

THE PHILOSOPHY BEHIND CONCEPT LEARNING

How is it superior to rote memorization?

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Experiences, events, objects, and ideas existing in the world around us may contain some common qualities although differing in many others. The common qualities represent a separate class. Once an individual has perceived, and is aware of the similarities and contrasts between events, ideas, objects, and experiences in that class, he can be said to have learnt a concept.

Concepts are the fundamental agents of intellectual work. Titchner defined concept as a "symbol which holds a large number of particular ideas together". A concept can also be defined as the "categorization of objects and events on the basis of features and relationships which are either common to the features and relationships or which are judged to be so by the individual."

But how is the proper, accurate, and meaningful categorization possible? The answer is, it requires "understanding". Battro (1973) describes concept as "the understanding of the meaning of a word". So, although words and concepts are always used at the same time, and may be confused to be the same at times, they are not one and the same. Words represent the concepts. For example, 'chair' is a word, representing a class of objects which always have a seat, a back and legs. A child having learnt this concept will be in a position to identify different varieties of chairs as "chair." Whether made up of rough logs of wood joined together with crude nails, or of

beautifully carved wood and covered with fine tapestry, both will be perceived as chairs by any one who has a clear concept of what a chair is. Similarly, someone who understands what a 'bird' is will put a tiny sparrow and a huge eagle in the same category, i.e., bird, though aware of the differences in the size, life style etc. of the two. So once the concept is learnt one can link up the common features and attributes, no matter how different is the situation, under which objects are being presented.

The above definitions and examples of the concept of 'concept' suggest that:

- a concept represents a quality shared by different objects, events, experiences, and / or ideas which makes them appear as one single class.

- Words serve as symbols for concepts. If an individual has understood what a particular word conveys (i.e., its meaning) he can be said to have learnt the concept.

In order to really learn a concept the individual must perceive commonalities in a class of objects, events, etc. The commonalities perceived by him may or may not necessarily be perceived by others.

Bruner and his colleagues (1956) have, analyzed the nature of a concept. To them a concept carries two critical features:

- a) Attributes, i.e., simple differentiation of the relevant attributes from the irrelevant ones.

- b) Rule, i.e., the way the relevant attributes are combined to define which events are instances of the concept.

For example, a room has walls and a ceiling on top of the walls. So the walls and a ceiling are two relevant attributes of the concept of 'room'. The rule combining the two attributes is, that both walls and ceiling atop the walls must be present. Whether the walls and the ceiling are constructed of concrete or wood is an irrelevant attribute and the concept of room is complete even without considering it.

Klausmeier (1984) regards concepts as mental constructs that are critical components of a maturing individual's continuously changing, and enlarging cognitive structure and which once learnt at higher levels of understanding are increasingly used in four ways to:

1. identify newly encountered examples and non-examples of the concepts;
2. understand principles involving the concept;
3. understand taxonomic and other hierarchical relations of which the concept is a part;
4. solve problems requiring understanding of the concept.

Concept Learning

Although 'concept' is a very important topic in the study of human development, no significant research work can be traced in this field before 1950, of course with a few exceptions. It was in the 1950s that researchers began to

take more and more interest in 'concept learning', and this interest finally lead to the appearance of Hunt's Concept Learning, An Information Processing Problem, (cited by Sills, 1968) and Bourne's Human Conceptual Behavior (cited by Johnson, 1971).

The initial 'Concept learning' researchers tended to investigate the unidimensional concepts. This was the simplest form of concepts, which could be defined by a single attribute alone. Since the concern of research in this realm was with concepts on a very simple level, some researchers (e.g., Osgood, 1953) raised the question whether concept learning was really different from learning any other habit. It was not before 1956 that a non-ambiguous analysis was done by Bruner and his colleagues. Apart from talking about the two critical features of concepts, Bruner and his colleagues also made a differentiation between 'concept formation' and 'concept identification'. This differentiation was also supported by the later researchers. To these writers concept formation refers to actually learning a new concept involving perceptual learning of some degree.

A clear view of how concepts are acquired, and what factors influence concept learning and concept utilization has been provided by Johnson (1971, p. 409) in an illustration of how a child might learn a concept:

"Children are often able to say words before they have a complete understanding of the word, i.e., before they know the concept. Consider a child's learning of the concept "dog". It is likely that in his everyday experiences he will encounter a series of objects some of which are examples of the concept (positive instances) and other non examples (negative instances). On occasions child will mistakenly label a nondog "dog", or he may err in the direction of

labelling a dog "nondog". Both of these general types of errors will meet with disapproval and correction (informative feedback) if a knowledgeable person is present. Eventually errors cease to occur, and the child is considered to have learned the concept."

According to Vygotsky (1962), "process of development from childhood to adolescence takes place by way of qualitative new acquisitions". He describes three phases of development in concept formation:

- a) The child unites diverse concrete objects in groups under a common 'family name' and on the basis of external relationship.
- b) He forms 'potential concepts' by establishing objective relationships and connections, uniting and generalizing single objects, and singling out certain common attributes. This is objective and connective thinking.
- c) He considers the elements "outside the actually existing bond" between objects, "detaches", "abstracts" and "isolates" the individual items. He then attains the formation of genuine concepts. Words are integral to the first two developing processes and maintain their guiding function in the third.

Theoretical Models of Concept Learning

Conditioning theories, and hypothesis-testing are the two main approaches towards the study of how people learn concepts (Johnson, 1971). The conditioning models stem from the stimulus response associative theory. An example of this theory, which has received greatest attention in application to conceptual behavior, is the cue-conditioning model of Bourne and Restle (1959). The stimulus situation,

in this model, is considered to be a large set of cues which are either relevant or irrelevant to the classification. Learning is seen as a process in which relevant cues are conditioned whereas the irrelevant ones are adapted or ignored. Every time when a stimulus and feedback is presented, some constant proportion of these cues is conditioned or adapted.

The hypothesis-testing model on the other hand appears to be an extension of cognitive theories. In this model the concept-learner actively selects and tests possible solutions. Two important representatives of this model are the strategy-selection model of Restle (1962) and the hypotheis-testing model of Bower and Trabasso (1963). According to both of these models, the subject randomly selects a number of hypotheses from a population of relevant and irrelevant hypotheses. The sampling of irrelevant hypotheses sooner or later leads to an incorrect classification, thus prompting the subject to sample again. This process continues until eventually a hypothesis is sampled which leads to continuous correct responding. Both of the two concept learning models have been applied within the restricted domain of simple conceptual tasks, in which both have done quite well in predicting parious aspects of the data (e.g., average number of errors, and of trials taken to solve problems). "However, at this time they must be viewed as only tentative accounts of conceptual behavior. It might also be noted that the conditioning model would appear to be concerned with the problem of concept learning, whereas the hypotheses model seems to be directed more toward concept identification, since it assumes that the various possible diemensions or hypotheses are available to the subject" (Johnson, 1971, p. 412).

A discussion on the role and importance of concept learning, in the attainment of knowledge remains incomplete without an account of the various theories of the development of concepts. While many psychologists have contributed to this subject, one may find two theoretical approaches, which are relevant to the present study. These are based upon the contributions of:

A Jean Piaget

B H.J. Klausmeier

What is Rote Memorization?

Rote memorization is a very favorite technique of students, in Pakistani set up at least, for successfully getting through an examination. Only very few students can imagine to get through a test without a conscious effort to rote memorize chapters and chapters from their textbooks.

The concept of rote memory here is obviously not the same as "memory". No one will deny the importance of memory as being one of the basic elements in learning. From the very acquisition of language to even more superior mental functions, memory plays a very significant role. All great (and even not very great 'pieces of art, literature, science, and philosophy are based upon language, human experience, experimentation, and observation thus involving memory somehow or the other.

The significance of memory, and then a good memory, is not questionable. What is important here is how the role of the memory varies in two different forms of learning i.e., concept and rote learning. While preparing for participation in a quiz program, memory is one major skill of the

participant, whereas for a philosopher who is going to present his theory of 'social adjustment' the main contributors will be his own thinking, theoretical orientation, and observations. In these two situations the role of memory is quite different. In the former it is only memory that one relies upon while in the latter it is just one of the tools of accumulating information.

Knowledge entirely based upon memory (or rote memorization) has been defined by Hilgard (1971) as "verbatim learning by repetition". Zimbardo (1980). describes rote recall as "Recall for material learned verbatim without regard for meaning". These and other similar definitions of rote memory and rote recall suggest that rote knowledge is, knowledge attained verbatim, after many repetitions of the same content until it is 'learnt by heart'. Here, emphasis is upon memorizing and then remembering the content, and not on the meaning of what is being learnt. The process of rote memorization is the same for meaningful and meaningless verbal material i.e., the content is stored in the memory by continuously repeating it. Time required for rote memorizing any information depends upon its difficulty level and the individual's familiarity with it.

It was in 1885 when German psychologist, Herman Ebbinghaus reported on a series of pioneer studies on memorization and a truly quantitative measure of retention. In order to avoid the influence of the subjects' prior knowledge and learning in his studies he introduced the 'nonsense syllables'. Every syllable was meaningless and consisted of three letters -- two consonants with a vowel in between, e.g., DAX, LAJ, or NAX. Ebbinghaus used himself as his only subject. he would study a list of nonsense syllables for as long as he could finally recall and

repeat the list accurately, twice in a row. He noted down the time taken in learning the list. Then after spending some time in learning other lists, he would re-learn the initial list, and the time taken for learning measured. The measure of retention was the amount of time by which the second trial was shorter than the first one.

But how does one really rote memorize any verbal material? The answer is, it involves repeated verbal exercise plus something else. The main technique, other than repeating any verbal material again and again, for rote memorizing and recalling the content memorized this way is the 'anticipation' method. In this method once the subject is exposed to a part of the material he has 'rote memorized', he has to 'guess' or, to anticipate, the next portion to come.

The anticipation method can be used for both serial memorization and paired associate memorization. In the paired associate learning the item appearing on the window of the memory drum serves as a stimulus to the subject and in response to it the subject anticipates the other half of the pair. In case of serial memorization the item appearing on the aperture acts both as a stimulus and a response. When for the first time the subject anticipates the item to appear on the aperture it is his 'response'. When the item is presented there it is the 'stimulus which leads to the anticipation of the next item. Once again when the anticipated item appears it is the response to the previous item while a stimulus for the following item.

The students trying to rote memorize text content consciously or unconsciously adopt the same technique. Every sentence, paragraph, or page is memorized in association with the previous and the next ones. The material to be retained is memorized in form of a chain,

every loop of which is interlinked with the preceding and the subsequent loop. In order to recall any portion of the text, the student first tries to bring to his mind a complete picture of the whole context in which that portion exists. In order to recall the middle stanza of the national anthem the individual tries to recall the initial stanza first. That is why the students depending totally on rote memorization find it very difficult to narrate some random chunk of a story or a poem learnt by heart, if they are not allowed to tell the preceding section.

Rote memorization is a function of short term memory, which is the memory system where only limited amount of information can be stored, and that also for a limited period of time. At times the short term memory can retain some information for time periods as short as just thirty seconds. One very frequently quoted example of short term memory is that of remembering unfamiliar telephone numbers. Once you find a number from the directory, you can dial it for as many times as you wish, without looking back at the directory. After some time, for example after an hour or so, you tend to forget it. The same happens with the students who rote memorize information for their tests, and having reproduced it in their test papers they, after some time, complain about forgetting all that they 'knew' very well few days ago.

The short-term memory can retain information with a limited capacity. One can remember only a restricted amount of information for a shorter time period if he has rote memorized it. Some say one can store only about five to seven unrelated items at a time, whether words, letters, numbers, or something else (Zimbardo, 1980).

Greater amounts of information can be stored in the

short term memory for 'longer' durations if:

- a) The Items are Related with Each other.
- b) Rehearsals are made.

The rote memorized information can be retained in the short term memory for longer duration if it is rehearsed actively. If one keeps on repeating the information for some time he can retain it in the memory for more and more time. But obviously if it is a matter of just rote repetition, the retention is not permanent. One can retain it only as long as he can repeat it. One starts forgetting the information as soon as he stops repeating it.

Rote Versus Concept Learning

With the growing interest of researchers in the realm of concept learning, rote learning is also being studied as a significant factor in verbal learning. In experimental investigations concept learning is considered to be any activity which requires a subject to group two or more objects or events together. It is assumed that this classification activity leads to the development of categories, or concept, so that the subject can correctly categorize any new object as an example or nonexample of the concept. If the classification is reasonably consistent it is considered that knowledge of the concept has been acquired. Such activities appear to be more important for abstract thinking and efficient functioning, when compared with the type of behaviour that occurs if each new stimulus is responded to as something entirely unique. Lowenkron (1968) demonstrated this difference in an experiment. Eight different categories, i.e., all the squares in category A and all the hexagons in category B. The problem had a simple

conceptual solution, but the subjects could also possibly just memorize the correct response for each stimulus. The results showed that approximately one-third of the subjects adopted a rote solution and it took these subjects much longer to correctly classify the stimuli.

But where many investigators have attempted to demonstrate differences between the two types of learning, many others have sought relationship between the two, illuminating the involvement of rote learning in specific instances. The learning of concepts involves both associationistic and cognitive aspects. Initially, before finally learning a concept, a child learns a lot of pairings. He first learns that a cow is an animal, an elephant is an animal and a goat is an animal. Then soon he perceives differences and similarities among these members of the same class 'animal'. Finally he is in a position to determine the relevant criteria for classifying 'animals' and ignores the irrelevant criteria e.g., size, shape, colour etc. Ultimately the child is capable of differentiating between animals and non-animals even when he encounters an animal or non-animal he has never seen before, only by comparing its characteristics with those common to all examples of animals known to him. The involvement of rote learning is illustrated by this example of concept learning. It is this type of associationistic learning which develops the capacity for such cognitive behaviour as concept learning. Several experiments have demonstrated the relationship between rote learning and concept learning with paired associates. Rote, systematic concept, and random concept learning were compared by Metzger (1958). The experiment involved geometrical forms as stimuli, to which single digits were the responses. In the rote condition such pairs were received where each stimulus was paired with a different response. In the systematic concept condition two similar

stimuli paired with each response were used. The random concept condition also involved two stimuli paired with each response but they were not systematic or similar. Systematic and random concept conditions were also studied with four stimuli for each response.

No difference between the rote and the systematic concept conditions was found by Metzger. The systematic concept condition was found no better than the random concept condition when there were only two stimuli per response. Higher performance resulted from an increase in the number of stimuli to four per response, for the systematic concept condition. To Jung (1968) several factors may have prevented concept conditions from doing better than the rote condition." A rapid rate of presentation may have restricted mediational processes. Similarly the presence of only two stimuli per response may have been too few to permit the subject to identify them as a conceptual grouping. The pairing of several stimuli to a given response does not constitute a concept situation unless there is some perceivable similarity among those stimuli".

A comparison was made between rote learning, Metzger's systematic concept learning and functional concept learning. Either single or double digits would make the task more difficult and widen the predicted superiority of the concept condition. For each response the functional concept condition received two stimuli which had been judged similar by subjects in rote and systematic concept conditions. The assignment of stimuli to responses was based on ratings of similarity by other subjects. It was found by Fallon and Batting that both concept conditions were better than the rote condition when double digit responses were used. Also the functional concept condition was better than the systematic concept condition. This supported the

view that Metzger's subjects may have been unable to detect any similarity among the group of stimuli paired with each response in his systematic concept condition. Smith, Jones, and Thomas (1963) also made a comparison between rote and concept learning. The stimuli were circular colour caps or patches which came from series, differing only with respect to hue. Nonsense syllables of medium difficulty were used as responses. A high similarity set was composed of consecutive caps in the series, whereas every fifth cap in the series composed the low similarity set. One, two, or four different caps were paired with each response. It was maintained by the investigators that if the several items paired with a given response are adjacent caps on the scale it involved concept learning. Rote learning, they said, was involved if the caps paired with a given response are non-adjacent on the hue scale. No distinction was made between the two forms of learning where only one stimulus was paired with each response. However, the type of learning involved was considered rote if the stimuli were non-adjacent, and conceptual if they were adjacent.

The result obtained by giving a hundred trials at the subjects' own pace, showed that concept learning was significantly superior to rote learning. Attaching more stimuli to each response improved this superiority.

It was suggested by Smith Jones, and Thomas (1963) that all concept learning situations involve rote learning. If more stimuli from the same category are paired with the same response, rote learning for each pair is not necessary.

The same response would be appropriate for any stimulus within the category, even if it had not been previously encountered in the experiment. Rote learning, on the other hand, requires that each pairing be learned

independent of the others, since the several stimuli which are paired with a particular response come from non adjacent regions or categories.

Keeping in view this discussion one can understand that a person can be said to have learnt a concept if he:-

- is aware of its attributes.
- knows what rules connect these attributes
- can identify the examples of the concept; and
- can differentiate or discard the nonexamples of the concept, from the examples.

And if one fulfils these requirements, he can identify the application of the concept in any form, any style. Knowledge based upon concept-learning is in fact based upon its understanding, and so is long-lasting. Understanding of concepts in a given course of education prepares one for concepts ahead. Lack of awareness of the different parts that construct a conceptual gestalt, hinders the understanding of any concept presented in a style somewhat different from what the individual knew previously, and demanding even a slightly modified way of perceiving.

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