DISCOVERY LEARNING vs RECEIPTION LEARNING
PARADIGMS: IMPLICATIONS FOR THE CLASSROOM
TEACHER AND THE RESEARCHER*

Phua Swee Liang
Ministry of Education

Introduction

There has been considerable confusion clouding these two forms of learning approaches - reception and discovery, in the research literature. Reception learning is often identified as rote-learning (Ausubel, 1963) and discovery learning is a rather illusive concept which means different things to different researchers (Dearden, 1967, Richards, 1973). Ausubel (1969) has managed to sort out some of these confusions by his postulation of the two distinctive dimensions of the learning processes - one is the reception : discovery dimension which deals with the means by which knowledge to be learnt is to be presented to the learner and the other is the meaningful : rote dimension which refers to the alternate ways in which the learner may incorporate such knowledge into his existing schemata. He emphasized that these two dimensions are relatively independent such that it is possible to have these four kinds of learning - (1) meaningful-reception, (2) rote-reception,

* This paper was submitted as a result of the Primary Workshop discussions and has direct relevance to Topic 1 of the Primary Workshop printed in the next section. The Editorial Board welcomes articles on topics discussed at the Workshops.
meaningful-discovery, (4) rote-discovery. According to him, the essential distinction between pure reception learning and pure discovery learning lies in the manner in which the material to be learnt is to be presented to the learner. In reception learning, the entire material to be learnt is presented to the learner in its final form and all he is required to do is to internalize it. In discovery learning on the other hand, the principal content of what is to be learnt is not presented in its final form and the learner is expected to reorganize or restructure the material given in some fashion before he incorporates it into his cognitive structure. In other words, the answer is withheld from the learner and he has to discover it himself. In actual practice however, examples of pure reception learning or discovery learning are hard to come by (DeCecco, 1968). Instead many varieties of these two kinds of learning situations exist.

Discovery Learning

According to Glaser (1966), discovery learning involves two events - one concerns learning by discovery and the other is associated with learning to discover. Though this appears to be a useful distinction, many of the writers or advocates of the discovery approach have tended to disregard it. In the literature, discovery learning has often been referred to in a variety of ways, though more often than not, it is 'learning by discovery' rather than 'learning to discover' that is implied. Darden (1967) and Ausubel (1969) restricted discovery learning to 'learning by discovery' and defined it as 'what is to be learnt has to be found out by the learner himself'. Others (Kersh & Wittrock, 1962; DeCecco, 1968) described discovery learning as that completed with limited or no guidance from the teacher. Bruner's (1961) interpretation of discovery learning can be inferred from his concept of discovery which he maintains,
"... is not restricted to the act of finding out something that before was unknown to mankind, but rather include all forms of obtaining knowledge for oneself by the use of one's own mind. ... It is in essence a matter of rearranging or transforming evidence in such a way that one is enabled to go beyond the evidence so reassembled to additional new insights."

(p. 22)

Gagné (1966) gave an interpretation of the term 'discovery in learning' in an exceedingly broad sense. He regarded any process that involves searching and selecting as discovery, and maintained that there are different functions of discovery for different varieties of learning. He differed from many other writers in that he even extended his concept of discovery to the learning of motor skills (cf. Hawkins, 1966; Dearden, 1967). Richards (1973) summed up what is involved in discovery learning as follows:

"At its core all discovery learning involves an individual confronting a situation 'open' in some significant respect and attempting to 'close' it by finding out for himself the one possible answer or one or more of the many possible answers."

(p. 144)

The common thread which tends to run through all these various definitions of discovery learning is the emphasis that the learner must find out or discover for himself what is to be learnt. This leads to the crucial question, 'how is he to find out what is to be learnt?' Dearden (1967) proposed three different models of discovery learning. The first of these is the 'pre-school model' in which discovery learning is regarded as synonymous with the typical daily accidental learning of a pre-school child as he performs his activities and explores his
environment. Learning in this situation is a 'discovery for oneself under the pressure of real interest and in the course of spontaneous activity'. Second is the model of "Abstractionism". This is a more contrived situation where the conceptual structure to be learnt is embedded in some materials and presented to the learner in such a way that the common features and relationships among certain things are noticed or 'abstracted' by him. The final model is the 'problem-solving' model. In this conception of discovery learning, the teacher's activity is to focus the learner's attention and effort in the direction that ensures that appropriate discoveries will be made by the learner.

Another attempt at describing the different models of discovery learning was also made by Biggs (1971). The types of models Biggs described are 'impromptu discovery', 'free exploratory discovery', 'guided discovery', 'directed discovery' and 'programmed learning'. The names themselves are self-explanatory and, as is also implied by them, the distinction between some of these is not too clear.

A good description of the different kinds of discovery learning situations exemplified by the models and curriculum development projects is that presented by Richards (1973). He differentiated the different aspects of discovery learning situations into five dimensions. The 'process-product' dimension is similar to the two different but related facets of 'learning by discovery' and 'learning to discover' as distinguished by Glaser (1966). Bruner (cited in Wittrock, 1966; p 35) also recognized this dimension. The 'accidental-planned' dimension concerns the nature of the starting point from which learning by discovery develops. Learning by discovery can be triggered off by a variety of situations ranging along this 'accidental-planned' dimension. The 'autonomous-directed' dimension refers to the form
and extent of guidance or structure given to the enquiry process once it is in progress. This dimension as Richards has rightly pointed out, represents the distinction most frequently used in the literature to differentiate various types of discovery learning situations. The 'concrete-symbolic' dimension is associated with the extent to which learning situations involve the manipulation of concrete objects by the learner. Finally, the 'open-closed' dimension emphasizes the end-product of the enquiries. In any discovery learning situation, 'there may be one definite answer or more than one and there may be one method of approach or many'.

Learning situations can be found which exemplify all combinations of these five dimensions. This is explained by the following illustrations:

"To illustrate, guided learning (involving teacher-pupil questioning and discussion) might proceed from an unplanned starting point, involve much activity with concrete objects and the open-ended, with learning to discover as one of its main objectives. Or, it might be deliberately planned from the very beginning, involve a minimum of physical activity and have one definite end in view, with discovery simply serving as a means. Other combinations of these factors might operate in different discovery situations".

(p 150)

It has been realized that discovery learning on the part of students can result from either inductive or deductive teaching. There is recognition that discovery learning cannot and should not be equated with laissez-faire or unstructured learning situations nor should it be interpreted that students should discover everything anew (Bruner, 1966; Dearden, 1967). Kendler (1966) in his 'Reflection on the Conference', expressed that there
is recognition among the participants at the conference that in discovery learning situations, guidance can be given to students and added:

"Students can be encouraged, prodded, and shaped to discover. In short, learning by discovery implies controlling the behaviour of the student just as the old-fashioned drill method. The only difference is the pattern of control".

(p 172)

Bruner (1966) suggested six ways in which teachers may prepare students for discovery learning. These contrived situations include organizing learning materials in such a way that the learner can:

1 develop the attitude that he can 'use his head effectively to process problems even when overcome by limited or unconnected information;

2 approach the new material to be learnt in a way that is analogous to the Piagetian processes of assimilation and accommodation;

3 cultivate the appropriate motivation for learning;

4 learn the strategies and heuristics for information processing and problem-solving;

5 make productive use of their own self-cues;

6 develop the 'capacity for handling information flow manageably so that it can be used in problem-solving'.

There is general consensus in the literature that discovery learning cannot be treated in an all-encompassing way. Though discovery is often characterized by flexibility in organization of the learning environment, the choice of any particular situation needs to be considered in terms of these factors: 1) the nature and content of the subject matter to be taught, 2) the kind of learners, 3) the educational objectives to be attained
and 4) the learner's learning history.

The promoters of discovery learning have hypothesized many merits for this approach of learning. Bruner (1961) pioneered in this direction by claiming four major benefits for the learner: 1) increase in general intellectual potency, 2) improvement in motivation via the shift from extrinsic reward (which may follow from learning) to intrinsic reward (e.g. interest in the activity itself), 3) enhancement of memory processes in that he is more likely to make the learned material easier to retrieve and reconstruct, and 4) acquisition of the heuristics of discovery. According to Dearden (1967), discovery learning also has the added advantage of allowing more scope for individual differences and permitting a more intelligent appreciation of what one is doing.

Ausubel (1969) argued for a more balanced assessment of the relative pedagogical values of reception and discovery approaches to learning. He admitted that the discovery method can be legitimately used with palpable advantages only when it is used discriminately. Five instances where it can stand out over reception learning were described. These include

1 Transmission of subject matter to children who are at the Piagetian stage of concrete operation in their cognitive development and to adolescents who are relatively less equipped with the basic concepts and terminology of a given discipline;
2 Evaluation of the meaningfulness and depth of learning of a particular concept or generalization;
3 Problem-solving;
4 Transfer of learning; and
5 Motivation.

Kagan (1966) gave equally compelling arguments for and against the discovery method of learning. He outlined
these four advantages of discovery learning: 1) It creates arousal and consequently maximizes attention during learning; 2) The greater intellectual effort required in discovery learning leads to an increase in the value of the task; 3) It increases the learner's expectancy that he is able to solve different problems independently; and 4) It helps those children who have a passive dependency conflict with respect to the teacher, to resolve it because discovery method gives such children, "... more latitude and freedom and removes them from the submissive posture ordinarily maintained between teacher and children."

Kagan also cautioned that discovery method is not appropriate for children who have low initial motivation, and impulsive children who are apt to jump to wrong conclusions when they are placed in discovery learning situations to formulate their generalizations. Also children below the age of 9 have not learnt the joy of discovery and for them the incentive value attached to discovery is rather fragile. For this reason they may not derive the benefits that are associated with discovery methods when they are put in such situation.

Reception Learning

The distinctive feature characterizing reception learning is that what is to be learnt is directly imparted to the learner (Dearden, 1967; Ausubel & Robinson, 1969). The impartation of this knowledge need not be confined to the traditional picture of an authoritative teacher telling something in an incomprehensible manner to a group of passive recipients who just accept the information and commit it to memory. According to Dearden, information can be imparted directly in various forms and ways, such as a 'reasoned explanation of something
or an experimental demonstration of it'. Other examples of reception learning situations can be information gathering from textbooks or from machine programmes.

Ausubel (1969) maintained that reception learning can be both meaningful and rote, depending on how the learner responds to the generalization given. The learning is meaningful in so far as the learner can relate what is presented in generalized form by the teacher to his existing structure of experience in some fashion. On the other hand, if he just memorises the information given by the teacher, then rote-learning results. Some of the advantages of reception learning are to be found in this quotation from his writings (Ausubel, 1963; p 19):

"The art and science of presenting ideas and information meaningfully and effectively—so that clear, stable, and unambiguous meanings emerge and are retained over a long period of time as an organized body of knowledge— is really the principal function of pedagogy. This is a demanding and creative rather than a routine and mechanical task. The job of selecting, organizing, presenting, and translating subject-matter content in a developmentally appropriate manner requires more than the rote listing of facts. If it is done properly it is the work of the master teacher and is hardly a task to be disdained. . . . Beginning in the junior high school period, students acquire most new concepts and learn most new propositions by directly grasping higher-order relationships between abstractions. To do so meaningfully, they need no longer depend on current or recently prior concrete-empirical experience, and hence are able to bypass completely the intuitive type of understanding.
that is qualitatively superior to the intuitive level in terms of generality, clarity, precision and explicitness. At this stage of development, therefore, it seems pointless to enhance intuitive understanding by using discovery techniques."

Besides Ausubel, Carroll (1964) has also pointed out that reception learning when supplemented by practice can be an effective means of learning concepts and principles while Dearden (1967) claimed that its merit lies in the area of skill mastery. It is also a well-recognized fact that reception learning is a more economical way of learning in terms of time spent. In reception learning situations, the learner has also the advantage of having a more organized view of the discipline he is studying because the teacher, being more qualified and richer in experience, can obviously organize the information more effectively for learning than the novice learner can.

The above review of the literature gives a representative sampling of the underlying assumptions and conceptual issues of the reception and discovery learning paradigms.

Validity of Assumptions

Many of the claims on the superior pedagogical value of discovery learning have not been borne out by research evidence. (Craig, 1956; Kittell, 1957; Kersh, 1958 & 1962; Wittrock, 1963). It has been found that when the criterion of learning is how fast subjects learn easily understood rules or how well they remember and use these rules to solve problems, reception learning and discovery learning tend to produce equivalent results. Ausubel (1963) maintained that expository teaching has greater pedagogical value than what most people would like to believe. He argued that many
concepts are better introduced by expository teaching for some children. Rowell et al (1969) obtained results which lend support to Ausubel's claims. Other corroborative evidence is to be found in the study of Roughead and Scandura (1968). Their findings led them to emphasize the point that in Mathematics, 'what is learned' during guided discovery can sometimes be identified and taught with equal effectiveness by expository method.

Conflicting findings have been found with respect to Bruner's (1961) claim that learning by discovery increases the learner's interest and ability in future situations. Kersh's (1958, 1962) findings seem to provide supportive evidence while Craig (1965) obtained contradictory results.

Ausubel (1969) attacked the indiscriminate use of discovery learning, and pleaded for a more balanced evaluation of the two approaches -- reception and discovery. In the same context he made an eloquent attack on these unsupported claims for discovery learning --

1) All real knowledge is self-discovered; 2) Meaning as an exclusive product of nonverbal discovery; 3) Subverbal awareness as the key to transfer; 4) Discovery method as the principal method of transmitting subject-matter content; 5) Problem-solving as a primary goal of education; 6) Every child a creative child; 7) Expository teaching as authoritarian; 8) Discovery learning organizes learning effectively for later use; 9) Discovery as a unique generator of motivation and self-confidence; and 10) Discovery as a prime source for intrinsic motivation.

Another small sample of studies appears to focus attention on the strength of discovery learning in facilitating the acquisition of the heuristics of discovery and transfer of learning. Guthrie (1967) obtained evidence to suggest that the discovery method facilitates transfer but not retention, while expository
teaching facilitates retention but impedes remote transfer. Worthen (1968) compared the expository and discovery methods of task presentation in terms of sequence characteristics in Mathematics. He found that the superiority of discovery sequencing stands out in the learner's ability to retain mathematical concepts and to transfer the heuristics of problem-solving. Anastasiow et al (1970) compared the effectiveness of these three teaching strategies of discovery, guided discovery, and didactic with a group of kindergarten children and using Mathematical principles of set, intersection, form and colour. The findings supported the general view that any effective form of teaching strategy would function equally well for content mastery but discovery techniques are more efficacious for the learning of principles. A subsidiary finding hinted that discovery methods work more effectively with learners of the higher ability range.

The denigration of reception learning is based on the misconception of equating it with a rote-learning. Research evidence seems to shed light on the efficiency of this method. Ausubel (1960) demonstrated that advance 'organizers' (prior presentation of highly generalizable concepts under which new learning may be subsumed) can be effectively used in reception learning situations to facilitate the incorporability and longevity of unfamiliar but meaningful verbal material. The convincing results of other similar studies (Ausubel & Fitzgerald, 1962; Ausubel & Yussef, 1963; Newton & Hickey, 1965; Merrill & Stoluwrow, 1966; Scandura & Wells, 1967; Grotelueschen & Sjogren, 1968) are substantive enough to refute the generalization that retention and meaningful learning are exclusive to discovery methods of learning. It has also been found that such 'organizers' seem to produce most apparent facilitative effects on learners with low ability, who presumably would lack the ability to organize and relate the new material to their existing
cognitive structure (Ausubel & Fitzgerald, 1962). In the learning of more complex tasks, advance 'organizers' may differentially benefit learners of superior ability (Crotelueschen & Sjogren, 1968) and those with more background knowledge (Ausubel & Fitzgerald, 1962), enabling them to learn the material which is beyond the capacity of the less able and less sophisticated ones.

Studies (cited in Allen, 1970) have shown that another pedagogical technique for enhancing the efficiency of expository teaching is cueing, using test-like questions. Allen (1970) investigated the effects of advance 'organizers' and questions on the learning and retention of written social material. His results showed that:

1) Questions resulted in specific facilitative learning effects which tend to diminish over time. Furthermore, the interacting effects of questions and advance 'organizers' appeared to vary with intellectual ability;

2) Advance 'organizers' also tended to have a differential ability effect on learning. For the less able students, they served to maintain the specific facilitative effect of questions and no general facilitative effect, while for the above average students, it did not maintain the specific facilitative effect of questions but did result in a general enhancement of learning.

A plausible inference that can be drawn from these studies is that by skilful organization and engineering of materials, enhancement of learning equivalent to that claimed for discovery methods can also be effected through direct impartation of information. A suggestion from these studies is that in the selection of introductory materials to facilitate learning and retention, variables such as intellectual ability and complexity of learning tasks must be taken into consideration.
Conclusion

1 Implications for the classroom teacher.

Discovery learning in school does not necessarily mean complete abdication of the teacher's responsibility in the learning situation. Rather it implies that the role of teacher becomes one more of guidance than of dispenser of factual information. Here teacher and learner participate cooperatively in the learning adventure and the former must be cognitively alert to be able to stimulate and provide imaginative encouragement to the latter. Discovery learning involves both freedom and structure and must not be confused with the laissez-faire environment.

The pedagogical strength of expository teaching can be reinforced by the teacher's skilful use of suitable introductory materials and the supplement of relevant practice. It is a more economical form of teaching with regard to time and should be used if the learning outcome can be effectively reached by either approach, e.g. content mastery and skill learning.

The adoption of any particular approach to use depends on a number of factors, as pointed out earlier on. To reiterate, these include the nature of the subject matter, nature of the learners, educational objectives to be achieved and the learning history of the learners. These factors must be considered in the light of the arguments and suggestions advanced by Ausubel, Dearden and Kagan, together with the empirical evidence provided by the research findings.

It must be noted that neither a pure discovery approach nor a pure reception approach can accommodate all the learning conditions necessary for achieving particular educational objectives with a particular group of students. In practice, a combination of the relative emphasis of each approach may be more appropriate.
DeCecco's advice that the selection of any one approach or combination of the two approaches should be governed by the answers to these questions 'For what purpose?’, 'For which students?’, and 'Under what learning conditions?’, is a useful one to follow.

Suggestions for the research worker

The overall research picture on these two approaches to learning is diffuse, because the interpretability of findings is confounded by numerous factors such as differences in semantics, the illusive nature of the discovery learning hypothesis and methodological problems. In more specific terms, information concerning the degree of direction given in discovery treatments, the taxonomic level of tasks involved, and the allocation of learning time as well as the intellectual composition of subjects have not been described in detail. In this respect, future workers should take cognizance of these short-comings and learn from the mistakes made by their predecessors.

The direction of future research studies should go beyond the controversial issue of discovery learning versus reception learning. Some examples of more meaningful research studies can be found from the missing links in previous studies. Craig's (1965) study has opened up an interesting area for further investigation. Though his study has shown that by providing continuing tasks, discovery approaches to learning may encourage 'out-of-school' activity, the question of 'what type of activity?' has been left unanswered. The study of Scandura and Wells (1967) pointed out that the underlying mechanisms by which 'organizers' improve test performance should be studied experimentally.

Another possible avenue to explore can be 'abstracted' from this statement by Ausubel (1969):
"... the research literature does not provide us with a range of serious attempts to measure the effect of various degrees of directedness in instruction over a variety of tasks similar to those which are now (or might be) taught in schools." (p 499)

To extend this suggested line of investigation, Kornreich (1969) added that 'an analysis of what educational prompts are optimal for achieving educational goals' should be considered. His study also paved the way for the further research to be done on problem-solving responses, that is, an investigation into how students arrive at their answers.

The usual comparison of the efficiency of different teaching strategies reported in the literature may not be meaningful in view of the fact that teachers generally tend to achieve excellence in a variety of conditions. A more useful investigation would be to study the frequency of teacher effectiveness in a variety of teaching styles (Anastasiow, 1970).

REFERENCES


Craig, R.C. Directed versus independent discovery of established relations. *Journal of Educational Psychology*, 1956, 47, 223-234.


DeCecco, J.P. *The psychology of learning and instruction: Educational Psychology*. Prentice-hall, Inc.. Englewood

Gagné, R.M. Varieties of learning and the concept of discovery. In L.S. Shulman et. al (op. cit.)

Glaser, R. Variables in discovery learning. In L.S. Shulman et. al. (op. cit.)


Kagan, J. Learning, attention and the issue of discovery. In L.S. Shulman et. al. (op. cit.)

Kendler, H.H. Reflections on the conference. In L.S. Shulman et. al. (op. cit.)


Kornreich, L.B. Discovery versus programmed instruction
in teaching a strategy for solving concept identification problems. *Journal of Educational Psychology*, 1969, 60, 384-388.


Wittrock, M.C. The learning by discovery hypothesis. In L.S. Shulman et al. (op. cit.)