A Response and an Addendum to Munby

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In "Teaching Strategies: Is Discovery One of Them?" one of my objectives was to offer some observations on the use of "strategy" in the language of education. I believed then and still do that when it is said one has a teaching strategy for the classroom there is an unwarranted assumption that the learning outcomes will be much greater than had the person been said to have a teaching method. I wanted to try to put the notion of "strategy" in education in some more balanced perspective.

Professor Munby's comments refer only to the second half of that paper which deals with the concept of discovery. As I understand it, the basic principle on which his paper rests, and with which I am in broad agreement, is that discovery is not just one kind of thing but rather is of a number of different kinds (though he does not wish to deny these types have something in common). He speaks of there being different "sorts" of discovery and other "types" or "senses" of discovery and identifies and discusses five such senses, to which I shall return later. Munby also suggests that, because there are different sorts of discovery, "different kinds of activities are needed in teaching" to bring about these different discoveries. This is an elaboration of his earlier statements that it is misleading to think there is a "single teaching method associated with discovery," or that " 'discovery' covers one particular style of teaching which has identifiable and common components."

I shall restrict my comments to Munby's central thesis which is (again) that there are different sorts or types of discovery and not just one thing we call "discovery." It is an interesting thesis and one worth further study, although I find the way it has been established and illustrated in Professor Munby's paper to be not altogether satisfactory. The difficulty is to provide a rationale to show that both this thesis and the conclusion drawn from it (that no one teaching method is associated with discovery) are plausible. Even if it were the case that discovery is all of a piece, it might still make sense to say that different teaching methods could be used in promoting discovery learning for, as I think Professor Munby recognizes, nothing logically follows from the meaning of "discovery" itself about the method(s) promoting discovery learning which may be used. Finally, suppose we do grant the truth of the basic thesis it may not follow that the types of discovery are what Munby has identified them to be. On what

basis have these five types been differentiated? Are they in all cases distinct types?

In trying to work through some of these concerns a useful place to begin is with some of the examples of discovery claims found in my paper (Stewart, 1979) which Munby says help to illustrate his central thesis. "Discovering footprints in the sand, sunspots, eggs, and sand dollars involves coming across the objects in some way in the material world.... This may be contrasted with the adolescent's discovery that he is in love.... It need hardly be said that this type of discovery is different from discovering the next member of a number series, which involves determining the rules governing the series and then applying them." But what is it that enables us to differentiate these cases of discovery and see them as distinct sorts or types?

One possible answer is that each alleged type is associated with a different prior searching process and it is the differences in these prior processes which enable us to distinguish different types of discovery. While it might be possible to show that the process one has to engage in to discover that 24 is the next member in a certain mathematical series is rather different from the process involved in discovering sunspots, the above suggestion will not do as providing a principle of differentiation. A prior search process is not a necessary preliminary for a discovery. Discoveries can be made without engaging in any such process. They can be made instantaneously and by accident. Moreover discovery is basically or essentially an achievement and to think that types of discovery can be differentiated by differences in preliminary search processes is to confuse achievements with tasks. Tasks which may lead up to discoveries are not discoveries themselves.

A more promising approach and one which Professor Munby refers to is to use differences in the types of "objects" or, more precisely, of the propositions which are discoverable as a principle of differentiation. It would seem that propositions such as that an egg is in the robin's nest, one is in love (or jealous), and 24 is the next member in a certain series are propositions of rather different kinds. But while this may be a necessary part of a principle of differentiation it is not sufficient. For it is not the case that different types of discovery are picked out merely by differences in the propositions discovered. What is required further is some reference to *verification* of the propositions discovered. This is not an arbitrary reference. It is part of the logic of "discovery" that anything which is discovered is necessarily verifiable because true. Given then that different types of proposition require different types of verification (e.g., that there are spots on the sun requires the test of sense observation; that 24 is the next member, etc., requires testing a mathematical formula through further instances) might this not be sufficient as a principle of differentiation? Such a principle basically is epistemological and this should not be surprising since "discovery" itself is an epistemological concept having a close logical connection with the notion of truth (or what is the case) and

verification. In light of this epistemological criterion of "discovery," to the degree that propositions of an empirical kind entail truth tests that differ from those for propositions of a mathematical kind, and to the degree that propositions of an interpersonal kind (e.g., that one is in love, or jealous) entail truth tests that differ again from each of the foregoing, it would seem to follow that the discovery involved with each of these propositions is of a different type or sort.

But the concept of discovery is a psychological one as well as an epistemological one. I tried to bring this point out in my paper by suggesting that "discovery" implies a subjective condition in addition to the above objective one in which a feature of discoverers rather than of what is discovered is picked out. Unless one has the relevant concepts and therefore some understanding of the sort of thing he has come upon, it could hardly be called a discovery. To discover presupposes certain conceptual structures have been grasped by the discoverer (an indispensable condition for discovery learning in the classroom). Discovering spots on the sun minimally implies the possession of relevant concepts of the physical world; that 24 is the next member, etc., relevant mathematical concepts; that one is in love (or jealous) relevant interpersonal concepts. A second necessary principle for differentiating types of discovery then may be extracted from this psychological criterion. Since developing the above sets of relevant concepts respectively cannot be achieved without having experiences of appropriate kinds — experiencing the physical world, numbers, and other persons each being different kinds of experience — it would follow that types of discovery can be further differentiated by appealing to different types of concepts around which human experiences are structured. We would thus have two principles of differentiation both of which are necessary: (a) distinctive types of verifiable propositions, and (b) distinctive conceptual structures. We could then "sort out" types of discovery according to the differences in the verifiable propositions discovered and in the conceptual structures presupposed.

In recent years educational philosophers, notably Phenix (1964) and Hirst (1974), have argued that human experience is differentiated into a number of distinctive "realms of meaning" or "modes of knowledge." These modes are said to be differentiated by the types of propositions, truth tests, and concepts around which human experience can be structured. Although the foregoing account about types of discovery is sketchy and needs more detailed working out, it seems to me that the one way we can make sense out of the claim that there are different types is by seeing discovery under the perspective of the different modes of knowledge and experience. Thus, for each mode one could identify a distinctive type of discovery. Discovery in each of the empirical scientific mode, the mathematical mode, and the interpersonal mode would differ in distinctive ways. If there are further modes such as the aesthetic mode or the moral mode, as has been suggested by Hirst, then in principle discovery in aesthetics could be differ-

entiated from discovery in morals as well as from discovery in the other modes.

Assuming that discovery is "modal" in the above sense, two conclusions may be drawn which relate to Professor Munby's paper. First, the different teaching methods which would be used in promoting discovery learning would vary, in the first instance, not in accordance with the particular types of discovery being pursued, but with the features of the basic modes of experience in which a piece of discovery learning is to take place. Second, a systematic framework is at hand for assessing whether the examples of types of discovery provided are validly distinct types. However, while the modes of experience provide a useful systematic guide for us in differentiating types of discovery, the modes do not release us in practice from the task of working out, within a mode, the requisite preliminary steps leading to a specific case of discovery learning in the classroom. For this we need also to take account of such things as specific objectives, psychological considerations, and so on.

Of the five senses of discovery discussed by Munby, the object sense and the psychological sense can be readily differentiated as distinct types. The object sense of discovery is an instance of discovery in the empirical scientific mode, and the psychological sense in the interpersonal mode of experience. In the first sense, the kind of discovery is determined by the particular type of truth tests and conceptual structures necessary for experiencing the physical world; in the second sense, by the particular tests and conceptual structures for experiencing interpersonal phenomena. But can the remaining three senses of discovery be systematically differentiated? Of this I am doubtful. The message sense of discovery in which one for example says "I just discovered from the weather forecast that. . . . " is a peripheral use of "discover" in which the expression "I just discovered" means "I just heard." With respect to the problem-solving sense of discovery a distinct type of discovery cannot be advanced here since types of problem-solving must themselves first be differentiated in accordance with modes of experience. Problem-solving in mathematics such as finding the next number of a series is just an example of discovery in the mathematical mode. It is not a further distinct type of discovery just because it is said to be a case of "problem-solving." So it is difficult to see what advantage this label has in contexts of discovery. Finally, with respect to the invention sense of discovery, again it is not clear what is being gained by the use of this category, or how it is justified as a sense of discovery at all. Is there in fact not a category mistake being made here by lumping "invention" with "discovery"? To invent is to make or create something, not to uncover or find out what is the case. Discoveries may be involved in inventions and inventions may be used in making discoveries but it does not follow that to invent is to discover in any sort of way, distinct or otherwise.

I am grateful to Professor Munby's paper for the encouragement to reflect further on the concept of discovery.

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