

The Application of Behavior Theory in Classroom Instructional Reform

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ABSTRACT

The traditional view is that the behavioral approach to learning places too much emphasis on discipline and training, which is not conducive to the development of interactive teaching relationships. This paper starts from the basic principles of behaviorism, analyzes the behavioral aspects of various examples of interactive instructional reform, and describes the correct implementation of behavioral methods in each instructional design process from a theoretical point of view. It also provides an in-depth analysis and illustration of the correct use of the four term contingencies, motivating operations, token systems, and group contingencies, and clarifies the guiding role of behavior theory in implementation of classroom instructional reform from both theoretical and empirical perspectives.

Keywords: Behavioral principles, Token system, Group contingency, Instructional reform.

1. INTRODUCTION

Applied behavior analysis is the study of human behavior, which takes observable and socially important human behaviors as the object of study [1]. It measures the target behavior by designing an observation system, and manipulates and controls the frequency of current and future behaviors by using motivating operations, antecedent stimuli, and consequences in the behavior principle to shape the desired behavior.

Teaching also involves observable and socially important behaviors, which are divided into two main branches: the behaviors of teaching and the behaviors of learning. The ultimate goal of education and classroom reform needs to be achieved by changing the behavior of teaching and learning in the classroom. Therefore, starting from the analysis of specific behaviors in teaching and learning and using behavioral principles in instructional design can describe, predict, and control classroom teaching and learning behaviors from the perspective of natural science, which is conducive to achieving the purpose of educational reform.

2. THE FOUR TERM CONTINGENCY IN THE CLASSROOM

2.1. The Four Term Contingency Principle

2.1.1. Contingencies and Operating Motivations

Human behavior is divided into respondent behavior and operant behavior, where respondent behavior is triggered by an antecedent stimulus and ends with the occurrence of the behavior. For example, a person's knee-jump reaction.

Operant behavior, on the other hand, usually consists of three components [1]: the antecedent stimulus, the operant behavior, and the consequence of the behavior, i.e., three term contingency. For example, seeing food, eating food, and being full correspond to the three parts of the operant behavior of eating food, respectively. Here, from a micro-evolutionary perspective, it is the outcome of satiety that increases the frequency of seeing food and eating food in the future, which is the meaning of the three term contingency.

The four term contingency adds to the three term contingency a state that the actor is currently in, which is called the state of the motivating operation, and the combination is called the four terms contingency. If a motivational action is added to the above example, that

is, when a person is hungry, he or she sees food, eats food, and is thus satiated.

2.1.2. Reinforcement and Punishment

There are two kinds of consequences in consequence associations, one called reinforcement and the other called punishment [1].

Reinforcement refers to an event that follows an operant behavior and increases the frequency with which the behavior occurs in the future. If the teacher asks a question, the student answers it, and the teacher praises the student for answering the question, then the likelihood that the student will answer the question when the teacher asks it in the future increases. A reinforcing effect of the student's behavior in answering the question. Note here that the direction of the praise determines the frequency with which the behavior will occur in the future: if the teacher praises a positive response, then the student's future response will increase; but if the teacher praises a correct response, then the student's future correct response will increase, and this does not preclude a decrease in the overall response. The distinction between the two has a great impact on accomplishing the goals of the curriculum, because it is often necessary to encourage students to respond positively to questions in order to identify and assess their understanding of the knowledge, and to guide them to think, judge, and ultimately come to the correct answer themselves. "Correct".

Another type of consequence of operant behavior is called punishment. It refers to an event that immediately follows an action-oriented behavior and makes that behavior occur less frequently in the future. Similarly, in a classroom where the teacher asks a question and the student responds (but incorrectly), the teacher responds by saying, "I can tell right away that you didn't listen well last class. This comment will reduce the frequency with which the student will answer the teacher's question again in the future, so in this case the teacher's comment is a punishment for the student's response to the question.

2.1. Three Term Contingencies in the Classroom

The application of the three term contingencies in the classroom is the process of using the outcomes that the teacher can provide to shape the desired behavior of students in the classroom. The frequency with which students initiate learning behaviors is an important indicator of a classroom's success, and the provision of outcomes in the three term contingencies will largely determine the success of the reform, assuming that the curriculum reform is a split-classroom approach in which students spend nearly half of the class time

initiating discussions, answering questions, role-playing, and giving presentations.

From an instructional design perspective, the provision of consequences can be distinguished into two broad categories: teacher-provided and student-provided. Teacher-provided contingencies are those consequences that are provided immediately after students have actively participated in the desired behavior of the sub-classroom activity. They may include:

a. Descriptive Compliments

Descriptive praise, provided by the teacher, provides differentiated reinforcement of students' classroom participation behaviors and allows students to further define what learning behaviors are promoted in the classroom, facilitating the development of effective self-management and self-motivation mechanisms.

b. Pre-agreed points for formative assessment results

The results of the examinations in the subclassroom necessarily include formative assessments [5], which allow the teacher to assign points to students after the desired behavior that meets the curriculum design has occurred.

Consequences provided by students can be similarly divided into the above two categories, with performance scored for the passing performance of each other after cross-checking the performance of the grouped opponents.

2.2. Application of Motivating Operations in the Classroom

A motivating operations refers to an objective state in which a person desires a desired consequence [4]. In the classroom, the environment and instructional materials can be cleverly set up to enhance the value of the reinforcing object and motivate students to engage in the desired behavior.

Suppose that one of the goals of classroom instruction is for students to be able to actively recognize signs of failure and make judgments about them. Then, creating failure symptoms in the course presentation materials or in the actual equipment without informing the students is an operation on motivation. In this case, some solid students will be brave enough to point out errors in the instructor's course material or presentation system.

Assuming that another goal of classroom teaching is to read the troubleshooting manual carefully and master the correct troubleshooting methods, then the classroom environment and teaching sessions can be set up as a red-blue confrontation, where the red side sets up faults and the blue side troubleshoots them. The motivation of this design forces both parties involved to read and

master the fault phenomenon and troubleshooting methods carefully, because only by reading and mastering the relevant content can they effectively set up the fault, correct troubleshooting, correct cross-checking, and score the correct score.

3. TOKEN SYSTEMS IN THE CLASSROOM

3.1. Theoretical Analysis of Formative Assessment to Enhance Learning Behavior

3.1.1. Token System

The token system, in English, is called Token Economy [2]. In layman's terms, the scoring system we use in our classes is an application of the token system. Students are questioned and evaluated and given a grade based on their level of performance, which is then added to their overall course assessment grade.

Although score-based assessment systems are common in general education, little is known about the key role of tokens in influencing student behavior. The key to the token system's effectiveness is the exchange of tokens for back-up reinforcement. For students in institutions of higher education, the one huge reinforcement that increases the frequency of their learning behavior is a successful graduation. The reason why students are able to maintain a high frequency of learning behaviors to achieve the highest grades on each assessment exam is because the performance on these exams is designed so that the end result needs to be supported by good grades in each individual unit of performance, and only by performing well in each learning module can they eventually meet the minimum graduation requirements first, and then good, excellent, and graduate with distinction and honor.

But why is formative assessment increasingly mentioned?

This change can be interpreted in two dimensions, the time dimension and the process dimension.

Traditionally, examinations are "one exam for life". In other words, a valid grade is earned on a single exam at the end of the study period, and tokens are issued after the course exam in the time dimension, which means that the token system is not designed to assess the student's learning behavior in the time before the exam.

The process dimension refers to the fact that many disciplines need to pay more attention to the process of student learning, such as the formation of ways of thinking, the shaping of values, and the skills of creative discovery, and that these important competencies are formed mainly during the learning process and need to be assessed, improved, and shaped in real time during

the regular learning process. From a token system perspective, it is about fine-graining the assessment, increasing the number and frequency of sessions, and using weights. In this way, numerous process indicators can be assessed throughout the learning process, making it easier for teachers to revise their instructional plans and for students to adjust the direction and extent of their efforts against the learning objectives.

3.1.2. Schedules of Reinforcement

The assessment and scoring results are presented as a single reinforcement as shown in the figure, where the small horizontal lines of all curves represent a single valid assessment score. The four reinforcement schedules can be seen as follow.

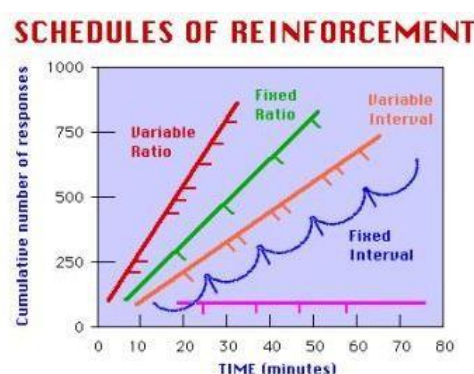


Figure 1 Comparison of Behavioral Frequencies for the Four Basic Reinforcement Schedules

Explanation of the figure.

a. Here, we borrow the data from the behavioral experiments in the figure as an analogy, and human learning behavior is also fully constrained and influenced by the reinforcement schedules [7].

b. Theoretically, the most frequent cumulative number of learning sessions produces the best learning outcomes and better achievement of the stated instructional goals.

In the case where the number of assessment sessions is determined, the rate of change, i.e., the number of learning days as a reference, i.e., the number of unspecified days after the start of the learning session for one assessment produces the most cumulative number of learning sessions for the student.

c. Understanding of reinforcers: Each assessment is an activity that contains both positive and negative reinforcement elements. When a student receives a desirable score on an assessment, it is a reinforcement of their previous effortful learning behavior and will increase the frequency of their active learning in the future; an unsatisfactory score on an assessment is an outcome that the student will try to avoid and is a negative reinforcement of their effortful learning behavior.

In contrast, the regular test setting performs a fixed interval reinforcement program. Students' learning frequencies form a curve called ratio strain, which means that students will study in high bursts just before a set assessment time, then minimize their learning frequencies after the assessment is over, and then reach a higher learning frequency just before another fixed assessment time.

To conclude, the effects of operant reinforcement can be stretched out so that long periods of activity are devoted to each reinforcer. Standard routines for doing this, schedules of reinforcement, space out rewards in time or according to amounts of response. Although a little reinforcement can be made to go a long way by these means, no reinforcement at all usually causes a gradual withering away of the response pattern previously built up under its influence. For one reason or another, this extinction of behaviors when reinforcement is removed is less immediate after experience of sparse or variable rewards.

3.2. Key Points for Implementing the Token System in the Classroom

After the above analysis, we clearly see the relationship between the design of the token system and formative assessment.

3.1.2. Basic Design Elements

a. Clarity Principle

Unlike previous exams, the goals of formative assessment are diverse and heterogeneous. Teachers need to use learning goal analysis techniques in their course design to effectively present learning goals to students and to clarify what success criteria are through presentations and other means. Sharing learning objectives, developing a sense of quality, and working together to develop success criteria will help students take responsibility for the quality of their own learning and encourage them to become conscious, active, and self-disciplined learners.

b. Consistency

Consistency is based on the principle of clarity. After presenting the learning objectives and grading criteria clearly to students, teachers need to pay attention to the consistency of implementation and teach students to use the established criteria to score and evaluate their peers when they are peer-assessed. When students view peer learning behavior from the perspective of the assessor, they will have a better understanding of the learning objectives.

c. Standard Gradient Principle

The token scoring system for formative assessment can be adjusted quantitatively when implemented to

raise the "price" of competency assessment with varying criteria when developing advanced learning skills. For example, suppose that the goal of the instructional process is "to become proficient in the identification and elimination of common faults in a component. At the beginning of the teaching process, in order to get students up to speed, increase enthusiasm, and encourage advancement, the scoring system for formative assessment may set the standard of one point for simple fault identification and elimination. Recognition and troubleshooting are used as criteria for earning 1 point, and so on. At the same time, grading students with a compliment or title can create a graded difference in their actual problem solving ability that approximates a real working environment, e.g., students in a class that can successfully troubleshoot more than five randomly given simple problems are upgraded to Level 2 Engineer. A token scoring system with one point for a random simple failure. In this way, the "price" of token scoring in the classroom, i.e., the cost of the student's learning effort, is increasing, but the students are always well motivated and maintain a high and consistent frequency of learning behavior.

3.1.2. Advanced Design Essentials

a. Precautions for Using Punitive Tokens

Incentives are often used more often than punishments because the use of punishments, while they may reduce problem behaviors, does not help students build the capacity for proper skill acquisition.

However, there are special circumstances in which punitive measures must be implemented to ensure successful completion of the educational objectives. For example, in subjects where the instructional objective involves safety, there are red lines that accompany the acquisition of corrective operational learning, which may be touched during formative assessment due to unknown circumstances or human factors, and punitive token deductions must be applied to the touching of these red lines, on a one-to-one basis, i.e., one penalty per occurrence. Until the red line violation is completely eliminated to zero. It is important to note that the purpose of punitive tokens is to completely eliminate misbehavior related to job safety, and that eliminating just one misbehavior does not achieve the purpose of our teaching. In practice, mandatory punitive scoring can be implemented but can be relatively small, while correct skill acquisition and demonstration can be rewarded at a high level, with differentiation driving the achievement of learning objectives.

b. Key Elements of a Wide-Range Token System

The token system can be implemented not only in one class, but also on a larger scale [3]. In colleges and universities that train engineers, students' self-directed learning and self-discipline can be driven to a greater

extent by decomposing the target skill groups and classifying the students with corresponding skill packages into appropriate levels, such as issuing them armbands with corresponding levels and giving each level of students corresponding "privileges". The "privilege" here is more of an honor, a symbol of business skills mastery, "privileges" can also be set up to increase the number of library books, extended hours, priority access to books in short supply, etc., or related to the curriculum. Access to virtual resources on the Internet, more opportunities for longer contact with laboratory resources, and so on, are "privileges" that are essentially commensurate with the skill level of the corresponding class of students and will facilitate the conditions for them to move to a higher level of proficiency and depth of study.

4. THE USE OF GROUP CONTINGENCIES IN THE CLASSROOM

The complexity of engineering technology as it evolves to the application level forces each of us, the learner and the applicator, to moderate the need for collaboration with team members in order to deliver engineering services faster and better. At the instructional level, teamwork skills may become an indicator and purpose of the learning process. Behavioral principles also offer solutions for teaching students to work in teams.

4.1. Types and Characteristics of Group Contingencies

It is generally accepted that cooperative learning is often more effective than individual learning, and that cooperative learning not only enhances positive relationships among students and fosters social skills, but also helps to maintain learning outcomes and even develop higher order thinking skills.

From the perspective of the behavioral principle, the behavior of each individual in the group, and the behavior of all persons in the group have varying degrees of influence on the common consequences imposed on the student group.

To take an example of a phenomenon we often encounter, the behavior of a single individual in a group of students, such as a student who surprisingly interacts perfectly with the teacher, answers the teacher's questions at a high level, and creatively articulates his or her own analysis and perspective, can influence the supervising professional's judgment of the teacher's teaching level, as well as the teacher's approach and attitude toward the class. This is called dependent group contingency, where one student meets the standard and all students benefit.

The behavior of the whole group of people, such as a teacher who assigns an after-school assignment that includes a review of the previous section and a preview of the next section, can affect the teacher's judgment of students' mastery of the content, and thus the teacher's pacing of the lesson, if a sample of students shows a high probability that they completed the assignment with high quality. This is a reciprocal consequence, where all students meet the standard and all benefit.

This is called an independence group contingency. Anyone who meets the standard benefits independently, but the standard is for all students.

The dependent group contingency develops good interactions between students, while the independent group contingency incorporates a token system and holds everyone accountable for their actions; the interdependent contingency uses general peer pressure to get everyone to perform better.

The disadvantage of the dependency effect is that if one person fails to perform, the benefit to the whole is affected; whereas the independence effect is insensitive to individual differences, in the dependent group contingency, one person's performance affects the benefit to the whole.

4.2. An Example Analysis of Implementation Points for Better Use of Group Contingencies

If the course is designed so that participants are randomly grouped, i.e., to perform the task of grouping group reports, but it is clear that the second group is weaker, in order to leverage the class to help the weaker group, then the instructor can design a dependent plenary group contingency. The teacher could declare that if the second group's group report is excellent according to the rubric, then all three groups will be excellent on this assessment. Such a group contingency would immediately improve the level of student interaction and allow the second group to receive intellectual support and assistance from the other two groups.

The following empirical findings, based on empirical research, can help us to design group contingencies more effectively in classroom design.

- a. Choosing an effective incentive method and content
- b. Set clear and appropriate standards of behavior
- c. To use them in combination with other methods
- d. Choosing the most appropriate group contingencies.
- e. Identify the target behavior and any other behavior that may be affected.
- f. Observation of individual and group performance.

5. CONCLUSION

1. Education is also behavior and can be designed using behavioral principles.

2. The methodological system of applied behavior analysis can serve the precise implementation of classroom instructional reform.

AUTHORS' CONTRIBUTIONS

A comparatively comprehensive introduction of behavior theory implementation methods is made to provide a plan B for classroom instructional reform.

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