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In order of importance, curriculum, motivation, academic ability, and teaching methods are described in this paper as principles affecting classroom learning that can lead to more effective instruction. Curriculum simply exposes students to appropriate content and subject matter. Educational research should concentrate on the evaluation of curriculum innovation, including recommendations to scrap irrelevant subjects in high school curriculums. The second principle is motivation (whether extrinsic or intrinsic) which is essential for classroom learning even when there is a good curriculum. The third principle of learning is academic ability. Intelligence is not highly changeable but neither is it fixed. The teacher should assume a positive attitude toward learning problems as she attempts to be effective. Less important than the others is the fourth principle, teaching methods, which only slightly affects subject matter proficiency. Research should be directed toward finding teaching techniques that minimize time and money expenditure, without regard for effectiveness. Selective use of appropriate reinforcements to shape learning behavior is recommended. (MH)

Functional Principles of Learning

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I shall briefly describe several principles of classroom learning that can lead to more effective instruction. These principles are not only worded differently from most principles of learning, but they differ from those principles in another dimension as well: Namely, they are immediately applicable to classroom problems. One of these principles is badly misunderstood and misinterpreted and, as a result, it has been selected for more extensive remarks.

The most important principle of classroom learning concerns curriculum. This principle appears obvious when stated in its essentials. Children do not learn something unless they have been exposed to the appropriate content. Students learn mathematics only if they are exposed to mathematics. Furthermore a reasonably bright and motivated student does not need an instructor in order to learn if there is exposure. Books were the major advance in the development of programmed, automated instruction. A little guidance in book selection meets a major part of ordinary instructional requirements. Some of today's undergraduates who are highly critical of undergraduate education give one the impression that they have never heard of a library. They may actually be more concerned, however, with therapy than with academic learning in their insistence on equality and dialogue between instructor and student.

The principle as stated above seems obvious, but there are a number of applications that are far from obvious to laymen or to teachers. The new math has been widely acclaimed, but has it been evaluated from the curriculum needs of high school students, that is to say, from the curriculum needs of general education? I do not know the answer, but I have reason to be skeptical.

A general principle of faculty behavior is that faculties tend to think of curriculum problems in terms of preparation for the doctorate in their discipline. This principle applies to humanists, physical and biological scientists, and even psychologists, in addition to mathematicians.

A second example is far from obvious to most persons, but is clearly obvious to a student of transfer of training. There is no sound educational basis for the offering of Latin in any secondary school in this country, yet Latin is and will continue to be one of the languages most commonly taken, whether eagerly sought by students for mistaken reasons or crammed down their throats by families and faculties. There is only one educational purpose better served by Latin in the curriculum than by other curriculum content. This is to acquire a reading knowledge of Latin. Clearly such a specialized purpose is better handled in specialized education at the college level than in general education at the secondary level.

There is a good deal of merit, from this point of view, in the demand for curriculum changes for students in our ghettos, but it is also a demand that can miscarry. Classical world history has little relevance for the students, but neither does African prehistory. Swahili has only slightly more merit than Latin. There are no replacements for English and mathematics.

The Land Grant acts of 100 years ago had extremely important classroom learning effects because they had far-reaching curriculum effects. Even pure science had to be brought in to the curriculum over the dead bodies of most faculties. The Land Grant acts stimulated the development of applied physical and biological sciences and added to the pressures to emphasize pure science. The effects were felt of course in research as well as in instruction. Perhaps we need today analogous legislation for the problems of the cities that will lead to the development of new colleges comparable

to those in engineering and agriculture. The burgeoning liberal arts colleges, even those in our Land Grant institutions, will not do the job of curriculum innovation that needs to be done.

My final statement with respect to this principle is a recommendation to educational psychologists. I would like to see more attention paid to curriculum problems by educational researchers. Curriculum innovation has more pay-off possibilities than most other forms of educational innovation, but sophisticated evaluation is essential.

The second principle of classroom learning is summed up under the rubrics of motivation, interest, and incentive. Students do not learn, even if exposed to the right curriculum content, if they go to sleep on every exposure. The motivation of the learner is essential for classroom learning.

There is a major difference in emphasis at this point between theory of classroom learning and psychological learning theory. The latter theorist can, as Guthrie did, make a good case that learning depends upon contiguity only. Tolman, also, though differing in other respects from Guthrie, stated that reinforcement (or reward and punishment) were not central to learning per se. He stressed the difference between learning and performance. In contrast, Thorndike, Hull, and Skinner have given reinforcement a central place. Nevertheless, both sets of learning theorists would agree that incidental learning or latent learning, if it takes place at all, is not very effective in changing performance. After the selection of appropriate curriculum content children must attend to it. If they attend, they are motivated.

There has been a good deal written about the importance of intrinsic as opposed to extrinsic motivation for classroom learning. A good deal less

has been written accounting in any detailed fashion for the development of intrinsic motivation. A few psychologists follow Rousseau and assert that man is naturally good, from which it somehow follows that intrinsic motivation to learn academic things is innate, but this does not satisfy most of us. As a basis for deciding upon educational policies and techniques, the Rousseau-like view of human nature is just as limited as the opposite religious belief that man is naturally depraved. Neither redemption from original sin nor corruption by society is an adequate basis for educational planning. The infant homo sapiens is a small, helpless animal with enormous potentiality for both good and evil who is shaped in his development by his genetic constitution and by his society. Since we have no control over the former, we need to concentrate on the social substrate for his behavior. Techniques that induce motivation for classroom learning are important whether the motivation be termed extrinsic or intrinsic.

The third principle on my list concerns the importance of academic ability or intelligence. Within the average classroom intelligence does not make the all-or-nothing contribution to variance that the right curriculum or its absence, or motivation or its absence, make, but the contribution is still very large. It is very difficult to prevent bright, motivated students from learning while the evidence that superior teaching makes much difference with such students is very slender indeed.

The importance of this principle does not depend on a view that intelligence is a fixed capacity of the person. On the contrary, I view intelligence as the aggregate of intellectual skills, knowledge, learning sets, and generalization tendencies available to the individual at any one period of time. Furthermore, I define intellectual by the consensus among

psychologists that is represented by the sampling of the behavioral repertoire by tests like the Stanford and Wechsler scales. There are biological, including genetic, and psycho-social substrates for the repertoire of responses we call intelligence, but it is not possible to draw inferences about either substrate from knowledge of a test score alone. Even for a small child the repertoire is large, and it continues to grow with motivated exposure to intellectual content. Because of the size of the repertoire, change takes place slowly. Intelligence is not fixed, but neither is it highly labile. In consequence the intellectual level prior to a learning experience typically is associated with a good deal of the variance in proficiency at the conclusion of the learning experience.

Since intelligence is not a fixed capacity, not merely by definition but by mounting positive evidence that the genetic component of variance is substantially smaller than 80%, the classroom teacher cannot assume a fatalistic attitude toward learning problems. On the other hand, it is exceedingly doubtful that any instructional gimmick is going to make an important difference over any brief interval of time. The principle, in other words, introduces a note of caution and humility, though not of pessimism, into discussions of teaching effectiveness.

In fourth place in the list of principles is the complex of variables that can be termed teaching methods or learning situations. Furthermore, if the dependent variable is proficiency in the subject matter, there is a substantial gap in importance from the third to the fourth principle.

There is ample empirical basis for this evaluation of methods. Whether a particular experiment shows a statistically significant difference or not does not matter. Contribution to variance is uniformly small. The generalization is so well supported, at least by the usual experiments

extending over the usual time periods, that we should give consideration to systematic evaluation of quite different dependent variables. The dependent variables of time and money to reach a given level of proficiency may turn out to be most relevant to this class of independent variables. TV instruction and computer based instruction should certainly be evaluated on these grounds in any event, but I am suggesting that time and money are generally more important criteria than proficiency for research on methods.

It is also important to look at the effects of method on attitudes, which is another way of saying that it is important to determine the effects of instruction on subsequent motivation. By the end of the 6th grade students should not only read well, but they should like to read. Students could enter the 7th grade knowing little arithmetic, and still have ample time to prepare for high school mathematics, as long as they had favorable attitudes toward arithmetic and mathematics. It has become a popular research strategy to see how far down in the grades abstract concepts and processes can be taught. Whether the results are positive or negative has relatively little bearing on educational planning. Will the average child who has been taught algebraic concepts in the first grade be more proficient in arithmetic and be more interested in taking more mathematics at the time of high school entrance than a student who has been taught by more traditional methods? A comparison with students whose formal training in arithmetic is delayed until the junior high period would also be of interest. Experimental data indicate that such a group will catch up with controls in proficiency in two years, but effects on attitudes and subsequent mathematics learning are unknown.

My evaluation of the effects of teaching methods on proficiency in subject matter leads to a further generalization: the highest pay-off from

the use in the classroom of knowledge of learning principles comes from applications to motivation of individual students and to management of the classroom of students rather than to the teaching of subject matter per se. Thus we return to the principle which is so badly misinterpreted by teachers and laymen for the more extended remarks promised earlier.

A primary source of misunderstanding is the wide-spread attitude toward control of behavior that is best labelled moralistic. It appears to be deeply imbedded in our culture and is highly resistant to change from the courses in general, educational, and child psychology that are typically required of teachers in training. This suggests, incidentally, that there is something wrong with our courses.

The moralistic view of human performance (motivation) is that people (children) should behave in certain ways. If they don't, they are bad. If they are bad, they are exhorted to do better or are scolded, nagged, or in other ways punished for their failure. The moralistic approach does not consider the possibility of changing the situation. Children ought to change and should want to change from this point of view. Furthermore, when a psychologist interested in applying principles of learning to classroom problems does manipulate the situation to produce a desired performance, he is frequently accused of bribing the child. The relatively wide-spread use of this term of opprobrium merely documents my characterization of the typical approach to motivation as moralistic. It is not a serious criticism.

A critic at this point might jump to the conclusion that I am just another Skinnerian or behavior modifier and, incidentally, think that he was answering my criticism by so doing. A criticism is never answered by pigeon-holing it, and I submit that I am simply being psychological. The psychological approach to human performance is at least as old as John

Dewey and the beginning of the functional school of psychology. The psychologist determines what performance is needed and then finds ways to produce it. Responses are shaped by the appropriate and differential use of rewards and punishments. While Skinner has stressed the use of reward, and for very good reason, the psychological approach does not neglect punishment. Punishment is used, however, for its effects on performance, not moralistically in retribution. For a more extended logical analysis of the role of punishment in learning I still recommend Guthrie's writings. For a well documented experimental example of the effects of punishment I suggest Solemen's publications.

Note that the difference between the psychological approach and the more common moralistic one is not in the differential use of rewards and punishments, but in the <u>appropriate</u> use of reinforcements. The human infant is coerced into becoming a social being by the use of rewards and punishments in every society. Certain uses of reinforcement in a given society are more intelligent than other uses. Societies also differ in the kinds of performance they want and thus different behaviors are reinforced. The moralistic approach uses reinforcement, but its use of reinforcement is partially blind, it is stubborn in its blindness, and it rejects a more rational approach. The choice is between irrationality and rationality, and this time I'll gladly admit to being thoroughly Skinnerian rather than Rogerian in my philosophical point of view.

Use of an M & M to reinforce desirable behavior in the elementary school is frequently termed bribery, as previously noted, but we bribe business men with the expectation of profits and boast of the merits of our free enterprise system. We also bribe with fees physicians whose responsibility it is to promote health and fight disease and lawyers who have the

responsibility to assist in the maintenance of a just society. We do not call this bribery. When inexpensive trinkets are used to reinforce learning behavior in 6 year olds, even after these same 6 year olds have failed to respond to nagging criticisms and exhortations to improve, it becomes bribery. There is clearly something wrong with the critic who expects more dependence on long-range, altruistic, socially desirable goals on the part of a child than of an adult.

While I can see no basis for rejection of the selective use of reinforcement in shaping desired behavior, this is not to say that there are no problems yet to be solved. We do need to know more about the transition from extrinsic to intrinsic motivations. (While there are some problems in the precise definition of these terms, for the moment I shall depend upon a common sense understanding of them.) Clearly one cannot depend on M & Ms throughout the life span. Study of the development of more general motivational dispositions is required. Let us be psychologists, however, and not moralists as we proceed