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ABSTRACT

Using a developmental model, the author explains a hierarchy which describes how a young child learns to respond to various types of environmental stimuli and discusses some educational consequences of a reinforcement stimuli deficit. Development is seen to take place in succession beginning with the primary level, proceeding to the social, symbolic, and abstract levels with each level dependent upon learning to respond to reinforcing stimuli at the previous levels. It is suggested that learning problems such as hyperactivity may be due to the selection of reinforcers at the wrong developmental level. Educators are encouraged to emphasize a student's developmental level of responsiveness to reinforcing stimuli (such as teacher's reaction to child's behavior) as well as eliciting stimuli (such as instructional materials or activities). (DB)

Developmental Reinforcement and Education[1]

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The use of hierarchies to describe human phenomena in the social and behavioral sciences has long been a historical fact. The concept of hierarchy was originally used in the medieval writings of Dionysius Aeropagiticus to describe the system of church government used to grade priests into ranks. In modern times, the concept has been used analytically to describe and explain a wide variety of phenomena.

Freud, in formulating the theoretical basis for his psychodynamic system, used a hierarchy to explain the development of the id, ego and superego. The hierarchy was composed of five stages of development: oral, anal, phallic, latent, and genital. As the child developed through these five stages, the id, ego, and superego changed in focus (Freud, 1950, 1959). Maslow (1943) used a developmental hierarchy to explain the development of human needs. Bloom and others (1956) used a developmental hierarchy to explain the development of intellectual abilities. Krathwahl, Bloom, and Masia (1964) used a similar model to define the stages of development of student attitudes toward learning, and Piaget and Inhelder (1956) used a developmental hierarchy to explain the process of cognitive development.

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[1] A section of this paper has been published in the Illinois Journal of Education, 63, 5, 1972.

RATIONALE

Using a developmental model, this article will use a hierarchy to describe the developmental reinforcement process as it occurs in a child's life and discuss some educational consequences of a deficit in this development.

Developmental reinforcement is a process that begins at birth and ends with the termination of life. Within this span of time, there are critical events that must take place in the child's life in order for him to develop normally. To establish a perspective of the developmental reinforcement process, a hierarchy has been developed which will provide a framework for examining the child's life as the process takes place. This process involves the establishment of responsiveness to a variety of environmental stimuli which acquire, through learning, reinforcing properties.

The developmental reinforcement process is composed of a hierarchy of four levels. Development takes place in succession beginning with the primary level, proceeding to the social and symbolic levels, and ending with the abstract level. Development at the social and symbolic levels occurs simultaneously, but both levels are dependent on adequate development at the primary level, as is the abstract level. The abstract level proceeds from development at the social and symbolic levels. If the child does not learn to respond with satisfying emotional feelings to primary

reinforcement, it is unlikely that he will learn to respond constructively to reinforcement at higher levels.

PRIMARY LEVEL

At the primary level of the hierarchy, satisfying the child's basic biological needs is important. For example, when the child experiences hunger pangs, mother reads the signal and responds by picking up the child, holding him securely, and feeding him. These acts, performed by mother in response to the child's signal of hunger or other discomfort, are the discriminative stimuli for primary reinforcement[2] that will acquire through learning reinforcing value. Thus, this stimuli becomes very important. It facilitates the child's emotional development.

As mother performs these reinforcing acts, the child begins to move gradually toward a satisfying emotional state and eventually experiences relief from the discomfort caused by hunger or other discomforts. The satisfying emotional state resulting from relief can be observed and measured through internal changes in respiration, heart rate, galvanic skin response (GSR), and facial vascularity (Jones, 1930; Morgan, 1965).

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[2] The term primary reinforcement is used to denote original reinforcing stimuli. Since relatively little is known about why primary reinforcers work, it is difficult to give a better definition of them than that they are reinforcing without any history of acquisition of their reinforcing value.

Physiological changes are brought about in the child through the pairing of primary reinforcement with other discriminative stimuli which surround mother during feeding.

The reinforcing events (holding, talking, rocking, etc.) that occur during and are somewhat incidental to feeding are very critical to the development of the child. If the child is deprived of this type of reinforcement or stimulation in conjunction with feeding, he will develop transitory deficits on developmental tests (Schaffer, 1965). A relationship between tactile stimulation and maternal love, such as the production of erotic stimulation by fondling and gentling, has been identified by Rashkis and Singer (1959). Taubenhaus (1968) has observed profound emotional changes occurring in children who were confined to their cribs during hospitalization in the early months of life. Racamier (1968) has asserted that restrictions in mobility coupled with the lack of tactile stimulation are likely to impede the growth of social relations.

When stimuli such as the acts performed by mother while feeding the child acquire discriminative power, it also acquires a reinforcing power as well (Bijou and Baer, 1961). The anticipatory sucking, diminution of crying, smiling, and the exhibition of other approach behaviors by a child when picked up by mother are indicators of her acquired reinforcing power. Therefore, the child has learned that mother is a discriminative stimuli which signifies satisfaction and contentment. As a result of this learning

the child will begin to search out the source which leads to effective gratification of needs. The child has learned these responses as a result of pairing the delivery of primary reinforcement with the resulting physiological states (e.g. lack of hunger and pain, stimulation, rest, etc.).

Through the process of learning, the initial satisfaction gained from feeding is generalized to other sources of pain and discomfort. For example, the sensations associated with injury, cold, and illness are sufficiently similar to the pain of hunger that the child will make the same approach responses he made to mother when he was hungry. That is, the child who approached his nurturant mother when he was hungry will approach her when he experiences pain or discomfort for other reasons. Further, since mother is similar to other people, the child will, in varying degrees, generalize these positive responses to a variety of people. In brief, the initial satisfaction the child receives from mother's ministrations to satisfy the child's biological needs forms the basis for learning whether or not people are a source of reinforcement and whether or not approaching them leads to satisfaction.

SOCIAL LEVEL

Once the child generalizes the satisfying emotional responses associated with biological satisfaction he begins to respond to mother's soothing voice, her familiar face, her smiles, and the like. These social stimuli are beginning to take on new meaning--they become reinforcing to the child.

At this point, when mother says "good baby", strokes his body, smiles, and repeats soothing vocalizations, those familiar changes associated with biological satisfaction are made. Here too there are changes in his galvanic skin response, heart beat, respiration, facial vascularity, and in some instances the child will respond by having an infantile erection. These were the satisfying emotional responses originally associated with primary reinforcers at the primary level. Now these responses can be elicited by social stimuli, which has acquired reinforcing power as a result of learning.

In the early stages of the learning process, the child glances at approaching people. He will stop sucking mother's breast or a bottle to look at whomever may be feeding him, then continue again. After many pairings of the discriminative stimuli surrounding mother during feeding with primary reinforcement, the child appears to become aware of her presence and of other adults who have been associated with the satisfaction of biological needs. The satisfying emotional feelings associated with biological satisfaction are generalized to such a degree that picking up the child is sufficient to stop his crying before his troubles are alleviated. The child may be distracted from his hunger for a few minutes by the soothing vocalizations mother makes, her gentle rocking, or other forms of attention. This kind of social stimuli acquires reinforcing value and become effective enough to bring about a temporary satisfying emotional state.

As response maintenance to these social reinforcers increases, the child will almost always stop crying momentarily when he hears the voice of adults and often at the sight of an approaching person. At feeding time, the child will begin to play and smile in response to mother's speech, instead of taking the milk that was once the primary source of satisfaction. The child is beginning to increase his responsiveness to social reinforcement. In a sense, he is becoming sociable.

The fact that development at all levels is dependent on adequate development at the primary level cannot be overemphasized. To insure normal development through the social, symbolic, and abstract levels, it is imperative for him to learn to respond with satisfying emotional feelings to mother's ministration of biological satisfaction (primary reinforcement). Subsequently, the child learns to respond to social, symbolic, and abstract reinforcement.

The importance of mother, or a mother substitute, in the developmental reinforcement process cannot be disassociated from the ongoing developmental process. Mother's caring for the child in the form of objective love acts (Rashkis & Singer, 1959) or supplying the child with primary and social reinforcement facilitates the generalization of satisfying emotional feelings at subsequent levels in the hierarchy.

SYMBOLIC LEVEL

As the child develops strong response tendencies to reinforcers at the primary and social levels of the developmental reinforcement process, he gradually begins to achieve satisfying emotional feelings from symbolic reinforcers. During the process of growing up, mother buys the child small things or gives him money to buy candy for performing given tasks. She then pairs this act with another effective primary or social reinforcer by telling the child how good he looks or how well he has performed the task or by giving him an approving smile. This in turn gives satisfaction to the child. The satisfying feelings experienced by the child are very similar to those emotional feelings gained from mother's application of primary reinforcement at the primary level.

At this level in the hierarchy, the satisfying emotional feelings gained from the satisfaction of biological needs at the primary level generalize and become associated with symbolic stimuli. The child learns to respond to such things as clothes, money, and tokens, and later to such things as certificates, green stamps, and diplomas. These symbolic stimuli have become reinforcing because they have gained the potential for eliciting satisfying emotional feelings. In other words, the principle of generalization is beginning to operate at the symbolic level. Since this is a gradually occurring process which started at the primary level, the child will eventually generalize these emotional responses to other and more varied forms of symbolic stimuli.

ABSTRACT LEVEL

After the child has progressed through the primary, social and symbolic levels, he gradually begins development at the abstract level of the developmental reinforcement process. At he abstract level the child reaches the highest level of development in the hierarchy of reinforcement. Development at this level is also dependent on establishing an adequate foundation at the primary level. In addition, development at the abstract level is dependent on adequate development at the social and symbolic levels.

At the abstract level, the child will experience satisfying emotional feelings from reinforcers that are abstract in nature. Etymologically, the term abstract comes from two Latin words, ab and trachere, which literally mean to draw away. In this context, abstract reinforcer refers to those reinforcers that are intimately involved with language development but have no concrete referent outside of the language system. For example, the child will learn through association to respond with satisfying emotional feelings to his concept of good, his concept of honesty, his values, his concept of God and later his philosophy of life, or his concept of the nature of the universe. He is learning to evaluate his own behavior relative to a language-based criteria. In order for these concepts to become reinforcing to the child, he must have developed responsiveness to the meaning of these ideas that are transmitted primarily through language.

Development at the abstract level begins when the child responds with satisfying emotional feelings at the social level. When the child's mother or father reinforces him with smiles and words of approval for performing developmental tasks, he is beginning to learn through pairing to respond with the satisfying feelings derived from primary reinforcement. Through the process of generalization the child begins to internalize these concepts and ideas. At the abstract level, the child achieves the highest level of autonomy when he is able to reinforce himself through self-evaluation or other self-reinforcing consequences. At the age of five or six, the child has sufficient language development and vocal control to tell himself subvocally that he has performed in a desired or acceptable manner. Through learning, self-evaluative responses can become so reinforcing that the child can maintain his own behavior in the same or similar manner as external reinforcers did at the social and symbolic levels. Here the child can set for himself self-reinforcing or self-punishing consequences depending upon the quality of his behavior relative to his self-imposed standards. It is the child's ability to reinforce himself through self-evaluation and subvocal messages that produce internal satisfaction to maintain his behavior independent of environmental consequences. This internal language system has been described by Luria (1960).

At the abstract level, the child achieves the highest level of reinforcement. Development at the abstract level is dependent upon the

child's ability to reinforce himself. When the child conceptualizes an ideal self, based upon his social, philosophical, or value system the self-evaluation is based upon abstract formulations. The abstract level of reinforcement maintains behavior toward high ideals and in some cases produces internal satisfaction that outweighs externally imposed reinforcement.

REINFORCEMENT AND EDUCATION

The developmental reinforcement model has tremendous practical utility in education. Especially when we find children in schools throughout the country who are supposed to be highly motivated to learn under poor or inadequate reinforcement systems. These reinforcement systems are inadequate because educators have failed to take into consideration the developmental nature of how children learn to respond to various types of reinforcing stimuli. As a consequence, many children, particularly those who are weakly motivated or less well endowed intellectually, display marked intellectual deficits despite years of fruitless attendance in school. The developmental reinforcement model provides a basis for conceptualizing how a child learns to respond to various levels of reinforcing stimuli, and provides a practical strategy for working with children who have not learned to respond at higher developmental levels.

Since the performance of a learner is highly affected by reinforcement conditions, developing and selecting an effective reinforcement system is

extremely important. The relevance of reinforcement variables in changing behavior is illustrated by the results of experiments comparing responsiveness with and without contingent reinforcement. In a program of research on reading, Staats and others (Staats, Staats, Schultz, and Wolf, 1962) used programmed materials with preschool children to teach them to read words individually which were then combined into short sentences. When the children were praised for responses but were not given primary or symbolic reinforcement, they worked at the reading tasks for 15 to 20 minutes, but then became bored, restless and asked to leave the situation. After the children failed to be responsive in the original situation, the researchers introduced tangible rewards consisting of candy, trinkets, and tokens that could be exchanged for attractive toys. When the children were given primary and symbolic reinforcement contingent upon reading achievements, the children's short attention span quickly increased. In addition, the children worked at the reading task for 45 minutes and participated actively in subsequent sessions.

A second group of four-year-olds performed the reading task contingent upon reinforcement for two sessions, then the reinforcers were discontinued until the children ceased to participate, following which primary and symbolic reinforcers were again reinstated. During the initial reinforcement sessions the children attended closely to the reading material and worked actively at acquiring new reading responses. When the reinforcers were withdrawn, the children's attention, participation, and

reading achievement rapidly deteriorated. Staats (1965) has further demonstrated that, given an appropriate reinforcement system, young children will engage in complex learning activities with sustained interest over an extended series of sessions.

The major focus of the above studies was on the development and selection of an appropriate reinforcement program for increasing academic achievement. Concomitantly, the studies demonstrated that the use of social reinforcement (praise) was ineffective with children who had not learned to respond at the social level. When a combination of primary and symbolic reinforcers were utilized in conjunction with social reinforcers, the children's short attention span suddenly expanded from 15 to 20 minutes to 45 minutes. Numerous other studies (Risley, 1974) have demonstrated that if appropriate reinforcers are selected and made contingent upon the production of appropriate behavior, young children will engage in complex learning activities with sustained interest over an extended period of time.

The significant changes in academic behavior observed in the above studies illustrate how low persistence on academic tasks can result from the selection of reinforcers above the developmental level of the children. This response deficit is often attributed to a basic deficit in the child in the form of short attention span, low frustration threshold, learning disability, emotional disturbance or academic retardation. Levin and

Simmons (1962) found that short attention span in hyperactive boys, which is generally looked upon in clinical theory (Redl and Wineman, 1951) as reflecting high impulsivity, weak ego control, and a generalized ability to tolerate frustration, may in fact be due to the selection of reinforcers at the wrong developmental level. For example when boys were praised for appropriate behavior, they rapidly stopped responding. In some instances the boys responded in a highly disruptive fashion by throwing educational materials out the window or by climbing on equipment. On the other hand when a primary reinforcer (food) was used, the boys' persistence on the task continued even when the reinforcement was progressively reduced and eventually discontinued completely. The supposedly short attention span of neurologically handicapped and retarded children has also been markedly increased by selecting reinforcers at the appropriate developmental level (Martin and Powers, 1967).

How can a child be taught to respond at higher developmental levels of reinforcement? One important initial step is to endow social stimuli with reinforcing value. Developing responsiveness to social reinforcers is very important, since human behavior is often strengthened, sustained, and modified by praise, positive attention, approval, encouragement, and affection. Endowing social stimuli with reinforcing potential can be achieved by identifying an effective primary reinforcer and consistently associating a social stimulus with its presentation. This is achieved by presenting the neutral stimulus (social) immediately prior to the primary

reinforcer. Through the process of association, the social stimulus will acquire reinforcing potential similar to that of the effective primary reinforcer.

Once the first step is achieved, the educator can proceed to the second step by identifying a symbolic stimulus and pairing it with an effective primary or social reinforcer. This process will, as in the case of the social stimulus, endow the symbolic stimulus with reinforcing potential similar to that of the social or primary reinforcer. Additional experience should be provided with both social and symbolic reinforcers so they will become effective in a variety of learning situations. The final step involves endowing abstract stimuli with reinforcing potential. This is done so a child can achieve autonomy through being able to generate self-evaluation and other abstract reinforcing consequences for the purpose of maintaining his own behavior independent of the environmental consequences.

One of the established prerequisites for entering school is that a child must have developed responsiveness to various types of reinforcers at the social, symbolic, and abstract levels. The child must be able to derive satisfying emotional feelings from reinforcement contingencies using these reinforcers. The reinforcement contingencies used by teachers, peers, and other adults must have the potential for eliciting satisfying emotional feelings. If these feelings are not elicited, the child may make inappropriate responses to the learning situation and may exhibit behaviors associated

with unhappiness, insecurity, immaturity, emotional disturbance, hyperkinesis, neurological impairment, mental retardation, or cultural deprivation. Typical behavioral manifestation for a child with a reinforcement deficit in the school setting includes very short attention span, inability to remain in seat at the appropriate time, inability to complete a task, continuous distraction of other students, excessive hostilities or fears, and erratic thought processes. In short, the child will have trouble adjusting to his new environment, and the presence of all these behavior patterns can be related to a reinforcement deficit.

When a child enters school for the first time he will have had numerous experiences at all levels of the hierarchy. However, if he has not learned to associate reinforcers at all levels of the hierarchy with satisfying emotional feelings, he will not exhibit the behaviors associated with the motivation to learn. In addition, the child will not be motivated to learn in an environment that utilizes discriminative stimuli that have not acquired reinforcing protential. In order for a child to have a "love for learning," he must have learned to respond to the reinforcers utilized in the environment and derive satisfaction from their use.

If we conceptualize all the activities of a teacher in terms of behaviors produced before a learner makes a response and after a learner makes a response, we would have two categories of teacher behavior, eliciting and reinforcing. Eliciting behaviors are those behaviors designed to generate some response from a learner. These teacher behaviors are generally

instructional in nature and include activities such as providing instructional materials, methods of instruction, approach to instruction, and establishing a learning environment. These activities are the subject matter of the methods courses in teacher education programs.

Reinforcing behaviors are designed to respond to what a learner does in the learning situation. A teacher may make a favorable or unfavorable comment, frown, place a mark on the learner's paper, or do any number of things which might follow a response made by a learner. However, reinforcing behaviors which are designed to respond to what a learner does is a neglected area of study in methods courses, but one of the most important variables in the teaching and learning process.

The task of logically explaining the different developmental levels of responsiveness of learners to various types of eliciting stimuli is rather simple. For example, a learner reads grade one material or grade two material. However, when a second dimension is added and we state that a learner also has different developmental levels of responsiveness to reinforcing stimuli (for example, the learner is responding to primary, social, symbolic, or abstract reinforcement), consideration is generally overlooked. If the learner is to experience success during the teaching and learning process, his level of responsiveness to eliciting as well as reinforcing stimuli must be given maximum consideration.

Generally speaking, teachers are very effective at establishing a learner's developmental level of responsiveness to elicitors in reading,

mathematics, and other content areas. This has resulted from the tremendous amount of attention given to the subject matter in teacher education courses. Training relative to establishing a learner's developmental level of reinforcement has been given little or no attention in teacher education courses. Procedures for establishing level of responsiveness to reinforcement were used in research by Garris and Peter (1972) and a detailed description of the procedures can be found in Prescriptive Teaching System: Individual Instruction (Peter, 1972). The learner's level of reinforcement must also be given an equal amount of attention if the learner is to succeed in school. If the learner's reinforcement level is not given consideration in the educational program, he may begin to behave in a manner incompatible with successful adjustment in the school setting.

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