CRITICAL THINKING: PROBLEM-SOLVING OR PROBLEM CREATING?

For some time now I have been puzzling over what we really have in mind when we say that the schools should be doing a better job of helping students develop their critical thinking abilities. Although most educators agree that something should be done, there is no consensus on how to go about it. I suspect that this is partly because there is no consensus on what critical thinking is. I offer no definition. But I do have some reflections that, I hope, will contribute to our understanding of critical thinking.

I will begin with a thought experiment. Imagine Harry Stottlemeier and his classmates materializing and showing up as fully matriculated fifth graders in a school in your area. Imagine also that, although they know nothing about IAPC's Philosophy for Children programs, the fifth grade teachers in this school express serious concern about the critical thinking skills of their students. They are disturbed by the national trend toward lower scores on standardized reading and math tests, and they are keenly interested in programs designed to aid their students in "problem-solving".

Among Harry and his classmates, who would these teachers identify as the best test-taker and problem-solver? I suspect the overwhelming choice would be Tony. He is bright, quick, analytical, very good in math, and highly motivated to find answers. Who would they identify as the most imaginative thinker? This would be a more difficult choice, but I would place Lisa, Suki and Ann near the top of the list. Who would be identified as the best critical thinker? If test scores and demonstrated problem-solving skills are the marks of critical thinking, Tony would be the likely choice.

However, my choice is Lisa. My fear is that far too many teachers and administrators would pick Tony. It is generally acknowledged that we do not have machine-graded tests that are a good measure of creative thinking. If critical and creative thinking are quite distinct, it might be thought, as many apparently do, that machine-graded tests can be a good measure of critical thinking. My view, however, is that it is precisely Lisa's creative thinking that gives her the edge over Tony in critical thinking. Furthermore, critical thinkers like Lisa may sometimes have greater difficulty with machine-graded tests and problem-solving tasks than the Tony's of this world. Lisa is as much a problem- *creator* as a problem- *solver*. This is a mark of her philosophical turn of mind.

Virtually all educators agree that we need to do a better job of helping students develop their critical thinking. IAPC contends that its Philosophy for Children program is well suited to meet this objective. I agree that it is. Lisa would feel more at home than Tony in classrooms that model IAPC objectives. Would this be true in other classrooms that claim they are trying to improve the critical thinking of their students? In this age of accountability and testing, the reverse might well be the case.

While accountability and testing are important, critical thinking of the kind exemplified by Lisa should also be encouraged. My worry is that this is not widely enough acknowledged or appreciated. I will now try to spell out some of my concerns in greater detail.

What is Critical Thinking?

Robert Ennis offers the following succinct definition of "critical thinking":[1]

> *"Critical thinking", as I think the term is generally used, means* **reasonable reflective thinking that is focused on deciding what to believe or do.**

A positive feature of this definition, as Ennis points out, is that it does not exclude creative thinking:[2]

> *Formulating hypotheses, alternative ways of viewing a problem questions, possible solutions, and plans for investigating something, for example, are all creative acts that come under this definition.*

However, even with this inclusion of creative thinking, Ennis' definition may be too narrow. Certainly critical thinking can be used to decide what to believe or do. But it can also be used to make sense of what one reads, sees, or hears, to make inferences from premises with which one may disagree or about which one has no particular view, and so on. Of course, this can eventuate in making decisions about what to believe or do, but this need not be the primary focus.

For example, consider the following pair of sentences recently discussed in E.D. Hirsh's *Cultural Literacy:*[3]

1.   Three turtles rested *beside* a floating log, and a fish swam beneath them.
2.   Three turtles rested *on* a floating log, and a fish swam beneath them.

In an experiment by Bransford, Barclay and Franks, subjects presented with the first sentence consistently, but mistakenly, recalled their original sentence to be:

3.   Three turtles rested on a floating log, and a fish swam beneath *it*.

Subjects who were originally presented with the second sentence did not recall their sentence as:

4.   Three turtles rested beside a floating log, and a fish swam beneath *it*.

Understanding the differences among these sentences, including the inferences that can or cannot be made from the original pair, requires critical thinking. But the primary focus is on understanding meanings rather than on deciding what to believe or do.

Ennis' taxonomy of critical thinking skills is actually broader than his definition of "critical thinking" would suggest.[4] For example, it includes dispositions to seek clear statements of questions, to be open-minded, to seek as much precision as the subject permits, to think in an orderly manner and to be sensitive to the feelings and level of understanding of others; and it includes abilities such as focusing on the context of an argument, detecting unstated assumptions, clarifying arguments, making inferences from premises and interacting with others in a reasonable manner.

But, as Ennis observes, critical thinking is commonly associated with problem solving.[5] And he does not warn the reader that this association might be too narrow. My experience has been that many teachers do think of critical thinking too narrowly in terms of problem solving. This explains some of the resistance many have to Philosophy for Children – which could be thought of as problem *creating* as much as problem solving. Highly developed critical thinking frequently poses more questions than answers. It opens up new avenues for inquiry and, in this sense, is creative as well as critical.

This is not to deny the value of critical thinking in problem solving, even though, as I will soon argue, problem solving does not always involve critical thinking. However, the exercise of critical imagination that sometimes creates more problems than it solves (at least in the short run) should be encouraged; and it is here that Philosophy for Children flourishes.

Problem-solving and Critical Thinking

To explore relationships between problem solving and critical thinking, let us consider a math problem:[6]

20 is to 30 as 10 is to
a) 5; b) 10; c) 15; d) 20; e) 25

If John answers, c) 15, does he display critical thinking skills? Not necessarily. This depends on how he arrived at this answer and, perhaps, why other answers were not selected. Suppose he reasoned this way: "This is obviously a question about ratios. I've seen problems like this before. 20 is 2/3 of 30. 10 is 2/3 of 15. So, 15 is the right answer." But what is it about the problem that led him to view it as a problem about ratios? If this occurred to him only because of its familiarity, problem solving skills were used; but it is not clear that any critical thinking was required.

Suppose Amy selects, d) 20. [This answer is frequently selected by teachers to whom I present this problem.] She reasons: "In each case the difference between the first and second number is 10." She might not have noticed that 20 is 2/3 of 30. Instead, she might simply have noticed that 30 is 10 greater than 20. Is this answer wrong? It might well be marked wrong on a standardized test. But it is not at all clear that it should be marked wrong. Although Amy's procedure might not be what the test makers had in mind, it could be objected that they should have made their intentions more clear. As far as critical thinking is concerned, neither John nor Amy seems to have employed really striking critical thinking skills, although Amy might be given the edge in creative thinking.

Now suppose that a third student, Mark, circles both c) 15 and d) 20. He does this because he thinks that both answers are acceptable and he circles both as a way of indicating that the question lacks precision. This response (which would be machine-graded as wrong) does exemplify an important critical thinking skill – as does Mark's refusal to opt for one "best" answer.

Many teachers commenting on this problem suggest that, since the test makers probably had c) 15 in mind as the correct answer, they should not have included d) 20 as a possible choice. That is, they object that this is a poorly constructed problem. Well, let's replace d) 20 with d) 30.

Susan now answers: "I think that 20 is to 30 as 10 is to 10." On the face of it, this answer seems so absurd that we might suspect that Susan either isn't taking the problem seriously or she needs a math lesson. However, she explains: "If you add ten to each of the second numbers, the first number will be 1/2 of the second new number."

Anyone who can offer this explanation also has some understanding of ratios. But, obviously, not everyone who understands ratios will take such an imaginative approach to the problem. Suppose Susan now playfully adds: "I see that 15 would work. But so

would 10. I chose 10 because it wasn't so obvious. I had to think harder to come up with that answer. I like challenges like that. Besides, it was supposed to be a *problem,* wasn't it?" Here we can see critical imagination at work – but only because Susan is given an opportunity to explain her thinking.

To prevent "clever" responses like this from ruining a test (or Susan's score), we might drop b) 10 from the possible choices. Let's replace b) 10 with b) 60. So now the problem reads:

20 is to 30 as 10 is to
a) 5; b) 60; c) 15; d) 30; e) 25

Kevin now says: "I think 20 is to 30 as 10 is to 5. If you add 20 to each of the second numbers, the first number will be 2/5 of the second." He adds: "Of course, 25 could be right, too. After all, 20 is smaller than 30 and 10 is smaller than 25. 30 and 60 would work, too."

At this point one might object that the problem needs to be "disambiguated" – if it is stated with greater precision, such answers will clearly be inappropriate. Here is an attempt:

This is a problem in ratios. Consider 20/30. If 10 is the numerator, what denominator should be selected if the ratio is to match 20/30? [*Note: Do not add or subtract from the denominators.*]

a) 3; b) 7; c) 15; d) 23; e) 31

This way of stating the problem seems reasonably clear. [If necessary, we could add: "No 'clever' answers allowed!"] But this clarity comes with a stiff price. The need for critical thinking skills in solving the problem is minimal.

Of course, we do want students to be able to understand and solve problems with ratios. But we also should want students to detect ambiguities, explore alternative possibilities and at least occasionally come up with unconventional approaches to problems.

Unfortunately, there seems to be much that conspires against the exercise of critical thinking – both in the schools and in ordinary adult life. I still vividly recall our daughter Susan, then 11, declaring at the dinner table, "You can't get away with being philosophical in school." One of her illustrations was being told that her alternative way of extending a number series was incorrect. She was asked to provide the next three numbers in the series: 1, 4, 9, 16 . . . She correctly supplied: 25, 36, 49. But, rather than getting these numbers by squaring 5, 6, and 7, she noticed that the differences between numbers in the series were 3, 5, 7, 9, and so on. So, she solved the problem by addition. Susan's reward was being told that she was wrong – rather than being told that her method was interesting, even though not what her teacher had in mind. Rather than being encouraged to explore why her method matched the results of the squaring method, Susan was given the message that only the "tried and true" path was worth pursuing.

This message is not only for children. A short time ago all administrators at my university were required to take a PLATO computer course on affirmative action and equal employment opportunities. The intent of the program was to increase our understanding of and sensitivity to legal and moral concerns in these areas. Unfortunately, the software program permitted no departure from what was literally stated in the accompanying textual materials. For example, the text on sexism stated that curricula have contributed to sexism. A reasonable inference from such a statement would be that the homework issuing from curricula can also contribute to sexism. However, since this inference was not made in the text, that choice was "incorrect" on the multiple choice test. Ironically, rather than enhancing the sensitivity of readers to important and complex issues, the PLATO program encouraged a mindless adherence to a rather unimaginative text.

The current effort to raise the speed limit on freeways has reminded me of some difficulties I had many years ago with the written driver's exam for the State of Michigan. At that time the speed limit was 70 mph. One question asked whether one should slow down and check the on-coming traffic before entering a freeway or speed up to match the speed of the on-coming traffic. I opted for slowing down, on the grounds that my Volkswagen Beetle could not match up with the cars moving at 70 mph. Furthermore, since a high percentage of cars were traveling well in excess of the speed limit, I concluded that I would be violating the law if I were to try to match the speed of on-coming traffic. I attempted to explain my choice to the person who administered the exam. She tersely replied, "They just want the most logical choice!"

Apparently the "most logical choice" is one that does not allow for significant exceptions (inherently slower vehicles) – and it disallows the contextual discretion and judgment essential to competent driving. The purpose of the exam, it might be replied, is to determine whether drivers have *general* knowledge of the rules of the road and good driving practice. No doubt some such knowledge is important, but equally important is critical judgment – something such tests are neither designed to measure nor encourage.

The moral of these stories is mixed. On the one hand, critical thinking can sometimes impede test-taking. Successful test-taking is important, and critical thinkers are not always rewarded for exercising

their critical capacities. On the other hand, successful test-taking is actually only a small part of one's life. Of more permanent significance is one's ability to engage in flexible, reflective thinking. If we are to truly encourage the development of such thinking, we must be prepared to accept "trouble" – occasional unconventional answers, times when more questions than answers surface and occasional challenges to the assumptions of teachers. I think we should welcome such "trouble" – it's part of what makes teaching a worthwhile and exciting profession. A worry is that the association of critical thinking with problem-solving will predominate at the expense of a more balanced view that includes problem creating. Only if the latter is accepted can we expect philosophy to have a significant place in the classroom – and only then will we have critical thinking at its best.

Lisa and Tony Again

Earlier I indicated that, if asked to select a model critical thinker from *Harry Stottlemeier's Discovery,* my choice would be Lisa. Lisa's critical thinking is invariably creative, as illustrated in several passages.

It is Lisa in Chapter One who upsets Harry's discovery. Harry is convinced that if true sentences are reversed, they become false. If she had understood more precisely what Harry wanted and followed his lead, perhaps she would have provided him with more "confirmations" of his discovery. Instead, she comes up with a stunning counterexample: "No eagles are lions." This leads Harry and Lisa to rethink his discovery. Notice, however, that it is Harry who makes the revision: "That's it! If a true sentence begins with the word 'No,' then its reverse is also true. But if it begins with the word 'All,' then its reverse is false."[P. 4] Lisa is silent. Perhaps her thoughts here are similar to those she has later when discussing some syllogisms with Fran:

Fran, I don't think we can say for sure yet that what we've done is right. There may be cases like the one I gave you before where the conclusion turns out true instead of false. Maybe we just haven't tried enough different types yet and maybe there are some rules we don't know yet. [P. 77]

It is clear in Chapter Three that she does have reservations about Harry's rules. After dreaming that all animals are catlike, Lisa concludes:

So all animals aren't cats, but in make believe they can be! And in dreams they can be. I can imagine what I please, and when I do, Harry's rules won't apply." [P. 12]

For the moment she is satisfied. However, it is quite consistent with Lisa's inquisitiveness that later she might wonder if, in some sense, Harry's rules apply even to "make believe." Final closure on complex issues is not something we can expect from Lisa.

It is also Lisa, in Chapter Four, who has trouble with Mrs. Halsey's suggestion that students write a paper on the topic, "The Greatest Thing in the World". Lisa points out that 'greatest' could mean 'biggest' or 'most important'. In Chapter Eleven, Lisa recalls looking at herself in the mirror after being told she looks like a Pekinese. Now she reflects:

But the other day Grandma said, "Never judge a book by its cover," and it occurred to me that books and people are alike in one respect: they're both full of thoughts. I wonder if that's silly? Anyhow, one thing I know for sure is that mirrors lie; they don't show you as you really are.

Shortly after this insightful piece of self-reflection, Lisa turns her attention to the conflict between her school and the religious convictions of Dale Thompson and his family. She wonders why none of the students talk about Dale now that he has left school. She suggests that they are ashamed:

"Because we didn't do anything to help him?" Harry asked. "Yes, I suppose so – although honestly, Harry, I don't know what we could have done. No, I think we're ashamed of the way we think about things, because if people could have realized the awful results of thinking the way they do, they might not be so ready to do bad things." [P. 57]

Lisa's critical thinking has now enriched her social understanding by providing a deeper explanation.

Finally, although she has been one of the major contributors to the development of logical ideas in *Harry,* in Chapter Seventeen, Lisa challenges the value of talking about reasoning in class. She recalls a poem her father read to her:

It said the thoughts in our minds are like bats in a cave, and these ideas go flying about blindly, keeping within the walls. But then, in the last line, the poem says that every once in a while, "a graceful error corrects the cave". [P. 95]

Tony asks Lisa if she is suggesting that they should all learn to make "fancy mistakes":

"I'm just saying," said Lisa, "that you should keep an open mind, and don't think you know it all because you've figured out a few rules of thinking." Lisa looked for a moment more at Tony, and then glanced across

the room at Harry. "I'd like to keep working on it, I really would. It was fun. And it does seem to work with the way we talk. But I don't think it works with the way we imagine, or the way we feel about things, or the way we dream . . . "[P. 95]

So, here we have Lisa's critical thinking at its best – modestly embracing what can be firmly established, while remaining open to the possibility that human understanding may require other ways of thinking as well.

Lisa says that Tony thinks everything is very simple: "Like he has one number, he adds a second to it, and then he figures out what the third one is – it's the sum of the first two – you know, like seven plus three make ten. So he thinks that if you take one sentence, and you add another one to it, you should be able to get a third sentence which is the result of adding the first two together."[P. 75] Tony wants answers. Where clear, decisive answers are available, he is probably a delight to his teachers.

However, if Tony really does think that everything is very simple, I'll have to agree with Lisa, who often finds things to be complex and confusing. In any case, if we were choosing sides, Lisa would be my first choice for a critical thinking team. I will illustrate why with a final example.

Irving Copi presents this "brainteaser" in his *Informal Logic:*[7]

> Mr. Short, his sister, his son and his daughter are fond of golf and often play together. The following statements are true of their foursome:
>
> a. The best player's twin and the worst player are of the opposite sex.
> b. The best player and the worst player are the same age.
>
> Which one of the foursome is the best player?

Tony would assume that there *must* be an answer to this problem, and he would quickly and efficiently work it out. Lisa might look at the problem and say that it cannot be solved because we cannot assume that the unnamed twin is a member of the foursome.

The irony here is that critical thinking seems to be the loser. By making an unwarranted assumption, Tony is able to come up with an answer. Perhaps the consolation would be if Lisa were to go on to say: "Of course, if we *could* assume that both twins are members of the foursome, the best player would obviously be the daughter."

At this point Harry might repeat a contrast he draws between Tony and Lisa in Chapter Seventeen: "He can show how he proceeds, and you can't."

However, Lisa might repeat her reply: "What makes you think I can't?"

I would still choose Lisa.

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Footnotes

1. Ennis, Robert, "A Conception of Critical Thinking – With Some Curriculum Suggestions," in *Newletter on Teaching Philosophy,* American Philosophical Association, Summer 1987, p. 1.
2. Ibid.
3. Hirsh, E.D., Jr., *Cultural Literacy* (Boston: Houghton Mifflin, 1987), p. 38.
4. Ennis, p. 2.
5. Ibid.
6. This problem was inspired by problem #5 of the WASI Test in Arthur Whimbey and Jack Lockhead, *Problem Solving and Comprehension,* 3rd ed. (Philadelphia: Franklin Institute Press, 1982), p. 4. The WASI problem does not provide 20 as a possible answer, thus making it more likely that 15 will be selected. However, as the discussion above shows, 5 and 10 could be selected, and they are among the WASI choices.
7. Copi, Irving, *Informal Logic* (New York: MacMillan, 1986), Ch. 1.