

Learning Theory of Conditioning

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ABSTRACT: This paper presents learning theory of conditioning. According to conditioning theory, learning is a process of change that occurs because of the conditions which then cause a reaction. To make that person study, we must give certain conditions. The most important thing in learning according to conditioning theory is continuous practice. Priority in this theory is learning that occurs automatically. This theory says that all human behavior is also the result of conditioning, that is the result of training or habit of reacting to certain conditions or stimuli experienced in life. The weakness of this theory is that learning only happens automatically and activeness and personal determination in certain learning such as learning about certain skills and habituation in young children.

KEYWORDS: learning theory, conditioning, children, student, learning process

I. INTRODUCTION

In the learning process the priority is how the individual can adapt to environmental stimuli and then this individual can react. The reaction is an attempt to create activities as well as finish them, and finally get result that make changes to the individual as a new thing and increase knowledge. The behavioral change must be in the form of repetitive stimuli that are beneficial to individual and have a positive value in learning new thing. Learning aims to change the positive nature, meaning that if someone learns something new depends on the stimulus around it (environmental factors that are conducive in providing comfort in the learning process), including the activeness of mental process that is often trained and eventually become an activity that is accustomed to do. There are factors from inside which include 1) Health, If people are always sick (headache, cold, fever) resulting in a lack of enthusiasm for learning and psychologically often experience mental disorder and feel of disappointment because of conflict. 2) Intelligence, Intelligence and talent factors greatly influence the progress of learning. 3) Interest and Motivation, Great interest (strong desire) for something is a big capital to achieve goal [1]. Motivation is self-encouragement, generally because of the awareness of the importance of something. Motivation can also come from outside, namely encouragement from the environment, such as teacher and parents. 4) How to learn, It should be noted that learning technique, how the note is learned and the arrangement of study time, places and other learning facilities [2].

There are factors from outside which include 1) Family, he family situation (father, mother, young and old brother, young and old sisters, and family) is very influential on the success of children in the family. Parental education, economic status, residence, percentage of parent relationship, words, and parental guidance, influence the achievement of learning outcome [3]. 2) School, place, school building, teacher quality, educational instrument set, school environment, and student ratio per class (40-50 students), affect student learning activities. 3) Society, if the resident condition in the community consists of educated people, especially most of their children have good education and good moral, so those will encourage children to study harder. 4) Surrounding Environment, house building, surrounding atmosphere, traffic condition, and climate can influence the achievement of learning goal, conversely places with a cool climate can support the learning process.

II. CLASSICAL CONDITIONING THEORY**2.1 Ivan Pavlov**

Ivan Pavlov is a Reflexology Psychologist from Russia who conducted experiments with dog. The dog's muzzle is dissected so its salivary glands are outside its cheeks and the dog put in a dark room and there is a hole in front of the muzzle where it is function to offer food or spraying light. At the muzzle that was dissected, a hose is attached to the tube outside the room so it can be seen whether the saliva is released during the experiment or no. The results of the experiment said that the reflexes can be learned and can be changed due to training, so two types of reflexes can be distinguished, namely conditional reflex / reflex that is studied, namely the release of saliva due to receiving / reacting to certain colors of light, or to a particular sound.

The above theory is also called classical theory, which is a procedure for creating new reflexes by bringing stimulus before the reflex occurs. It is called classical because it started the name of this theory to appreciate Ivan Pavlov's first work in the field of conditioning, and to distinguish it from other theories. This theory is also called respondent conditioning. This theory is often called contemporary behaviorists or also called S-R psychologists who argue that human behavior is controlled by rewards or reinforcement from the environment [4]. So in learning behavior, there is a close relationship between behavioral reaction with stimulation. Teachers who hold the view that the past, present and all behaviors are reactions to their environment and are the result of learning. This theory analyzes the incidence of behavior by studying the background of reinforcement towards the behavior.

2.2 John B. Watson

He was the first person in the United States who develop learning theory based on Ivan Pavlov's research. Watson believes that learning is a process of reflex or conditional response through a substitute stimulus. Humans are born with some reflexes and emotional reactions in the form of fear, love, and anger. All other behaviors are formed by the relationship of new stimulus responses through conditioning [5]. He conducted experiments on feeling of fear in children by using mouse or rabbit. From the result of the experiment, it can be concluded that the feeling of fear in children can be changed or trained. Children are not initially afraid of rabbit and are made afraid of rabbit. Then children are trained so they do not become afraid of rabbit.

2.3 Conditioning Theory(Guthrie)

This theory extends the discovery of John B. Watson about learning, which suggests strategy or method to change bad habits based on this conditioning theory. Human behavior as a whole can be seen as a series of behaviors consisting of units.

These behavioral units are reaction or response from previous stimuli and then those units can also be stimuli which cause response to further behavior units and so on. In this conditioning process, there is generally a process of association between successive units of behavior. The exercise repeatedly strengthens the association that exists between one unit of behavior with the next unit of behavior. In Ivan Pavlov's experiment on dog, it is important to note that certain stimuli can be changed with other stimuli [6].

According to Guthrie, to use bad habits must be seen in a series of behavior units, then try to eliminate units that are not good or replace them with other positive behaviors. In changing behavior or habits in animal and human, there are several methods. First, the Incompatible Response Method. Human is an organism that always reacts to certain stimulants. If a reaction to the stimulus has become a habit, then the way to change is to connect the stimulus with a response that is opposite or the bad reaction that is about to be removed. There are two examples of this, change the behavior of children who are afraid of rabbit in order children are not afraid anymore, by giving food that children like in many times until children are not afraid of rabbit. Then change the behavior of alcoholic to not being alcoholic, by giving an injection that causes vomiting before offered the drink and it done so many times in order the person wants to vomit when sees the drink. Second, the Boring Method (Exhaustive Method). Bad behavior is left alone for a long time, so the person becomes bored [7]. Through this method, an example can be used as follows. Taming a wild horse into a saddle horse, using alternately cowboys who train to ride the horse in a row so eventually the wild horse is tame. Third, the Change of Environment Method by separating the bad relationship between S and R, which will eliminate the bad habit caused by a stimulant (S) by changing its own stimulator.

2.4 Operant Conditioning Theory (Skinner)

The theory of operant conditioning from Burrhus Frederic Skinner, a behaviorist who is considered controversial, with the theory of habitual response behavior, is the youngest learning theory and is still very influential in the learning psychology today. His most recent paper is entitled "About Behaviorism". In his work, behavior is formed by the consequence caused by the behavior itself. Like Pavlov and Watson, Skinner also

thinks of behavior as a relationship between stimulant and response. The difference, Skinner makes further details, which distinguishes two types of responses, namely respondent response and operant response.

2.4.1 Respondent Response (Reflexive Response)

Respondent response is a response caused by certain stimulants, for example the release of saliva after seeing certain foods, and generally such stimuli precede the response it causes.

2.4.2 Operant Response (Instrumental Response)

Operant response is the response that arising and development is followed by certain stimuli. Such stimulants are called reinforcing stimuli or reinforce because they stimulate response that has been carried out by organism. So, such responses follow certain behavior that has been done. For example, a child who learns to do an action then gets a gift, so the child becomes more active in learning (the response becomes more intensive / stronger).

The fact that the type of response is reflexive is very limited in humans, and the second type of response (operant response) is a large part of human behavior and the possibility to modify is almost unlimited. Therefore, Skinner focuses on the second type of behavior, which is important how to give rise, to develop, and to modify behavior.

The procedure for forming behavior in Operant Conditioning is as follows.

1. Identify things that are reinforcer (prize) for the behavior to be formed.
2. Analyzing and identifying the small components that form the wanted behavior, then the components are arranged in the right order to get to the formation of the wanted behavior.
3. The order of the components as a temporary goal, by identifying reinforcer (prize) for each component.
4. Conduct the formation of behavior, by using a sequence of components that have been arranged.

So, Skinner considers reward or reinforcement as the most important factor in the learning process, and the purpose of psychology is to predict and control behavior. An important difference between Pavlov Classical Conditioning and Skinner Operant Conditioning is that in Classical Conditioning, there are consequences to that behavior. Reinforcement is not needed because the stimulation gives the wanted response [8]. So, operant conditioning is a learning situation where a response is made stronger due to direct reinforcement. The experiment is to use mouse in a cage, using a discriminative stimulus (a sign to strengthen the response), such as button, light, and food transport. In addition, it also uses a reinforcement stimulus in the form of food.

In education, operant conditioning guarantees a response to stimulus. If the student does not propose a reaction to the stimulus, the teacher may not be able to guide the behavior toward the goal of behavior change. The type of stimulus is as follows.

1. Positive Reinforcement: presenting a stimulus by increasing the probability of a response.
2. Negative Reinforcement: unpleasant stimulus restriction, which if stopped will result in a probability of response.
3. Punishment: giving an unpleasant stimulus.
4. Primary Reinforcement: stimulus to fulfill physiological needs.
5. Secondary or learned reinforcement.
6. Modification of teacher behavior: the teacher's treatment towards students according to their pleasure interest.

The reinforcement scheduling consists of four ways of reinforcement scheduling which outlines when and how a response is made.

1. Fixed ratio schedule: based on the presentation of lesson material in which the new reinforcement gives reinforcement response after a certain number of responses occur.
2. Variable ratio schedule: which is based on the presentation of learning material with reinforcement after a number of average responses.
3. Fixed interval schedule: which is based on time unit.
4. Stay between reinforcement.
5. Variable interval schedule: giving reinforcement according to the first response after a response error.

III. SYSTEMATIC THEORY (CLARK C. HULL)

This theory uses similar principles to those other behaviorists, namely the basis of stimulus-response and the existence of reinforcement. This theory is also in an effort to develop learning theory.

According to Hull, a need must exist in someone who learns before the response can be strengthened on the basis of reducing that need. In this case, the efficiency of learning depends on the magnitude of the reduction and satisfaction of the motives that led to the response made by the individual. Every object, event, or situation can have a value as an amplifier if it is associated with a decrease of depression condition or the lack in individual, namely the object, event, or situation that can answer the need when the individual responds [9].

The reinforcing principle uses all motivating situations, ranging from biological impulses which are someone's main need to results that reward someone, such as money, attention, affection, and high-level social aspiration. So, the main principle is a need or motive must exist in a person before learning occurs; and what is learned must be observed by people who learn as something that can reduce strength or satisfy their needs [10].

Two things that are very important in the learning process from Hull, namely the existence of motive or motivation (incentive motivation), and drive stimulus reduction (reduction of stimulus). The speed of response changes when the size of the gift (reward) changes. The practical use of learning theory from Hull for classroom activity is as follows.

1. Learning theory based on drive reduction or drive stimulus reduction.
2. Instructional objectives must be formulated specifically and clearly.
3. Classrooms must be arranged in such a way as to facilitate the learning process.
4. The lesson must start from the simple / easy to the more complex / difficult stage.
5. Anxiety must be raised to encourage willingness to learn.
6. Exercise must be distributed carefully so there is no inhibition. In other words, fatigue must not disturb the learning activity.
7. The order of subjects is arranged in such a way.

IV. CONNECTIONISM LEARNING THEORY (THORNDIKE)

Thorndike's theory in the United States is known as Connectionism learning theory because learning is the process of forming a connection between stimulus and response. This theory is called Trial and Error theory and this theory is in order to choose the right response for a particular stimulus. His research looked at the behavior of various animals including cat, the behavior of children and adults. The object of the research is confronted with new situations that are not yet known and let the object perform various patterns of activity to respond to the situation. In this case, the object tries various methods of reaction, so it finds success in making a connection of a reaction with its stimulation [11]. The characteristics of learning with Trial and Error are such as there are motives driving activities, there are various responses to the situation, there is elimination of responses to the fail / wrong attempt, and there is a progress of the reaction to achieve the goal.

Based on the result of his research, Thorndike discovered the following laws.

1. Law of readiness: if a reaction to a stimulus is supported by readiness to act or react, then the reaction becomes satisfactory.
2. Law of exercise: semakin banyak dipraktikkan atau digunakannya hubungan stimulus-respons, makin kuat hubungan itu. Praktik perlu disertai dengan reward.
3. Law of effect: if there is a relationship between stimulus and response and is followed by satisfying state of affairs, then the relationship becomes stronger. If on the contrary, the strength of the relationship is reduced.

V. BANDURA THEORY

According to A. Bandura, learning is more than just a change in behavior. Learning is the attainment of knowledge and behavior based on the knowledge (Social Cognitive Theory)).

Through observational learning theory, Bandura considers that the problem of psychological processes is considered too important or only explored in part. People can involve themselves in symbolic thought, people tend to guide themselves in learning, and their environment can be influenced by artificial behavior. According to Bandura, what important is someone's ability to abstract the information from other people's behavior. Decision making is done which behaviors will be an alternative and then do the selected behavior. The principle of learning according to Bandura is an attempt to explain learning in natural situation. This is different from the

situation in the laboratory or in the social environment which requires a lot of observations about behavior pattern and their consequences [12].

Bandura's criticism of learning as the relationship between stimulus and response is (1) it is not very clear about obtaining a new response. In a natural situation, according to Bandura, people will do more than just imitate existing behavior, and (2) only observe direct learning, namely people behave in something and experience the consequences. In contrast, Bandura said that a child in the personal relationship with an adult, through the interaction of the child with parents, with child's feeling of irony and others causes the child to imitate certain behaviors. So, imitation is not limited to one parent, the relationship between parent and child is not the only prerequisite for imitation. Likewise, fear of an attacker is not a prerequisite for imitating behavior [13].

A person's behavior and environment can be modified. A book has no effect on someone, unless there is someone who wrote it and someone who chose to read. Thus, the reward of punishment will not have much meaning, unless followed by the birth of the expected behavior. Obtaining complex behavior is not only caused by a two-way relationship between the person and the environment, but a three-way relationship between behavior-environment-inner event (reciprocal determinism). Example: A person who has practiced will develop a feeling of confidence. That person's behavior provokes a new reaction, which in turn affects the confidence which then leads to the next behavior and can describe the new behavior, even though that person did not do [14].

The main role of behavioral model from outside provides a variety of possibilities, namely (1) the behavior is exemplified / imitated, (2) the behavior reinforces or weakens, and (3) the behavior causes a move to a totally new behavior. The sequence of steps in learning observation is a behavior model; the model is considered; coding and memorizing behavior; obtained symbolic code; motivation to behave; ability to behave; and behavior.

The analysis of learning theory of behavioristic psychology as a learning theory from behavioristic psychology as explained above is broadly grouped into two, namely conditioning theory and connectionism theory. Conditioning theory is divided into four, namely (1) classical conditioning, (2) conditioning (3) operant conditioning, and (4) systematic behavior. All of the discoverers of the theory are discussed about learning theory through different experiments so as to produce a way of learning. There are learning theories that are similar or continue previous theories in general towards learning behavior.

VI. CLASSICAL CONDITIONING

Through dog experiment with the sound of the bell as stimulation and food as a response so the dog's saliva comes out. Human is equated with dog, in the sense that human behavior is controlled by reward or reinforcement. In learning behavior, there is a close relationship between behavioral reaction with stimulation. This theory is called by Ivan Pavlov classical theory because he first discovered it. This theory is suitable for that era and now it seems that this theory applies to children only [15]. Entering the 21st century, the development of technology and information is very much different compared during the time the discovery of this theory, so human behavior also changes with the time. Even if there are still similarities, this can be found in nation that the live is still very left behind, so not all nations can apply this theory. It really depends on the welfare of a nation and the level of need (Maslow's theory of need).

VII. CONDITIONING THEORY

John B. Watson was included a group of classical conditioning experts who developed the theory that Ivan Pavlov discovered. Human behavior as a result of conditioning (the result of training), or this theory emphasizes continuous practice. Learning is a process that occurs from the reflection of conditional responses through a substitute stimulus. Humans are born with some reflexes and emotional reactions such as fear, love, and anger.

Conditional learning theory emphasizes that it is a process of change that occurs because of the conditions that cause a reaction (response). The core of this theory arises from experiment that children who initially had feeling of fear can be changed or trained not to fear through mouse or rabbit. So, continuous or repetitive practice will change human behavior, in this case only small children, not for adults. Through continuous practice, it may be more appropriate to learn the nature of certain skills or habits and habituation to small children. The weakness of this theory is that learning occurs automatically, activeness and personal determination in certain learning matters [16].

This theory was discovered by Guthrie who expanded his learning theory from J.B. Watson theory in the form of changing bad habits. The method of changing bad behavior is done through the opposite reaction method, the

boring method, and the method of changing the environment. Guthrie's theory is the development of the J.B. Watson learning theory which continuous exercises as reflections process / conditional response occur through a substitute stimulus, then change the bad habit as described above. Therefore, this theory is better than previous theories such as Ivan Pavlov and Watson. As for the development of the situation and the current conditions are better so the conditions of behavior are also different in line with the times. Therefore, the nature of bad habits at this time is also in different level.

VIII. OPERANT CONDITIONING

According to Skinner's theory, behavior is formed from the consequences caused by the behavior itself, while behavior is the relationship between stimulus and response. There are two kinds of responses, namely respondent response and operant response (arising and developing followed by certain stimulants and Skinner's focus on this behavior). In the process of learning reward or reinforcement becomes the most important factor in this theory, because the stimulus reinforces the response that has been done. For example, a reward system for children who have done good result, so children become more active in learning. But on the other hand, the habit of getting a gift will change children's behavior; they always wait for prize, and if there are no prizes do not want to study. This will become a habit until adulthood, while the success of learning is in its own interest for a better future.

IX. SYSTEMATIC BEHAVIOR THEORY

This theory was discovered by Clark C. Hull, who uses principles similar to other behaviors, namely based on stimulus-response and the existence of reinforcement. This theory also develops the theory of learning that need must exist in a person who is learning. Two important things from this theory, namely the existence of motive motivation and stimulus reduction, as well as the speed of responding changes when the size of the prize changes. So, through this theory the prize is a determinant of the speed of response, and this theory will form a children's learning behavior that depends on the gift that will be given. This theory is only possible in people who are still children not for adults. If this continues into adulthood, it will damage the mentality.

X. CONNECTIONISM THEORY

This theory was discovered by Thorndike, who used experiments of cats, children, and adults that learning is the process of forming a connection between stimulus and response. This theory is also called the Trial and Error Learning theory. Individuals who learn to do their learning activities through a process of trial and error in order to choose the right response for a particular stimulus. In this theory, the object tries various ways to react so the object can find success in making a connection between a reaction and its stimulation. This theory formulates laws, namely the law of readiness, law of exercise, and law of effect. Learning is through the trial and error process and law of effect.

This theory equates human with animal and it is not always that human's behavior can be influenced by trial and error. Then he views learning as mere asocial between stimulus and response, thereby strengthening the association with exercises. He saw that the learning process take place mechanically, he did not see it as a point in learning and ignored the understanding as a basic element in learning [17].

From the analysis above, it is clear that the learning theory of behavioristic psychology proposed by behaviorist psychologists, often called contemporary behaviorist or also called S-R psychologist, it is that human behavior is controlled by reward or reinforcement from the environment. Therefore, in the learning behavior it turns out there is a close relationship between behavioral reaction and the stimulation.

Based on some understanding of behavioristic theories and concepts in the description above, it can be concluded that learning is an attempt to adjust to the condition or situation around us, in this process includes getting new understandings and attitudes. Thus, there is a change in behavior that previously did not know / understand become understanding something.

XI. CONCLUSION

According to the result of the study, the learning process through a trial and error process and law defect: are all behaviors that result in a satisfactory situation (in accordance with the demands of the situation) will be remembered and studied as well as possible. The weaknesses of this theory are (1) seeing humans as mere

mechanistic and automatism is equated with animals, it not always human behavior can be influenced by trial and error (not absolute behavior), and (2) views learning only as a social interaction between stimulus and response, so what is important in learning is to strengthen the association with exercises, or continuous quiz, and (3) because the learning process takes place mechanically, then definition is not seen as an essential part of learning. They ignore definition as an essential element in learning.

With the description above, it is clear that learning is an important activity that must be carried out by everyone as maximal as possible to be able to overcome or obtain something. The principles of learning include physical and spiritual maturity; such as healthy body, strong, adequate age, and psychologically and have the ability to think including memory and fantasy; have readiness; mental readiness (interest, motivation), and healthy physical; understand the purpose; the direction of learning objectives is understood by knowing the benefits of learning; have the ability; sincerely in doing and expecting satisfying and maximum result, test and exercise; are something need to be learned and to be repeated in order to enter in the brain; the factors that influence learning, namely the factors that influence the achievement of learning outcomes, it originate from inside and outside of the person who is learning.

XII. REFERENCES

- [1]. Mowrer, R. R., & Klein, S. B. (2019). A contrast between traditional and contemporary learning theory. *Contemporary Learning Theories: Volume II: Instrumental Conditioning Theory and the Impact of Biological Constraints on Learning*, 1.
- [2]. Mackintosh, N. J. (2019). Classical and operant conditioning. *Companion Encyclopedia of Psychology: 2-volume set*, 379.
- [3]. Usman, U. A., & Ogbu, J. E. (2019). Application of classical and operant conditioning theories of learning in cooperative member education and staff training. *GLOBAL JOURNAL OF APPLIED, MANAGEMENT AND SOCIAL SCIENCES*, 16.
- [4]. Allen, M. T., Handy, J. D., Miller, D. P., & Servatius, R. J. (2019). Avoidance learning and classical eyeblink conditioning as model systems to explore a learning diathesis model of PTSD. *Neuroscience & Biobehavioral Reviews*, 100, 370-386.
- [5]. Maselena, A., Huda, M., Jasmi, K. A., Basiron, B., Mustari, I., Don, A. G., & bin Ahmad, R. (2019). Hau-Kashyap approach for student's level of expertise. *Egyptian Informatics Journal*, 20(1), 27-32.
- [6]. Gallistel, C. R., Craig, A. R., & Shahan, T. A. (2019). Contingency, contiguity, and causality in conditioning: Applying information theory and Weber's Law to the assignment of credit problem. *Psychological review*, 126(5), 761.
- [7]. Agussalim, M., Limakrisna, N., & Ali, H. (2017). Mutual Funds Performance: Conventional and Sharia Product. *International Journal of Economics and Financial Issues*.
- [8]. Agussalim, M., Ndraha, H. E. M., & Ali, H. (2020). The implementation quality of corporate governance with corporate values: Earning quality, investment opportunity set, and ownership concentration analysis. *Talent Development and Excellence*.
- [9]. Agussalim, M.P., Rezkiana, A., Ali, H. (2016). Analysis Work Discipline and Work Spirit toward Performance of Employees (Case Study Tax Office Pratama Two Padang). *International Journal of Economics and Research*. *
- [10]. Assagaf, A., & Ali, H. (2017). Determinants of Financial Performance of State-Owned Enterprises with Government Subsidy as Moderator. *International Journal of Economics and Financial Issues*.
- [11]. Assagaf, A., & Ali, H. (2017). International Journal of Economics and Financial Issues Determinants of Financial Performance of State-owned Enterprises with Government Subsidy as Moderator. *International Journal of Economics and Financial Issues*.
- [12]. Agussalim, M., Limakrisna, N., & Ali, H. (2017). International Journal of Economics and Financial Issues Mutual Funds Performance: Conventional and Sharia Product. *International Journal of Economics and Financial Issues*.
- [13]. Szedlak, C., Callary, B., & Smith, M. J. (2019). Exploring the Influence and Practical Development of Coaches' Psychosocial Behaviors in Strength and Conditioning. *Strength & Conditioning Journal*, 41(2), 8-17.
- [14]. Dahlqvist, F., & Kozen, D. (2019). Semantics of higher-order probabilistic programs with conditioning. *Proceedings of the ACM on Programming Languages*, 4(POPL), 1-29.
- [15]. Walther, E., Blask, K., Halbeisen, G., & Frings, C. (2019). An action control perspective of evaluative conditioning. *European Review of Social Psychology*, 30(1), 271-310.

- [16]. Baeuchl, C., Hoppstädter, M., Meyer, P., & Flor, H. (2019). Contingency awareness as a prerequisite for differential contextual fear conditioning. *Cognitive, Affective, & Behavioral Neuroscience*, 19(4), 811-828.
- [17]. Kalmbach, A., Chun, E., Taylor, K., Gallistel, C. R., & Balsam, P. D. (2019). Time-scale-invariant information-theoretic contingencies in discrimination learning. *Journal of Experimental Psychology: Animal Learning and Cognition*, 45(3), 280.