The Effects of Step Size, Mode of Response and Student Ability on Programmed Learning

Thomas Mackie

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THE EFFECTS OF STEP SIZE, MODE OF RESPONSE AND STUDENT ABILITY ON PROGRAMMED LEARNING

by

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Thomas Mackie
MACKIE, Thomas James
THE EFFECTS OF STEP SIZE, MODE OF RESPONSE
AND STUDENT ABILITY ON PROGRAMMED LEARNING.

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Psychology, experimental

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During recent years there have been many studies investigating the effectiveness of various programmed teaching methods. The purpose of the present study was to investigate three aspects of programmed learning: step size, response mode and student ability.

1. Step size. According to some studies, programmed items produce optimal learning if they are worded and sequenced in such a way that the material is simplified and the student receives a large percentage of positive reinforcements (Duncan and Gilbert, 1967; Homme and Glaser, 1959; Porter, 1958; Skinner, 1958).

Such a small step program requires a great deal of time to develop a vocabulary, each student starting at a common point and progressing through a good number of repetitive items. A possible solution to the problem of presenting large amounts of material in a small period of time is to use large-step programs, such as those devised by Crowder and Pressey. Whereas Skinner feels small steps are necessary to prevent errors, Pressey (1950) is less concerned with error rate, stating that errors can be useful. Just as a high jumper need not start setting the bar at very low heights but at the height he first misses, so also a student might better begin a program at the point where the first errors occur.
Such errors, Pressey feels, will also function as a motivation for the student, and he makes no attempt to set up "prompts" or cues to insure a low error rate. Crowder (1958) attempts to write programs that anticipate errors, providing special instructions for specific mistakes. He questions whether small steps are as necessary with older students dealing with somewhat familiar material, as compared to younger naive students.

Undoubtedly a small-step program takes longer than a large-step program, if the difference in step size is substantial. Whether or not the time is wasted may be another matter. A number of studies found large-step programs more efficient (Smith and Moore, 1962; Goldbeck, 1960). Blank and Pysh (1967), as well as Shay (1961), found no significant differences in learning that could be attributed to step size, and these findings support the position of Crowder and Pressey.

In contrast, Evans, Glaser and Homme (1959) investigated the effect of step size on learning, using four groups, each using a program with a different number of steps covering identical material. Here step size was increased by omitting various items which were repetitive; other investigators have increased step size variously, some arbitrarily reducing the total number of frames regardless of content. They found that small-step programs produced significantly fewer errors on immediate and delayed performance tests than did large-step programs.
However, there was a clear time differential between the groups because small steps took longer. Coulson and Silberman (1960) obtained much the same results; the small-step program was significantly better as a learning device, although it took more time. Perhaps the small-step program may be the best introduction to programmed learning, but after the initial stages the value of small steps may be questioned. The proper step size in programs is still being investigated.

2. Response mode. Williams (1963) and Skinner (1958) have advocated the use of constructed response items, while Crowder (1958) and Pressey (1950) have advocated the multiple-choice mode. Pressey (1927) utilized a simple punch-board device to provide immediate feedback to multiple-choice responses. Skinner (1961) felt Pressey's approach was more appropriate for testing than for teaching because a high error rate implicit in Pressey's method would increase the probability that errors would be repeated. That such repetition of errors does occur in such a method has been shown by a number of studies (Elley, 1966; Lovelace, 1966; Green, 1962; Mechner, 1961; Melargano, 1960). Pressey, however, found that under conditions of immediate feedback, wrong alternatives in a multiple-choice question did not confuse the learner but clarified meanings. Coulson and Silberman (1960), as well as Evans (1960) found no significant difference in posttest scores between students using the constructed response mode and those using the
multiple-choice mode.

Skinner, in his linear programs, used the student's response as an integral part of the learning sequence. However, in the intrinsic programs of Crowder and Pressey, the student's response became a diagnostic tool rather than a learning device. The response indicated the completeness and accuracy of the student's "covert" learning, which could subsequently be modified or corrected and then strengthened. This is in opposition to Skinner's dictum that only behavior that is emitted and reinforced is learned. Crowder and Pressey did not limit themselves strictly to consideration of overt behavior; they regarded behavior as symptomatic of internal organization or changes, not as a final result of reinforcement contingencies in the environment. Like the research on step size, there appears to be some ambiguity regarding the importance of overt and "covert" responses in programmed learning.

3. Student ability. A program made up of small steps includes many prompts and a good deal of repetition. Such a program has a low error rate, and should eliminate the ability differences of students. A study by Porter (1959) revealed that in the teaching of spelling there was no significant relationship between intelligence scores and the achievement of the group taught with machines, though there was a significant positive relationship between these two factors when a conventional classroom method of
teaching was used. Presumably, the programmed machine acted as an "equalizer" of the intelligence factor in learning.

A number of other studies have found a positive relationship between student ability and performance on a program. Shay (1961), using students from three different ability levels as measured by standard intelligence tests, taught them the use of Roman numerals. He found that intelligence was positively related to posttest scores at the .001 level of significance. Hampton (1967) obtained similar results for servicemen who had been grouped according to scores on the Armed Forces Qualification Test. Ashbaugh (1964) found that the requirement of an overt written response actually interfered with learning for those students having high scores on the California Test of Mental Maturity. This somewhat contrasts the findings of Hartman, Morrison and Carlson (1963) in which students with high verbal aptitude did better on constructed response programs while less verbal students did better reading a complete text with no constructed response required. Another study by Feldman (1965) found those students with higher verbal scores on the S.C.A.T. did better on a posttest involving transfer.

This current study was designed to determine the effect of step size, mode of response and student ability on learning material presented by a programmed text. It was expected that a small step program requiring a
constructed response would eliminate ability differences, as predicted by Skinner. Secondly, it was expected that performance of high ability students using the large step multiple-choice program would not be diminished, but that low ability students using such a program would perform at a significantly lower level. Previous studies of the variables affecting programmed learning have often been contradictory and sometimes ambiguous. Some of these contradictions may have resulted from failure to consider more than one or two of the major variables affecting programmed learning. This study was designed to study the effects of three major variables, step size, mode of response and student ability. Mode of response was combined with the variable of step size, in that the small step program required a constructed response, while the large step program required a multiple-choice response.
Method

Subjects

The Ss in this experiment were 58 freshman introductory psychology students at Kellogg Community College, consisting of 23 males and 35 females. Points were credited toward their course grade if they completed all sets used in the experiment. Tests and quizzes administered during the course of the experiment did not affect Ss' course grades; Ss were informed that tests were for diagnostic purposes only.

Apparatus

Subject material consisted of the first eleven sets of Holland and Skinner's Analysis of Behavior, 1961 edition. One group of Ss completed the sets in the conventional manner, writing in the constructed response. The other group was given a modified form of the same sets, edited to omit repeated items within each set (see appendix A). Those Ss using the edited program responded to each frame by selecting from a three-item multiple-choice statement printed next to each frame, using the Pressey-type punch board as the mode of response.

Procedure

Ss were divided into two groups matched on the basis of scores made on the natural science and social studies
sections of the ACT test. Performance of high and low ability Ss within each of these two groups also was analyzed. Ss were defined as high ability if their combined natural science and social studies standard scores averaged above 21, low ability being averages below 19. Table One indicates ability characteristics of the two matched groups, as well as the characteristics of the high and low ability groups within each major group.¹

Each S was given a 60-item pretest consisting of equal numbers of multiple-choice and constructed response items (appendix E). The dependent variable in this study was the improvement on the posttest over this pretest. The use of such gain scores as the dependent variable was considered appropriate since all Ss were naive, which was confirmed by their pretest scores. Following the pretest, set I of the Holland and Skinner program was used to adapt all Ss to either the conventional or modified form of programmed material. Sets two through eleven were covered in four training sessions, each lasting a maximum of one class period, 50 minutes.² The training sessions replaced regular classroom studies for all Ss during the experiment, covering one-and one-half weeks.

¹A total of four Ss dropped out of combined groups I and II, while three Ss dropped out of combined groups III and IV.

²Since the experiment required group training, each training session was the length of a regular class session.
Table 1

Group ability characteristics in terms of mean standard scores on natural science and social studies sections of the ACT test

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean social studies standard scores</th>
<th>sd</th>
<th>Mean natural science standard scores</th>
<th>sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional, small step, constructed response mode</td>
<td>24</td>
<td>19.75</td>
<td>4.16</td>
<td>18.46</td>
<td>4.47</td>
</tr>
<tr>
<td>I High ability</td>
<td>12</td>
<td>24.50</td>
<td>2.46</td>
<td>23.67</td>
<td>3.64</td>
</tr>
<tr>
<td>II Low ability</td>
<td>12</td>
<td>15.00</td>
<td>5.34</td>
<td>13.25</td>
<td>5.32</td>
</tr>
<tr>
<td>Modified, large step, multiple-choice mode</td>
<td>25</td>
<td>19.96</td>
<td>3.71</td>
<td>18.72</td>
<td>3.59</td>
</tr>
<tr>
<td>III High ability</td>
<td>12</td>
<td>24.08</td>
<td>3.06</td>
<td>23.67</td>
<td>3.29</td>
</tr>
<tr>
<td>IV Low ability</td>
<td>13</td>
<td>16.15</td>
<td>4.22</td>
<td>14.15</td>
<td>3.86</td>
</tr>
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Step size was varied by having one group read the sets in their conventional, small step form. The other group read the modified sets consisting of larger steps. Large step in this study was defined as removal from each set of the conventional program of any response item which was repeated. If the term "reflex" was required as a response in a particular set, the frame which first required this response was kept in the set, but all subsequent frames requiring the same response were omitted from the set. This permitted Ss to move more rapidly through the sets, reduced redundancy, but at the same time eliminated many contextual cues in each set. As a result, the large step program had a total of 193 frames, compared to 358 frames in the conventional form of the program.

The response mode for the group reading the conventional program was the constructed response, written on a separate answer sheet. For the other Ss reading the modified program, three multiple-choice options accompanied each frame. These Ss responded by using a Pressey-type punch board, and were instructed to keep responding until the correct response had been made.

For a particular training session, Ss were given the appropriate program of two or three sets. If upon completion of the sets S had made more than ten per cent errors on any set, he was instructed to review the set again. All Ss were given a short quiz at the end of each
training session, each quiz consisting of from ten to twelve items, composed equally of multiple-choice and constructed response items. These items were different from the pretest posttest items, to insure that performance on the posttest was a function of the program and not of practice. Time required by each S to complete the sets in each training session was recorded. Two days following the last session, the posttest, identical with the pretest, was administered. An analysis of variance was used to compare mean gain scores on the posttest for all groups.
Results

A comparison of pretest and posttest scores for high and low ability groups is shown in Figure 1. Pretest scores of the high ability groups (1 and 3) and low ability groups (2 and 4) appear to be quite uniform, the means being less than a point apart on the 60-item pretest. Mean pretest scores for the two high ability groups were 13.66 and 17.33, while the two low ability groups scored 13.53 and 13.15.

Mean gains in terms of number of correct items on the posttest for all groups is shown in Table 2. Largest gains were made by high ability Ss using the conventional, small step program, while smallest gains were made by low ability Ss (group 4) using the modified large step program with the multiple-choice mode of response.

In an analysis of differences between mean gain scores on the posttest, Table 3 indicates a significant difference in gain scores exists between the groups using the small step conventional program and groups using the large step modified program, the F being significant at the .05 level. Also, a significant difference was found to exist between gains made by high ability groups and gains made by low ability groups, the F being significant at the .01 level. However, in an
Group I: conventional, small step, high ability
Group II: conventional, small step, low ability
Group III: modified, large step, high ability
Group IV: modified, large step, low ability

Mean pretest score

Mean posttest score

Fig. 1. Mean pretest and posttest scores by ability groups.
Table 2

Pretest and posttest scores and mean gain

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pretest mean</th>
<th>Posttest mean</th>
<th>Gain on posttest in terms of correct responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional, small step, constructed response mode</td>
<td>15.99</td>
<td>40.70</td>
<td>24.71</td>
</tr>
<tr>
<td>I High ability</td>
<td>18.66</td>
<td>45.16</td>
<td>26.50</td>
</tr>
<tr>
<td>II Low ability</td>
<td>13.33</td>
<td>36.25</td>
<td>22.92</td>
</tr>
<tr>
<td>Modified, large step, multiple-choice mode</td>
<td>15.49</td>
<td>35.66</td>
<td>20.17</td>
</tr>
<tr>
<td>III High ability</td>
<td>17.83</td>
<td>42.41</td>
<td>24.58</td>
</tr>
<tr>
<td>IV Low ability</td>
<td>13.15</td>
<td>28.92</td>
<td>15.77</td>
</tr>
</tbody>
</table>

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Table 3

Analysis of variance of mean gain scores made on posttest by program method and student ability

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (type of program)</td>
<td>251.78</td>
<td>1</td>
<td>251.78</td>
<td>5.19</td>
</tr>
<tr>
<td>B (student ability)</td>
<td>469.77</td>
<td>1</td>
<td>469.77</td>
<td>9.69</td>
</tr>
<tr>
<td>AB</td>
<td>83.48</td>
<td>1</td>
<td>83.48</td>
<td>1.72</td>
</tr>
<tr>
<td>within cell</td>
<td>2181.15</td>
<td>45</td>
<td>48.47</td>
<td></td>
</tr>
</tbody>
</table>

#significant at .05 level.
##significant at .01 level.
analysis of the interaction effect of ability and type of program, no significant difference was found.

During the course of the experiment, the quizzes given at the end of each of the four training sessions measured Ss' retention of material presented during each session. Figure 2 reveals the successive quiz scores made by each group throughout the four sessions of the experiment.

There appears a tendency for differences in performance by each group to become more pronounced as the testing progressed. Performance of all groups was fairly uniform on the first trial quiz, but quiz scores diverged more on later trials, particularly on trial four. A total of fifteen percentage points separated the highest and lowest groups on the first trial quiz, while more than 25 percentage points separated the highest and lowest groups on the fourth trial quiz. On the first trial session a close relationship appears between quiz score and student ability, regardless of type of program used. However, group IV (low ability, modified program) shows poorer performance overall, with the exception of the initial trial session.
Fig. 2. Mean percent correct on four trial session quizzes by ability groups.
Discussion

Analysis of the performance of the two groups indicates that those Ss using the modified large step program (Groups III and IV) had gain scores averaging approximately 4\frac{3}{4} points less than Ss using the small step program. This significant difference in gain scores supports the contention of Skinner (1958) that small step programs are superior to large step programs.

The endorsement of the Skinnerian approach, however, must be qualified. Since the two variables of step size and response mode were combined in each of the two program forms, a degree of confounding probably occurred. Such an experimental design decreases our ability to draw specific conclusions regarding the one variable of step size.

Ss using the large step program spent an average of thirteen fewer minutes per session to complete the ten sets of the program. The conventional program group took an average of 155 minutes to complete the total sets, compared to an average of 103 minutes for the modified program group. This time advantage was achieved apparently at the expense of significantly lower gain scores for the group using the large step program. However, had the large step group been instructed to use the extra free time during each trial session to review the completed sets, their performance might possibly have equaled that of the small step group.
The prediction that a small step program would eliminate the effect of student ability was not confirmed, since high ability Ss made significantly greater gain scores. In light of the differences in performance between the low and high ability groups using both types of programs, it would seem that programmed instruction needs to be individualized, just as most other forms of instruction have been individualized. Programmers might devise two or more forms of a program, possibly varying the number of steps in accordance with the learning abilities of the students. If successful, such individualization of programming would eliminate any difference in the performance of high and low ability students.

In this study the criteria for ability were ACT scores in natural science and social studies. These scores reflect ability to solve problems, discriminate and grasp implied meanings. More specific measures of ability might be developed to be used in planning programs for students with varying abilities. Present IQ scores are typically too imprecise as criteria for learning ability. The student in the future could be assigned to one of several variations of a program, such assignment determined by his specific abilities. The Structure of the Intellect project (Guilford and Merrifield, 1960) has investigated as many as 125 factors of intelligence. What this means to the programmer is that perhaps when programming is more refined, such factors as "mechanical
intelligence" and "ability to handle abstract symbols" will be considered in writing and selecting programs, in order to meet the individual differences of students using the programs.

It was expected that an interaction effect between student ability and type of program would occur, and that this would raise the performance of the more able Ss using the large step program, offsetting the effect of the large steps in the program. No such interaction was found; it appears bright students will surpass less able students, but this superior performance does not depend upon the type of program used.

Performance on quizzes given at the completion of each of the four training sessions, as shown in Figure 1, reveals a sharp decline on the fourth quiz. One possible explanation for these lower scores might be that earlier quizzes may have been intrinsically less difficult. Another possible explanation is that the errors made on earlier quizzes, particularly quiz three, may have lowered the motivation of Ss and so reduced later learning and performance.

Future research is needed on the interaction of step size and student ability, utilizing various definitions of both step size and ability. Analysis of progressive changes in performance at each stage of learning may provide more valid answers to questions concerning a program's effectiveness than simply using a pretest posttest design. Such
research may result in individualized instruction in the area of programmed instruction.
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Appendix A

Modified, Large Step Program

Part I Reflex Behavior

Conditioned Reflexes

Turn to next page and begin

Since the young child salivates the very first time candy is put in his mouth, we ____ (can or cannot) attribute this reflex to learning.

2-4

If the child is to learn to salivate to the word "candy," "candy" and eating candy must occur nearly ____.

2-8

When the conditioned stimulus can no longer elicit the response, the conditioned reflex is said to have been extinguished. If the word "dandy" is repeatedly presented alone, the conditioned salivary reflex is ____.

2-12

When a man's hand is touched by a hot surface or receives an electric shock, the hand is immediately withdrawn. Since this reflex is not established by previous conditioning, it is a(n) ____ ____.

2-16

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In a reflex, a sufficient explanation of the response is a description of the preceding _____.

1. (a) response 
   (b) stimulus 
   (c) reaction

2-1

On the first occasion when a young child simply hears the word "candy," his mouth ________ water.

5. (a) will not 
   (b) may 
   (c) can

2-5

After conditioning, the word "candy" alone will elicit salivation in a conditioned reflex. The word "candy" is a learned or ______ stimulus.

9. (a) conditioned 
   (b) unconditioned 
   (c) reflexive

2-9

A conditioned reflex is extinguished when the conditioned stimulus is repeatedly presented _____ the unconditioned stimulus.

13. (a) without 
    (b) with 
    (c) after

2-13

In this unconditioned hand-withdrawal reflex, heat is the ______-ed ______.

17. (a) conditioned stimulus 
    (b) unconditioned stimulus 
    (c) none of these

2-17
When food in the mouth elicits the secretion of saliva, the whole series of events is called a(n) _____.

2-2

(a) reflex  
(b) response  
(c) stimulus

No learning (or conditioning) is necessary in order that candy in the mouth elicit salivation, but the word "candy" will make a child's mouth water only after some _____ has taken place.

2-6

(a) conditioning  
(b) extinction  
(c) forgetting

The word "candy" is a learned or (1) _____ stimulus. Candy in the mouth is an unlearned or (2) _____ stimulus.

2-10

(a) unconditioned, conditioned.  
(b) conditioned, unconditioned.  
(c) conditioned, conditioned.

In conditioning, the word "candy" is repeatedly presented _____ the unconditioned stimulus.

2-14

(a) with  
(b) separately from  
(c) none of these

After conditioning, a bell will elicit movement of the arm. The conditioned stimulus is the _____.

2-18

(a) arm movement  
(b) bell  
(c) none of those
Candy put in the mouth of a child for the first time ___ salivation.  

2-3

To p. 6

When a child has often had candy in his mouth after hearing the word "candy", the word alone may cause ___.

2-7

To p. 6

Conditioned stimuli presented repeatedly but not paired with unconditioned stimuli cease to elicit the response. If the word "candy" is often repeated without pairing with candy in the mouth, it ___ elicit(s) salivation.

2-11

To p. 6

The process by which a conditioned stimulus loses its power to elicit the conditioned response is called extinction. When the word "candy" is presented alone, the conditioned reflex undergoes ___.

2-15

To p. 6

End of Set
Appendix B
Protest-Posttest

Multiple-choice: Choose the best answer.

1. Which of the following is a response? (a) sweating, (b) blinking, (c) speaking, (d) all of the above.

2. Which one of the following is a stimulus object? (a) a loud sound, (b) a touch on the skin, (c) a phonograph record, (d) all of the above.

3. Magnitude is to strength as latency is to (a) threshold, (b) time, (c) size, (d) source.

4. The stronger the stimulus, the (a) higher, (b) shorter, (c) weaker, (d) stronger.

5. The response of salivation to a previously neutral stimulus is called the (a) unconditioned response, (b) conditioned response, (c) conditioned stimulus, (d) unconditioned stimulus.

6. Extinction of a classical conditioned response will occur if (a) the conditioned stimulus is presented for a series of trials without the unconditioned stimulus, (b) the unconditioned stimulus is presented for a series of trials without the conditioned stimulus, (c) neither the conditioned nor the unconditioned stimulus is presented for a series of trials, (d) both the conditioned and unconditioned stimuli are presented for a series of trials.

7. In Pavlov's experiments the meat powder was sometimes used as the (a) unconditioned response, (b) conditioned response, (c) conditioned stimulus, (d) unconditioned stimulus.

8. A conditioned reflex occurs when (a) a dog salivates while eating, (b) a dog salivates at the sight of food, (c) both of these are true, (d) none of these are true.

9. As the number of trials in which a conditioned stimulus is presented alone increases, the magnitude of the conditioned response (a) increases, (b) decreases, (c) will recover, (d) remains the same.

10. During the acquisition stage of conditioning, the latency of the conditioned response (a) gradually increases, (b) gradually decreases, (c) remains the same (d) is not predictable.
11. The reverse of conditioning is called (a) extinction, (b) reinforcement, (c) generalization, (d) unconditioning.

12. A stimulus which has acquired the ability to evoke a reflex response is called (a) unconditioned stimulus, (b) conditioned stimulus, (c) neutral stimulus, (d) reflex stimulus.

13. Words like "love" and "hate" may elicit emotional responses since they are typically (a) unconditioned stimuli, (b) conditioned stimuli, (c) unconditioned reflexes, (d) neutral stimuli.

14. After conditioning, the response elicited by a previously neutral stimulus is the (a) unconditioned stimulus, (b) conditioned response, (c) unconditioned response, (d) reflex.

15. Movement of the stomach and intestines in digestion involves the (a) striped muscles, (b) striated muscles, (c) skeletal muscles, (d) smooth muscles.

16. Which type of response mechanism is usually involved in the organism's action upon the external environment? (a) smooth muscle, (b) striated muscle, (c) glands, (d) all of these.

17. Reinforcement may be defined as (a) conditioning, (b) any event that strengthens the tendency for a response to be repeated, (c) any event that strengthens the tendency for a stimulus to evoke a response, (d) a tendency for learning to proceed on an all-or-nothing basis.

18. Operant behavior may be called (a) respondent behavior, (b) emitted behavior, (c) elicited behavior, (d) instinctive behavior.

19. The type of response which is strengthened by its consequences is called (a) reflex, (b) operant, (c) classical, (d) none of these.

20. Pecking a key is an example of behavior which acts upon the environment. Thus the pigeon's behavior constitutes what type of response? (a) classical, (b) operant, (c) reflex, (d) all of these.

21. Turning off a television commercial is reinforced by (a) termination of a positive reinforcer, (b) presentation of a negative reinforcer, (c) termination of a negative reinforcer, (d) presentation of a positive reinforcer.
22. A mother's giving candy to her child to stop his temper tantrum will be reinforcing for the mother by the (a) presentation of a negative reinforcer, (b) termination of a negative reinforcer, (c) presentation of a positive reinforcer, (d) termination of a positive reinforcer.

23. A pairing of two stimuli is necessary for conditioning what type of behavior? (a) respondent, (b) operant, (c) both a and b, (d) none of the above.

24. There is no eliciting stimulus for _______ behavior. (a) respondent, (b) operant, (c) classical, (d) reflex.

25. The temporal order in operant conditioning is (a) behavior followed by reinforcement, (b) reinforcement followed by behavior, (c) stimulus followed by reflex, (d) reflex paired with a stimulus.

26. A reinforcer which is effective without prior reinforcement is known as a (a) classical reinforcer, (b) primary reinforcer, (c) conditioning reinforcer, (d) secondary reinforcer.

27. When the song writer wrote, "I'd walk a million miles for one of your smiles," he was referring to (a) the gradient of reinforcement, (b) the tendency for organisms in learning situations to form a cognitive map, (c) a form of secondary reinforcement, (d) none of the above.

28. Money buys many things. Money is a (a) generalized reinforcer, (b) primary reinforcer, (c) generalized primary reinforcer, (d) none of the above.

29. A stimulus which acquires the property of a reinforcer is called a (a) primary reinforcer, (b) conditioned reinforcer, (c) generalization, (d) all of the above.

30. A synonym for conditioned reinforcer is (a) secondary reinforcer, (b) generalized reinforcer, (c) primary reinforcer, (d) both b and c are true.

Supply the omitted word or words for each of the following:

In a reflex, the more intense the stimulus, the greater the (31) ________ of the response.

In a reflex, the (32) ________ of a stimulus is the intensity which is barely sufficient to (33) ________ a(n) (34) ________.
A stimulus which elicits a response without previous conditioning is called a(n) (35) ________; a stimulus which elicits a response only after conditioning is called a(n) (36) ________.

When a response is elicited by a stimulus without previous conditioning, the sequence is called a(n) (37) ________.

To condition a reflex, a neutral stimulus is (33)_______ with a(n) (39)_______.

In conditioning a reflex, as the number of pairings of the conditioned and unconditioned stimuli increases, the latency of the conditioned reflex (40) _______ and the magnitude of the conditioned response (41) _______ until both reach a limit.

A young child is afraid of furry animals. Furry animals are brought closer during each meal. While enjoying the food (an unconditioned stimulus), responses are conditioned which are (42)_______ with fear.

When a young child's fear of furry animals is eliminated by bringing him gradually more and more into contact with harmless furry animals, his fear is said to be (43)_______.

Lying generates stimuli which have acquired the power to elicit the conditioned responses which occur in (44)_______.

Certain groups of responses, such as those elicited by a sudden loud sound, are characteristic of a state of (45)_______.

Name the response systems involved in the following: walking to the table, putting food in the mouth and chewing it, (46)_______ muscle; moistening food with saliva, (47)_______.

Food given to a hungry animal does not reinforce a particular response unless it is given almost immediately (48)_______ the response.

To get an animal to emit a response more frequently, we (49)_______ the response.

It might be said that "a pigeon has acquired the habit of pecking a key," but the only thing observed is an increased (50)_______ of responding after reinforcement.
Operant behavior has direct consequences on the environment; a consequence which results in an increase in the subsequent rate of the operant response is called a(n) (51) blank.

If an airplane spotter never sees the kind of plane he is to spot, his frequency of scanning the sky (52) blank. In other words, his "locking" behavior is (53) blank.

Two ways of effectively preventing unwanted conditioned behavior are: to (54) blank it by withdrawing reinforcement, or to condition some (55) blank behavior.

Reaching for a glass of water or saying "Water, please" are examples of (56) blank behavior; any specific instance of such behavior, however, is called a(n) (57) blank.

A conditioned reinforcer can become a(n) (58) blank reinforcer by being paired with several unconditioned reinforcers appropriate to various deprivations.

You will not continue to work if your pay checks "bounce" because the (59) blank generalized reinforcing effect of such a check disappears in (60) blank.