

Inquiry Learning

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Inquiry learning has become such a widely used catch-phrase in education today that it has almost ceased to have meaning for us. Often it is used interchangeably with *discovery*, *problem solving*, and *inductive teaching*. More often it is used in so broad a sense as to encompass all that is desirable in the "new" curricula. In this usage it is little more than a marketing slogan. This state of affairs has prompted an attempt to sort out rhetoric from design, with particular reference to several "inquiry-centered" curriculum projects, in the paragraphs that follow.

Overview

Strategies for learning by inquiry most often tend to be found in curriculum designs which value: (1) the ways of knowing represented in a particular area of study—rather than interdisciplinary studies or "core" programs; (2) active programs of study which invite students to learn by doing, and to put knowledge into their own terms, formulations, and interpretations in ways that make sense to them. The Anthropology Curriculum Study Project (Chicago, Illinois) can serve as an example of (1). In the unit entitled *The Study of Man*, students work with archeological site maps, slides of the ecology of the Kalahari Desert (location of the site), site reports, etc. and, operating with methods appropriate to the anthropologist, attempt to generalize from the data to uncover what sort of civilization flourished there. Since students are dealing with an actual site they may then compare their conclusions with those reached by professionals.

An example of the second might be taken from Jerome Bruner's *Man: A Course of Study*. In the unit on Eskimo life students become aware of the rigors of arctic life and the need for transportation to the sea during the winter in order to fish. They then decide what requirements a sled must fulfill (including storage or disposability when spring

comes) and set about designing and constructing one which fulfills these requirements.

It is apparent that characteristics (1) and (2) may both be represented in a single curriculum. As in both the examples above, students are actively engaged with authentic materials and use methods appropriate to the social sciences. In the second example, more clearly than the first, students are encouraged to come up with their own terms and to generalize (about the Netsilik's life styles) in ways that make sense to them.

From these examples it is possible to infer that inquiry learning places far less emphasis on the acquisition of substantive information than the traditional social science unit of study. Instead, emphasis is on independent research and practice in finding out information for one's self, on organizing and labeling it, on drawing inferences and tentative conclusions from it, and on making predictions and testing them.

One of the major premises of inquiry learning, one espoused by Jerome Bruner in his various writings, is that students are more likely to make their own what they discover for themselves. The ideal inquiry curriculum, then, is one which arranges encounters with experiences, ideas, observations, values, etc. in a way that students may discover, not the ideas and observations themselves for they are the *givens*, but the *relationships* that operate among them. In Bruner's now-classic experiment with slot machines, those students using systematic learning styles learned to predict the recurrence of certain patterns. In short, they grasped the relationship between number of trials and the cyclical reappearance of combinations of lemons, oranges, and cherries.

Another major premise is that *knowledge of how to get and handle* information is at least as important as getting *knowledge about* the world around us. Obviously, the former requires the latter; how-

ever, much of education has been characterized by exclusive attention to the latter. Perhaps an even stronger justification for inquiry learning is found in the claim that knowing how is more productive, more generally applicable, than knowing what. Hence, a student who through inquiry learning has gained experience and practice in the various ways information may be sought, arrayed, displayed, and used is better equipped to deal with present and future situations than the student who possesses solely "encyclopedic" knowledge.

It is on the basis of these premises, then, that advocates of inquiry learning claim that inquiry, supported by an adequate inquiry-focused curriculum, is a greater humanizing force in certain aspects of education than instruction which tends merely to transmit information, to teach the interpretations of others, and to over-simplify problems and modes of problem solving. This humanizing force is conceived as an approach to schooling capable of equipping students to cope effectively as well as inventively with the familiar and the novel in knowledge, and consequently providing them with a measure of control over their physical, mental, social, esthetic and emotional environments.

In summary, inquiry learning acknowledges the importance of the student's role in the process of knowledge making and warranting. Ideally, such a role frees the student from deficient knowledge and prepares him to deal effectively with problem situations at theoretical, policy, and applied levels.

Limitations of Inquiry Learning

Most inquiry learning advocates do not claim to have a panacea for educational ills. Rather, they observe that it provides a way to account for the diverse ways of knowing that we observe when we look at professionals in the process of making knowledge, in school practices. Nevertheless, the limitations of inquiry are as important as the claims. Following are some of the major constraints on the use of inquiry procedures in the classroom:

- *the extent to which inquiry is appropriate to the area of study.* To date, inquiry curricula are available in anthropology (Anthropology Curriculum Study Project), social studies (Man: A Course of Study), language study (Language Systems Program of Hawaii English Project), science (A.A.A.S., Foundational Approaches to Science Teaching), and

mathematics (Project S.E.E.D. and others). It is altogether possible that inquiry is not an appropriate curriculum theme or instructional strategy for the study of areas such as vocational training, literature, history, or the fine arts. It may be that other approaches are required to teach manipulative or technical skills, esthetic response, historical research, or data gathering.

- *the extent to which suitable classroom materials are available.* For example, in order to develop units for the Language Systems Program of the Hawaii English Project, planners had to provide classroom sets of basic reference materials that could also be understood by 4th to 6th grade students, locate and secure films and tape recordings (or have films and tapes made) of authentic situations appropriate to the topic of the unit, and write activities (in mobile, manipulative, and worksheet form) which exemplified some inquiry skill characteristic of the language and social sciences. Inquiry skills in this program (adapted from A.A.A.S., since language study is treated from the perspective of science) include:

1. asking productive questions
2. observing
3. classifying
4. measuring
5. using notational systems
6. reporting
7. experimenting
8. hypothesizing and predicting.

In several of these units students take polls, conduct surveys and interviews, and display their findings in graphs. The activities and resources for these must be designed, tested, and produced in advance of their classroom use. *The Study of Early Man* unit already described and *Man: A Course of Study* likewise require numerous and frequently expensive items: 16mm sound films (Baboon Social Organization), slides, tapes, a facsimile journal, data cards, realia (Venus of Willendorf cast), etc. While authenticity is always the goal, frequently compromises have to be made because of a variety of factors including cost, availability, and accessibility to students. More often than not, curriculum developers have had to settle for *approximating* the modes of inquiry of the social scientist or for *simulating* situations and settling for giving the student a taste of what real inquiry is like.

- *the extent to which the study can be made teachable.* Teacher preparation for inquiry presents impressive problems. If one is dealing with a teacher-made curriculum, the teacher assumes the responsibility for performing at a Ph.D. level of competence in the discipline and for providing significant experiences and materials which will facilitate his students' inquiry. In an area such as English where there appear to be several disciplines (literature, language, and perhaps rhetoric), it seems unreasonable to expect expertise in all these disciplines. In the instance of Project S.E.E.D., the assumption is made that the teacher will be a Ph.D. level mathematician who is competent to determine the nature and caliber of student insights into mathematical concepts. How reasonable is it to expect that public schools will be able to find such trained professionals or even borrow them from the universities in the quantities that are required? An alternative, of course, is the skillfully developed curriculum package which has been put together with the assistance of such professionals. Teacher preparation then becomes a matter of observing competently handled demonstrations with the curriculum materials, proceeding through the units by role-playing as students and as teachers (perhaps in a micro-teaching situation), and learning to become more a research director than an expositor and interpreter.

- *the extent to which the study can be made learnable.* The study should be intrinsically interesting to students, providing active and interactive, rather than passive and lock-step, learning environments. Inquiry learning must also account for a variety of student learning strategies. Bruner identified two distinct approaches students used in solving the problem of the slot machine plus one group which was apparently unable to anticipate patterning and consequently found nothing but randomness. There also seem to be fairly clear cut preferences that students have for assimilating information. Some do well with printed materials, but many more do poorly. They should have the option of learning from talking to others, watching films and slides, listening to tapes, and so forth. Inquiry must also account for Piagetian "stages of learning" (or in a milder form, Whitehead's stages of romance, precision, and generalization). If one is a Brunerian, then inquiry imposes the obligation to render the

key questions and ideas in forms that are accessible to students of the appropriate age, while maintaining the intellectual honesty of the area of study. Units which cannot be taught without changing the authentic nature of inquiry probably ought not to be taught until students mature sufficiently to grasp the study in its intellectually honest form.

Kinds of Inquiry

John de Cecco in *The Psychology of Learning and Instruction* suggests that there is a continuum of degrees of instructional guidance which can help us characterize a wide variety of "inquiry" programs:

- (1) Highly guided: Teacher/program provide both the principle and the problem solution;
- (2) Partly guided: Teacher/program provide the principle that applies but not the problem solution;
- (3) Partly guided: Teacher/program provide the problem solution but not the principle that applies;
- (4) Unguided: Teacher/program provide neither.

He also suggests that most inquiry of discovery programs today fall into the second and third categories. At the highly guided end of the continuum we would find expository or lecture approaches to teaching, while at the unguided end, Summerhillian or free school approaches would be the norm. The inductive approach (characterized in 3) is found in the following examples:

Richard Suchman, *Inquiry Training* (science). Students view a discrepant event, then play a form of *Twenty Questions* with the teacher in an effort to discover the explanation for the event. The claim is that students thereby learn to ask productive questions. The problem here as in other inductive teaching approaches is that the answer is already known to the teacher, consequently the lesson becomes little more than a dance of the seven veils. In all honesty it cannot be regarded as genuine inquiry.

Hilda Taba, *Training for Thinking* (social studies). Students are led from observation, using a particular framework, to a series of grouping and labeling activities. Interpretable questions are then elicited. Finally, students work on a cognitive task which involves the prediction of consequences.

Science Curriculum Improvement Study (S.C.I.S.)

Many of the activities in S.C.I.S. may be regarded

as examples of de Cecco's second characterization: discovering instances to which a principle may apply. In one activity treating the properties of substances, students were told that substances may be acid or alkaline. They then proceeded to test with litmus a variety of unidentified substances to determine their particular properties.

One aspect in which de Cecco's continuum fails to satisfy the requirements of inquiry is his omission of the emphases on process rather than content. Many of the curricula cited earlier in this article are less concerned with deductive or inductive procedures than with having students gain experience with the various ways of finding and handling information that characterize particular disciplines.

Another respect in which de Cecco slights inquiry is in the matter of problem solving. Many areas of study have both well-defined and poorly-defined problems or questions which practitioners are continually attempting to solve. A well-defined problem is susceptible of solution through the application of a variety of inquiry techniques. On the other hand, a poorly-defined problem needs further work on the formulation of the problem even before research techniques may be applied. Most relatively successful inquiry programs have dealt with well-defined problems. Interdisciplinary and humanities programs have generally run into trouble when trying inquiry approaches, perhaps because they tend to deal with poorly defined problems. There is still a third kind of "problem"—a puzzle formulation. Most vocational education courses have these—auto shop, for example. The problem before the students is to listen to and observe a faulty engine, then run through a set of checks to isolate the abnormal condition, and repair it. This kind of problem solving should probably not be regarded as true inquiry any more than Suchman's inquiry training, for in both cases, solutions are already known and deprive students of any experience in warranting their findings.

The Case Against Inquiry

Lee J. Cronbach, David Ausubel and others have frequently argued against the claims of inquiry learning. Some of their major points have been:

- (1) to make a practicing intellectual of the student requires a long term effort and an intellectually

respectable subject matter. Most schools are not organized to support this.

- (2) inquiry is most effective in those disciplines which have highly organized learning structures.

- (3) intuitive understanding (fostered by discovery learning) is not useful beyond the elementary school years since the whole thrust of secondary education is (or should be) aimed at teaching relationships between high order abstractions and unifying principles of the discipline. These are best taught by expository teaching.

- (4) expository teaching is more efficient in terms of student effort and class time, but must be combined with practice and the learning of "advance organizers"—those concepts and principles which will help students organize their subsequent learnings.

Conclusions

Ideally, then, inquiry teaching will stress process over content and genuine investigation of authentic, well-defined problems over puzzles and other contrived mystifications. Inquiry learning probably includes a certain amount of expository teaching in introductions to the problems for study, in the exemplars of method, and in the data. In the absence of a teacher who is a practicing expert in the field of study, exposition and activities may be handled through professionally designed program materials—readings, worksheets, tapes, films, slides, etc.

Inquiry procedures may not be appropriate to all fields of study.

The inquiry approach as presently conceived seems most appropriate to those studies which are most defined. Where pedagogical objectives call for the learning of substantive information exclusively, inquiry is inappropriate, but where objectives call for the study and practice of investigative skills, inquiry seems most appropriate.

To succeed, inquiry procedures require considerable support in the way of adequate design, research resources, various curriculum materials and an appropriate plan for teacher preparation.

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