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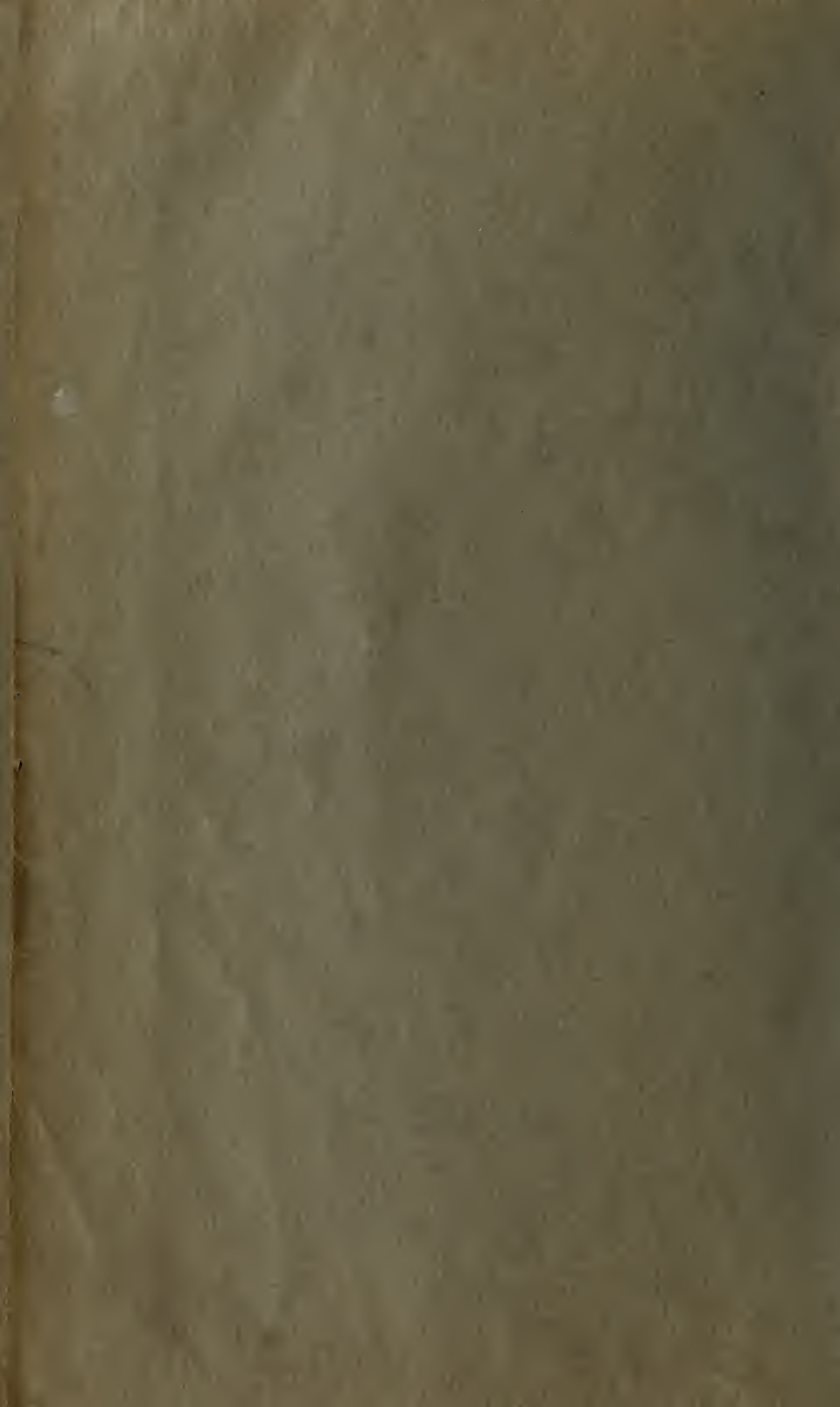
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PRINCIPLES RELATING TO THE ENGENDERING OF SPECIFIC HABITS

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PRINCIPLES RELATING TO THE ENGENDERING OF SPECIFIC HABITS

The nature of specific habits. A specific habit is an acquired control of conduct which results in an unvarying response to a given stimulus. Thus one who has habituated the multiplication combinations will respond automatically and with a high degree of accuracy to requests for products such as, 8 times 6, 7 times 4, 6 times 9, and so forth. One who has memorized dates in history is able to answer automatically such questions as, "When was the Declaration of Independence signed?" or "What was the date of the Civil War?" One who has "learned" the Latin conjugations will respond "without thinking" to a question such as "What is the present active infinitive of *amo*?"

A conspicuous phase of the outcome of the study of most school subjects consists of a multitude of specific habits which provide prompt and accurate responses to certain stimuli. Some of these controls of conduct are commonly described as "memorized facts." Others are characterized by motor responses as in handwriting, type-writing, stenography, manual training, and oral phases of a foreign language. Skill in such a field requires the possession of a certain group of specific habits.

The term "habit" is frequently used to designate a more general control of conduct than those illustrated in the preceding paragraphs. For example, we speak of the habits of neatness, courtesy, accuracy, or truthfulness. A moment's reflection will reveal that each of these controls of conduct exists in various degrees of generality. Thus one may be neat in the matter of keeping his shoes polished—a specific habit. On the other hand he may be careless concerning his hair or linen. Proper attention to each of a large number of elements of personal appearance requires a specific habit. Thus, when we say that an individual possesses a general habit of neatness, we imply that he possesses a large group of specific habits.

One may be neat in dress, but not neat in housekeeping, or sewing, or letter writing. A "general" habit of neatness which applies to all situations thus appears to be a composite of a number of less general habits, each of which is analyzable into more specific habits.

Engendering specific habits an important phase of education. It is obvious that one of the chief responsibilities of the school is to engender a large number of specific habits. The assertion is sometimes made that this is preeminently the task of the first six grades, but the engendering of specific habits continues through the high school and even into college. When one reflects that each arithmetical combination, each word in spelling, each form of inflected words in Latin, and so on and on, is the occasion for the formation of a specific habit, the extent to which teaching consists of the engendering of specific habits becomes apparent. The development of the ability to perform certain specific acts with precision and dispatch should not be regarded as the only function of our schools, but it represents a very important task.

In our anxiety lest school work become too formal and mechanical, we are in danger of erring in the other direction; and in our constant attempt to teach pupils to think, we may fail to have them acquire essential specific habits. The acquisition of these habits is not destructive to thinking; on the contrary, they often clear the way and furnish the materials for reflective processes. In the words of Bryan and Harter,¹ "Automatism is not genius, but it is the hands and feet of genius."

The process of habit formation. The essence of the process of habit formation may be expressed in three words—*repetition with attention*. After an appropriate beginning has been made, the desired response to the stimulus must be repeated until it is made automatic.

The teacher's task in engendering specific habits. The teacher's task in engendering specific habits is complex and varied, but six general phases may be recognized:

1. Stimulating the pupils to engage in appropriate learning activities. Much of this phase of the teacher's task is accomplished through the choice and assignment of exercises for the pupils to do.

2. Devising and assigning appropriate learning exercises. This is probably the most important phase of the teacher's task.

3. Giving pupils general rules and suggestions for doing the learning exercises assigned.

4. Evaluating pupils' performances for the purpose of determining the effect of the learning activities in which they are engaged,

¹BRYAN, W. L., and HARTER, NOBLE. "Studies on the telegraphic language. The acquisition of a hierarchy of habits," *Psychological Review*, 6:344-75, July, 1899.

and consequently their needs for additional instruction. This phase of the teacher's task is frequently called "diagnosis."

5. Assigning supplementary learning exercises to correct deficiencies revealed by diagnosis. These include questions to be answered by the pupils, explanations to be listened to, and illustrations to be observed.

6. Giving direct assistance. This overlaps with two and five.

Purpose of this circular. In the following pages of this circular, a reasonably complete list of the principles or general rules relating to the engendering of specific habits is presented. In general, the statement of the principle is accompanied by some justification, and where it seems necessary, by an illustration, showing its application to the teacher's task. The principles are considered with respect to their application to the work of the upper grades and the high school, though many of them, if not all, apply to any division of our educational system.

Rules for the teacher versus rules for the learner. In general, the rules are stated in terms of teacher activity and therefore explicitly relate to some phase of the teacher's task. A few of the principles imply procedures to be followed by the learner, and therefore form the basis for rules which the teacher may give his pupils.

Sources of the principles relating to the engendering of specific habits. The principles relating to the engendering of specific habits presented in the following pages have been derived from general psychological principles, educational theory and the reports of certain investigations. Specific references to these sources are not given in the majority of cases, but the bibliography furnishes a list of the more important books relating to this subject.

Principle I. The teacher should analyze each unit of instruction to determine the possibilities and needs for engendering specific habits.

In general, desirable habits are not acquired if their formation is left to chance. On the contrary, an explicit effort on the part of the teacher is usually required to engender them. Thus, it is important that the teacher have clearly in mind the specific habits which the learner should acquire and then make provisions appropriate for their formation. In engendering specific habits, as in other types of teaching, the teacher should plan his work each day in detail and with care.

It will be noted that Principle I specifies that the teacher should consider both the possibilities and the needs for habit formation. This suggests that not all learning can be or should be habit formation. The teacher must decide what should be habituated and what should not. However, it is not within the scope of this circular to suggest those principles that should guide him in making such decisions.

Principle II. The teacher should not ask the learner to acquire a habit until near the time for its use.

There is considerable experimental evidence for this principle. Radossawljewitsch found that, after meaningful material had been learned to the point of errorless reproduction, it was forgotten at approximately the following rate: one hour 29 percent; one day 32 percent; one month 80 percent. Ebbinghaus found that he forgot meaningless material at an even faster rate: about 42 percent within twenty minutes. It follows that there is great waste in learning material long before the occasion for its use arises. For example, it would be folly to learn a list of words in a foreign language a month before they were to be used in reading or translation.

Indeed, we can carry the principle still farther and say that learning is often most economical when it results from use. Experiment has shown that time and effort may be saved by learning material while using it rather than by first memorizing and then using it. The extent to which this is true depends upon the degree to which the learner consciously attempts to learn the material while he is using it. Thus, the student by solving problems in which reductions, ascending and descending, are made, may learn the portion of the metric system commonly used in physics. However, in this case an explicit effort to fix the relationships in mind is a prerequisite for learning the tables. A student may mechanically replace one number by another almost indefinitely without learning the relation between them.

It may be added that there is another advantage in making clear to the pupil the use of the specific habits which he is asked to learn. The recognition of a need is the basis of a strong motive for learning. Incidentally, the practice of pointing out the need for specific habits will tend to prevent the teacher from requiring the learning of useless material, or of that which may be useful eventually but which is not needed at present.

Principle III. When a group or succession of related habits are to be formed, the teacher should assign the learning exercises designed to lead to their acquisition in a psychological rather than in a logical order. (This is a special application of Principle II.)

By the psychological order is meant the order best suited to the needs, interests and capacities of the learners. By the logical order is meant the order implied by sequential relationships existing among the habits themselves.

In studying a foreign language, a logical order would be first to acquire a considerable vocabulary, then to learn the necessary grammatical principles and inflections, and finally to make use of this body of knowledge in reading, writing or speaking the language. A more effective procedure is adopted when only enough vocabulary and grammar are learned to introduce and continue some use of the language. While mastering the mechanics of the language, a pupil should not be expected to maintain the interest and to put forth the effort which are requisite to economical learning without any measure of the satisfaction that results to him from reading, writing or speaking the language.

Another illustration may assist in making the point clear. A logical procedure in mastering factoring in algebra would demand that all cases which the student is required to master should be taken up in logical order. The simplest case would be taken first, then the next, and so on until a mastery of all cases is acquired. Such a procedure, however, violates two of the three requirements of psychological procedure, namely, (1) that the order in which the learner is asked to acquire specific habits be in harmony with his needs, and (2) that learning exercises be adapted to his capacities. It is not necessary that the whole range of factoring be mastered in the earlier part of the course, and it is likely that the harder cases will be beyond the capacities of most of the members of the class. Hence a psychological order of mastery of the topic necessitates the omission of the more difficult types, or at least their postponement until a later time in the course.

Principle IV. The teacher should endeavor to get the learner to understand clearly just what response is to be habituated.

In understanding this principle, it will be helpful to distinguish between responses that are chiefly motor in character and those that

are predominantly mental. In most, if not all, cases of motor learning, the pupil is not able to make the correct response at first, but gains skill only through practice in which trial and accidental success play an important part. If he is studying German, for example, he may not be able to pronounce correctly the word "ich," but he can and should have a clear auditory image of the correct sound before attempting to speak the word. Or, to take another case, the student in a sewing class may be unable to make a particular kind of stitch satisfactorily, but she should have clearly in mind the desired characteristics of the stitch and the proper procedure in making it.

When the difficulty of the response depends upon its mental rather than its motor aspects, the pupil should be able to give the response correctly before repetition to automatize it is begun. For example, in declining a Latin noun it is both possible and desirable that the correct forms be learned at the beginning. There is no occasion for trial-and-error learning, since the correct response can be given from the start. Principle IV requires that the student be conscious of the correct form for each case before drill upon the declension is begun.

Principle V. The teacher should endeavor to arouse in the learner a sufficiently strong desire to form the particular habit or to attain the particular skill so that his initial attack will be accompanied by a high degree of interest and enthusiasm.

The meaning of this principle is quite clear, and its importance is generally recognized. It is a fundamental educational tenet that changes in the pupil result only from his own efforts. Hence the pupil must be active. But mere activity is not enough, there must be the proper mental set or attitude accompanying the activity. The time-worn aphorism, "We learn to do by doing," needs to be interpreted with caution. We learn to do a thing right by doing it right, but we make no progress toward correct performance by any amount of careless, thoughtless, indifferent repetition.

Principle VI. The teacher should employ appropriate procedures and devices so that the learner will maintain an attitude of interest and attention throughout the process of repetition.

It is not enough that the pupil have a strong motive at the beginning of a learning task. If the initial motive loses its force before the habit becomes fixed through drill, new incentives, new means of arousing effort must be applied from time to time. Repeti-

tion is, in general, essential to habit formation; but repetition without the proper attitude on the part of the learner is of no avail. To quote Thorndike:² "The amount of practice should always be considered in the light of its interest and appeal to the pupil's tendency to work with full power and zeal. Mere repetition of bonds when the learner does not care whether he is improving is rarely justifiable on any grounds."

Principle VI, therefore, is a very important one. It is elaborated by stating a number of subordinate principles which will serve as suggestions for its application.

1. The teacher should make clear to the learner the level of achievement he is expected to attain.

The application of this principle is limited by the fact that objective standards have been established for relatively few specific habits. We cannot say, for example, how many equations of a certain type a first-year high-school student should be able to solve in three minutes, nor how long it should take an eighth-grade student to identify fifty focal dates in American history, nor how well a piano selection should be played. Yet in every such case the teacher must have some standard of achievement, however well or poorly defined it may be in his consciousness, which he desires the pupil to reach. Such objective standards as have been established should be utilized. In other cases the teacher, guided by his experience and judgment, should set up tentatively such goals as seem appropriate. When he has clearly and definitely formulated his goal he should inform the pupil as to the quality of performance expected of him.

2. The teacher should provide some means for informing the learner in regard to his progress in the acquisition of a habit. It is particularly important for the learner to know when he has reached his goal. Standardized tests are useful for this purpose.

Experiment has shown repeatedly that knowledge of progress is an effective incentive to improvement. Indeed, it is doubtful whether a teacher can do any other thing which will so stimulate a learner to greater effort as keeping him informed of his progress on successive performances. If the progress is satisfactory, the learner is encouraged and spurred to further effort; if unsatisfactory, he is made conscious of his shortcomings. As a result of knowing his status he

²THORNDIKE, E. L. "The psychology of drill in arithmetic," *Journal of Educational Psychology*, 12:183-94, April, 1921.

strives to beat himself—a most desirable form of emulation. He will repeatedly fix as his goal a higher score or a better performance than he has yet attained and then exert his full powers to reach the advanced goal.

The criticism that much of our school work is too vague, too indefinite, too aimless, is no doubt just. The pupil does not know just what he is to do, how well he is expected to do it, nor how well he is doing it at any particular time. In his endeavor to educate himself, he is to a great degree a chartless voyager, unacquainted with his destination, uninformed as to his course, unaware of his reckonings at any moment. Surely he will toil more vigorously at the oar if he knows from time to time just how far he is from port and at what rate he is approaching the harbor.

3. If improvement ceases before a satisfactory level of achievement is attained, the teacher should make the learner feel that his limit of achievement has not been reached.

Probably few persons ever even approximate their potentialities. Among the reasons why their progress in learning ceases before the limits of their improvability have been reached is their failure to realize that continued progress is possible. If a learner comes to feel that he can improve no further, this conviction acts as an almost insuperable barrier to progress. If after months of practice he can typewrite forty words a minute and believes he can never do more, any further gain in speed will be very slow and difficult, if not impossible. Such a student should be made to believe that with a little more practice he can attain a speed of forty-five words a minute; and, having attained that rate, he should then strive toward a new goal of fifty words with the same complete confidence in his power to reach it.

4. In engendering many types of specific habits the teacher should require practice under a time limit.

This will be found a useful means of increasing concentration of attention and strength of effort. Pupils who proceed slowly in practice are usually careless and inaccurate, simply because an abundance of time makes vigorous application unnecessary. Although accuracy should not be sacrificed in securing rapid performance, rate of performance is often an important consideration.

It will be emphasized later that speed alone should not be made the goal. It should never be striven for at the expense of accuracy.

The point here is that a more intense application—and hence more rapid improvement—will result from giving some attention to the time element in the pupil's performance. It will be found effective, for example, to encourage pupils to decline *bonus, bona, bonum* correctly in twenty seconds, or in two minutes to name in order the Presidents of the United States and the years during which each served.

5. In endeavoring to secure continuous and persistent effort to learn, the teacher may employ emulation, that is, show the learner what others have done.

Perhaps the most desirable form of emulation, as was suggested under "2" above, is the pupil's endeavor to surpass his former record. If competition among members of a group becomes too keen, it may lead to undesirable results. Yet it is effective, and in moderation is probably not injurious. One harmless form is, showing the pupil what pupils in other schools have done. Standardized tests and scales will be of some service in this connection.

6. Group competition is a desirable form of emulation.

Group competition is largely free from the objectionable features of individual emulation, and where properly employed is very effective. Furthermore, it cultivates social tendencies that are desirable, such as working for the welfare and honor of the group—a section, class, school, or city. It may take such forms as vocabulary matches in foreign language, ciphering contests in arithmetic, debates, and so forth.

7. The teacher should provide variation in the practice so that the repetition will not become monotonous.

Any procedure loses its effectiveness if it becomes monotonous. If the teacher is lacking in resourcefulness, energy or enthusiasm, he probably will take the line of least resistance and conduct all recitations, including drill periods, in much the same manner day after day. The result is likely to be a steadily diminishing interest and enthusiasm on the part of the learners. The work becomes formal, mechanical, lifeless. It is therefore highly desirable that different devices be employed to lend variety to the practice. The drill may be oral or written, with individual pupils or in concert, at the blackboard or on paper. It may often take the form of games or contests. In the latter case, group competition with a relay feature involved is frequently effective.

8. When oral concert work is employed, it is frequently desirable for the teacher to identify the leaders and to request them to remain silent while the others continue the drill.

There are occasions when oral concert work can be used advantageously, as in drilling upon declensions and conjugations in language, repeating poetry that is being memorized, or reading a foreign language to acquire facility and smoothness of expression; but if it is not carefully conducted, it frequently benefits only the relatively few who are most active—and incidentally least in need of the drill. The weaker members of the group tend to be silent or to follow the leaders. The latter should be asked to remain silent while the less active are forced to respond.

9. The teacher should keep the physical conditions of the classroom favorable to learning.

Interest and attention are more easily maintained if pupils are physically comfortable. The teacher should attend to the temperature, light and ventilation of the classroom, and should see that all possible distractions are removed. Excessively high temperature, foul air, poor light (resulting frequently from opaque shades covering half or more of the lighting surface), lack of adjustment of seats and desks to the sizes of the pupils, the presence of needless books and various other objects on the pupils' desks, unnecessary distracting noises—all of these are conducive to restlessness and inattention, and can usually be corrected with the expenditure of comparatively little time and effort.

10. The teacher should endeavor to get his students to understand the function of repetition, the necessity for concentrated attention, and the importance of "the will to learn."

This principle applies with more force to upper-grade and high-school students than to pupils in the lower grades. In the case of the former, much drill may and should be done during study periods or at home. If the pupil understands that repetition is indispensable to mastery, he is more likely to give his attention to this aspect of learning than if he does not realize the necessity for it. Likewise, concentrated attention frequently requires effort, and the student who knows that rapid improvement results only from attentive repetition should be more willing to put forth the necessary effort. Finally, if he is aware that the mental attitude, which we may call "the will to learn," is a great factor in his progress, he will be impressed with a deeper sense of his responsibility in the matter.

Principle VII. The first step in the process of engendering a specific habit usually should be a demonstration by the teacher, accompanied by an explanation.³

This principle applies to many, though not all, cases of habit-formation. Sometimes demonstration alone may be sufficient as, for example, in the pronunciation of most words, but if the sounds involved are difficult to make, an explanation of the necessary position of tongue or lips may be of assistance. It has been stated in Principle IV that the learner must have a clear grasp of the response to be made. Demonstration, accompanied by explanation in most cases, is the quickest and surest means of assuring this condition.

Principle VIII. In most cases of motor skill there are certain better methods, but not necessarily one best method.

This principle implies that it is not necessary to require all pupils to perform an act in precisely the same manner. On the contrary, some allowance must often be made for the individuality of the learner. However, it should be noted that the principle states that there are at least *better* methods. Some methods, which may be adopted by the learner if he is left to his own resources, are inferior to others that he might use, even though there is no one best method for all pupils in doing that particular thing. In penmanship, for example, there may be no one best position for each part of the hand in the case of all pupils, since some variations may be justifiable on account of the structure of the hand; but the untaught penman is almost certain to employ a position that is far from the best possible for him.

Principle IX. Trial and accidental success play a large part in motor learning, but frequently the teacher may shorten the learning process by suggesting "better methods."

Mention has already been made (Principle IV) of the fact that responses which are chiefly mental differ from those which are chiefly motor in that the former may be correctly given from the first, while in the latter case correct responses usually result from a process of so-called trial-and-error learning. This principle calls attention to the fact that the course of trial-and-error learning may often be

³Principles VII, VIII, IX, and X are especially applicable to the formation of motor habits.

materially abbreviated by proper assistance on the part of the teacher. It is imperative for two reasons that the teacher remember these facts. In the first place, he will not so soon become discouraged when satisfactory motor responses are not immediately forthcoming from his pupils but will continue his efforts, knowing that time and practice are requisite to skilled performance. In the second place, he will recognize that by careful guidance and direction he can save much time and energy on the part of his pupils and will constantly be studying the performances for the purpose of detecting defects in their methods—incorrect movements, movements out of their proper order of relationship, superfluous movements—which he may help to remedy.

Principle X. In general, the teacher should seek to focus the learner's attention upon the objective result of movements rather than upon the movements themselves. In cases where it seems advisable for the learner to observe his movements, his attention should be directed to those to be performed rather than to those to be avoided.

No inconsiderable portion of school work consists in acquiring motor skills, in such activities as penmanship, drawing, singing, playing a musical instrument, pronouncing words, manipulating apparatus, sewing, and using tools in industrial arts. In practicing to develop such skills, it is usually better to have the learner observe the results than to focus attention upon the movements. For example in singing, a better tone will be secured by listening to the sound produced and comparing it with an image of the desired tone than by giving attention to the position and movements of the lips, tongue, throat, and so forth.

Sometimes it is necessary to call the learner's attention to the movements made, as when bad habits of fingering the piano have been initiated. In such a case, it is better for the learner to center his attention upon the desired movements rather than upon those to be avoided. An illustration of the effect of focusing the attention upon the wrong thing is furnished by the familiar example of the inexperienced bicyclist who fixes his gaze upon a stone or tree with the determination to steer clear of it, the result being a collision with the object he tries to avoid. The movement that predominates in consciousness is likely to be performed.

Principle XI. The teacher should instruct the pupil to memorize by wholes rather than by parts.⁴

This principle is generally advocated by authorities on methods of teaching, but it can hardly be said to have been established beyond question for all learners or for all types of learning. It probably holds for most learners in memorizing meaningful material, especially after training in its use has been given.

If not instructed in regard to the method to be followed, most persons would proceed to memorize the Gettysburg Address sentence by sentence, that is, by parts. The opening sentence would be repeated as many times as proved necessary in order to learn it, then the second sentence would be memorized and joined to the first, and so on through the selection. By the whole method, the entire selection is read through without repetition of any of its parts; then it is repeated as a whole until learned as a whole.

Such material as this address, which is meaningful and essentially a unit in itself, doubtless can be more economically learned by the whole method. If the amount to be memorized is large, it can best be broken up into smaller parts and each part then learned by the whole method.

Principle XII. The teacher should instruct the learner to use recall in memorizing. However, he should not attempt recall until the learning has advanced to such a stage that correct responses can be given.

By recall is meant the repetition of the material without reference to the text. As soon as the learner is able to repeat correctly any portion of what he is attempting to memorize, he should do so without looking at the page. Gradually more can be added until the whole can be repeated without reference to the text.

Recall may be practiced when memorizing either by wholes or by parts. If a poem is being memorized as a whole, after a few repetitions there will be portions that have been learned to the point of perfect reproduction. When the learner, in the course of later repetitions, comes to these portions, he should exercise recall, enlarging these parts and adding others as soon as possible. The application of the method to memorization by parts is obvious.

⁴Principles XI to XV inclusive are particularly applicable to the formation of habits in which the mental element predominates.

The procedure defined by this principle results in greater concentration of attention than is likely to accompany mere rereading of the text. Since the rate of learning depends upon the degree of attention rather than upon the number of repetitions, the use of correct recall leads to economical memorization. Furthermore, by employing this procedure the learner is more conscious of his progress at any time, which is an aid to learning, and also is made aware of the parts that present special difficulty and require particular effort and attention.

However, the warning contained in the second sentence of the principle should not be neglected. Recall should not be attempted too soon, that is, before it can be done correctly. Here, as elsewhere, repeating an error strengthens it instead of leading to the correct form.

Principle XIII. The teacher should direct the learner's attention to associations among the facts that he is asked to learn.

Good habits of memorizing and of recalling material rest largely upon the establishment of associations among the facts learned. These associations may consist of relations of time, of place, of cause and effect, of similarity or dissimilarity, and so forth.

Principle XIV. Sometimes it is appropriate for the teacher to suggest mnemonic devices to the learner.

Systems of so-called memory training have been constructed upon the basis of mnemonic devices, which are highly artificial aids to memory. The value of such devices is limited since the associations they establish are mechanical and meaningless. However, a mnemonic device occasionally may be useful. The otherwise meaningless word *vibgyor* serves to suggest the names of the spectral colors (violet, indigo, blue, green, yellow, orange, red) into which sunlight is decomposed by a prism and also the order in which they appear on the screen after the dispersion. In music, *f-a-c-e* aids in recalling the letter-names of the spaces of the staff. The order in which members of the cabinet succeed to the presidency is easily remembered by calling to mind the fictitious *St. Wapniac*. Such mnemonic devices are frequently helpful in learning facts that have no natural basis of association.

Principle XV. In conveying to the learner the response that he is to make, the teacher should not limit his appeal to a single sense. Different senses should be utilized at different times.

Experiments have indicated that simultaneous appeals to several senses are not in general highly effective. For example, if a French word and its English equivalent are to be learned, they may be presented visually, pronounced aloud by the pupil, and then written. Thus four distinct appeals may be distinguished, namely, visual, auditory, vocimotor, and manumotor. It appears that the result of this composite appeal is not so satisfactory as if the visual stimulus alone (or perhaps the auditory in the case of young pupils) were employed.

However, if these appeals are made at different times, it is probable that more effective learning will result than if only one of them—the visual, for instance—is employed at each repetition. Thus, in learning a vocabulary, the words may first be presented visually; at another time the auditory appeal may be made; at a third time the words may be written; and so on.

Principle XVI. The teacher should endeavor to engender habits in the way in which they will be used.

This principle results from the fact that habits considered here are specific. A slight change in the conditions of use may render a specific habit partially or wholly ineffective. Ability to spell a word orally, when the attention is focused upon the act of spelling, does not guarantee that the word will be spelled correctly in writing a letter, when the attention is likely to be centered upon the thought to be expressed. Again, a habit may function in one direction and not in the reverse. The student may know the English equivalent of a foreign word but be unable to give the foreign word when the English is presented, or he may know a series of facts in one order, but be unable to give them in another order. Thus, the person who knows the alphabet from A to Z cannot, unless he has given it particular attention, repeat it from Z to A, at least with anything like equal speed and accuracy. Hence, if it is desired that the learner know a series in different orders, he must be given an opportunity to learn it in these orders. Or if, as in arithmetical combinations or Latin forms, it is necessary to be able to use any fact of a related group with speed and accuracy, drill must be given upon it out of its setting in the group.

Principle XVII. The teacher should avoid engendering superfluous habits. If such are acquired, they should be eliminated as soon as possible.

A very common violation of this maxim, which will probably occur to the reader, is the practice of the beginner in arithmetic who counts on his fingers when adding. This habit, of course, slows up his mental processes materially and prevents his ever attaining any satisfactory proficiency in the operation. In a like manner, though perhaps to a smaller degree in most cases, many acts that are to be rendered habitual become burdened with useless and retarding superfluities. For example, in teaching the pupil to translate Latin into English, many teachers advise him to search through the sentence and find the subject and verb, then determine the relations of the other words. A moment's reflection shows that this can never lead to proficiency in reading Latin. We do not read English in that fashion, neither did the Roman boy so learn to read Latin. On the contrary, the meaning and use of each element of the sentence should be determined as soon as it is encountered; or, at least, the various possible interpretations should be held in mind until such a point is reached in the sentence that the proper interpretation can be selected.

Good illustrations of the violation of this principle may be found in the field of motor habits. In type writing, the learner may make the error of lifting his fingers too high above the keys, and as a result, an appreciable amount of time and energy is wasted in operating the machine. As another example, the habit of looking at the fingers on the keyboard in playing the piano may be cited. This interferes with the reading of the music and probably hinders the development of skill and technique in controlling the instrument.

Principle XVIII. The teacher should insist upon absolute accuracy in practice. Accuracy first, speed afterwards.

This principle applies with greater force to those acts which are chiefly mental than to those which are chiefly motor, since the former, as has been said previously, can be done accurately from the beginning whereas the later usually cannot. But even though motor acts cannot be performed accurately at first, the learner can and should keep the desired result in the focus of consciousness and should constantly strive to attain it rather than to develop speed at the expense of the quality of the performance.

The validity of this principle is readily apparent when we remember that habit formation consists of establishing bonds between given stimuli and desired responses. In each case a definite neural pathway is to be established between stimulus and response. If the nervous impulse is deflected to the wrong course, the correct response cannot follow. But if the proper connection is once made and is then strengthened by attentive repetition, the time necessary for the response will gradually decrease until the physiological limit of the learner's improvement has been reached.

Principle XIX. The teacher should be alert in detecting errors in the learner's performance and persistent in bringing such errors to the learner's attention.

It has already been pointed out that repetition of errors without any effort to improve only strengthens them. It is futile to hope that, as if by magic, they will disappear if only they are repeated often enough. The pupil should not be expected to correct errors of which he is unaware, and practice when he does not have a definite purpose in mind is likely to be ineffective.

Principle XX. In the case of a series of responses to be automatized, the teacher should be careful to include each member of the series in the exercises for practice.

The validity of this principle rests upon the fact that habits implied in it are specific. Hence, making one of a series of responses is no guarantee that another of the series will be made. On the contrary, each and every response of the series must be automatized.

One illustration of a very common violation of the principle may be found in addition in arithmetic. After the pupil has learned the forty-five addition combinations, he is given practice in applying them in doing examples. If a set of examples for use in drill be selected from the textbook and analyzed to determine what combinations occur in solving them, it often will be found that some of the combinations do not appear at all. Similarly, the teacher should exercise care in formulating drill material, otherwise some responses will not be practiced. This caution, of course, will apply to other subjects as well as to arithmetic.

Principle XXI. The teacher should provide more repetitions for those responses that afford the most difficulty.

This principle requires no justification. Most teachers are aware of its importance and doubtless endeavor to observe it in devising

exercises for drill. However, a teacher may violate it more often than he realizes. It was pointed out in the discussion of the preceding principle that an analysis of drill material in arithmetic will often reveal the complete absence of some combinations and will show also that the relative number of occurrences of the different combinations does not always agree with their relative difficulty. A given set of multiplication examples, for instance, may include the combination 2×3 ten times and the combination 9×7 once, or not at all. This principle suggests that the opposite condition should prevail. An analysis of the learning exercises employed in other subjects will often disclose a similar anomalous situation.

Principle XXII. The teacher should constantly bear in mind that pleasant feelings facilitate progress in learning.

Thorndike attaches great importance to the effect of pleasant feelings on the strength of the tendency toward the response which they accompany or follow immediately. If, for example, one is learning to operate the typewriter and experiences feelings of pleasure and satisfaction in the act, the neural bond between the stimulus afforded by each letter and the act of striking a particular key is thereby made stronger than when the learner is indifferent toward the matter. On the other hand, if the response is accompanied by a feeling of discomfort or dissatisfaction, the tendency toward it is thereby weakened. It should be noted that it is immaterial whether the response is correct or incorrect; the tendency toward *any* response is strengthened by agreeable feelings and weakened by disagreeable feelings. It should also be observed that the effect of the feeling is similar if it follows, instead of accompanying, the response.

The inference is obvious. Feelings of pleasure should be associated with successful responses, feelings of annoyance with unsuccessful responses. Whenever the association is the reverse, namely, feelings of satisfaction with incorrect performance and dissatisfaction with correct performance, repetition defeats its purpose. If it is desirable to automatize a particular response, the result may be reached much more quickly if the response is accompanied or followed by a feeling of satisfaction to the learner than if it is met with indifference on his part. On the other hand, if it is desired to eliminate a particular tendency toward response, it is only necessary that this response be invariably associated with discomfort, and it will disappear.

Principle XXIII. The teacher should never drill the few at the expense of the many.

Every teacher realizes that individual differences in pupils result in much more rapid learning by some than by others. As a consequence, part of the class will reach the desired level of attainment while others are in earlier stages of achievement. If the drill of the entire class is discontinued at this point, the slower pupils suffer. On the other hand, if the drill of the whole group is continued, the time of the brighter pupils is wasted. How to proceed for the best interests of all is a difficult problem. The various suggestions that have been made for providing for individual differences cannot be treated in this circular. However, some means should be found, if possible, to bring the slower pupils up to the desired standard of attainment without sacrificing the time of the more rapid learners. The high-school student may reasonably be required to devote some time to practicing the exercise out of class until he attains the proper proficiency, but in such a case there is danger of improper or wasteful procedure if this practice is not closely supervised or directed. It may often be possible for those needing further drill to meet with the teacher during special hours fixed for that purpose and thus continue their learning under his direction.

Principle XXIV. The teacher should provide for a proper distribution of practice.

Two elements are involved in a proper distribution of practice, namely, the length of the intervals between successive practices and the amount of time devoted to each practice. The teacher is therefore confronted by such questions as these: In order that learning may proceed most economically and effectively, should drill be given daily, or on alternate days, or weekly, or how often? Should the intervals between practices be uniform or should they vary in length? How long should the drill period be—ten minutes, or twenty minutes, or forty minutes, or some other length? Should the length of period be constant or should it vary with the degree of habituation which has been reached?

Unfortunately the answers to these questions cannot at present be given conclusively for all types of learners and all kinds of learning. The most effective distribution of practice for the primary-grade pupil in learning the addition combinations and for the high-school student in learning a Latin conjugation may be quite different.

Furthermore, the distribution that is most economical for a particular student when he is mastering factoring in algebra may not be the best one when he is acquiring skill in shorthand or in sawing a board. It is probable, however, that the following suggestions will hold true in all cases.

1. If the learning task is relatively short and easy, the first learning may be most economically achieved by massed rather than by distributed effort. For example, if one is memorizing a short poem, which he can learn to the point of immediate errorless reproduction in a quarter of an hour, he will save time by learning it at one sitting rather than by distributing the learning over periods of two minutes length. It should be said, however, that a greater number of later repetitions will be needed for permanent retention if the first learning proceeds by the former plan.

2. If the learning task is long or difficult, distributed effort will save time and energy. Thus, if two hundred lines of poetry are to be learned, it is advisable to devote a little time, say ten or fifteen minutes, each day to the task until it is completed rather than to attempt to learn the entire two hundred lines at one time.

3. In the early stages of habituation of mental responses, frequent—perhaps daily—practices are desirable. As the approach to automatic response proceeds, the intervals between practices may be gradually lengthened until further drill is unnecessary. In automatizing motor responses it seems that daily practices are not economical even in the early stages of learning.

4. It is usually held that relatively short practice periods bring the best returns for a given expenditure of time. The proper length of the period depends upon several factors, among which are (1) the maturity of the learner, (2) the nature of the learning activity, and (3) the degree of habituation to be attained. In general, the pupil may profitably continue practice at one time as long as he shows a high degree of efficiency, or in other words till fatigue effects begin to appear.

Principle XXV. The teacher should provide exercises for continuing the learning to the required degree of efficiency.

All of the preceding rules and principles are intended to assist the teacher in deciding (1) what habits should be established, (2) when the learning should begin, (3) what attitude should be aroused and maintained in the pupil, and how this may be done, (4) how often and for what length of time practice should be given, and (5)

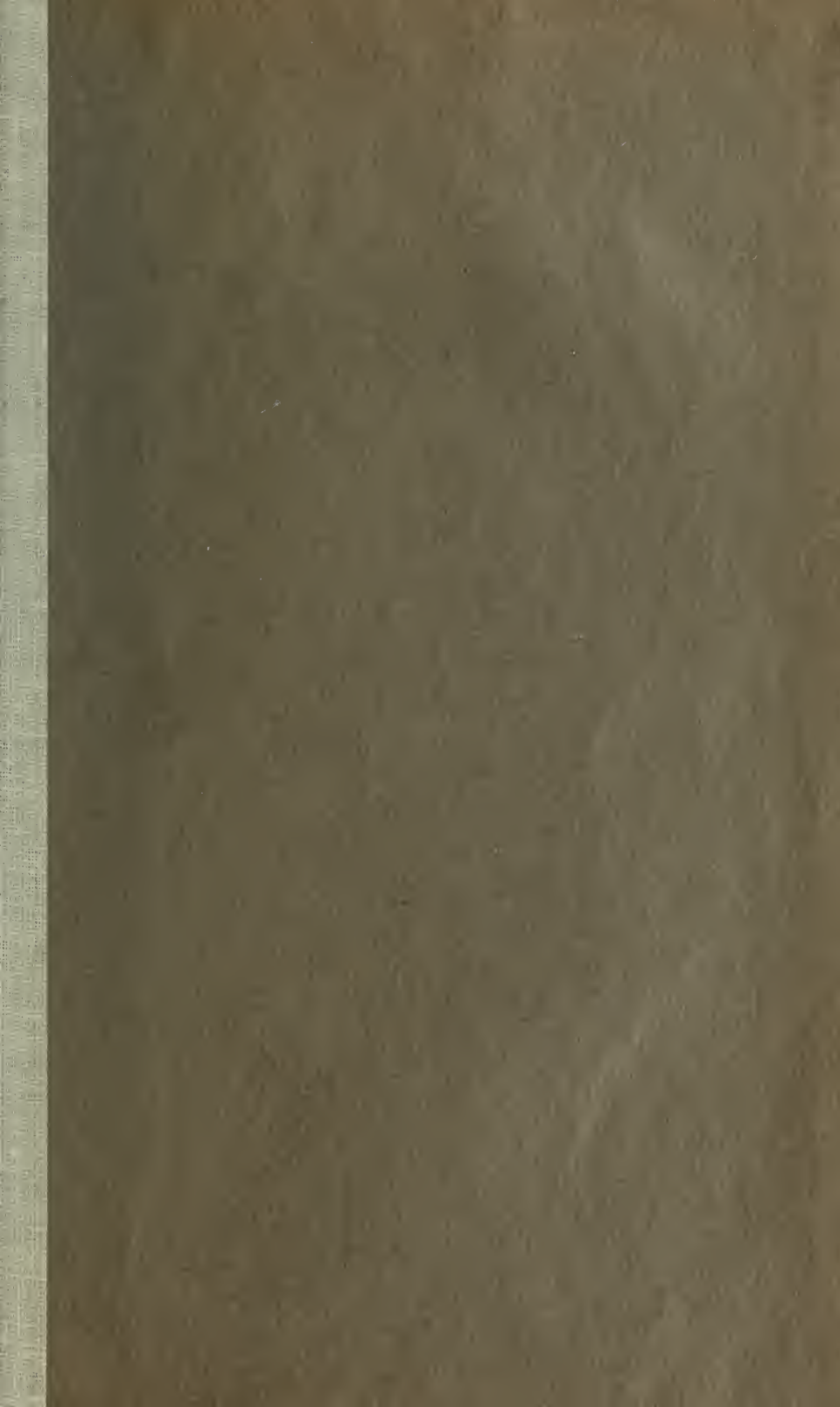
what further considerations should be kept in mind by the teacher in directing the practice. Yet one thing more is needed, without which all else is of little avail. The learning must not be stopped at too low a level of habituation. As suggested earlier in this discussion, the teacher should have some standard of attainment which he wishes the pupil to reach. This standard should be entirely justifiable in the light of educational objectives, and no achievement below the standard should be acceptable. Underlearning is always unsatisfactory learning, and often is little better than no learning. Hence learning should be carried to the proper level, and occasional repetitions should be provided later to guarantee that this level will be retained. It is eminently true in habit formation that whatever is worth doing at all is worth doing well. It is the teacher's task to decide what is worth doing and how well it needs to be done; then the effort should not be discontinued short of the goal.

Concluding statement. It has been the aim of the writer to call attention to the importance of habit formation in the classroom and to offer some suggestions which, it is hoped, may be helpful in directing this process. It is not implied that this is the chief end and aim of education. However, no one can doubt that there are both room and need for improvement in this phase of school training. A plea for interest in the work is by no means a plea for a soft and easy education, if such a thing can be conceived. It is only a plea for the avoidance of the wasteful and ineffective methods of attempting to force pupils to learn without any enthusiasm or pleasure in their work. We quote again from the authors mentioned on p. 4: "There is happily no need to choose between the galleys and the circus as models for the school and home. There are many schools and homes where hard tasks are preformed in a good temper; where thorough drill does not arrest, but prepares the way for higher development; where children begin to do what they must later do to succeed in any business—pass cheerfully from interest in desired ends to a resolute drudgery necessary for the attainment of those ends.

"If this view of education is correct, the course of study has no more important function than to make clear the essential habits involved in the mastery of each school subject, and the order in which these are to be acquired; and the teacher has no more important duty than to arouse in children such an interest in some higher aspect of the subject that they will willingly lend themselves to mastery of its details."

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