technical equipment and background information are readily available, and the subject of audio-visual aids is one of rapidly increasing importance and one which requires detailed teaching by qualified specialists. Walker (1971) while surveying the use of Audio Visual Aids in further education at Birkbeck College, as a part of a series of manpower studies, reports that problems associated with software contribute more to the under utilisation of audio-visual aids than any other factor.

Margarain (1967) in a study titled short-term memory as a function of input modality, to determine how far visual and auditory storage might

be separate and the kind of storage that might be involved during simultaneous visual and auditory presentation, reports that auditory retention is superior to visual for a series of items over a short term. Visual material is usually presented in displays as simultaneous items which are quickly resolved and replaced. Long term retention is not required, but spatial resolution is. Presentation of auditory material requires time before comprehension is complete. Consequently the auditory store must be more efficient over time.

2.10.1 Comparative effectiveness studies

Lumsdaine and May (1965) in their chapter on mass communication and educational media prepared for the Annual Review of Psychology, concluded that from the standpoint of stimulus properties, "film and TV can be considered substantially identical media for many purpose." Most studies reported do not reveal reliable differences between instruction by films as compared to conventional methods, over a wide range of subject matter, age, abilities, and conditions of use. There are studies to show that learning by motion pictures are significantly superior to learning by face to face methods and vice versa. No significant differences in achievement were found when students were taught by either motion pictures, television or conventional instruction in public speaking (McElroy, 1958) ninth grade Science (Champa, 1958; VanderMeer, 1950 b), eighth grade explanatory Science (Huffman, 1958), high school chemistry (Popham and Sadnavitch, 1960), high school physics (Sadnavitch and Popham, 1961) and college physics demonstrations (Tendam, 1961). While reviewing research studies Allen (1960) cited several studies to indicate that motion pictures are as effective as conventional

Instruction in teaching factual information and perceptual motor skills. Greenhill (1964) while reviewing research on instruction film and television commented that in general no significant differences were found in the bulk of studies conducted comparing filmed courses with direct instruction in such subject matter areas as college psychology and communication skills, high school chemistry, physics, history and industrial arts.

Allen (1957, 1959, 1960) while reviewing literature, on comparing the effectiveness of televised instruction with face to face instruction by teacher, states, that these studies show no significant differences between achievement of students taught in the conventional manner and through television. At University level, no reliable differences in the instructional effectiveness of TV as compared to conventional instruction were obtained in teaching Spanish verbs (Bundy, 1960), Metrology (Carpenter and Greenhill, 1958), slide rule operation (Gordon, Nordquist, and Enger, 1959), and humanities (Erickson and Chausow, 1960). At the high school level, students taught over TV achieved as much as students taught conventionally in mathematics (Berger, 1962), slide rule operation (Anderson and VanderMeer, 1954), and Math computation as opposed to problem solving (Jacobs, Bollenbacher, and Keiffer, 1961). In the elementary schools, no reliable differences were shown between televised and conventional instruction in teaching Scientific reasoning (Dietmeter, 1961), and sixth grade science (Enders, 1960). Furthermore, TV frequently has been found equally as effective as conventional instruction for promoting long term retention of learned material (Allen, 1959; Kumata, 1960 a; Benschoter and Charles, 1957; Curry, 1959). Retention tests were administered at intervals which ranged from two weeks to three years after original learning.

Occasionally significant differences in achievement have been found to favour televised instruction. Superiority of televised instruction was reported by Pasewark (1956) in teaching typewriting, advertising (Kumata, 1960 b), and in humanities (Erickson and Chausow, 1960); high school chemistry – Negro students (University of Alabama, 1961), geometry (Johnson and Harty, 1960), and Math lessons (Berger, 1962). High ability level students learned significantly more by TV than by conventional methods in psychology (Dreher and Beatty, 1958) and in science (Jacobs and Bollenbacher, 1959); on the other hand conventional methods of instruction were most effective for low-ability students in science (Curry, 1959, 1960; Jacobs and Bollenbacher, 1959, 1960). Barrow and Weastley (1959) found that televised programmes on current events produced significantly greater learning of factual information than comparable programmes presented by radio, even though the same experienced script writer prepared TV and radio versions of the lessons to utilise the full potentialities of both media, with relatively equal emphasis on various content aspects.

Moldsted (1964) cites a study by Steward in which college students from two ouniversities were taught factual information by one of the three methods: Programmed instruction, a motion picture, or a combination of these two media. The programme covered the same factual material as the first 40 frames of the film. On a test given immediately after learning, and on a retention tests given at one day and six day intervals after learning, the programme-only and programme-plus-film groups did significantly better than the film-only group.

2.10.2 Utilisation studies

Ketcham and Heath (1963) found that three showings of a film on the life of Wadsworth produced significantly more learning than a single showing of the film. McTavish (1954) found that for all levels of students-university and high school-two showings of the films produced significantly more learning than a single showing of the film. Although three showings of a film also produced significantly more learning than two showings, the learning gain attributed to three over two showings was only the one showing. Kendler, Cook and Kindler (1953) found that time spent in review i.e., repeated showings - is probably the most significant factor consistently shown to be important regardless of the media employed. Anderson (1956) compared achievement of students when the teacher made efforts in stressing points covered by the film and the teacher making no efforts to stress such points made by the film. There were significant differences in favour of teacher stress to supplement points made in the film, but only for students at the two extremes in ability. VanderMeer (1950 b) in a report on his findings says that no significant differences among methods - study guides before and after film viewing, film only group and conventional method group - were noted on tests of recall, but the film with study guides group was consistently superior to the other groups on a retention test administered after three months of the original learning on General Science.

Studies in the area of Television suggest methods for using TV most effectively, both as a single medium and in combination with other media. Schramm and Oberholtzer (1964) found that the most effective combination of learning activities to integrate with a television course in elementary school, Spanish varied with grade level. For fifth graders, a combination

of TV plus teacher-directed practice, electronic aids with feedback, and parent participation at home was most effective. For sixth graders, a combination of TV plus teacher directed practice, programmed instruction and a parent participation was best. He found that in using televised instruction for Spanish, programmed instruction combined with teacher directed practice was found to be better than either alone. Hayman (1964) - who used a larger sample of 13000 against Schramm who used 12000 - found that a second viewing of the televised lesson was more valuable when the students had no additional instruction as compared to its value when other instruction was provided. Bryan (1961) supplemented instructional TV in high school chemistry and physics with (a) correspondence study (b) a teacher trainee who personally tutored the learner, (c) both correspondence study and tutoring. Though comparisons among methods were inconclusive for the physics subject matter, analysis of the data from chemistry groups revealed a significant difference in favour of supplementing TV with correspondence study and a tutor as compared to supplementing TV with either correspondence study or a tutor alone.

A large portion of research studies in designing multi-media, concerns the utilisation practices and proof of the instructional value of particular media and strategy, as compared with conventional teaching methods. There are also studies on particular aspect of a multi-media presentation. The nature of the stimuli is varied too determine the effect on learning of that particular variable. Kemp (1975) has reported the summary of the survey of a large number of experiments and studies conducted by Hoban and VanOrmer (1950) for over thirty years. Mostly these relate to the production of slides, filmstrips and films. Some relevant aspects reported by Kemp (1975) are:

1   Use of personal pronouns: Use direct forms of address in comment-
     aries. Avoid passive voice.

2   Concentration of ideas: Ideas or concepts should be presented at
     a rate appropriate to the ability of the audience to comprehend them.

3   Summary: Summarise points and present important and relevant
     information in an introduction.

4   Repetition: Repetition is one of the most effective means for increas-
     ing learning.

5   Pacing: Rate of development or pacing should be slow enough to
     permit the average learner to grasp the materials as it is shown.

6   Errors: The learning of performance skills will be increased if you
     show common errors and how to avoid them.

7   Participation: Learning will increase if the viewer practices a skill
     while it is presented on the screen, provided the presentation is slow.

8   Music: The experiments suggest that music does not add to the
     instructional effectiveness of an instructional film.

9   Picture-Commentary relationship: With films designed to teach
     performance skills, where learning is measured by non-verbal tests,
     the pictures appear to carry the main teaching burden.

10   Colour: Experimentation has not demonstrated any general overall
     increased learning as a result of using colour in instructional film.
     It is to be remembered that the studies related to the period prior
     to 1950.

2.10.3 Basic studies

Travers (1964) while reviewing research studies reported that verbali-
sation of response, was a particularly effective participation technique.

Similarly Kendler, Cook and Kindler (1953) found that making students to make responses orally during a map reading film produced significant learning gains over non participating groups. Lumsdaine, May and Hadsell (1958) reported that student participation, introduced between sections of the film by systematically evoking responses with printed questions produced significantly greater learning than the non-participation version, and was as effective as a double showing of the film which required more time. The item analysis revealed that the superiority could be attributed to items which were directly covered by participation questions. Michael and Maccoby (1953) also reported that audience participation produced significantly greater learning than non-participation for those test items which were practised during participation. It was reported that providing learners with information as to the corrctness of their responses during participation was the major contributor to the learning gains demonstrated in this study. Travers (1964) and Allen (1957) concluded that knowledge of results is an extremely effective component of the participation technique.

Muller (1965) reported that there was no significant difference between scores on verbal and diagramatic tests for differing methods of instruction. In a report, Ketcham and Heath (1963) points out that for a film on the life and works of Wadsworth, a visual which did not directly portray the sound track (but which was shown with the sound track) produced significantly greater learning than the sound track alone.

Gropper and Lumsdaine (1960) compared the achievement of sixth and seventh graders when the televised instruction required a written of mental responding and when no such responding was required. The active response group performed significantly better than the no response group

and this result was obtained again on a retention test administered one and one half weeks after the post-test. This report was supported by a second study by Gropper and Lumsdaine (1961 b). This demonstrated the superiority of student response over no response for televised instruction. The strategy was that the televised lessons requiring student response were modified to provide opportunities for students to respond either in writing or mentally (thinking). In a later experiment, the same investigators (1961 b) demonstrated programmed T.V. lesson on airplanes, satellites, body chemistry and chemistry sequenced in small steps, with mastery of each step enabling students to proceed to next step, requiring active responding by students yielded significantly higher achievement than the identical lesson not requiring active responding. The authors conclude that merely encouraging students to make active responses without ensuring and employing methods for making correct responses, we can add to the effectiveness of instruction. Gropper and Lumsdaine (1961 a) point out that learner characteristics as well as conditions of instruction must be considered when deciding how to maximise achievement for each student. High I.Q. students performed better producing significantly more learning than the conventional, when the TV lessons required students to respond, both on a test of immediate and delayed retention. Low I.Q. students retained significantly more, as measured by the delayed test, when they learned by the conventional TV lesson as compared to the active response programmed TV lessons.

In a study on the application of some types of viewer participation techniques to learning from televised instruction, Thiagarajan (1980) reported that an increase in learning was recorded at the five percent level of significance by oral participation groups over non participation groups in two British High Schools. The groups were, without any type of participation

and the second one was to view workbook participation. The third was to view with oral participation. There was no significant difference between workbook participation and either oral or control versions. Pucel (1973) conducted a study to test the feasibility of teaching a method course totally or partially by telelecture to in-service vocational teachers. This was an one semester course on principles of teaching vocational subjects. The conclusions indicated (1) A professional course may be presented with equivalent results either by traditional or telelecture methods; (2) Student attitudes were not adversely affected by either course content or method or presentation; and (3) Telelecture was more economical in costs and in travel time.

2.10.4 Other studies

Allen (1974) searched the literature to determine what recommendations could be made between the intellectual abilities of learners and the ways instructional media can be designed. After exploring a number of relationships, he presented generalised statements that can assist a producer to design audio visual materials that will better serve the intellectual abilities of each of three groups of learners low, middle, and high mental abilities. He concludes by saying that successful learning opportunities must be provided for students for all intellectual abilities.

Briggs (1970) has proposed to seek ways to use a single medium for the optimum length of time for the most appropriate set of objectives and decide among the alternatives of group instruction, individualised, teacher conducted or automated instruction. Keisler and McNeil (1962) combined programmed instruction with other devices and found that the strategy was

workable. Goldbeck, Shearer, Campeau and Willis (1962) studied the effects of integrating programmed learning with classroom teacher, and found that the programmed learning integrated with classroom conventional teaching was significantly effective than conventional instruction. Rationale for the development of multimedia instructional sequences have been presented by Brown and Thornton (1963), Briggs, Campeau, Gagne and May (1967); and Johnson (1960) and procedures for designing multimedia sequences have been presented by Bannistar (1970), and description of instructional systems presented by Banathy (1968), Oettinger (1969), Thrzebistowski (1968), Bannistar (1970), Briggs (1970), Briggs (1972), Rowntree (1974), Briggs (1975), and Briggs (1977).

2.11 Shortcomings of the Literature

As background for the literature review to follow, it will be useful to outline some of the more general shortcomings which characterise multi-media research. Admittedly, the quality of such experimental studies on the multi-media package is extemely uneven and they contradict one another, judged on a number of criteria:

a   Most comparative effectiveness studies do not provide evidence that steps were taken to insure equal coverage and emphasis on content by the media being compared.

b   In a majority of comparative effectiveness studies, no systematic analysis was made on the relative contributions of media and (when the teacher was a component of the instructional package) learning by the experimental group.

c   Many studies reviewed take into account the effect of prior ability level of students on performances. But some did not control the differences in prior knowledge of the subject matter so that it was impossible to determine whether the greater effectiveness of one method over another was due to the method itself, or to the fact that experimental group students knew more about the topic initially than did the control group students. None could control "environmental learning" when learning through mass media is available these days in plenty.

d   Only few studies could be locted which have relevance to this study the main purpose of which is validate "a multimedia package" for instructor training in a natural environment with resources and facilities. Only examples of media research which the investigator hoped would be relevant to this study have been quoted.

existing

2.12   Limitation of Studies on Media Research

The media research cited in the foregoing paragraphs sought answers to questions like:

1   Comparative effectiveness studies: Can programmed instruction teach better than standard textbooks with or without a teacher? Can still projected media serve better if used with sound? Can filmstrips serve better than conventional teaching?

2   Utilisation studies: Will library assignment followed by a lecture substantially increase learning than traditional classroom lecture alone? Will accompanying, preceeding, or following textual material with pictorial charts add materially to the amount learning? Is media learning cost effective,

compared to others?

3   Basic studies: Will students who respond overtly   , **to programmed** learning material of various difficulty levels learn **substantially more than** students who respond mentally to the same material covertly?

These are **very important and relevant issues, but to date,** research hasnot provided much generalizable information. There are many uncertainties in the choices involving media. There are no clear cut suggestions on the actual choices of media based on media research; the choices rested more directly upon analytical research conducted primarily in the laboratory environment. The choices appear to have involved more decisions based on intuition or experience than is desirable. Thus, neither laboratory nor other studies provided complete information to eliminate the uncertainties involved in making such choices. Of course teachers have been choosing and using media to teach, for years, probably basing their decisions on a mixture of past experience and intuitive judgement, rather than on any explicit, systematic process. The point, the investigator desires to make here, is that, neither the learning psychologist nor the classroom teacher can justify such decisions entirely on the basis of evidence from present media research.

Let us now consider the first three steps of accepted media selection process. That is, (a) specifying behavioural objectives, (b) identifying types of learning involved, and (c) conditions to be provided to insure that the objectives will be met, that is kinds of instructional events. The instructional developer then selects media and methods which will supply these learning conditions. For this he refers to media literature, and what does he find? He cannot find precise nature of learning activities for which a given

medium was superior. He finds instead, cryptic descriptions of lesson content such as, "eighth grade geometry," "ninth grade science," "tenth grade history lesson," "pedagogy", or "college 1st year mathematics." Moreover, by and large, these are not entire course materials covering the whole syllabus, but only a few classroom activities. Subject-mater descriptions of this type are not very useful, because one cannot be sure what types of learning were involved. The instructor developer has to then resort to step (c) above, namely extrapolations of findings from labooratory studies to conduct the analysis of the learning conditions.

Consider a teacher, who wishes to teach his students "under water colour photography," "draw a flow chart depicting the process involved in the manufacture of steel," or "recognise instances in plant specimens where the process of photosynthesis has been terminated." If the research on media has subsumed instructional objectives under, "a B.Ed. or Diploma in Photography course in Colour Photography," "a second year shop science course for craft instructor training," and "an advanced course in Metrology," can the classroom teacher apply these to his objectives on under water colour photography on motion, manufacture of steel, photosynthesis instructor training or Metrology? No, he has no way of determining this from descriptions in the research reports, and he hasn't time to request the investigators to send him learning materials used in their studies, so he can judge whether his objectives appear to be like those for the experiments reported. He is forced to reply upon his hunches, because he has no other alternative.

2.13   Suggestions for Future Media Research

Though we can take many of these results into consideration, we

cannot completely follow all these findings for Indian conditions as the researches done in Great Britain or United States differ due to the socio-economic, cultural and other environmental differences with those prevailing in our conditions and society. This highlights the need to undertake media researches in our country. It is possible for us, to conduct researches on many of these topics, with variations in our conditions and it is not necessary that we should replicate in toto, the entire research reported in the more advanced countries.

In his analytical review of media studies, Norberg (1961) observed, "The present common research practice of trying the new medium or the new practice first in one subject-mater area and then another, is justified, perhaps, on the ground that our present theoretical base doesn't seem to provide for better alternatives." A similar view is also expressed by Glaser (1962) who anticipated that, "....... application of current theories of learning will be less fruitful at the present time than application of current findings." Perhaps we are left with no other alternatives at present, and it is necessary for future research to provide for the (a) explicit definition of various learning tasks used, (b) careful identification of learning conditions required for each of these tasks, (c) judicious selection of media to be evaluated, (d) cost effectiveness and feasibility, and (e) thoroough analysis of media, learner, and environment - related characteristics to determine the nature and extent of their influence on experimental results. (Romiszowski, 1981). The study of this nature calls for extensive resource and funding. Media research for modular training defining the exact job performance and tasks involved, and selection of media and methods under various conditions of learning is a proposal that could be undertaken as a future research. While doing so, care must be taken to take an entire course and not bits of a few lessons

or demonstrations, that will provide employable skills.

When standard requirements for good experimental design are met, media studies of the kind outlined above should produce more useful and generalizable principles than have been produced by most of the present media studies. The factors to be taken into consideration, will include media, learner, subject-matter, situational characteristics which taken together form the basis for being able to determine the relative appropriateness of a given medium for a given instructional objective, in terms of satisfying learning conditions required by the task. When this is done, it is hoped that it should provide stable foundations of a science of instructional media.

2.14   SUMMARY

In summary, various media typically have their own special advantages, enabling the instructor to use each appropriately. It is usual for one to seek both authoritative content and effective presentation of the stimulus, along with any other desired instructional events, the media may contain. An Instructor may choose a book rather than a film or programmed material because the book has more authoritative content as the stimulus; the Instructor is then willing to supply the other events not contained in the book rather than sacrifice the authoritative content. Recent research demonstrations have shown that learning from films or TV can be improved by breaking up the continuous presentation of stimuli in order to pose questions, to provide a pause for the learners to think or write their answers and then to provide feedback (Briggs, 1977). It has also been shown that learning from print material can be enhanced by providing "self-test" questions-based on the objectives-which the learners respond to, before taking a test over the object-ives. The learner can check the answers with an answer key supplied to

him. The effectiveness of this technique of using self-tests over chapters in text-books was first demonstrated by Pressey (1950) and his student (Briggs, 1947). This has been confirmed by more recent research (Frase, 1970). Pressey coined the term "adjunct auto-instruction" for this technique. These research findings suggest that when a required instructional material is used, a shortcut planning could be:

1   State Objectives for each chapter

2   Prepare self-tests and answer keys for the learners to use as a part of their study, and focussing the study on the objectives

3   Administer objective referenced tests for each Chapter, Unit, Module

4   Conduct group discussion of a general nature on learner's problems.

Whatever be the media and materials selected for a specific topic of lesson the teacher can design a plan based on these suggestions so that learners actively focus on the parts of the materials relevant to the objectives and not attend passively to the total stimulus materials.

This chapter has thus described the review of literature on development of multi-media packages and relevant research on instructional development. The review helped in identifying the major concepts and principles that aid individualised learning and controlling the instructional system. The guiding principles have been utilised in developing the present course on audio visual education. The next chapter, "Conceptualisation of a model for individual skill learning," deals with a few models in the preparation of instructional materials, and describes in detail the one designed for developing the multimedia instructional package for the course on audio visual education.