An investigation of the novelty effect in programed instruction

Frederick Sale Jr.

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AN INVESTIGATION OF THE NOVELTY EFFECT
IN PROGRAMMED INSTRUCTION

by

Frederick Sale, Jr.

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Dr. Robert J. Filer, Chairman

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AN INVESTIGATION OF THE NOVELTY EFFECT
IN PROGRAMMED INSTRUCTION

by

Frederick Sala, Jr.

A thesis submitted in partial fulfillment
of the requirements for the degree of Master of Arts
in Psychology in the Graduate School of the
University of Richmond
April 1966
To my wife, Gerry
ACKNOWLEDGEMENTS

The author wishes to express his sincere appreciation to the members of his thesis committee -- Dr. Robert J. Filer, Chairman, Dr. Merton E. Carver, and Dr. William H. Leftwich -- for their invaluable guidance in the performance of this study.

Additional thanks are in order, again to Dr. Leftwich as well as to Mr. Richard Patten, from whose classes the subjects for this project were drawn.
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Chapter I.

BACKGROUND

The use of immediate-feedback mechanical devices to instruct, or as an aid to instruction, is by no means a new idea (Stolucow, 1961). As far back as 1866, Halcyon Skinner developed and patented a spelling machine for use as an aid to the teacher; and in 1873 Jevons created a logic machine which could generate solutions to logical problems represented symbolically. In 1915, Ordahl and Ordahl built a simple teaching machine designed to teach serial skills to mentally retarded children. In 1918, H. B. English invented a device to train soldiers to slowly squeeze a rifle trigger; his device provided immediate knowledge of results by means of a manometer with a visible liquid column which rose as the soldier squeezed.

At about the same time, in 1915, Sidney L. Pressey -- now known as the "grandfather of the teaching machine" -- first began his efforts along this line; and his initial machine was described and exhibited at APA meetings in 1924 and again, with some improvements, in 1925 (Morrill). This machine presented multiple-choice questions one by one within a framed window (hence the name "frame" applied to a single unit of information in a program). The student operating the machine pushed one of four buttons corresponding to his choice of answers; and the machine would present the next frame if the answer was correct or stop automatically if it
was incorrect, thus providing immediate feedback to the student. In a 1926 article, Pressey describes the addition to his machine of a mechanism which automatically presented a small piece of candy as a reward for each correct answer.

In 1930, Peterson devised the ChemoCard, a self-scoring, immediate-feedback device consisting of a chemically treated paper on which the student marked his answers with a special ink. If he marked the correct one, the ink turned dark; if his answer was incorrect, the ink turned red. This idea aroused virtually no interest among experimenters then or since. In 1932, Pressey described a newly-developed answer sheet which could be scored by an automatic scoring device which recorded errors by item; and Little, in 1934, experimentally used this answer sheet in classroom situations and found it to be more effective than conventional testing techniques. In World War II the U. S. Navy introduced the Automatic Rater -- a device bearing some resemblance in technique to Pressey's original machine -- in which questions were flashed on a screen and students pushed buttons to answer them. In 1950, the ever-active Pressey came out with the idea of the punchboard, which also provided immediate feedback.

In spite of these gradual developments, however, the status of the teaching machine remained virtually at a standstill -- in oblivion, as far as the general public was concerned -- until 1954, when B. F. Skinner published an article stressing the importance of reinforcement in learning and suggesting that programmed teaching methods might well be used to this end. As a basis for his position, he cited studies with pigeons, rats, dogs, monkeys, human chil-
dren, and psychotics which demonstrated the empirical relationship of behavior to its consequences and the changes in behavior which can be effected through reward.

A second article by Skinner in 1958 gave programmed instruction the impetus it needed to become a foremost subject for academic research and development; and Morrill (1961) observes that the rapid growth in the interest in programing since that time is reflected by the increase of articles on the subject in the literature. He found only six prior to 1948 but more than 50 by 1960, most of these in the late 1950's. Only two years later, in 1962, Schraam reviewed over 100 studies of programmed instruction, although some of these were unpublished. Today, there are countless books, even more articles, and three entire journals — one of the latter originating from Great Britain — dealing specifically with developments in the field of programing. Abroad, Hartley (1964) describes the growth of interest in programed learning since 1960; and he refers to workshops on programing in Jordan, Nigeria, and Brazil, with representatives from Sweden, Chile, Sudan, Gaza, Syria, and Lebanon. A further review of current literature discloses articles on programing from Canada, South Africa, the USSR, and France.

The uses of programs are as broad and varied as the field of education itself. In the academic world, Schraam (1962) estimates that hundreds of schools and approximately a million students have been exposed to programed instruction, and these figures are continually growing. Programs have been used effectively with students from two years old to the college post-doctoral level, and with groups of mentally retarded students as well as students in the gifted I. Q.
range. In the field of special education, Ashcroft (1961) reports on the successful use of programs to teach the fundamentals of reading and writing braille to the blind; and Fessant (1963) describes programs for instructing deaf children in industrial arts. Eldred (1965) describes programed high school courses for mental patients under the age of 21 at Vermont State Hospital; and he points out the unique fact that these programs have had some unexpected therapeutic value, since the gradual progression of course presentation and the built-in low error rate allow mentally ill students who have repeatedly experienced rejection and failure to achieve a rewarding degree of academic success.

In the field of military training, instructors have followed the trend toward the development of programed instruction of all types of subject matter. Typical of these developmental efforts are studies in the U. S. Navy described by Schramm (1962) and in the U. S. Air Force reported by Ahma (1964) and Davies (1964). The latter author refers to one two-year period in which no less than 46 different programed courses on technical subjects were written, tried, and evaluated. Similar work is being done abroad, notably in England in the Royal Navy (Wallis & Wicks, 1964) and the Royal Air Force (Knight, 1964).

The characteristics and requirements of industrial training bear many similarities to those of the military. In both areas, programed instruction fills a unique role by (1) accelerating training; (2) permitting training on an individual, non-scheduled, or remote-site basis; (3) relieving a critical shortage of qualified instructors; (4) releasing instructors for advance preparation or sup-
plemental duties; and (5) standardizing complex technical instructional material (Meacham, 1964). As a result of these benefits, Abma in 1964 found approximately 350 programs available commercially to industrial users. In addition, a number of large industries have tailored-made one or more programmed courses to their own specific requirements, such as IBM (Hughes & McNamara, 1961), Convair (Keys, 1964), Ford Motor Company (Stewart, 1963), The Life Insurance Management Association (Welsh, Antonelli, & Thayer, 1965), Bell Telephone (Holt, 1963), Eastman Kodak Company (Bruce, 1963), and DuPont (O’Donnell, 1963).

5.
The most active proponent of programed instruction today is B. F. Skinner (1961a, 1961b, 1963). He states that the purpose of any teaching is simply to expedite learning, as students would eventually learn by themselves anyway. The teacher's job is to arrange conditions under which more effective learning takes place. Skinner sees programed instruction as a vehicle for applying the principles of operant conditioning to the classroom, not only to facilitate and standardize learning, but also to minimize the effects on learning of individual differences in student ability by allowing each student to work toward the same learning criterion but each at his own rate of speed. For Skinner, programing is linear, with each frame containing only a very small bit of information — seldom if ever more than a sentence. Each frame ends with a question calling for a brief constructed response on the part of the student. These questions provide the opportunity for the active student responding which Skinner feels is essential to learning; and each question is presented several times, first with strong prompting cues which are gradually withdrawn as the response in repeatedly elicited. This technique ensures a low error rate — less than 10% errors is Skinner's ideal — thus avoiding elicitation (and learning) of erroneous answers, as well as providing reinforcement to the student as he sees that his answers are correct. Skinner suggests
that reinforcement also might come from the exploratory and manipulative activities of the students working the program. It was Skinner, too, who first emphasized the necessity of a logical sequence in the presentation of programmed material.

The other primary theories of programmed instruction center around the “adjunct autoinstruction” of Pressey (1962) and Norman Crowder’s branched, or intrinsic, programing (1960). Over 90% of the programs written today, however, are in the Skinnerian, or linear, style (Schrama, 1962). For this reason, it is this latter theoretical approach which will be investigated in this study.

Investigators of the variables which differentiate between the major theories have had a difficult time supporting one point of view over another. Several studies comparing linear and branched programs (Senter, Hieberg, Abma, & Morgan, 1964; Kaufman, 1963; Silverman, Malaragno, Coulson, & Estavan, 1961) have found no significant differences in learning caused by the two types. The question of constructed-response vs multiple-choice questions in program frames is as yet unanswered definitively, since the effectiveness of either type seems to depend on the subject matter and purpose of the program (Williams, 1963 and 1965; Fry, 1960). Another controversial point is that of whether, as Skinner insists, active responses must be elicited in a program before learning can take place; here again, evidence is equivocal, with the bulk of studies showing no significant differences in learning resulting from overt and covert responding (Fisk, 1964; Tobias & Weiner, 1963; Alter & Silverman, 1962; Roe, 1962 and 1960; Morrill, 1961).

Even the need for a logical frame sequence is questionable in
the face of studies such as those by Levin and Baker (1963) and Hamilton (1961), who compared programs with logically and randomly ordered frames and found no significant differences in learning. An interesting point in this context is noted by Roe (1960), one of whose subjects misread the directions for his programmed text and followed the frames down the page instead of from page to page, causing him to see the items in this order: 1, 40, 79, 118, 157; 2, 41, 80, 119, 158; 3, 42, 81, 120, 159; etc. He was still able to attain a high score on the criterion test. The cueing advocated by Skinner has been found in at least one experiment (Tripp, Tripp, & Hahn, 1963) to be of different value at different age levels. With regard to the student himself, Skinner's theory concerning minimization in programmed instruction of individual differences in ability was supported in earlier studies to a large extent. A number of more recent investigations (Fiks, 1964; Larkin & Leith, 1964; Williams, 1965 and 1966; Carroll, 1963; Alter, 1963; Lambert, Miller, & Wiley, 1962), on the other hand, have found learning to be significantly correlated with student I. Q. or other ability measures.

On the basis of the evidence presented above, it is apparent that no one theorist has found the ultimate answer to consistently superior programing. In addition, there is now an increasing number of studies which raise valid questions as to whether programmed instruction in general is in fact superior to conventional teaching (Jennings, 1965; Goldberg, Dawson, & Barrett, 1964; Goldbeck & Campbell, 1962; Silberman, Melaragno, Coulson, & Estavan, 1961). A typical finding has been that well-structured text or lecture material, or programmed material with the answers already filled in, can pro-
duce learning at least equal to that caused by programmed instruction. There are indications, too, that there is some relationship between student attitude toward a program and learning from that program (Stewart, 1963; Cartier, 1963; Morrill, 1961); and some investigators feel that the unprecedented success of programmed instruction thus far may have been due, at least to some extent, to its newness and uniqueness (Welsh, Antonelli, & Thayer, 1965; Abma, 1964; Schramm, 1964). In partial support of this opinion, a study by Goldberg, Dawson, and Barrett (1964) found that favorable attitude toward a program decreased among students as they worked through it over a three week period. Cartier (1963) found that motivation affected learning from a program assigned to college students as homework. In connection with Skinner's animal operant conditioning analogy, Fowler (1965) cites extensive evidence showing that organisms exhibit a decline over time in the investigation of unfamiliar stimulus objects to which they receive extended exposure, since increasing familiarity with these stimuli allows curiosity and exploratory motivation to dissipate and the stimuli to become less "novel." If, as Skinner says, the laws of human and animal learning and behavior work the same way, then a similar decrement in student curiosity toward programmed instruction (suggested by Skinner as one main motivator in this type of situation) might be expected to occur over exposure time.

It is for these reasons that it is felt that the possible novelty effect in programmed instruction should be thoroughly investigated. The newness of programming in all phases of education, together with the apparent simplicity of the small steps for stu-
dents using programs, may have caused an initial favorable reaction
to the method which even now may be wearing off very gradually as
public familiarity with the programing concept grows. Popham (1964)
studied this possibility using a 1,850-frame program on plane geo-
metry presented on a Forderg $2002$ teaching machine to 23 sixth
grade students divided into two groups equated on the California
Test of Mental Maturity and the SRA Arithmetic Test. Both groups
used the program for an entire semester; one group had used a simi-
lar program on algebra during the preceding semester, while the other
received only the geometry program. It was felt that any novelty
effect affecting programed learning would have worn off for the for-
mer group but not for the latter. Findings failed to support the
novelty effect hypothesis when the groups showed no significant dif-
fences in learning on an early test during the semester or on a
final test of all second semester programed material. An attitude
questionnaire concerning the program showed no difference between the
groups at the end of the second semester.

Three difficulties are seen with the Popham data which make it
difficult to draw definite, generally-applicable conclusions from
them:

(1) In view of the recent evidence showing differential ef-
fects on program results of student age and maturity, it is question-
able whether findings pertaining to eleven-year-olds can safely be
generalised to industrial, military, college, or even high school
populations.

(2) As Popham himself observes, the study was conducted in a
college demonstration school, where the students had become accustomed
to adult observation for seven years. This fact in itself might well minimise any experimental "Hawthorne effect" for both groups.

(3) Even though Popham was concerned with a possible early-dissipating novelty effect and attempted to find it by testing both groups after completion of the first 600 frames, it might be that such an effect has an even shorter life, thus dissipating for the one-program group before their completion of 600 frames. Popham reports no comparison of the success of his programmed instruction with that of conventional instruction of the same material; and the majority of studies making such a comparison have used much shorter programs in the experimental situation (Schramm, 1964). From a practical point of view, as well, a review of current literature reveals that many programs in use in industry and the military are fairly short; and Abma (1964) states that program length for the 350 commercially available programs he found ranges down to only 50 frames.

In the only other study of its type, Porter (1960) reports findings similar to those of Popham in an investigation extended over a five-month period; but the objection cited in (3) above would apply on this case as well.

The present study was designed to overcome, at least to some extent, the above problems by using older, experimentally naive subjects and shorter programs. A comparison is made between successive performances by a group of college students on a series of three programs. The null hypothesis is that there will be no significant differences between performances on the three programs. On the other hand, significant decreases in effectiveness of performance by the
subjects on each successive program could be taken as evidence that
the expected novelty effect operating initially in the learning situ-
ation dissipates with increasing exposure of the subjects to programed
instruction, while the opposite results — significant increases in
performance from program to program — would show the facilitative
effects of practice.
Chapter III.

PROCEDURE

SUBJECTS: Participants for this experiment were obtained on a volunteer basis from among students of Introductory Psychology at the University of Richmond. Subjects were all female, ranging in age from 19 years 0 months to 22 years 1 month, with a mean age of approximately 20 years 1 month. Exclusive use of female subjects was felt to be justified on the basis of evidence such as that reported by Carr (1960) from a study by Porter showing no significant differences between performances by male and female students on programmed instruction.

MATERIALS: Three programs were selected for use in this study:

- $P_1$: an introductory course on salesmanship by J. S. Schiff (1964), of which Section I, "Prospecting," consisting of 70 frames, was used in entirety;
- $P_2$: a programmed course for training bank tellers developed by Psychological Consultants, Inc., of which the first 85 frames of Unit III, dealing with the detection and handling of counterfeit money, were used; and
- $P_3$: a self-instructional course on basic accounting by Wentworth, Montgomery, Gowen, and Harrell (1963), of which all 97 frames of Part 2, "Outputs," were used. All three programs were presented by book; and these particular programs were selected for the following reasons: (1) each one deals with material of which the average Introductory Psychology student would have
litle or no detailed knowledge; (2) none of the programmed lessons used required prior knowledge of the subject matter on the part of the students; (3) all three programs deal with some phase of business knowledge, although each is unrelated to the others (thus eliminating any transfer of subject matter from one program to the next); and (4) each program incorporates the short frames, constructed-response questions, and linear format advocated by Skinner. All three are "vertical" in form, with frames presented in sequence down each page and correct answers provided opposite each question. Subjects were provided with cardboard masks to cover the correct answers.

**METHOD:** The 24 Ss were divided into six groups of four each to control for any possible effects of relative program difficulty or length or relative criterion test difficulty, these three groups received the three programs in one of the following orders: O1, 1-2-3; O2, 2-3-1; O3, 3-1-2; O4, 1-3-2; O5, 2-1-3; or O6, 3-2-1. Ss received their programs in three separate sessions during three successive weeks. In the first session, all Ss were initially given standardized instructions concerning the use of the programs (see Appendix A) and their questions were answered. At the beginning of each of the two subsequent sessions, Ss were again permitted to ask questions concerning the use of the programs only. As each S completed a program, she was given a 30-item written criterion test consisting of constructed-response questions based on material covered in the program (see Appendices B, C, and D). During the course of the experiment, subjects received no feedback as to their performance on the criterion tests, nor were they told the purpose
of the study.

Three sets of experimental data were recorded — mean numbers of errors made during acquisition on each program by each group, mean program completion time to the nearest minute for each group on each program, and mean post-test scores for each group in each session. Ss were not told that a record of time was being kept. Each set of data was analyzed using a 6 x 3 ANOV design with repeated measures (Winer, 1962), as follows:

**EXPERIMENTAL SESSION**

<table>
<thead>
<tr>
<th></th>
<th>S₁</th>
<th>S₂</th>
<th>S₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₁</td>
<td>P₁</td>
<td>P₂</td>
<td>P₃</td>
</tr>
<tr>
<td>O₂</td>
<td>P₂</td>
<td>P₃</td>
<td>P₁</td>
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<tr>
<td>O₃</td>
<td>P₃</td>
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<td>P₃</td>
</tr>
<tr>
<td>O₆</td>
<td>P₃</td>
<td>P₂</td>
<td>P₁</td>
</tr>
</tbody>
</table>

In each case, row means would give an indication of the effects, if any, of different program presentation order. Column means would show the effects of the dissipation of the hypothesized novelty effect or of practice.
Chapter IV.

RESULTS

During the course of this study, experimental sessions for
the individual subjects were held from five to nine days apart, de-
dpending on the subjects' availability, with a mean interval between
sessions of approximately seven days. More stringent control on the
length of this inter-session interval was not considered necessary,
since the use of programmed instruction — particularly in industry
and the military — is frequently characterized by flexible sche-
duling.

Based on the data obtained, the sections of the three programs
which were used were found to have the following over-all error rates —
2.7% for P₁, the salesmanship course; 1.6% for P₂, the bank teller
training course; and 4.4% for P₃, the program on basic accounting —
all well below Skinner's suggested criterion of 10% maximum incorrect
responses. Mean over-all amount of learning, based on criterion test
scores, was 73.00% for P₁, 93.67% for P₂, and 75.67% for P₃. All
experimental sessions averaged 39.7 minutes actual program working
time, with P₁ requiring an average of 26.2 minutes to completion,
P₂ requiring 39.9 minutes, and P₃ requiring 53.0 minutes. Because
of the large differences between raw data within all three of the in-
vestigated parameters of the three programs, conversion of all data
to T scores was felt to be necessary to allow comparability between
cells in each ANOV (Cronbach, 1960).
In the analyses of variance, notably significant results were obtained in two areas. First, with respect to errors made in working through the programs, the effects of repeated exposure to programmed instruction over the three experimental sessions was significant at the .05 level (see Table I). A Newman-Keuls test of differences between ordered means showed a significant (.05 level) decrement in such errors from the second to the third session but not from the first to the second (see Table II). There were no differences on the ANOV between the six groups which received the three programs in different orders, nor was there significant O x S interaction.

Secondly, the effects on program completion time of three successive uses of programmed material were significant at the .05 level (see Table III). Using the Newman-Keuls procedure, a decrement in time required for completion was found to be significant at the .05 level from the first to the second and from the second to the third working sessions (see Table IV). Again there were no significant differences between the six groups attributable to the effects of program presentation order, and O x S interaction was not significant.

In the third area investigated — mean group scores on successive criterion tests — analysis of variance revealed no significant main or interaction effects of either of the two factors (see Table V).
### TABLE I.

Summary of analysis of variance for errors made on programs.

<table>
<thead>
<tr>
<th>Source</th>
<th>d.f.</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order (O)</td>
<td>5</td>
<td>73.20</td>
<td>.76</td>
</tr>
<tr>
<td>Subj. w. groups</td>
<td>18</td>
<td>95.90</td>
<td></td>
</tr>
<tr>
<td><strong>Within subjects</strong></td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sessions (S)</td>
<td>2</td>
<td>243.76</td>
<td>4.06*</td>
</tr>
<tr>
<td>0 x 3</td>
<td>10</td>
<td>59.40</td>
<td>.99</td>
</tr>
<tr>
<td>S x Subj. w. groups</td>
<td>36</td>
<td>59.98</td>
<td></td>
</tr>
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</table>

* $F_{.95}(2, 36) = 3.32$
**TABLE II.**

Summary of Newman-Keuls test for differences between mean errors during each experimental session.

<table>
<thead>
<tr>
<th>Differences between pairs of ordered means</th>
<th>$S_3$</th>
<th>$S_2$</th>
<th>$S_1$</th>
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<tr>
<td>$S_3$</td>
<td></td>
<td>20.10*</td>
<td>23.64*</td>
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<tr>
<td>$S_2$</td>
<td>3.5*</td>
<td></td>
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</tbody>
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* Significant at .05 level
TABLE III.

Summary of analysis of variance for required program completion time.

<table>
<thead>
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<th>Source</th>
<th>d.f.</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order (0)</td>
<td>5</td>
<td>118.73</td>
<td>.83</td>
</tr>
<tr>
<td>Subj. v. groups</td>
<td>18</td>
<td>143.53</td>
<td></td>
</tr>
<tr>
<td>Within subjects</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sessions (S)</td>
<td>2</td>
<td>181.52</td>
<td>5.57*</td>
</tr>
<tr>
<td>O x S</td>
<td>10</td>
<td>40.24</td>
<td>1.24</td>
</tr>
<tr>
<td>S x Subj. v. groups</td>
<td>36</td>
<td>32.57</td>
<td></td>
</tr>
</tbody>
</table>

* F .95(2, 36) = 3.32
**TABLE IV.**

Summary of Newman-Keuls test for differences between mean program completion times.

<table>
<thead>
<tr>
<th></th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
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<tbody>
<tr>
<td>Ordered means</td>
<td>211.53</td>
<td>200.35</td>
<td>189.53</td>
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<thead>
<tr>
<th>Differences between pairs of ordered means</th>
<th>$S_3$</th>
<th>$S_2$</th>
<th>$S_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_3$</td>
<td></td>
<td>10.82*</td>
<td>22.00*</td>
</tr>
<tr>
<td>$S_2$</td>
<td></td>
<td></td>
<td>11.88*</td>
</tr>
</tbody>
</table>

* Significant at .05 level
TABLE V.

Summary of analysis of variance for criterion test scores.

<table>
<thead>
<tr>
<th>Source</th>
<th>d.f.</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order (O)</td>
<td>5</td>
<td>27.28</td>
<td>1.90</td>
</tr>
<tr>
<td>Subj. w. groups</td>
<td>18</td>
<td>14.32</td>
<td></td>
</tr>
<tr>
<td><strong>Within subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sessions (S)</td>
<td>2</td>
<td>14.30</td>
<td>.26</td>
</tr>
<tr>
<td>O x S</td>
<td>10</td>
<td>8.34</td>
<td>.15</td>
</tr>
<tr>
<td>S x Subj. w. groups</td>
<td>36</td>
<td>54.09</td>
<td></td>
</tr>
</tbody>
</table>
Chapter V.

DISCUSSION

From the foregoing results it is apparent that this study offers no support for the hypothesis of a novelty effect in programmed instruction which would facilitate early performance and then subsequently dissipate, causing an accompanying decline in performance.

Instead, there is strong evidence here that practice in the use of programs leads to an over-all decrease in working time (see Figure 1) — in this case after the first and again after the second programmed lessons — as well as a somewhat slower decrease in errors made on the program (see Figure 2), here after the completion of the first two lessons. While it might be argued that the time decrement alone is not necessarily indicative of improved proficiency — that it might, in fact, show increasing loss of interest and a growing desire on the part of the students to "get it over with" — the accompanying decrease in errors greatly strengthens the case for improvement through practice.

The large size of both these decrements is all the more striking in view of the fact that the subjects only worked through a total of 252 frames in the course of the experiment. Since there is no reason to assume that either completion time or error rate reached asymptote at this point, additional experimentation involving more programmed material over a longer period of time, but with working time and error measures taken on a daily basis, would be of value in
FIGURE 1.

Decrement in mean completion time across experimental sessions.
FIGURE 2.

Decrement in mean errors across experimental sessions.
determining the upper limits of the effects of practice on these two variables.

It is worth mentioning here that the lack of significant interaction in the analyses of variance points to the fact that differential program lengths and difficulty do not appear to have any bearing on the facilitative nature of the practice effect.

The lack of a significant improvement in learning as measured by the three criterion post-tests (see Figure 3) indicates that practice in this situation affects immediate performance variables rather than retention of programed subject matter, although it is possible that different results on the tests might have been obtained if all the programed lessons had dealt with the same subject, thus allowing for some transfer of subject-matter training from one session to the next as well as transfer of the mechanics of program use.

There are three possible explanations of the results obtained. The first is that there was no novelty effect in operation in this situation. In other words, the subjects may not have considered programed instruction as a new and unique stimulus at all, but rather as simply another teaching device. On the other hand, the effectiveness of the programed instruction method may have offset the effects of its novelty, thus causing any ultimate loss of interest or other unfavorable change in subject attitude to be offset by the increase in skill due to experience, with no loss in amount learned.

The third possibility is suggested by some of the animal research reported by Fowler (1965) which demonstrates that exploratory behavior in rats in many cases shows a decrease with prolonged ex-
Mean post-test scores expressed in T scores

Experimental sessions

FIGURE 3.
Consistency of criterion post-test scores across experimental sessions.
posure to unfamiliar stimuli but reappears in the presence of these same stimuli after the animal has been removed from them for a period of time. The extent of recurrence of this behavior is in direct proportion to the length of separation time from the unfamiliar stimuli. If the same were true with human subjects using programmed instruction, the novelty effect would presumably augment practice in each session by initially increasing student motivation and then reinforcing the students' performance through exploratory drive reduction -- a concept in keeping with a portion of Skinner's theory.

In view of the findings of this study, together with those of Popham (1964) and Porter (1960), it is safe to conclude, in any case, that the detrimental effects, if any, of repeated exposure to programmed instruction are negligible and that such exposure actually facilitates the use of programmed materials.
Chapter VI.

SUMMARY

Initially, an outline of the history of the development of immediate-feedback devices was presented, followed by a description of B. F. Skinner's theory of programmed instruction and why it works. A number of studies were then discussed which raise some question as to the complete tenability of any one theoretical position concerning programming; and the point was made, with some indirectly supporting evidence, as to the possibility of a novelty effect which has contributed to the widespread experimental success of programmed instruction thus far but which might ultimately wear off, leading to some commensurate decrease in effectiveness.

The present study, undertaken to investigate this latter possibility, used a repeated measures design to evaluate performance by a group of college students on three successive brief programs. The subjects were divided into six groups, each group receiving the three programs in a different order. Results showed no evidence of the hypothesised novelty effect, but rather of a practice effect, indicated by significant decrements from one program to the next in time required for completion and in errors made on the programs, but not by successive increases in criterion test scores. These results were discussed in the light of three alternative explanations, all of which led to the conclusion that program use leads to more effective subsequent program use.
APPENDICES
Appendix A.

Instructions for First Experimental Session

"The experiment in which you are participating concerns an investigation of some characteristics of programmed instruction. This is a special type of instruction involving the presentation of material in small steps called "frames" in a logical sequence, with each frame followed by a question to which the student is required to make a response. In the programs you will be using, correct answers are presented opposite each frame. Using the cardboard mask in front of you, you will cover all the correct answers on each successive page without looking at them. Write your answer to each question on your answer sheet as you complete each frame, then slide the mask down to uncover only the correct answer to the frame you have finished. If you find you have made a correct response, go on to the next frame; if you make an incorrect response, draw a line through it and write in the correct answer beside it before proceeding to the next frame. There will be no time limit for this work; and, on completion of your program you will be asked some questions on what you have read. Do you have any questions now concerning what you are to do?

"Now write your names in the upper right-hand corner of your answer sheets. Open your programs to the pages marked, be sure your answer masks are in place, and begin working. Remember to answer every question in each frame."
Appendix B.
Salesmanship Test

Name: ___________________________  Experimental Session #_________

Answer the following questions based on the material which you have just read.

1. The term "prospecting" means __________________________ and the two steps of the process are __________________________ and __________________________.

2. A __________________________ buys the salesman's product; a __________________________ might buy it but has not done so yet.

3. Customers may be lost because of __________________________ or __________________________.

4. Possible sources for names of prospects include ____________ and __________________________.

5. Obtaining from a prospect the name of another prospect is called the __________________________ technique.

6. The use of a recommendation from a well-known individual in business or the community is called the __________________________ technique.

7. Companies make up lists of __________________________ from the names of those who respond to advertising campaigns.

8. The two things that a salesman expends in making calls are __________________________ and __________________________.

9. The three questions that should be asked in qualifying a prospect are:

32.
10. Company requirements which have a bearing on customer relations include ____________, ____________, and ____________.

11. Prospects become customers most easily when ________________

12. Prospecting provides the salesman with his greatest opportunity to be ________________ and this ability is his only limit to the ________________ and ________________ of sources he can use to develop lists of prospects.

13. Another opportunity for the salesman to increase his customers comes through perceiving ________________ for his products.

14. One specific thing the salesman must determine before calling on a company is ________________.

15. How good a prospect is depends on his ________________ and ________________.

16. Prospecting techniques vary among salesmen depending on ______

17. An increase in productive calls by a salesman depends on his ________________.

33.
Appendix C.

Bank Teller's Test

Name: ___________________________ Experimental Session #_________

Answer the following questions based on the material which you have just read.

1. Counterfeit money is worthless because ____________________________

2. A bank is obligated to turn all counterfeit money over to ___

3. No individual may ______________ or __________ counterfeit money.

4. With respect to counterfeit money, the bank teller's job is to

5. The quickest way to spot counterfeit money in a stack of bills is ____________________________.

6. Appearance-wise, genuine money is characterized by ________ and ______________________ scattered through it.

7. Two portions of the portrait on a bill which should be checked for sharpness and distinctness are ____________________________ and ____________________________.

8. Two other portions of a counterfeit bill which are characteristically indistinct are _______________ and ____________.

9. The above tests are inadequate when ____________________________.

10. Another test for counterfeit is made possible through a knowledge of ____________________________.

11. The portrait of __________________________ is found on the $5
bill.
12. The portrait of a famous inventor, writer, and U. S. ambassador is found on the $_____ bill. His name is _____________________________.
13. ____________________________’s portrait is on the $20 bill, and a portrait of ____________________________ is on the $10 bill.
14. Our first president's picture is on the $_______ bill.
15. The portrait of ____________________________ is depicted on the $2 bill.
16. General Grant is shown on the $_______ bill.
17. Cash registers usually do not have a place for the $_______ bill.
18. On almost all bills the portrait faces to the _________; however, the picture of ____________________________ on the $_______ bill faces to the _________.
19. A $_______ bill might easily be "raised" to a $_______ bill.
Appendix D.
Accounting Test

Name: __________________________ Experimental Session #__________

Answer the following questions based on the material which you have just read.

1. End products of the accounting system are called ________________.

2. Payment to an employee for work performed is in the form of a ____________________________.

3. For payment purposes, employees fall into two categories, ____________________________ and ____________________________.

4. Payment for materials or services a firm has received is called ____________________________.

5. The accumulation of approved bills for periodic payment is called ____________________________.

6. Bills sent out by a firm are technically called ____________________________.

7. Such bills include two items of information, ____________________________ and ____________________________.

8. Another product of the accounting system evaluates the work of the firm's sales organisation. It is called the ____________________________, and the information provided by it is based on ____________________________ and/or ____________________________.

9. This same information may be expressed in terms of ____________________________ and/or ____________________________.

10. An organisation's sales may be categorised according to ____________________________, ____________________________, or ____________________________.

11. Quantities of materials on hand are shown by the ____________________________.
12. The profitability of a firm's product can be determined from
the _____________________________.

13. A projection of future financial operations is found in the
__________________________, expressed in terms of anticipated
__________________________ and ____________________________.

14. Another record, based on information from the previous projec-
tion and covering the same period of time, is the ______________
__________________________, which provides a comparison between
projected and actual financial operation.

15. The record of a firm's financial position as of a certain date
is the ____________________________, which reports the
firm's __________________________ and __________________________ on
that date.

16. The claims of creditors against a firm are called __________
__________________________.

17. For information on the changes in a firm's financial position
arising from regular business operations, management must refer to
the _____________________________.

37.
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VITA
Vita

The author, Frederick Sale, Jr., was born in Richmond, Virginia, in 1939; and he graduated from St. Christopher's high school in June, 1957. The following fall he entered the University of Richmond as a holder of a Bagley Scholarship. As an undergraduate, his activities included managing editor and staff artist, and then editor-in-chief, of the Richmond Collegian; art editor of the Messenger; vice-president and then president of Phi Delta Theta social fraternity; and vice-president and then president of the S. C. Mitchell Literary Society. Honors included Pi Delta Epsilon journalism honorary, Psi Chi psychology honorary, Scabbard and Blade military science honorary, Dean's List, Omicron Delta Kappa, and Who's Who in American Colleges and Universities. He graduated in 1961 with a bachelor's degree in Psychology.

From June 1961 to June 1962 he did graduate work in Psychology at the University; then, in February 1963, he entered the U. S. Army, holding an ROTC commission as Second Lieutenant in the Infantry. While stationed at Fort Dix, New Jersey, he married the former Miss Geraldine Edmonds of Richmond. On completion of his military obligation in August 1965 he returned to Richmond and resumed graduate study in September at the University. He obtained a Master of Arts degree in Psychology in June 1966.

Plans for the future include the attainment of a Ph. D. degree in Industrial Psychology.