# EVALUATION OF VIDEOTAPED INSTRUCTION: AN UNLIKELY ALTERNATIVE TO TRADITIONAL INSTRUCTION IN A UNIVERSITY SETTING



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by

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## ABSTRACT

Much current research has demonstrated that when maximum learning efficiency is desired, there are no consistent differences between instructional television (I.T.V.) and traditional instruction (T.I.). However, preliminary work here at Memorial University of Newfoundland has suggested that learning from T.I. was superior to learning from I.T.V. The present research attempted not only to evaluate the comparative effectiveness of I.T.V. and T.I. but also attempted to isolate the significant input variables which produce the actual learning in these situations, by introducing into the experimental teaching setting the "reverse" method of both I.T.V. and T.I. The opposite of traditional live lectures would be the videotapes of those actual live lectures while the opposite of the standard studio-produced tapes is to present, in sequence, the visual material of the studio tape live in the classroom. These experiments involved instruction on the topic of the cumulative curve followed by a difficult and carefully constructed posttest. Five different modes of presentation were evaluated: 1) live lectures, 2) videotape of live lectures, 3) live lectures using videotaped inserts, 4) studio-produced videotapes, and 5) a text condition. Although few significant differences were found in the two experiments, with respect to the order of effectiveness the following consistent differences

were found. First, live lectures produced superior learning; next, were videotapes of live lectures and live lectures using videotaped inserts; third, came studio-produced videotapes, and finally, the text produced the least effective learning.

The individual difference variables of intelligence, degree of anxiety, and degree of extraversion-introversion did not interact significantly with any particular method to produce maximum learning in any "type" of student. Also, correlational data revealed that students like and learn most not only from the methods which, in fact are the most effective, but also from the methods which they perceive to be most effective.

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# CHAPTER I

## INTRODUCTION

Since 1964, when Keller introduced his personalized system of instruction (P.S.I.) at Brazilia University for teaching Introductory Psychology, many similar instructional innovations have been introduced and evaluated in the higher educational setting. Even though Trent and Cohen (1973) conclude that:

> ...relatively few of the educational innovations developed during the 1960's with great hope for their widespread usefulness are in operation today,

many of these innovations seem to have triggered a new (or renewed) interest in, and a broader basis for, research in the higher educational setting.

One such innovation was introduced by Sullivan (1969) at Memorial University of Newfoundland (see Figure 1). Although the particular details of this study are not directly relevant here, the use of videotaped instruction for the slower students has indirectly led to the present research.

In Figure 1 the group instruction, given after evaluation one (Ev. 1) to those students who had not achieved a criterion of 80%, was videotaped instruction. Although this system as a whole worked well, its use was discontinued in 1970 since it was not universally accepted by all students and instructors. Today, this method of instruction is not

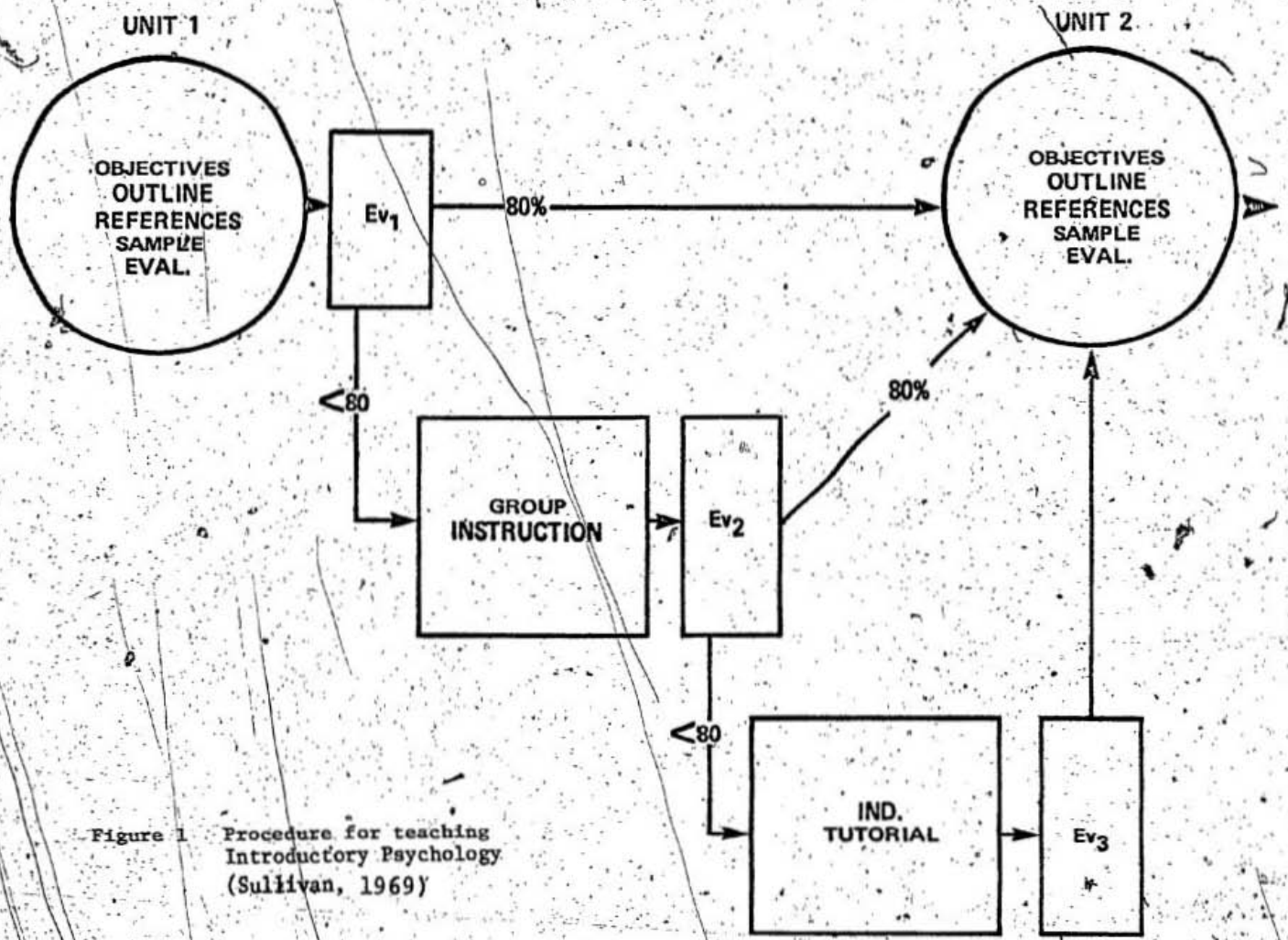



Figure 1 Procedure for teaching Introductory Psychology (Sullivan, 1969)

rigorously followed, but the use of videotaped instruction has returned as an integral part of the learning process at Memorial University of Newfoundland because continuing research (the present included) has discovered new procedures for incorporating television into the learning process.

It was because the videotaped instruction of the Sullivan (1969) procedure was not generally accepted by students and instructors that the present research was begun. The present research not only evaluated the type of videotaped instruction then being used at Memorial University of Newfoundland, but more importantly, it has attempted to improve the overall effectiveness of videotaped instruction by trying to combine it with other methods of instruction, and attempting to isolate the particular variables which are correlated with efficiency in learning from television (see Chu & Schramm (1967) and Dubin & Hedley (1969)). Indeed this seems relevant today for as Jamison, Suppes and Wells (1973) concluded in a survey of the appropriate literature, "There is very little evidence concerning the effectiveness of instructional television used in ways that utilize the unique capabilities of the medium" (p. 30).

## REVIEW OF THEORY AND RESEARCH

In light of a tremendous amount of current research there is little doubt that learning can and does take place from television. This has been conclusively shown in two

thorough reviews of the literature on the effectiveness of instructional television (I.T.V.), namely, Chu and Schramm's (1967) "Learning from Television: What the Research Says", and Dubin and Hedley's (1969) "The Medium may be Related to the Message: College Instruction by T.V.". In a completely different vein Bogatz and Ball (1971) have shown that pre-school age children are "significantly more advanced" than children of the same age were five or ten years ago because of such television programs as Sesame Street and the like.

Indeed I.T.V. as a method of teaching has existed since television became fashionable, and its forerunner, motion pictures, was used as a method of instruction as early as the 1920's (Dubin & Taveggia, 1968). Undoubtedly learning from television is here to stay since its use continues to increase dramatically according to a recent report by Dirr and Pedone (1978). The important question that teachers, instructors and educators must attempt to answer is if I.T.V. is the most effective mode of teaching available for the situation under consideration. According to Klima (1976),

> Potential users of instructional television should make certain that television is the best media to present their educational objectives, and the television teacher must develop a reservoir of technical information regarding the most efficacious use of the media.

Over the past 20 years there has been much discussion concerning the advantages, disadvantages and misconceptions of videotaped instruction (see Trottier, 1970; Smith &

Nagal, 1972). Although this discussion is not directly relevant here it should seem logical to assume that instruction through television is better than no instruction at all. Indeed a surprising number of studies have compared television instruction with no instruction to investigate whether students learn at all from television. The result is not surprising, they do. The I.T.V. group is consistently superior to the no instruction group.

Relevant evidence here was performed by Enders (1960). He showed that sixth grade students who had viewed a series of science programs on television did significantly better than a control group who did not watch these programs.

Indeed Chu and Schramm (1967) reviewed nine examples of research that compared I.T.V. with no instruction at all and in all nine those with I.T.V. learned significantly more.

However, the crux of the problem of the evaluation of I.T.V. lies not in its comparison with no instruction but in its comparison with traditional methods of instruction, and present-day research has demonstrated conclusively that in spite of any apparent theoretical advantages, in practice I.T.V. produces no greater learning than the traditional methods of instruction. (This point will be discussed directly). Undoubtedly, this is the major reason why there has been such a resistance to the adoption of I.T.V. in the educational setting (see Evans, 1972). This present research argues that the reasons why no significant differ-

ences have occurred between I.T.V. and T.I. is because the major variables influencing learning through television have not yet been isolated, and present-day research in the area of I.T.V. offers no guidelines on how to prepare an effective videotaped lecture. Certainly one purpose of this present research is to attempt to isolate some of these variables and, thus, offer guidelines for the preparation of an effective I.T.V. program.

## Learning from Television

Writing in 1967 Chu and Schramm made a comprehensive review of the literature involving I.T.V. Their review summarized 421 comparisons between I.T.V. and T.I. Their results are shown in Table 1.

TABLE 1

Results of 421 comparisons between instructional television and conventional teaching

| | No significant differences | Television more effective | Conventional more effective |
|---|---|---|---|
| Elementary | 50 | 10 | 4 |
| Secondary | 82 | 24 | 16 |
| College | 152 | 22 | 28 |
| Adults | 24 | 7 | 2 |
| Totals | 308 | 63 | 50 |

Note: From Chu and Schramm (1967)

As can be seen from Table 1, I.T.V. seems to be able to be used more effectively in elementary and secondary schools than at the college level; but even so the percentages of all cases where I.T.V. is more effective is only 7%, and this percentage would undoubtedly be lower if all studies which showed no significant differences were reported in the literature. On the basis of these results Chu and Schramm were forced to conclude that I.T.V. can be used as effectively as T.I. when learning efficiency is measured, but not that I.T.V. is any better (or worse) than T.I.

Similar findings were also forthcoming from Dubin and Hedley (1969). Reviewing exclusively at the college level, Dubin and Hedley provide a more detailed survey of the effectiveness of I.T.V. They reported on 191 different comparisons; 102 favored I.T.V. while 89 favored T.I. However, most of these differences (about 90%) were not significant at the standard level of statistical significance (.05). Dubin and Hedley concluded that in the higher educational setting instructional television produced no better learning than traditional instruction.

Dubin and Taveggia (1968) provide a third survey with a similar conclusion. They surveyed the results of 74 studies that compared various teaching methods at the higher education level. Dubin and Taveggia conclude that "from all of the studies taken together there was no evidence for the superior effectiveness of one teaching method over another at the college level".

Jencks, Smith, Acland, Bane, Cohen, Gintis, Heyns and Michelson (1972), after another similar review, sum up all these insignificant findings: "We see no evidence that either school administrators or educational experts know how to raise test scores" (through I.T.V.).

Two more recent reviews, Wells (1976) and Sullivan (1978) all report this same result - there are no significant differences between instructional television and traditional instruction. Indeed Wells (1976) best sums up all the relevant literature and offers a suggestion for the research of today.

> No significant differences is the most frequently quoted conclusion of surveys comparing the effectiveness of alternative instructional technologies. While this effectiveness conclusion does not differ for the research reported here ... (we need) to discuss alternative criteria for measuring effectiveness and to analyze potential research problems.

Why is there such a wealth of insignificant differences in this field and what further interpretations can be made from these results?

Interpreting these Insignificant Results - a "Misleading" Conclusion?

The previously mentioned unfavorable attitude that instructors and educators have toward I.T.V. would seem to be based upon fact. Certainly the review of the research into I.T.V. has shown that it produces no better learning than traditional instruction. Consequently, educators opposed to I.T.V. might argue "why bother to use (or introduce)

I.T.V. since traditional instruction is already available and just as good as I.T.V.". In contrast, the advocates of I.T.V. have argued that this is precisely the point - since I.T.V. is just as good as any other method of instruction - why not use it? By using I.T.V., instructors will have more time to pursue work in other areas, yet learning efficiency will not be diminished. (It would certainly "save" the instructor from giving the same lecture again.)

To support this contention that the introduction of I.T.V. would be advantageous to the learning process as a whole, the advocates of I.T.V. have used the aforementioned no-significant-difference findings to support their own point of view (see Table 2).

TABLE 2

Relative effectiveness of I.T.V. and T.I. by subject matter

| Subject | Number of comparisons | Percentage of comparisons in which I.T.V. did as well as or better than T.I. |
|---|---|---|
| Mathematics | 56 | 89.2 |
| Science | 100 | 86.0 |
| Social Studies | 77 | 89.6 |
| Humanities | 45 | 95.5 |
| Language | 77 | 88.3 |
| Skills | 26 | 96.1 |
| Miscellaneous | 40 | 75.0 |

Note: From Chu and Schramm (1967)

Based on this table Chu and Schramm (1967) conclude "there is no general area where television cannot be used effectively to teach the students". This certainly is true, but may be a little misleading since the heading for this table reads "Percentage in which TV groups do as well as or better than the conventional groups." Chu and Schramm seem to be using the finding of no significant differences to support a position in favor of I.T.V. However, they fail to point out the fact that if the heading of that table for the same data had read "Percentage in which conventional groups did as well as or better than the TV groups," the actual percentages for each subject area would be approximately the same as those in Table 2 (from Table 1) and this seems to be evidence against the introduction or effectiveness of I.T.V. Indeed if a third table had been introduced, "Percentage in which TV groups did significantly better than the conventional groups," the percentages would have been so small that they would be insignificant. It would seem that these findings can be simply interpreted to fit the position that one holds. It appears reasonable to simply conclude that what these data show is that I.T.V. is no better or no worse than conventional instruction when learning efficiency is the dependent measure.

Explaining These Insignificant Differences - A Problem of Control?

One reason offered why so many of these studies have shown insignificant differences in the criterion variables

has been suggested by Stickell (1963). Stickell applied the strict scientific requirements for adequate experimental design to 250 comparisons of I.T.V. with T.I. and showed that only 10 (4%) met these requirements. The most frequent reason a study was dropped from his comparisons was because of inadequate control of the subject population. Ideally, in this type of comparison (I.T.V. with T.I.), the same subjects should receive the two different methods of instruction on the same topic, and then compare their learning. Not only is this unrealistic but it also is experimentally inadequate because of the problems involved with progressive effects. Thus, when I.T.V. and T.I. are to be compared, two matched groups are a necessity. Most studies investigated by Stickell failed to meet this criterion. Many did not ensure that the different groups of subjects were at the same academic level or that the previous knowledge of the subject matter was equal for the different groups before the experimental manipulations were performed. Other control problems involved using different instructors for each of the different methods of instruction or having the same instructor teach toward different objectives for the different methods. Other investigators seem to have maximized the almost uncontrollable Hawthorne effect instead of attempting to minimize it (simply by informing the TV groups that they were taking part in a psychological experiment while saying nothing to the T.I. groups (or vice versa).

In a more recent critical review, Campeau (1974) found only about a dozen experimental studies that met the criteria that gave some assurance that their findings were interpretable.

This problem of insignificance has been viewed in a different vein by Averch, Carroll, Donaldson, Kresling and Puncus (1972). Although they agree that no one method of instruction has consistently produced higher test (learning) scores than any other method they argue that the reason is not that studies have found no significant input variables. Rather they state:

> The literature contains numerous examples of practices that do seem to have significantly affected student outcomes. The problem is that other studies, similar in approach and method, find the same educational practices to be ineffective; (thus no significant effect overall) and we have no clear idea why this discrepancy exists. (pp. x-xi, brackets mine)

This could possibly be a more valid summary of the current research since about one half of the studies reviewed by Chu and Schramm (1967), Dubin and Hedley (1969), and Dubin and Taveggia (1968) showed differences (however small) in favor of the television instruction.

If Averch et al. (1972) are correct, what factors could cause these results to balance out? Although Averch et al. offer no explanation for this discrepancy, more recent authors have.

Sullivan (1973, 1974) has offered explanations as to why half of these studies cancel out the other half.

Again the problem is one of control. Sullivan (1974) argues that there are many inherent difficulties in carrying out "pure" experimental research in the practical educational setting.

> Included prominently in these difficulties are the problems of insuring adequate controls - in both the practical and the experimental sense - and the problem of finding a precise yet common and readily understood measure of achievement and of other changes (e.g. in attitudes) which have taken place.

Sullivan (1973) demonstrated another important reason why these results may have cancelled each other out; namely, one of overgeneralization of results, particularly with regard to the characteristics of the learner and subject matter. Researchers in this area have continually made significant conclusions too broad - for when these conclusions were applied to a different population, or used for a different subject area, results have been insignificant. (For an example of this overgeneralization, see Sullivan, 1973).

This problem of adequate control is of course an obvious one for when research is taken out of the laboratory and brought into the classroom that research is subject to all the practical limitations of a classroom setting, such as time restrictions and inconsistent class decorum. Since much current research attempts to improve classroom instruction, that research should be carried out in the classroom setting. Researchers in this area must realize that greater care should be taken in an attempt to control the relevant variables of the classroom setting; or else "significant"

input variables might not be detected because of this control problem, and thus would be rendered useless (a type 1 error).

Aside from this problem of adequate control, a second reason offered as to why so many of these studies have shown insignificant differences in the criterion variables could be the measure of achievement used. In many of these studies the dependent variables which have been used to measure achievement have been global and perhaps not necessarily reliable achievement measures based on end-of-term grades.

Furthermore, most studies have been carried out over the period of a semester and during that time a considerable amount of learning has taken place outside of the learning situation, that is, individuals have a motivation to achieve and will perform other learning experiences which will help them toward that goal.

However, an exception to this tendency has been demonstrated by Sullivan and Hartley (1971). Sullivan and Hartley have produced results which are remarkably more consistent and coherent than other researchers in this field. Their investigations, which involved a comparison of live and videotaped instruction, have differed from the majority of studies in this area in the following ways:

First, they have worked with concepts which can be measured precisely and in which the level of previous knowledge is low. It was thus possible to measure achievement with greater precision than in most studies.

Second, each of their studies has been carried out within a short period of time (one class period) so that the possibility of contamination from extraneous variables, such as individual learning from other sources, has been greatly reduced.

Third, the topics they have chosen were of moderate difficulty such that a carefully constructed posttest would yield a wide range of scores and a ceiling or floor effect was not likely to be encountered. According to Marchant (1977) this ceiling or floor effect is a consistent problem in educational research of this type and he suggests this as possible explanation for the over-abundance of insignificant differences when the effectiveness of various teaching modes have been investigated.

Additional support for the importance of a carefully constructed posttest measure has been provided by Duck and Baggaley (1976). In a series of experiments involving videotaped instruction, Duck and Baggaley have also produced remarkably consistent results. Their dependent measure was obtained from a very complex and sophisticated attitude scale which has yielded a precise measure of student attitudes following various videotaped presentations.

Consistent Differences

As has already been mentioned, Sullivan (1969) introduced a new method of instruction for teaching Introductory Psychology at Memorial University of Newfoundland.

This method included videotaped instruction and it was because many students did not avail themselves of this instruction that educators at Memorial University wondered if I.T.V. was effective as a method of instruction. If so, what factors were important in its effectiveness; and how could it be improved to increase learning effectiveness? Since the literature on I.T.V. was inconclusive, it could not serve as a guide in an attempt to answer these questions. Consequently, Sullivan and Hartley (1971) conducted a series of pilot studies designed to assess the effectiveness of various I.T.V. presentations, and to compare each of them to a similar live presentation. In November 1970 the first study was conducted and tested the following methods of instruction:

1) Live lectures (LL): regular in-the-classroom instruction
2) Studio-produced videotapes (SV): which included slides, film clips, etc.
3) Videotape of live lecture (VL): the videotape of method one
4) Programmed Instruction (PI): which involved the drawing of graphs, etc., followed by response feedback
5) Text (T): which involved the reading of relevant material.

The results can be seen in Figure 2. They show that live lectures were better than the videotape of the live

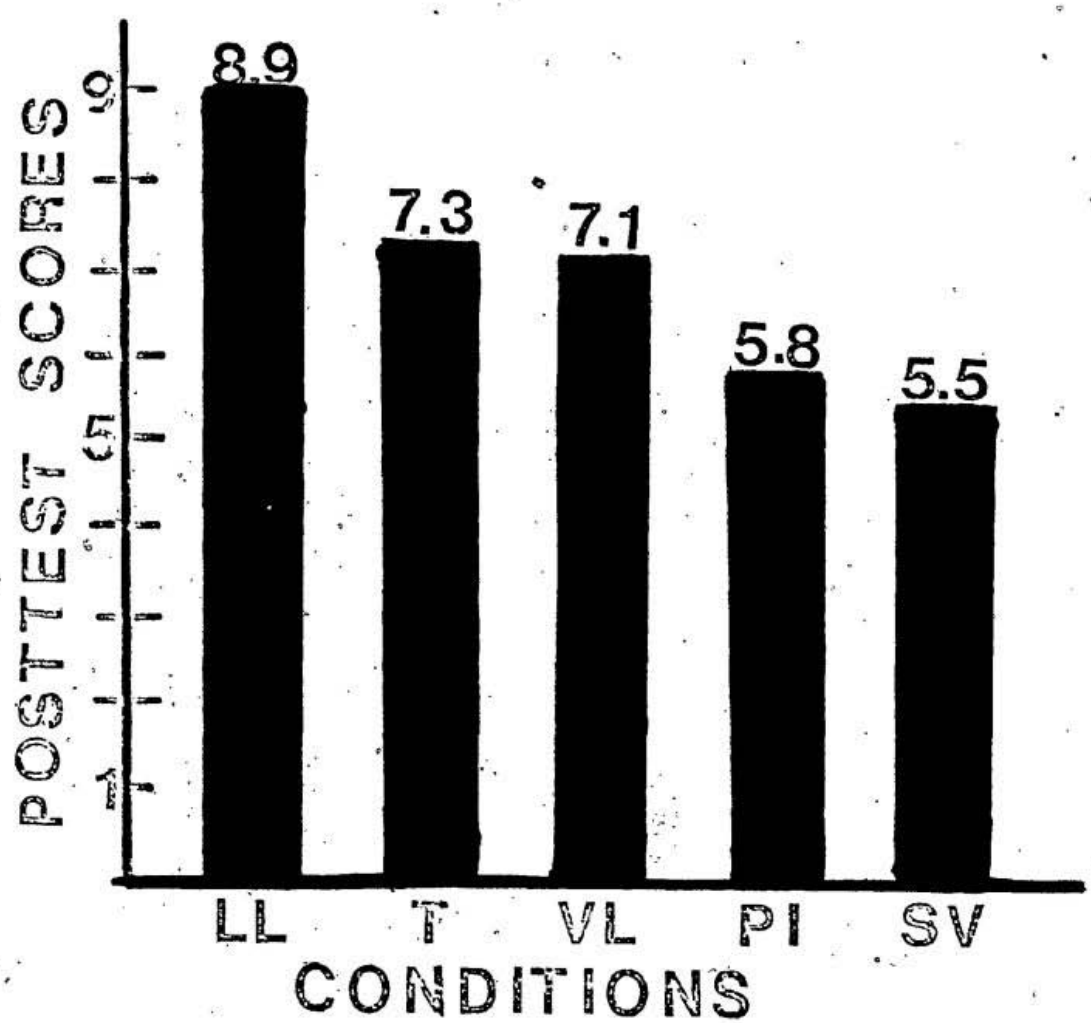



FIG. 2 Results, Nov. 1970
Mean Posttest Scores

(after Sullivan and Hartley)

lecture and the text. Significantly worse was the programmed instruction and the studio tapes.

In 1971 this study was repeated four different times, with four different instructors and minor differences in the methods used (improved scripts, etc.). The results, averaged over all five studies, were exactly the same as for the first study (see Figure 3). Sullivan and Hartley concluded on the basis of all these studies that the live lecture is the superior method of instruction while the studio tapes (I.T.V.) and the programmed instruction produce the least effective learning, with the videotapes of the live lecture and the text consistently between these two extremes.

Further evidence for this order in the effectiveness of these different teaching modes comes from a more recent study done at Pennsylvania State University (Goss & Croft, 1976). This study investigated three different methods of instruction in a beginning graphics course: traditional instruction (live lectures), television instruction, and individual programmed instruction. All methods produced significant learning when posttest scores were compared with a pretest given at the beginning of the course, but the traditional instruction was significantly superior to the television group who, in turn, scored significantly higher than the individual programmed group.

Sullivan and Hartley's (1971) results and those of Goss and Croft (1976) are clearly inconsistent with the other findings already mentioned which conclusively demonstrate

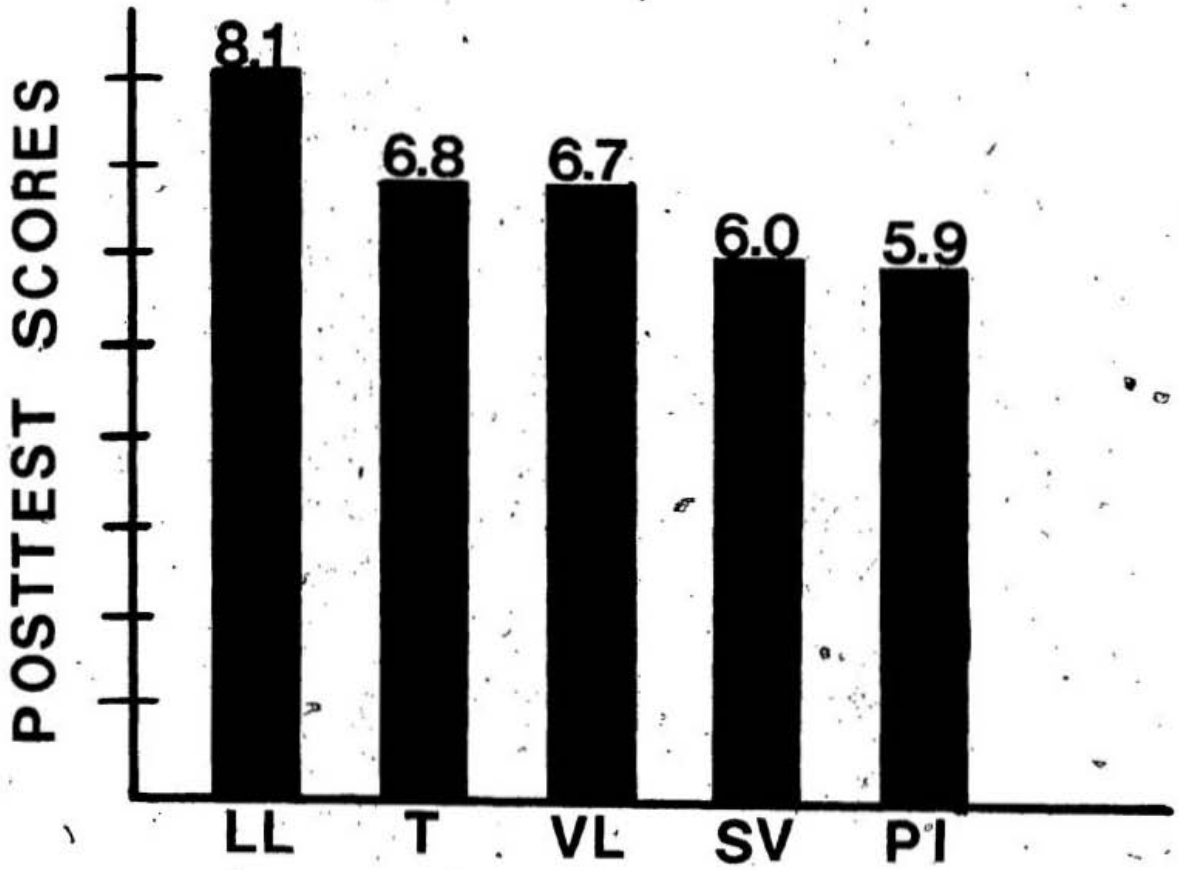



**FIG.3 Average results of five seperate presentations**

(after Sullivan and Hartley, 1971)

that I.T.V. is as good as any other method of instruction. Thus, one purpose of the present research was to replicate the Sullivan and Hartley (1971) investigation.

Individual Difference Variables

Another important factor related to the relative effectiveness of videotaped instruction is the fact that individual difference variables among students are sometimes correlated with learning effectiveness.

The importance of these variables cannot be overstressed. Indeed Sullivan (1973) demonstrated their importance in this way:

> Any given method of instruction may produce an improvement in the performance of one group of learners, but that same method may not necessarily facilitate the performance of other groups of students who do not have the same characteristics - and may, in fact, actually produce a decrement in the performance of students whose characteristics are markedly different.

Kogan and Wallach (1964) have explained this finding in another way. In studying the consequences of risk-taking behavior they have demonstrated the importance of what they call "moderator" personality variables. For example:

> If the sample under study were divided in terms of some theoretically-relevant characteristic (variable), such as degree of emotional disturbance, it could be found that a particular kind of relationship might hold for one of these subsamples but not for the other. Emotional disturbance under such circumstances could be described as a characteristic which "moderated" another relationship - that is, which influenced the form of this relationship (page vii, brackets mine).

Thus the present research hoped to investigate the type of relationship between some of these variables and the different methods of instruction used.

Much work has already been done in this area. Recent reviews of these trait by treatment interaction studies (like Gagné, 1967; Cronbach and Snow, 1969; Berliner and Cohen, 1973) suggest, with cautious optimism, that significant and important interactions of this type are, in fact, not a rare occurrence in educational settings.

Yet, Jamison et al. (1973) were forced to conclude that "a better understanding is needed of how student variables relate to achievement". They say this is because researchers have generally chosen to investigate student variables which are not appropriate for their particular measure of achievement. They emphasize that much further work is necessary in this area. (For exceptions see Williams (1963, 1965) on intelligence, Shrable and Sassenrath (1970) on anxiety, Attiyeh and Lumsden (1972) on student background variables, Witkin (1973) on cognitive style, and Brown, Brown and Danielson (1975) on student ability).

After a careful review of many of these aptitude by treatment interactions, Sullivan (1973) concluded that in the higher educational setting the three most important "individual difference variables" were intelligence, level of anxiety, and degree of extraversion or introversion.

From strictly a theoretical point of view, studies comparing live to videotaped instruction are a necessity if

we are to discover which method produces the "best" learning; however, in the applied sense a much more important application of this type of research is to be able to answer the question of how to make the most effective use of T.V. as an instrument of teaching and learning. To this end, a better understanding is needed of how student variables relate to learning efficiency from television before the most effective use of T.V. is found (see Serakin, 1956). For too long, educators have attempted to "discover" an instructional method which will suit all students. It is time to realize that individual differences exist among all students; and that since all students are not the same they are all not likely to benefit from the same kind of instructional approach. Maybe this is why "relatively few of the educational innovations developed during the 1960's...are in operation today" (Trent & Cohen, 1973), or why "the significant input variables in one study are insignificant in another similar study" (Averch et al., 1972).

The author's opinion is concurrent with that of Chu and Schramm (1967) and Clark (1978a) who hold that it is time educators and educational institutions offered students alternative ways of learning, and I.T.V. may very well be a viable alternative to conventional methods of instruction.

As a final note here, it is important to note that some investigators (Clark, 1978a, 1978b; Coombs, 1976) have attributed the general insignificance and disarray of the instructional television field to the dire lack of a

theoretical framework on which to be guided. This absence of a workable television-learning theory has rendered educational technology practically impotent when confronted with problems of and making predictions about learning from television. Indeed Clark (1978a) has concluded:

> In my estimation, we are not at the point yet where we have significant guidance from research on how to make intelligent selections from among the potpourri of techniques available to the producer for the production of mediated instruction that improves learning.

## PRESENT RESEARCH

In an attempt to explain why Sullivan and Hartley (1971) continued to find the live lecture superior to the studio-videotape result, the present research took a closer look at both the live lecture and studio tape presentations. It was noted that the instructor who gave the live lectures was not always the same one who prepared the studio tapes, and when the instructors were the same the scripts/lectures were not. So the present research kept instructors the same and scripts as identical as possible. Another difference between the live and studio methods was that the live lectures did not contain the same type of visual material as the studio tape. About one-half of the studio tape was comprised of slides, graphics and film clips while the visual material of the live lecture comprised only what the instructor put on the blackboard. The purpose of the visual aids in the studio

tape is twofold; one, to better explain the concept being taught, and two, to make the learning interesting. Could it be that by attempting to make the learning of the studio tape interesting, the visual material actually interfered with the learning of the important concepts and rendered the studio tapes less effective? In an attempt to answer this question the present research includes an unusual method of instruction, live-with-visuals. In this method the visual material of the studio tape is shown as separate clips under regular classroom conditions, with an appropriate live explanation similar to the studio tape between each clip. If the visual material is interfering with learning in the studio tape, it should also interfere with a live setting. But if it doesn't and the live-with-visuals produces more efficient learning than the studio tape, then the important variable in this type of learning is not the kind of visual material per se, but the method of presenting it.

This visual material was designed to meet two criteria set down in the literature. Both Marchant (1975) and Coldevin (1975) have demonstrated that the repetition of material is a helpful factor in I.T.V. productions. So some (about five minutes in total) of this material was, in fact, the visual repetition of material that had previously been spoken.

Goss and Croft (1976) argue that some material lends itself better to television instruction than other. They maintain that visually-oriented material (like the cumulative

curve - the material here) can be made inherently more interesting on television by the use of appropriate visual material than merely talking about that particular topic. So the remaining six to seven minutes of visual material involved the drawing of graphs, etc. in a manner unique to television. This manner was concurrent with the guidelines of Dwyer (1976) with respect to superimposition, detailed line drawing presentation, and photographic presentation. All of the visual inserts were explained by voice-over narration.

So in an attempt to better understand the efficiency of I.T.V., the present research investigated five different methods of instruction: live lectures, videotapes of live lectures, studio-produced videotapes, live with visuals and a text condition. To maximize learning differences each condition was preceded by a pretest. (For a review on the use of a pretest see studies by Hartley (1973) who showed that its effect depends upon the prior knowledge and the characteristics of the learner.) Each condition was then followed by an immediate posttest. The cumulative curve was chosen as subject matter. Numerous investigations have demonstrated that the subject matter chosen is a critical variable when T.I. and I.T.V. are to be compared. Brown et al. (1975), Elliott and Sebring (1976), Goss and Croft (1976) and Sullivan and Hartley's works suggest that the cumulative curve is appropriate for this type of investigation.

The final, although certainly not least important, reason for the present research also stemmed, in part, from

the Sullivan and Hartley (1971) observation that when videotaped instruction was compulsory, attitudes toward I.T.V. ranged from extremely favorable to extremely unfavorable for both students and faculty. This investigation is also borne out in fact. Detailed investigations of viewers' attitudes Coldevin (1975, 1977), Duck and Baggaley (1976) have shown that variables such as the lecturer's age, background, expertise, etc. can produce differential viewer attitudes.

Undoubtedly some students like and learn from I.T.V. If some of these student personality characteristics which correlate with learning from I.T.V. could be isolated, it would benefit both student and instructor alike. If any educational institution could predict beforehand which students would benefit most from which methods of instruction, it would improve learning efficiency. Consequently, the present research attempted to identify the "type" of student who learns best from different methods of instruction, particularly live versus videotape instruction (see Sullivan and Skanes (1971) and Skanes, Sullivan, Rowe and Shannon (1974) for similar investigations).

The individual difference variables chosen were concurrent with Sullivan (1973) - intelligence, degree of anxiety and degree of introversion or extraversion. Knowledge of the interaction of these variables with the different methods of instruction could vastly improve the learning efficiency of these "types" of students.

# CHAPTER II

## METHOD

### Study One

Subjects

The subjects were 236 first-year students registered for the Introductory Psychology course (Psychology 1000) at Memorial University of Newfoundland. These 236 subjects comprised 15 class groupings or sections.

The assigning of individual subjects to a given section (class) is not akin to true randomization at Memorial University of Newfoundland. The registration procedure at Memorial University of Newfoundland makes it possible that a group of atypical students could all register in the same section. Thus, the datum unit in these studies is sections (classes) and not individual subjects.

Since sections were randomly assigned to the given treatment conditions rather than individual subjects and since these sections are nested within treatments, both the internal and external validity of this work is in doubt because random selection and assignment of subjects cannot be assumed (see Campbell & Stanley (1963), the nonequivalent Control Group Design).

In an attempt to better meet both the internal and external validity of these studies the following steps were taken:

1) A pretest was administered to all subjects immediately prior to their given treatment condition. This would enable previous knowledge of the subject matter to be ascertained.
2) A general achievement measure (Grade 11 average) was obtained on all subjects to see if average achievement was constant across conditions.
3) As it turned out, when more than one section taught by the same instructor was used (instructors each teach three sections) each of these sections ended up (through random assignment) to be in different treatment conditions.
4) The possibility of "any other variable" affecting the result was further minimized by the fact that the subjects did not know an experiment was to take place. Total instruction lasted only 20 minutes, the posttest was administered immediately after the instruction and all took place in the subject's regular classroom at the regular class time.

Materials

The topic of the cumulative curve was selected as subject matter for the instruction. This topic was selected

for the following reasons:

1) The subjects' previous knowledge of this topic is very low and therefore the pattern of learning should not be contaminated by varying levels of previous experience across sections.
2) It is included as a topic in the Introductory Psychology course, and one that the student should understand if he is to comprehend the literature in learning.
3) Its basic fundamentals can be encompassed in one twenty-minute period.
4) Knowledge of its basic facts can be measured reliably and accurately by a well-constructed posttest.
5) The topic lends itself to application-type problems and these novel problems can also be measured reliably.
6) It is a moderately difficult topic and a carefully constructed posttest would yield a wide range of scores such that a "ceiling" or "floor" effect is not likely to be encountered.

The following materials were prepared:

1) Pretest - constructed as a control technique to measure previous knowledge, the pretest consisted of four, four alternative, multiple choice questions. Two of these

items required the student to compare sections of both a cumulative curve and a performance-per-unit-of-curve (see Figure 4); while the other two asked the student to identify specific sections of a given cumulative curve which corresponded to a particular rate of response (see Figure 5). The maximum score on the pretest was four. (Note: the pretest is included as Appendix A.)

2) Worksheet - during the course of some of the methods of instruction (the live lecture and videotape of the live lecture were better suited to this type of instructional device), the students were required to refer to a worksheet. It consisted of four items, three of which required the student to draw a different shaped curve at different times. During the course of the instruction requiring the worksheet the instructor would specifically ask the students to refer to a particular item on the worksheet; and sufficient time was allotted by the instructor to allow the students to draw the appropriate curves. The instructor immediately provided the students with the correct answer after all had finished. (Note: the worksheet is included as Appendix B.)

3) Five different methods of instruction were prepared. Each method consisted of essentially the same material and examples: an introduction to the concept of the cumulative curve, a comparison between cumulative and unit-of-time curves, and finally a series of cumulative curves showing different rates of responding. The five methods are as follows:

Which curve on the right corresponds to the indicated portion of the curve on the left

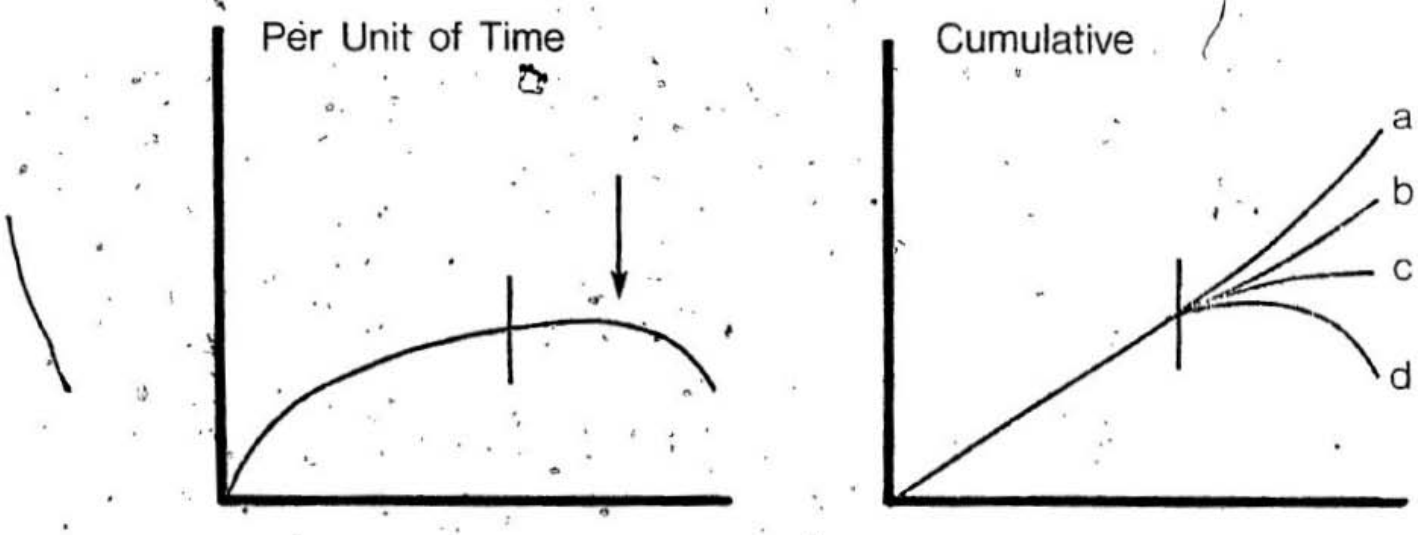
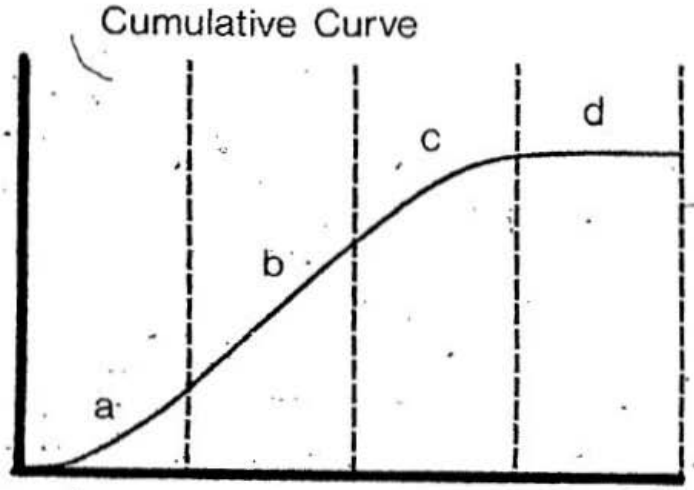



**FIG.4 Sample Item from Pretest**




1. Which section of this curve presents an increasing rate of response

   a b c d

2. Section d represents

   a an increasing rate of response
   b a decreasing rate of response
   c. a stable rate of response
   d. no responding

**FIG.5 Sample Item from Pretest**

a) Live lecture. This method of instruction is the traditional face-to-face lecture method. The instructor taught the topic in a way that involved extensive use of the classroom blackboard to demonstrate appropriate graphs, visual material, etc. This method involved the use of the worksheet; the instructor would put data on the blackboard, and on their worksheets the students were required to draw a cumulative curve to illustrate that data. In these "solo" live situations, the instructor was free to adapt his presentation to any individual problems arising in the class since he was oriented to his audience (the students). The same instructor used exactly the same predefined script for each of the different classes that comprised this condition. The total instruction time was 22 minutes, eight of which was worksheet time for the students.

b) Videotape of live lecture. This method was the videotape of a live lecture delivered under classroom conditions. In one of the classes that received the live lecture instruction (condition a, above) an educational television camera

crew recorded the entire proceedings (including any graphs or diagrams drawn on the blackboard and time spent on the worksheet) on videotape. This videotape was then used as a separate experimental condition and shown as a method of instruction to other classes.

It is important to note that any learning differences between this method and the live lecture condition can only be attributed to differences in the media of instruction since lecturer, script, visual material, pace, etc., are, by definition, exactly the same. (From an experimental method point of view this type of comparison between traditional instruction and instructional television offers "the purest control".) Although this method of instruction is a videotaped condition it is not the "normal" or "traditional" type of videotaped instruction since the lecturer made no effort to "look at the camera"; instead, his orientation was to the students. Any difference between this type of videotape and the "normal" studio-produced tapes could, of course, be attributed to this. (A taped live lecture changes the status of the student viewers from that of direct objects of instruction to indirect observers of the instruction.)

c) Studio-produced videotapes. The "traditional" made-in-the-studio type of instruction thought of when instructional television is mentioned. This studio videotape,

prepared with the help of our educational television personnel, was judged to be of high quality in terms of learning from television since it contained good slides, diagrams, and graphics as illustrations. The total duration of this tape was 23 minutes, 11 minutes of which was visual inserts.

This method of instruction covered exactly the same material as in the live lecture; indeed much of the data, graphs, etc., were identical. The lecturer on this tape was the same individual who administered the live lecture conditions; he was experienced with videotaped methods of instruction, having prepared many studio tapes beforehand. (The experience with preparing studio-tapes seems to be an essential variable in obtaining a "proper" comparison between live and videotaped methods of instruction (see Chu & Schramm, 1967). In this production, the lecturer was, of course, primarily oriented to the camera.

d) Live with visuals. In an attempt to isolate what variables are producing the learning which takes place during both videotaped and live conditions, a combination of both types of methods called live with visuals was introduced. This new method of instruction was a live lecture in the traditional oriented-

to-the-student sense, but instead of the instructor drawing data, graphs, etc. on the blackboard to illustrate the cumulative curve, the visual material he presented was the visual material of the studio-produced tape. In other words, this method consisted of presenting live in the classroom all of the visual material that was contained in the studio tape. All the visual material of the studio tape became separate visual inserts (audio included) on another tape which were presented on a video-cassette-recorder, one at a time, in the classroom with appropriate live explanation between each one. Each visual insert was separated by an interval of 10 seconds and between inserts the material presented live by the lecturer was the same as that in the studio tape. Of course, the sequence of these inserts was exactly the same as in the studio-tape. (This type of instruction is important from a theoretical sense in that it might help us to find out if it is better to present visual material live or on videotape. Since the visual material was exactly the same, any learning differences between this

method and the studio tape can be attributed to live vs. videotape differences. Again, an inherent "advantage" of this method over the studio tape is that here the lecturer is free to adapt his presentation to any feedback he might receive from the class, while this is not possible in any videotaped presentation.

e) Text. Because of the relatively good showing of the text condition in the early Sullivan and Hartley studies (significantly better than the studio tape and the programmed method), and since it is a completely different "kind" of instruction than the other four, it was decided to include a similar text condition. The actual script used by the lecturer in the live lecture condition (including exact data, diagrams and graphs, etc.) was prepared as the text. The students were simply permitted 20 minutes to read this material. This text condition included three sample questions at the end of the material which required the drawing of different shaped cumulative and unit-of-time graphs. These items were non-

compulsory and were merely included for the interested students under the heading "sample questions". (Note: The entire text condition is included as Appendix C.)

4) Posttest - The posttest consisted of 14 questions, made up from the following sections:

Part A. Four questions involving a comparison between a cumulative curve and a per-unit-of-time curve.

Part B. Four questions in which the student had to indicate the section of a given cumulative which showed a particular response rate.

Part C. Two questions in which the student had to continue drawing a cumulative curve to show a particular rate of response, and one in which the student had to describe the rate of a given cumulative curve.

Part D. One question in which the student was given some response-per-minute data (for a six-minute period) and had to compute the cumulative response column and draw the appropriate cumulative curve in the space provided, and one question in which the student was given a performance-per-minute graph (for a six-minute period) and asked to plot that data as a cumulative curve in

the space provided.

Part E. One long question in which the student was given response-per-minute data (for 10 minutes). The student was then required to:

i) compute the total response column;

ii) draw and label the cumulative curve and the response-per-minute curve for that data;

iii) indicate for each curve the section which showed increasing, stable, decreasing and no-response rates of responding.

The maximum score in the posttest was 30 and was made up as follows:

Part A - 4 points, Part B - 4 points,
Part C - 6 points, Part D - 6 points,
Part E - 10 points.

The final page of the posttest contained two questions. They were:

1) How effective did you find this method of instruction?

2) How did you like being taught by this method of instruction?

Both questions were rated on a five-point scale. (Note: The posttest is included as Appendix D.)

Procedure

Fifteen classes of Introductory Psychology took part in this experiment. Each class that was used had assembled in their classroom for what they thought was a regular class period. None of the students knew that an experiment was to take place. The experimenter went with the regular class instructor to the class and was introduced. The experimenter then explained, very briefly, that research on different types of instruction in first year university was being conducted and that, depending upon the results, significant findings might be incorporated into the course work. Three classes were assigned at random to each of the five different treatment conditions. Each class was then subjected to the following procedure (see Figure 6):

1) Pretest - After the purpose of the experiment had been explained, students in all conditions were given 5 minutes to complete the pretest. It was then collected.

2) Instruction - Immediately after completing the pretest each class received one of the five different experimental teaching conditions. All students were told that they would be given a short test at the end of the instruction, but that they were not to take notes during the course of the instruction.

For the live lecture and videotape of the live lecture conditions the worksheet was handed out just before the instruction began. The students were told that they would be informed by the lecturer (giving the instruction) when they

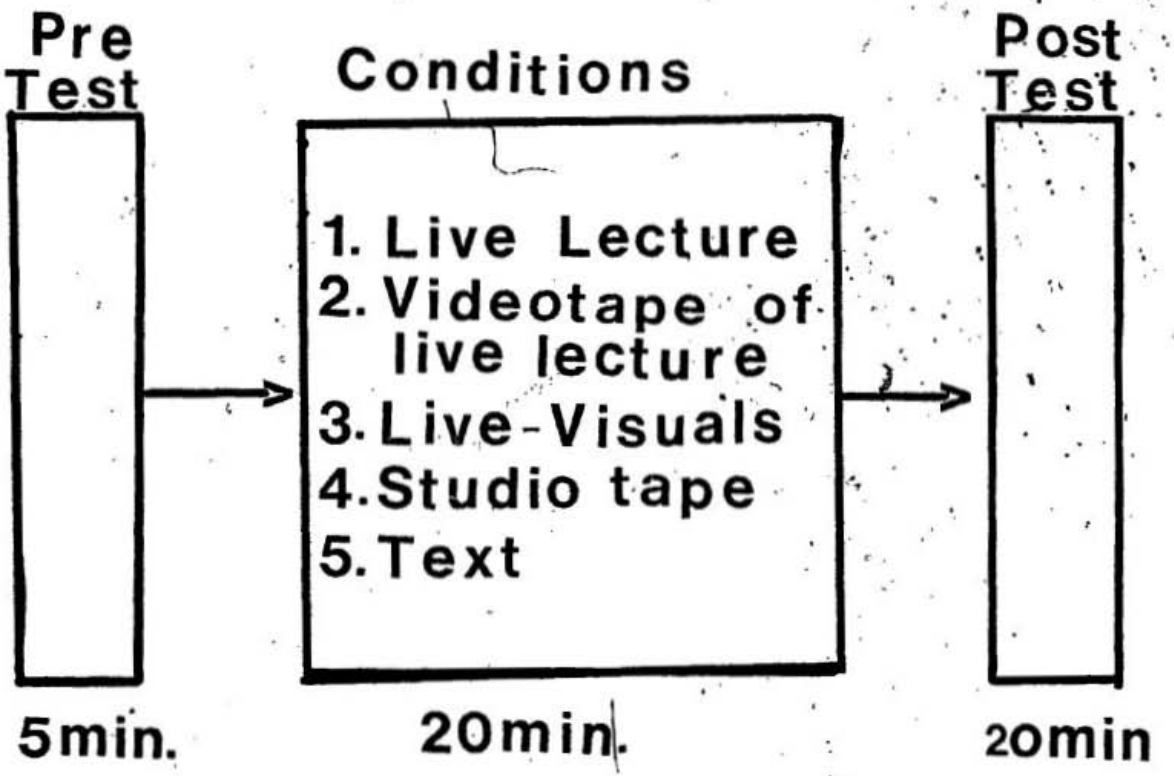



FIG.6 Experimental Procedure Study One

would have to refer to and use this worksheet. The worksheet was collected as soon as the instruction was completed.

Each method of instruction took approximately 20 minutes, and for all methods (except the text) the lecturer was the same person.

3) Posttest - Immediately after each method of instruction was completed the posttest was administered and the students were allowed 20 minutes to complete it.

With respect to the individual difference variables, approximately one week after the posttest, Form B of the Eysenck Personality Inventory was administered. This inventory took only five minutes to complete and gave a measure of anxiety and an introvert-extravert score for each student. For the other major variable, intelligence, a valid measure was not readily attainable, so two achievement measures were used: pre-university general ability level (the student's grade 11 average) and knowledge of psychology (the student's Introductory Psychology mark).
(Note: The Eysenck Personality Inventory, Form B, is included as Appendix E.)

# CHAPTER III

## RESULTS AND DISCUSSION

### Study One

Table 3 shows the mean pretest and grade 11 average scores (and standard deviations) by condition. As can be seen, there were no differences ($df = 235$, $F < 1$) in pretest scores since the mean for all five conditions was approximately one. So all conditions were equivalent on previous knowledge of the subject matter in that all knew nothing.

Also Table 3 shows that the mean grade 11 averages were not significantly different across treatment conditions ($df = 235$, $F < 1$). Thus all conditions were equivalent on general ability (intelligence) level.

A multiple regression analysis (Cohen, 1968; Overall & Spiegel, 1969) was used. This analysis statistically equated all groups on Grade 11 average and pretest score before calculating the posttest means. The full model consisted of the main effects (different methods of instruction, grade 11 average, psychology score, introvert/extravert score and anxious/nonanxious score) and the interactions of the different methods of instruction with the other main effects. These results are given in Table 4.

TABLE 3

Mean pretest and grade 11 average scores by condition

Study One

| CONDITIONS | Mean pretest score | Mean grade 11 average |
|---|---|---|
| Live lecture (N = 87) | .90<br>S.D. = .81 | 74.6<br>S.D. = 8.3 |
| Videotape of live lecture (N = 59) | .72<br>S.D. = .77 | 73.4<br>S.D. = 7.7 |
| Live with visuals (N = 75) | .84<br>S.D. = .65 | 75.2<br>S.D. = 7.9 |
| Studio videotape (N = 53) | .87<br>S.D. = .75 | 74.1<br>S.D. = 9.1 |
| Text (N = 78) | .76<br>S.D. = .71 | 75.8<br>S.D. = 8.6 |

Group Differences

Firstly, there were significant differences among the different methods of instruction. The text condition ($\bar{X}$ = 7.7) produced significantly lower posttest scores than any of the other methods. The live lecture ($\bar{X}$ = 10.9), the videotape of the live lecture ($\bar{X}$ = 10.3), the studio-produced videotape ($\bar{X}$ = 9.4) and the live with visuals ($\bar{X}$ = 10.0) did not differ significantly. Table 5 shows the appropriate Newman-Keuls multiple comparison table.

TABLE 4

Multiple Regression Analysis, Study One

| Variable | Reduction in $R^{2a}$ | $F^b$ |
|---|---|---|
| Groups | .04788 | 4.34* |
| Grade 11 Average | .07815 | 28.31* |
| Psychology Score | .01630 | 5.90* |
| Introvert/Extravert | .00001 | <1 |
| Anxious/Nonanxious | .01993 | 7.22* |
| Grade 11 Average x Group | .01367 | 1.24 |
| Psychology Score x Group | .00201 | <1 |
| Introvert/Extravert x Group | .00304 | <1 |
| Anxious/Nonanxious x Group | .00885 | <1 |

Note: N = 236

[a] $R^2$ (full model) = .42029

[b] df = 1/236, except for groups where df = 4/236

*p < .01

Even though there were no significant differences between the four "major" methods of instruction it might be worthy to note that they were in the direction of the Sullivan and Hartley studies (i.e., the predicted direction) with the live lecture best and the studio tape worst.

TABLE 5

Newman-Keuls multiple comparisons for posttest scores, Study One

| Condition | | Live lecture | Videotape of live lecture | Live with visuals | Studio tape | Text |
|---|---|---|---|---|---|---|
| | Mean | 10.9 | 10.3 | 10.0 | 9.6 | 7.7 |
| Live lecture | 10.9 | -- | 0.6 | 0.9 | 1.3 | 3.2* |
| Videotape of live lecture | 10.3 | | -- | 0.3 | 0.7 | 2.6* |
| Live with visuals | 10.0 | | | -- | 0.4 | 2.3* |
| Studio tape | 9.6 | | | | -- | 1.9* |
| Text | 7.7 | | | | | -- |

*$p < .05$

Individual Difference Variables

With respect to the ability level variables, both grade 11 average and psychology score proved to be significant main effects. This indicates that the higher the student's pre-university average the better his posttest score and the higher the student's introductory psychology mark the better his posttest score also. Yet this should not be surprising

since it is obvious that the better (brighter) students should be able to score higher on any measure of achievement.

However, the important comparisons for matching a student to his "best" method of instruction involve the interactions of these ability level variables with the different methods of instruction. Unfortunately, none of these interactions proved to be significant so a further breakdown of these variables is unnecessary. It would therefore seem to make no difference by which method of instruction a student of a given ability is taught.

With respect to the personality variables only the anxious/nonanxious variable was found to be a significant main effect. This means that the nonanxious students scored higher on the posttest than did the anxious students. The proportion of variance accounted for by the introvert/extravert variable was insignificant.

As before, the interaction of these personality variables with the different methods of instruction proved insignificant; so again it was not possible to match a student to the particular method of instruction which benefitted him "the most".

The results of the two information questions asked each student at the end of the posttest were as follows:

a) the correlation between actual effectiveness (measured by posttest score) and perceived effectiveness (measured on a five-point rating scale) was +.81. This

shows that the methods of instruction that students perceived as most effective, in fact, generally are the most effective and vice versa.

b) the correlation between actual effectiveness and liking (measured on a five-point rating scale) was +.64. This shows that generally students prefer to be taught by methods which are most effective. This finding is entirely consistent with Jamison et al. (1973) and Chu and Schramm (1967);

c) finally, the correlation between perceived effectiveness and liking was +.70. This indicates that students prefer to be taught by methods which they believe are the most effective, yet this is certainly not surprising.

To briefly summarize, the only significant difference between the methods of instruction was that the text produced inferior learning. The main effects of grade 11 average, psychology score and anxious/nonanxious score were significant but they did not produce any differential interactions with the different methods of instruction. Liking and learning are positively correlated not only with actual effectiveness, but also with the methods that are perceived to be the most effective.

In spite of the fact that the differences between the four major methods of instruction were not statistically significant, their order was consistent with past research with the live lecture best and the studio tape last. It was therefore felt that this was justification enough to replicate this aspect of the study. To add to this justification there were also two procedural problems with the instructions given to the students. They were:

i) Motivation problem. There existed at Memorial University of Newfoundland at the time of this study the procedure of giving "experimental credit" to students for participating in psychological experiments. It amounted to giving students one percent toward their final grade (this has since been discontinued for experiments done in class time and replaced by paying subjects for experiments done outside of class time). Some of the classes sampled had already used their experimental credit while others had not; thus all classes were not equal on this variable. This motivational problem was further confounded by the fact that in those classes where the experimental credit had been used, the experimenter was invariably asked "Does this test count anything toward our final grade?". In these classes

the experimenter was forced to reply that it didn't but stressed that this concept was part of their course and would be studied later. This problem did not arise in the other classes since it was understood that these classes were participating in the experiment for the "experimental credit".

ii) In this study the students were given twenty minutes to complete the posttest. From a control point of view it would seem desirable that all students be given a set amount of time to complete the posttest, and regardless of whether it was completed or not, it would be collected after twenty minutes. This was done in this experiment. However, a problem arose, not, as might be expected, with the students who did not complete the test, but with those students who finished early and were forced to remain until the twenty minutes were up. In some classes these students seemed to resent the fact that they could not leave when finished and (consciously or not) disrupted classroom decorem by talking, etc., rather than sitting quietly until the twenty minutes were up. This problem was

more evident in some classes than in others. In short, this control procedure created more problems than it solved and it was decided that it be eliminated from the next study.

For these reasons it was decided to conduct the aspect of this study dealing with the different methods of instruction again. However, since the interaction of the individual difference variables with the methods of instruction was not significant, it was decided that these individual difference variables would not be included in Study Two.

# Study Two

## METHOD

### Subjects

Two hundred and twenty-three subjects participated in this study. They were chosen in exactly the same way as for Study One, and comprised eight Introductory Psychology sections. No subjects from Study One participated in Study Two.

### Materials

The cumulative curve was again used as the subject matter. Pretest, worksheet and posttest were the same as in Study One. Only four methods of instruction were used in this study, and they were the live lecture, videotape of the live lecture, studio-produced videotape and live with visuals. Each of these methods was identical to that used in Study One. The text condition was dropped because it was significantly inferior as a method of instruction in Study One.

### Procedure

The experimental procedure of Study Two was very similar to that of Study One (see again Figure 6), with three minor exceptions: first, the concept of experimental credit had been dropped for all in-class experiments, so it was

not a factor in this study; second, when students were finished the posttest they were permitted to leave; and third, the only individual difference variable used was grade 11 average.

Results and Discussion

Table 6 shows the mean pretest and grade 11 average scores (and standard deviations) per condition. Again both pretest scores ($df = 222$, $F < 1$) and grade 11 average scores ($df = 222$, $F = 1.30$, $p = .30$) were not significantly different across conditions. So previous knowledge of the subject matter and general ability levels were again equivalent (matched) per condition.

TABLE 6

Mean pretest and grade 11 average scores by condition

Study Two

| | Mean pretest score | Mean grade 11 average |
|---|---|---|
| Live lecture (N = 55) | .93 S.D. = .72 | 75.7 S.D. = 9.2 |
| Videotape of live lecture (N = 62) | .86 S.D. = .72 | 77.5 S.D. = 8.1 |
| Live with visuals (N = 57) | .95 S.D. = .78 | 76.8 S.D. = 8.5 |
| Studio videotape (N = 54) | .84 S.D. = .75 | 76.3 S.D. = 8.8 |

The same multiple regression analysis as was used in Study One was also used again. This analysis statistically equated all groups on grade 11 average and pretest score before calculating the posttest means. The full model consisted of the main effects (different methods of instruction and grade 11 average) and the interaction of these methods with grade 11 average. These results are shown in Table 7.

TABLE 7

Multiple Regression Analysis, Study Two

| Variable | Reduction in $R^{2a}$ | F |
|---|---|---|
| Groups | .02944 | 2.16 |
| Grade 11 Average | .13382 | 46.83* |
| Grade 11 Average x Groups | .00196 | <1 |

Note: N = 223
[a] $R^2$ (full model) = .16552
*p < .01

Group Differences

Although the group differences approached significance (p = .07) the posttest means (live lecture 14.8, videotape of live lecture 13.0, studio-produced videotape 11.1, and the live with visuals 13.2) were not significantly different so further analysis was unnecessary. This means that no

method of instruction produced superior (or inferior) learning.

In spite of this the means were again in the predicted order with the live lecture best, the studio tape worst and the other methods between those two extremes. This result is identical to Study One.

Individual Difference Variable

The only individual difference variable investigated in this study, grade 11 average, proved to be a significant main effect. This indicates that the higher the student's pre-university average the better his posttest score. But this is not surprising; the brighter (better) students should score higher in any achievement measure. This result was the same as in Study One.

Again, the important comparisons for matching a student to the method of instruction which benefitted him the "most" involved the interaction of the grade 11 variable with the different methods of instruction. As was the case in Study One, none of these interactions proved to be significant. Again, it seems to make no difference by which method of instruction a student of a given ability is taught.

# CHAPTER IV

## CONCLUSIONS

The most significant aspect of these two studies is that with respect to the different methods of instruction the order of effectiveness is remarkably consistent; the live lecture produces superior learning while the studio-produced tapes invariably produce the least learning. The videotape of the live lecture and the live with visuals are consistently between these two extremes. If these studies are combined with the Sullivan and Hartley findings this same result is even more consistent.

So to conclude from these results: for relatively dry and difficult subject matter like the cumulative curve, when immediate learning efficiency is the dependent measure, live lectures (T.I.) are no more efficient than videotaped lectures (I.T.V.). If videotapes are to be used they could be videotapes of those live lectures or studio-produced tapes, since these two methods do not differ either. At Memorial University of Newfoundland an application of this finding has already been implemented and the use of studio tapes has greatly increased - they are now often used as a review of a topic after it has been completed in class. This use of I.T.V. has met with far less criticism from students and instructors compared to when I.T.V. was used as a method of teaching.

Even though I.T.V. is as effective as T.I. there may still be factors which limit its effectiveness. Aside from the apparently inherent "advantages" which T.I. has over I.T.V. (principally a "feedback" mechanism and a varying pace of presentation, see Trottier, 1970; Smith & Nagel, 1972) two further explanations are offered: First, it may be that the visual material inserted into the studio tape to make that instruction more interesting and illustrative actually interferes with the learning of the significant concepts in the tape. When this visual material is omitted from a videotape presentation (videotape of the live lecture) the differences between live and videotape methods are not as great as when it is present (studio-produced tape). It would be interesting to compare these methods to a videotape made in the studio which has no additional visual material.

Second, high school students in Newfoundland have very little experience with instructional television. It could be that these students have an inappropriate "set" when it comes to learning from television. They may view television as an instrument for entertainment and not as a medium for learning. Students in the studio videotape conditions certainly do not suffer from the Hawthorne effect, since it is hardly a "novel" experience.

## LIMITATIONS

Even though these studies produced few differences between I.T.V. and T.I., they are still not without their limitations. In fact this could be why they produced few differences. First, the fact that the individual difference variables did not interact with the various methods of instruction suggest that maybe these variables are not the appropriate input variables. Further investigations, using different individual variables are required. Second, these studies were carried out on the topic of the cumulative curve. Would these results still persist if a more interesting topic was presented as the subject matter. Third, these studies involved single-topic learning for only twenty minutes. A much more common use of I.T.V. and videotaped instruction is the production of a series of tapes for a whole course. Would these results still exist in a series of tapes? Would not interest affect learning more in a series of tapes than in a single tape? Similarly, visual material may also be more crucial in a series of tapes, since it may lend itself better to interest-arousing material. Although Coldevin (1977) has identified some of the variables important in a series of tapes, he has not investigated the effect of visual material. However, before this could be ascertained it would seem logical to compare standard studio tapes (with visual material) to studio tapes which by design contain no visual material. Finally, these studies inves-

tigated only immediate learning scores. Since remembering (or long-term retention) is as important a goal as immediate learning (or short-term retention) to most educators (see Clark, 1978a), it would be advantageous to discover if these differences in immediate learning would persist over time. It is conceivable that any given method of instruction could produce short-term but not long-term retention differences in the same subjects, particularly if the subject matter is rather dry, difficult and uninteresting.

## IMPLICATIONS

In conclusion, a few observations on the whole nature and concept of videotaped instruction are worth noting:

First, a curious aspect of all of these experiments involving videotaped instruction is that material is repeated much more often in the live presentations than in the studio tapes. (This is easily discovered when viewing a videotape of a live lecture and comparing it to a studio tape.) Since the methods do not differ this might suggest that the whole idea of repetition and pace of presentation might be a key variable in the production of more effective videotapes, which could conceivably produce superior learning when compared to live lectures. Indeed Coldevin (1975) found that the repetition of material combined with built-in pauses increased the effectiveness of studio tapes, but he did not compare these tapes to live lectures nor did he test in a

university setting.

Secondly, another obvious difference between live lectures and studio tapes (other than the media difference) is the presence of an audience. Studio tapes, by definition, involve no audience. Yet this audience difference might suggest that if an audience were present in the studio while the tape was being made, learning efficiency would be increased. The lecturer could orient to the audience (not the camera) and the regular visual material of the studio tape could still be presented. (In fact, the studio audience could see this visual material on studio monitors). Although general audience effects have been investigated (see Duck & Baggaley, 1976), this particular suggestion has not been documented.

Third, the vast majority of studies comparing live lectures to videotaped instruction have used standard size monitors (18-22 inch) for the T.V. conditions. Would learning through television be improved if larger screens (say 6 ft. by 8 ft.) were used? This screen size would more closely approximate the live lecture condition since facial and posture cues would be more easily observed by the students.

Fourth, could it be that creativity and spontaneity are necessary criteria for effective learning (like in the live and videotape of the live methods)? No "mistakes" were permitted in the studio tapes. They were remade by the producer-director until all speaking, editing, etc. were perfect. All were extremely polished and completely lacked

the spontaneity and occasional flaws so characteristic of "normal" live presentations.

Finally, these studies suggest that it would prove interesting to compare a regular live lecture delivered as part of standard course instruction to a live lecture on the same topic delivered for experimental purposes. Any differences between these two types of live lectures could possibly be attributed to the fact that the students participating in the experiment are excited about taking part in a scientific investigation (Hawthorne effect), and this could affect their posttest scores. Another explanation which is suggested is that a live lecture delivered for experimental purposes is much better prepared and organized than the regular in-class teaching lecture because of the constraints of time. When teaching for experimental purposes the lecturer must finish his lecture in time to administer a posttest, and for that reason he must be better prepared, and must know just how long he can spend on any one aspect of his lecture.

However, it will be no easy job to compare I.T.V. and/or T.I. to the <u>videotape</u> of a standard in-class lecture. For when an instructor is informed that his regular in-class lectures are to be videotaped he immediately combs his hair, shines his shoes, puts on his best suit and brings 27 pages of well-prepared notes with him to class, making his lecture anything but a standard teaching lecture. The solution to this problem (a hidden camera?) may prove as interesting

as the results found from it.

Although these experiments may have helped to answer the question "Are live lectures better than videotaped lectures?", they have posed an even greater one: "Given that videotaped lectures as they now exist are equivalent in effectiveness to live presentations, what significant input variables can be manipulated in the studio setting to produce television instruction that is better than our best live lectures?"

Research using the flexibility of the T.V. studio to discover new techniques in videotaped instruction (for preliminary work on camera angle, background detail and editing procedure, see Baggaley & Duck, 1976), or investigating new personality variables, or research involving different concepts as the subject matter, should help solve this problem.

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# APPENDICES

# APPENDIX A

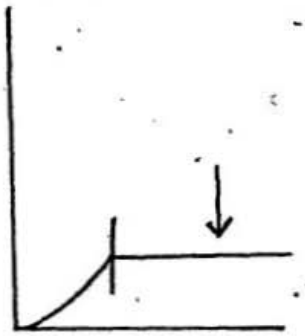
## Pretest

PRETEST

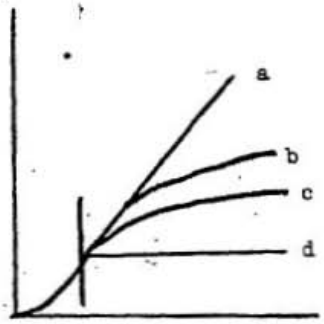
Name _____

1. Which curve on the right corresponds to the indicated portion of the curve on the left

a b c d



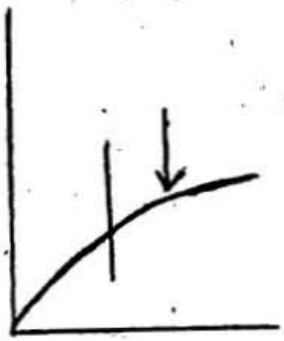
Per Unit of Time



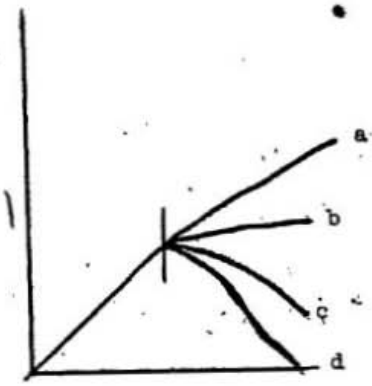

Cumulative

2. Which curve on the right corresponds to the indicated portion of the curve on the left

a b c d



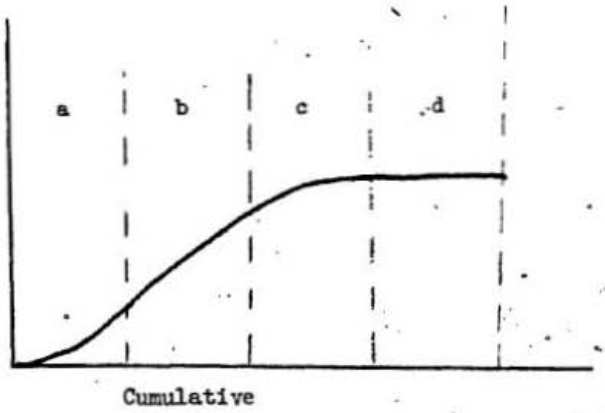
Cumulative




Per Unit of Time

3. Which section of the curve on the right corresponds to an increasing rate of response

a b c d




4. Which section of the curve above shows no responding:

a b c d none

# APPENDIX B

## Worksheet

# CUMULATIVE CURVE

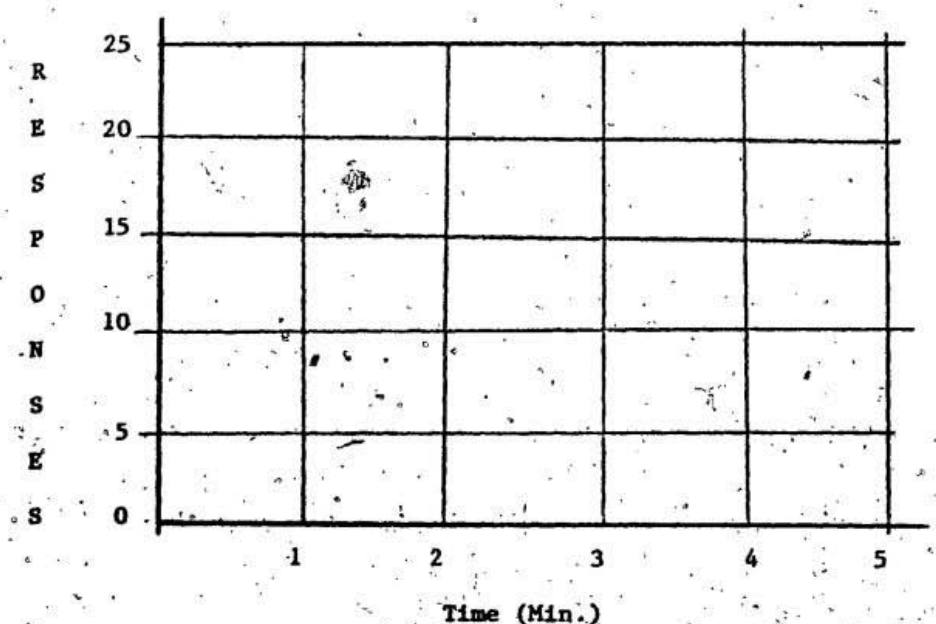
## WORKSHEET

1. Given the following data fill in the remainder of the "total response"column.

| Min | Responses per minute | Total Responses |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 5 | 10 |
| 3 | 5 | ___ |
| 4 | 5 | ___ |
| 5 | 5 | ___ |

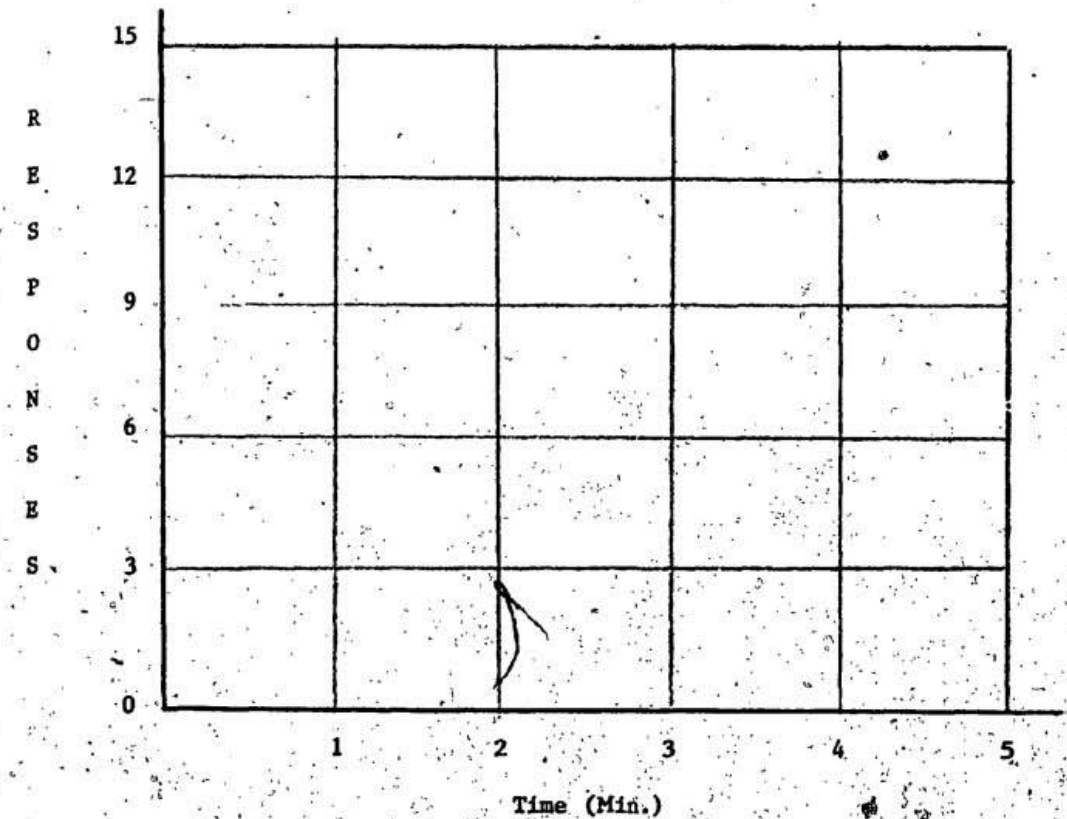
2. For the data given below sketch the performance per unit of time curve (responses per minute column) in the space provided.

| Min | Responses per minute | Total Responses |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 10 | 15 |
| 3 | 15 | 30 |
| 4 | 20 | 50 |
| 5 | 25 | 75 |



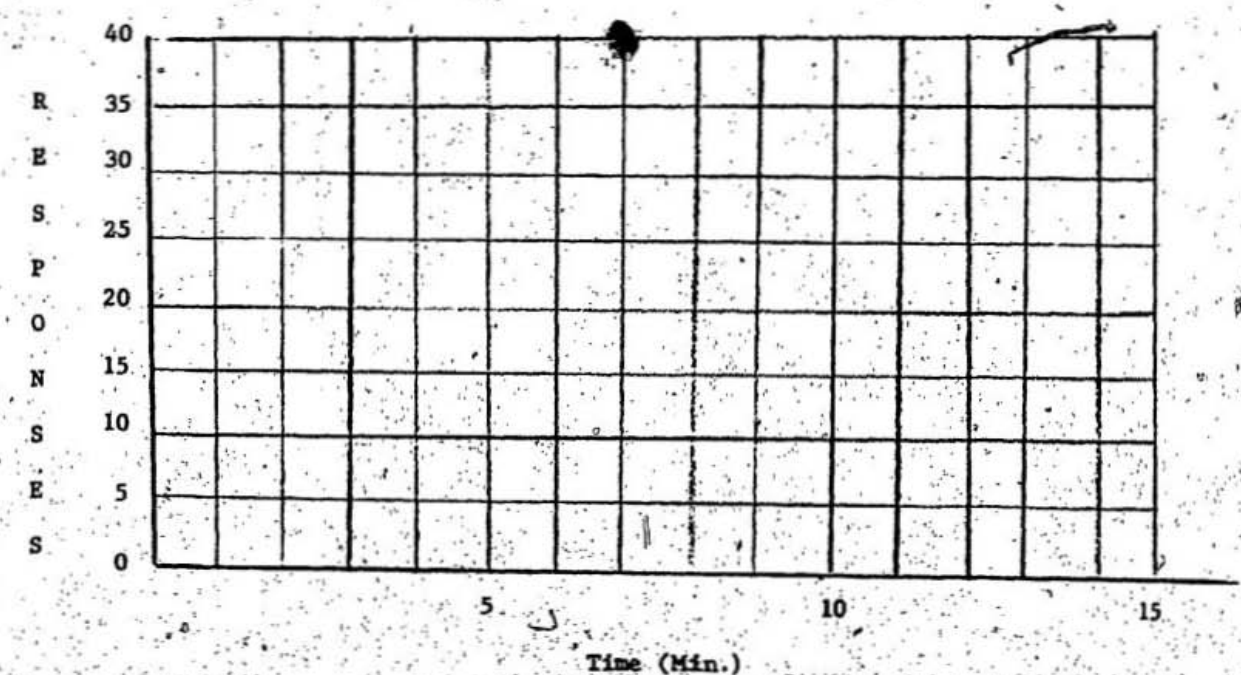
3. For the data below sketch the cumulative curve in the space provided.

| Min | Responses per minute | Total Responses |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 5 | 10 |
| 3 | 2 | 12 |
| 4 | 1 | 13 |
| 5 | 0 | 13 |



4. For the table below sketch both the per unit of time curve and the cumulative curve; and divide both curves into four distinct sections.

| Min | Responses per minute | Total Responses |
|---|---|---|
| 1 | 0 | 0 |
| 2 | 1 | 1 |
| 3 | 3 | 4 |
| 4 | 4 | 8 |
| 5 | 6 | 14 |
| 6 | 6 | 20 |
| 7 | 6 | 26 |
| 8 | 5 | 31 |
| 9 | 3 | 34 |
| 10 | 2 | 36 |
| 11 | 1 | 37 |
| 12 | 1 | 38 |
| 13 | 0 | 38 |
| 14 | 0 | 38 |
| 15 | 0 | 38 |



# APPENDIX C

## Text

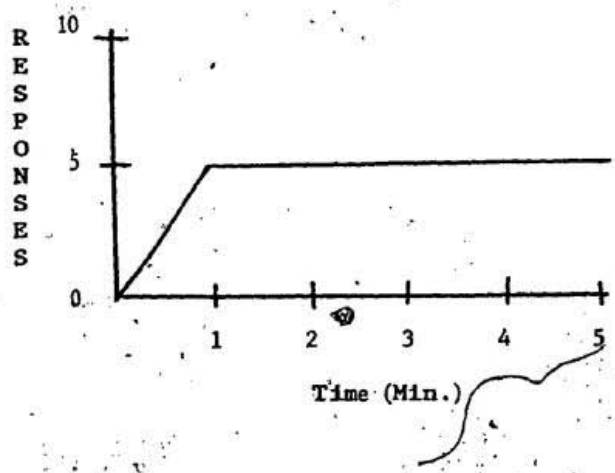
## The Cumulative Curve

You have about 20 minutes to read the text below. You will then be given a short test on this material.

What we'd like to talk about today is a particular way in which psychologists keep track of responses and this is called the cumulative record. There are many ways that we can keep track and do keep track of responses no matter what kind of responses they are. They can be learned responses. They can be reflexes, they can be any kind of response. First; we can only keept track of how many responses have occurred. Second, we can keep track of how many responses have occurred in a particular amount of time. And when we keep track of the number of responses that occur within a particular amount of time, we are talking about the rate of responding. And another way, a third way, is by use of the cumulative record. Now as we go along we will try to point out why we would be interested in using the cumulative record as opposed to just a number of responses or rate of reponse per unit time. The cumulative record is really very simple, what we do is record how many total responses have occurred upto and including a particular point in time for our subject. Let's take an example,

| MINUTE | RESPONSES PER MINUTE | TOTAL RESPONSES |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 5 | 10 |
| 3 | 5 | 15 |
| 4 | 5 | 20 |
| 5 | 5 | 25 |

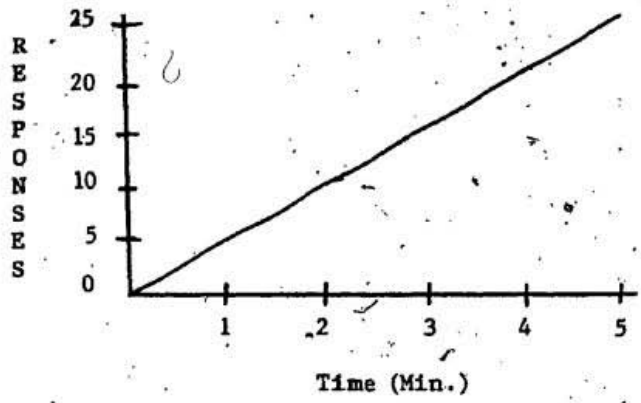
Suppose we sample an organism's behaviour for five minutes. Now we count the number of responses per minute and we say that this organism is responding at a constant rate - so that means he is making five responses each minute. (Column 2). Now we could graphically represent column 2 like this.




The X axis represents time (the minutes) and Y axis represents respones -- the frequency --. Now in the graph we have plotted above, you can see a straight line showing responses per unit of time. And this straight line represents constant responding, a constant rate of responding because its responses per unit time, in this case responses per minute.

Now, let's see in a cumulative fashion, in other words accumulating responses -- how the animal, the organism is responding. In order to do this, we look at the third column which we have called total responses -- total or cumulative responses. What we do to get the cumulative responses is to add up the responses to a point in time -- if we want the cumulative responses for three minutes that means we want to know

how many total responses the animal has made for the first three minutes, we add 5, 5 and 5 for a total of 15. And after 5 minutes the total is 25 response. Now we can also plot cumulative responses graphically.

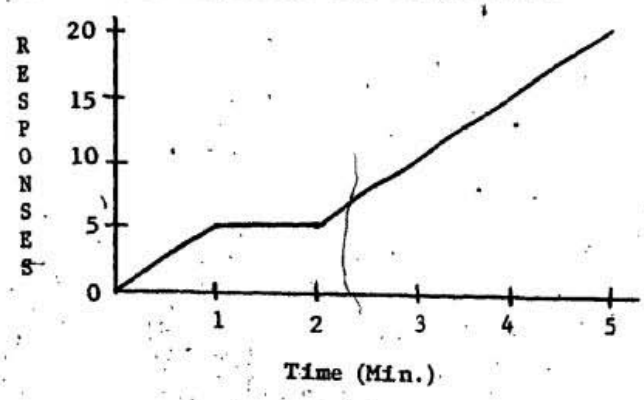



Notice how this curve is different than the first one we drew. But this is simply another way of looking at the same data as in the first curve. This is not responses per minute but cumulative responses. And this is called a cumulative record because we take into account the cumulative number of responses or the total responses over a period of time. Notice the relationship between the cumulative record the the per unit of time record -- both curves represent a constant rate of responding.

Now let's take another case -- let's change this example a little and instead of having constant rate of responding lets have an increasing rate of responding -- now take a look at this table.

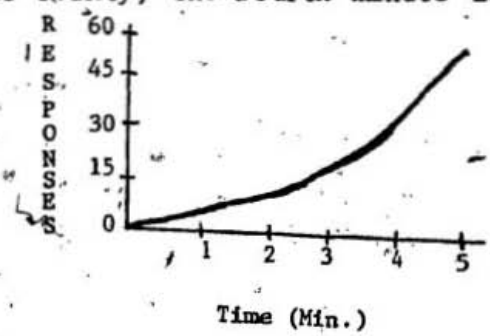
| MINUTE | RESPONSES PER MINUTE | TOTAL RESPONSES |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 5 | 10 |
| 3 | 10 | 20 |
| 4 | 15 | 35 |
| 5 | 20 | 55 |

Again lets plot the per-unit-of-time graph (column 2). Again on the X axis we have our minutes or our units of measure and the Y axis contains our responses.




We have plotted the response rate. Just the responses per minute. In the first minute he makes five responses, in the second minute he makes five responses. There is no change. The response rates are identical. Now in the third minute we ha ve an increase in his response rate -- he makes ten responses -- in the fourth minute he makes 15 responses and in the fifth minute he makes twenty tresponse. Remember, we are giving an example of increasing rate of response. Notice how the graph travels up in a straight line.

Now let's look at the cumulative number of responses for the same increasing rate of responses. The first minute the cumulative responses are five, second minute is ten, the third minute is twenty, the fourth minute is 35, and the fifth minute is 55.



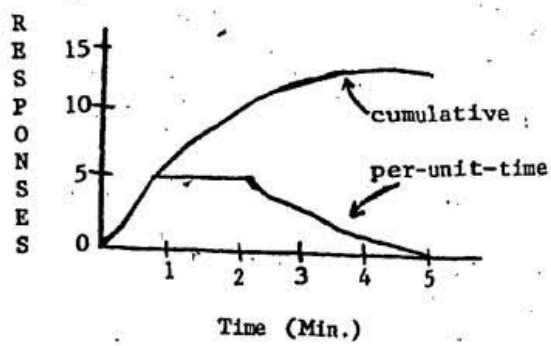

Notice how the cumulative record goes up as well. But notice that the per-unit-of time curve is less than the cumulative one. The reason simply is that we are adding each point to the previous point to get the cumulative curve. We are cumulating, so it stands to reason that the cumulative curve should be higher. But they reflect the same thing, an increasing curve shows an increasing rate of response.

Now let's look at the opposite case. Let's change the table a bit. Let's make it decreasing rate of response.

| MINUTE | RESPONSES PER MINUTE | TOTAL RESPONSES |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 5 | 10 |
| 3 | 2 | 12 |
| 4 | 1 | 13 |
| 5 | 0 | 13 |

In the first minute the animal makes five responses, in the second minute he makes five responses. Now in the third minute he only makes two responses. In the fourth minute he makes one response and he finally stops responding in the fifth minute.

Now let's look at the cumulative curve and the per-unit-of time curve on the same graph.

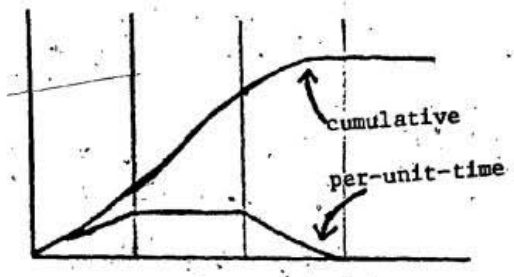



Notice how when the per-unit-of time curve begins to decline (fall toward the baseline); the cumulative curve still rises - even though its less than before. And this is one of the problems that we get in transferring from the response per unit time curve to the cumulative response curve; people tend to think that the cumulative response curve must also come back to the base line - back to zero. But that's impossible -- and here's why. The cumulative number of responses after one minute -- is five. After two minutes -- we add five more responses to it, its ten --; now after three minutes we have to add two more responses to those ten, so we have twelve -- after four minutes we add one more response to that twelve so there's thirteen and after five minutes we add no more responses to that and so it remains at thirteen.

Now suppose the animal didn't respond for another ten minutes, the total number of responses would still be the same - 13. If we were to draw those last 10 points on a graph, they would form a straight line parallel to the baseline - for the minimum number of responses - 13 - remains the same for we are adding on zeros each time.

Remember we have a decreasing rate of response and a decreasing rate of response tends to stop increasing our cumulative curve.

We have just looked at the basic principles of the cumulative curve then. Now let's take and put them together in one curve. Let's draw it without using numbers. The curve would first show increasing, then constant, then decreasing and finally no responding. Let's do it for responses per unit time and then for cumulative responses.




Notice in the first section - the increasing response section - how both curves rise, but the cumulative curve (on top) rises faster because it is concerned with total responses. The second sections of both curves show a stable rate of response. For the per-unit-of-time curve this is represented by a straight line

parallel to the baseline while for the cumulative curve it is represented by a straight increasing line in which the slope does not change. Notice in the third section how the per-unit-of time curve decreases to the baseline while the cumulative curve rises less steeply. Both represent a decreasing rate of responses and the fourth section - the section of no responding - the per-unit-of time curve remains at the baseline while the cumulative curve is a straight line parallel to the baseline for here the total response does not change.

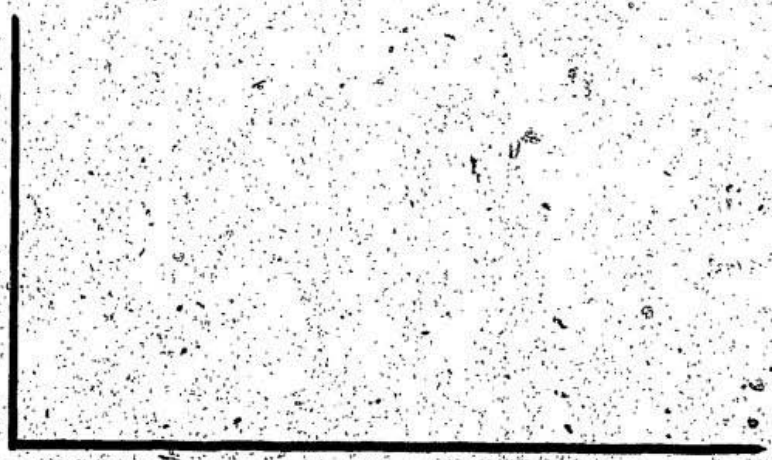
In conclusion then, the information gained from the per-unit-of time curve comes from how far the curve is above the baseline while in the cumulative curve we get our information from the slope of the line and remember the cumulative curve can never go down.

## EXERCISES

| MINUTES | RESPONSES PER MINUTE |
|---|---|
| 1 | 0 |
| 2 | 1 |
| 3 | 3 |
| 4 | 5 |
| 5 | 6 |
| 6 | 6 |
| 7 | 6 |
| 8 | 4 |
| 9 | 3 |
| 10 | 1 |
| 11 | 2 |
| 12 | 1 |
| 13 | 0 |
| 14 | 0 |
| 15 | 0 |

1. Given the above information you should now be able to express it in a cumulative curve table.

2. Now you should also be able to make a comparison of the two types of curves. If you draw both curves you should better understand why the cumulative curve <u>always</u> rises more sharply.



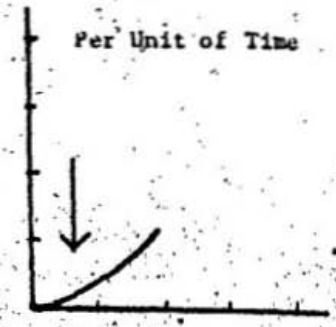
# APPENDIX D

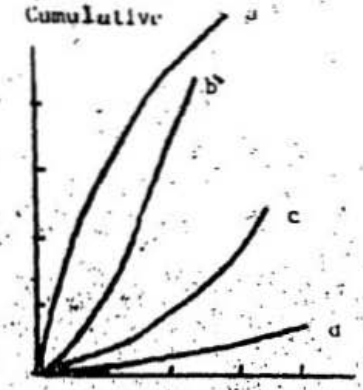
## Posttest

Name _____ Post Test IBM No. _____

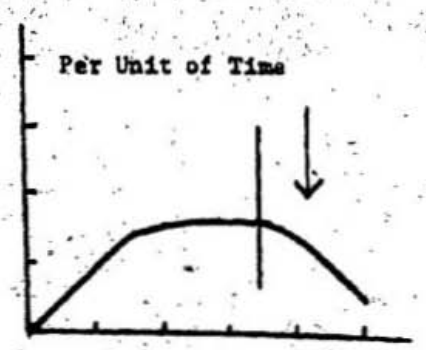
1. Given identical scales, which curve on the right corresponds to the indicated portion of the curve on the left?

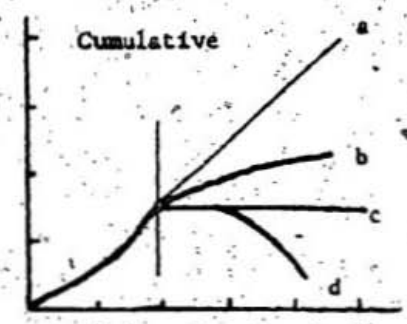
i) a
b
c
d



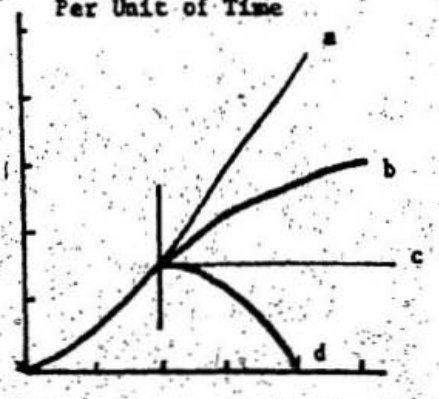

ii) a
b
c
d

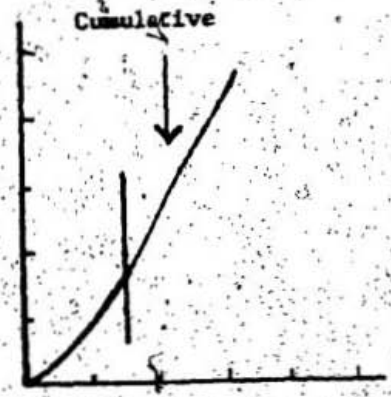


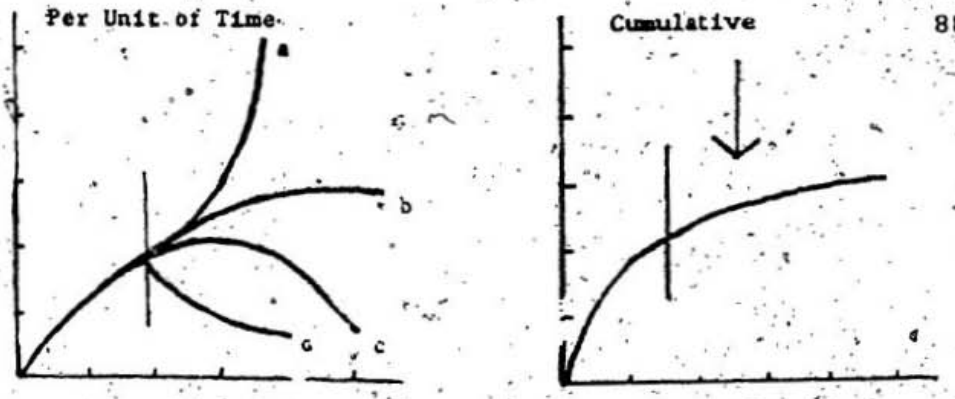

2. Given identical scales, which curve on the left corresponds to the indicated portion of the curve on the right?

i) a
b
c
d

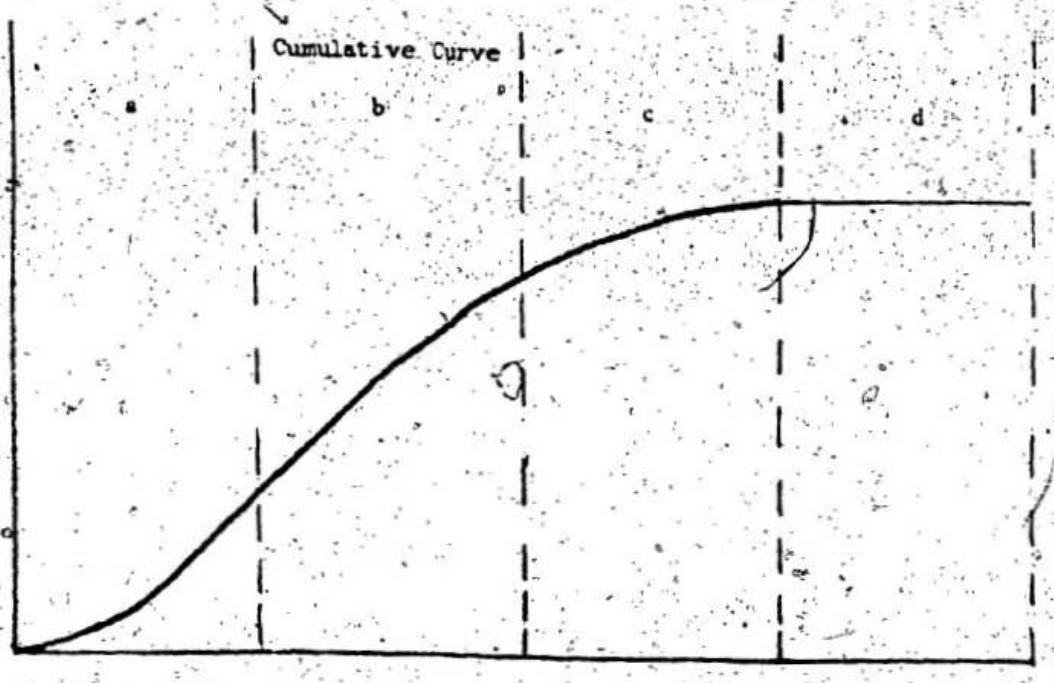


ii)




3.




(a) Which section of this curve presents an increasing rate of response

a b c d

(b) Which section of this curve presents a decreasing rate of response

a b c d

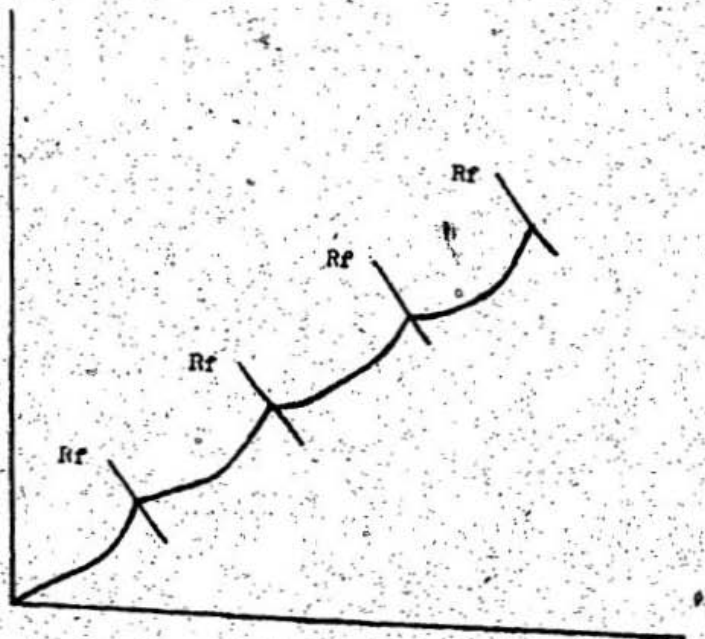
(c) Section b represents

a an increasing rate of response
b a decreasing rate of response
c a stable rate of response
d no responding

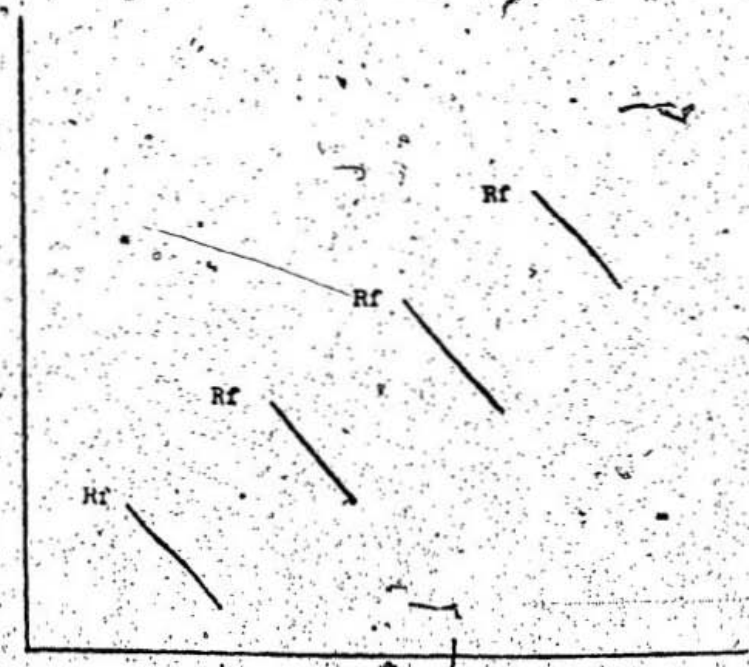
(d) Section d represents

a an increasing rate of response
b a decreasing rate of response
c a stable rate of response
d no responding

4. Continue the cumulative curve below:
In section a show a decreasing rate of response
In section b show an increasing rate of response

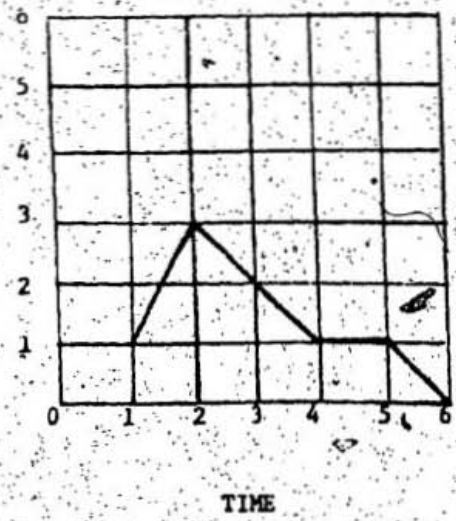

(a) The above cumulative curve shows the performance of an animal in a fixed ratio schedule of reinforcement. Comment on the animal's behaviour before and after reinforcement.

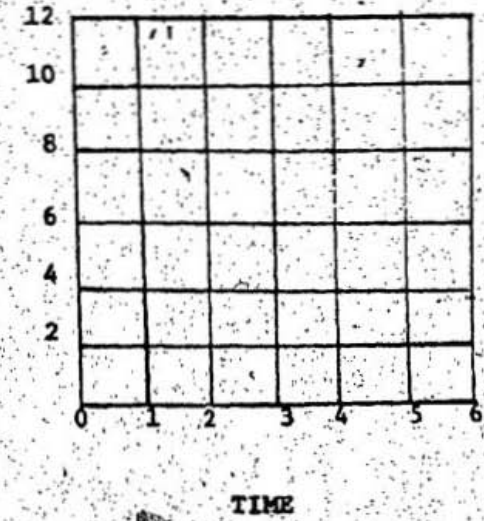



(b) Under fixed interval reinforcement the animal responds rapidly immediately after each reinforcement but the rate declines until the next reinforcement is given.

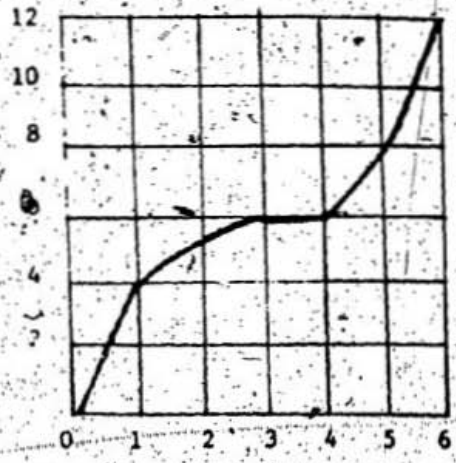
In the given diagram draw the cumulative curve to show the above performance.

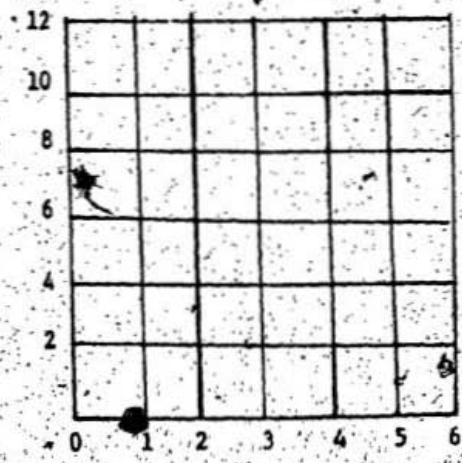
6. (a) Plot the data shown, in the form of a cumulative curve in the space provided.



(b) Tabulate and transfer the given cumulative curve into performance per unit of time curve in the space provided.




Time | Cum. Resp. | Resp. per unit of time

7. (a) Complete the following table and then draw the performance per min. curve and the cumulative curve in the space below.

| Min. | Response per Min. | Cumulative |
|---|---|---|
| 0 | 3 | |
| 1 | 3 | |
| 2 | 3 | |
| 3 | 5 | |
| 4 | 6 | |
| 5 | 8 | |
| 6 | 4 | |
| 7 | 3 | |
| 8 | 1 | |
| 9 | 0 | |
| 10 | 0 | |

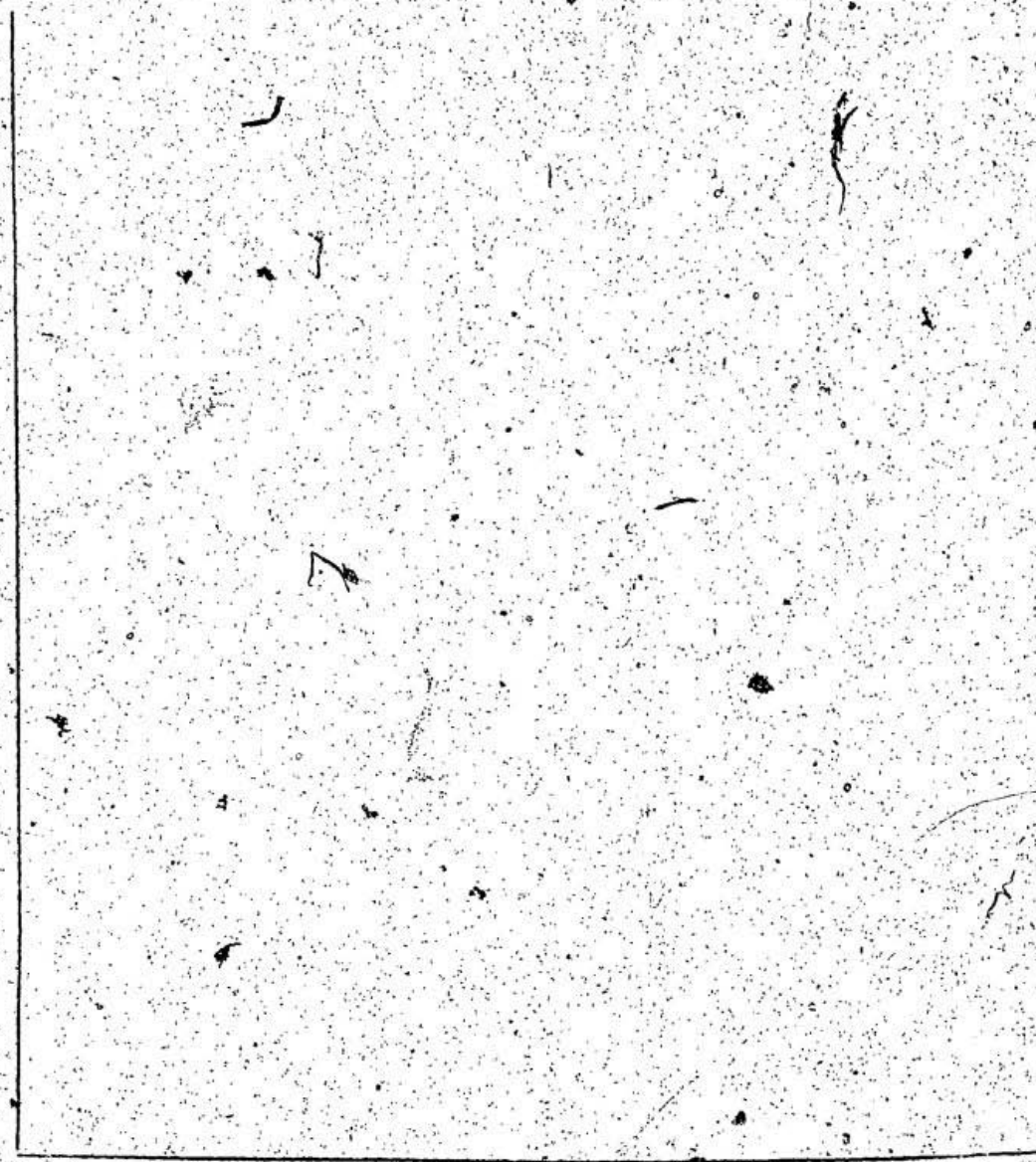
(b) Divide the two curves into four distinct sections, and label them as:

(a) for increasing rate of response

(b) for stable rate of response

(c) for decreasing rate of response

(d) for no response



TIME

(Please turn over)

How effective did you find this method of instruction? (Underline)

very effective quite effective no opinion either way

not very effective poor

How did you like being taught by this method?

very much quite a lot no feeling either way

not very much not at all

# APPENDIX E

## Eysenck Personality Inventory

PREVIOUSLY COPYRIGHTED MATERIAL,

IN APPENDIX E, LEAVES 95 AND 96,

NOT MICROFILMED.

EYSENCK PERSONALITY INVENTORY

BY H.J. EYSENCK
SYBIL B.G. EYSENCK

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