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Needed: Research in Critical Thinking

We need to close some of the gaps in research on teaching "the process of correctly assessing statements."

ALTHOUGH critical thinking is generally recognized as one of the most important goals of the schools, very little research has been done on the topic. On the average, less than two studies a year are published, just barely scratching the surface. Much needs to be done. In this article I will try to suggest kinds of research that are needed if the schools are to make more than the haphazard attack they are now making on the teaching of critical thinking, defined as "the process of correctly assessing statements."

Recently the staff of the Cornell Critical Thinking Project has undertaken the task of examining the literature on critical thinking and preparing a set of one-page reviews of the significant items —about 80 in all. On the basis of this examination we can see that there are vast gaps in the research on critical thinking. Some things are known about the psychology of deduction, about the development of children's thinking, and about criteria for judging statements. However, we do not know enough about these things and we need to know more about others.

An attack on the problem of critical thinking instruction must begin with some notion of what critical thinking is and some way of judging the extent to which critical thinking ability is present. Otherwise we will not know where we are going, nor when we get there, nor how to judge which is the best way to go. Hence first priority goes to the refinement of the concept, *critical thinking*, and to the development of critical thinking tests.

We might then turn directly to the practical question: What teaching methods and curriculum organization schemes are most effective? Yet this important problem can probably be handled most methodically if there is a good body of theory and basic knowledge to serve as a basis for selecting hypotheses and ideas to test. On the other hand our experience in testing teaching methods and curriculum organization schemes will help us to build up our theory. In view of this

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interdependence, the rest of the areas mentioned here should probably be attacked concurrently by different researchers, who should quickly make their results known.

Areas of Needed Research

Let us now consider these needs for research in somewhat greater detail.

Further refinement and definition of the concept, critical thinking: Each aspect of critical thinking must be intensively analyzed so that we can be clear about just what it is we want to get across. This year the Cornell Critical Thinking Project set out to discover the capabilities of children in the area of deduction, assuming that at least deduction was well-enough analyzed to enable us to go ahead with such research. We found that, as the work of the year developed, our major problem (with one exception) was determining just what it was that we wanted to get across. We made some progress this year in the area of deduction, yet we can see that there is much more work to be done. Aspects of critical thinking that need intensive analysis are the following:

1. Deduction
2. Assumption-finding
3. Definition
4. Explanation
5. Reliability of evidence and authorities
6. Generalization
7. Hypothesis testing
8. Evaluating theories
9. Detecting ambiguities
10. Detecting over-vague and over-specific statements.[2]

Development of critical thinking tests: In order that we be able to determine the relationships (causal and non-causal) between critical thinking ability and various other factors (such as teaching methods, personality traits, IQ, and age), we must have at our disposal a large supply of critical thinking tests. There must be general critical thinking tests for all levels of instruction from first grade through graduate study, and there must be several different types of these—not only paper and pencil tests.

Furthermore there must be tests of critical thinking in the various subject matter areas. It is notorious that some people who are good critical thinkers in one area are not so in another area. Critical thinking ability is therefore at least to some extent specific to the field in which the thinking takes place. Hence the relationships between critical thinking ability and various other factors mentioned in the previous paragraph must be refined and determined for each field in which critical thinking takes place. Fields in which critical thinking tests should be constructed at all levels at which these fields are taught include literature, grammar, composition, mathematics, biology, physics, chemistry, earth science, history, economics, sociology, philosophy, home economics, agriculture, auto mechanics, mechanical drawing, and marketing.

Since there are many different aspects of critical thinking (see preceding list) and since we will be interested in teaching each aspect, general tests for each must also be developed for the various grade levels. Then there should be aspect tests specific to the various fields of instruction—for example, a test in evaluation of evidence and authorities in history for grades ten to twelve.

At present the single greatest obstacle to the development of critical thinking instruction and research is the lack of

[2] This is a simplification of a list Robert H. Ennis presented in "A Concept of *Critical Thinking*," *Harvard Educational Review* 32: 81-111; Winter 1962.

a set of tests of the nature just described. Until we have a large body of tests, it will be very difficult to make a concerted attack on the problems of teaching critical thinking.

Discovering the learning capabilities of children: Another basic question is: "Of what are students capable?" Knowing the answer to this question will give us a clearer picture in the practical situation in which critical thinking must be taught. It will give us warning of places in which we are really falling down on the job.

But this is a very difficult question to answer. How can we ever tell that a student has done all of which he is capable? The best we can hope for is an indication of what he is capable of, given his environment. Even that is difficult, but possible. It is to this question that the Cornell Critical Thinking Project is currently addressed; we are making some progress, thus demonstrating that progress is possible.

Doing developmental studies: We also should know the patterns of human development in the various aspects of critical thinking under the various environmental conditions that exist today (without any particularly concerted effort to teach critical thinking). When do various abilities appear? Do they develop slowly or do they emerge full-blown? What precedes what? Such information would be useful at least for the present so that we can know where to start with the present generation. Furthermore if any of these aspects are not amenable to instruction, then if they are also necessary conditions for instruction in others, we should know when they appear.

Determination of subject matters that are particularly suited to the different aspects of critical thinking: A hasty examination of the logical structure of the various subject matter areas suggests that some are more conducive to some aspects of critical thinking than others. For example mathematics seems more conducive to the development of facility with deduction than to judging reliability of evidence and authorities. There should be a careful study of each subject matter area in order to determine what aspects of critical thinking are used in the area and to determine the extent of this use. Then there needs to be an empirical checking of this determination to see if instruction in the emphasized aspects can be effective in the subject matter area.

Development of theory: So that we can better understand what we are dealing with, and so that we can have more fruitful insights into teaching methods and curriculum schemes, a theory needs to be developed which will tie the aspects of critical thinking ability to each other and to numerous other variables. This theory must be testable but abstract. If we have a good theory, then we have guidance in developing hypotheses and ideas to test.

Here is an example, using a low-level (that is, not very abstract) type theory: "IQ" means general mental ability. Critical thinking, the process of correctly assessing statements, seems to require mental ability, but also to be susceptible to direct instruction. The results of instruction depend not only on mental ability, but on desire to please the teacher, interest, etc. Hypothesis: There is a higher correlation between IQ and critical thinking in uninstructed groups than in groups that have been instructed. This hypothesis is generated by the above low-level theory on the following as-

sumptions: People who have about the same mental ability are bound to pick up some critical thinking ability as a result of being exposed to the vicissitudes of life. Even though different things provoke different people, each is bound to have been provoked to some extent by one thing or another. (So there should be a medium correlation between IQ and critical thinking for untrained people.) When we introduce deliberate critical thinking instruction in school, however, we can expect certain traits (desire to please the teacher, interest in school, etc.) to become more influential than before, so we can expect the correlation between IQ and critical thinking ability to decrease, since not everyone has these school-success traits to the same degree.

If this hypothesis is refuted, then one possible explanation is that critical thinking ability is not susceptible to direct instruction. Thus this theory has generated an important hypothesis, the refutation of which would have an extremely significant possible explanation. There are of course other explanations, so, in this supposed situation, more research would be needed to settle the question.

This theoretical development will require the exploratory investigation of a large mass of potential relationships between critical thinking and other factors, such as, personality factors, IQ, age, sex, socioeconomic status, vocational interest, school grades in specific subject, class size, grouping, per-pupil expenditure, basic value commitments, child-rearing practices, reading ability, leisure-time activities and cultural background, to name a few. As a theory is developed, many new ideas for checking relationships will occur to us.

Teaching methods and curriculum organization: All of the proposed research that has so far been mentioned finds fruition in the development of adequate plans for teaching and curriculum organization. The proposed research can suggest ways of doing and organizing instruction on a comprehensive basis, but because there is inevitably a vagueness in theory, because different kinds of students require different kinds of handling, and because different resources are available to different schools, a number of comprehensive plans should be worked out. These must be tested under controlled conditions.

Although we are in no position to work out a comprehensive curriculum plan yet, we can do some preliminary controlled research on teaching strategy and tactics. Here are some of the questions that can be investigated with profit, although we must remember that the results might be specific to our contemporary situation:

1. Should the principles of critical thinking be deliberately made explicit at some point in the instruction?
2. If so, should these principles be drawn from the students in almost all cases?
3. Or should the teacher supply these principles as soon as he believes they can be understood?
4. Do the answers to the preceding questions vary for different ability levels?
5. How effective is the question, "Why?", in critical thinking instruction?
6. Does effectiveness of critical thinking instruction vary inversely as the size of the group?
7. Can critical thinking instruction be programed?
8. Is critical thinking instruction more likely to transfer if it occurs in more than one subject?
9. Which subjects are best adapted to which aspects of critical thinking?
10. Is the problem solving approach bet-

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ers and taught, will reflect this strain. It already does. We, the older generation, think of the difference between the generations as action-reaction, as the swinging pendulum. The young sense it, not as anything on one plane, but as an explosion. It is appropriate that the one to tell us of it is this explosive man, Marshall McLuhan, who is called by a professor of English now at Harvard, "the most seminal mind on the continent."

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ter adapted to critical thinking instruction than the subject approach?

In summary, critical thinking, which is here defined as "the process of correctly assessing statements," has ten major aspects, which have been indicated in this article.

As a result of our review of the literature, I am convinced that research in critical thinking has been virtually neglected, although many people speak enthusiastically about critical thinking. The following areas need attention by researchers: further refinement and definition of the concept, *critical thinking;* development of critical thinking tests (the greatest need at the moment); discovering the learning capabilities of children; doing developmental studies; determination of subject matter areas that are particularly suited to different aspects of critical thinking; development of theory (requiring establishment of connections with many other things); and study of teaching methods and curriculum organization. The task is monumental, but worthwhile.