

Teaching Informal Logic

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Teaching Informal Logic

- What is informal logic?
- Can it be improved by teaching?
- Some results from the Monash Critical Thinking Study

Argument mapping

Actively open-minded thinking

- Conclusions

1. What is informal logic?

'Informal Logic' is a term used to denote both a skill and an academic discipline.

The skill is the ability to construct, analyse and evaluate real arguments in natural language.

The discipline studies the theory of informal arguments and how the skill can be taught.

Other terms: informal reasoning, critical thinking, critical reasoning.

2. How good are people at it?

Evidence from a number of different sources suggests that the answer is: not very good.

2. How good are people at it?

1. Studies that show how many people find it difficult to provide reasons or arguments to support their beliefs. (Kuhn 1991)

Subjects in Kuhn's study were asked for their opinions on the following topics:

- What causes prisoners to return to crime after they're released?
- Why do children fail in school?
- What causes unemployment?

Subjects had no difficulty in offering opinions on these subjects.

However, when asked to give reasons or evidence to support their views, most were unable to do so.

2. How good are people at it?

2. Studies that reveal the existence of systematic biases in reasoning. (Kahneman et. al 1982, Baron 1994)

Examples

- Insensitivity to base-rates and sample size
- Belief in the 'law of small numbers'
- Confirmation or myside bias
- Outcome/hindsight bias

3. Can informal logic be improved by teaching?

Does a university education lead to improvements in informal reasoning?

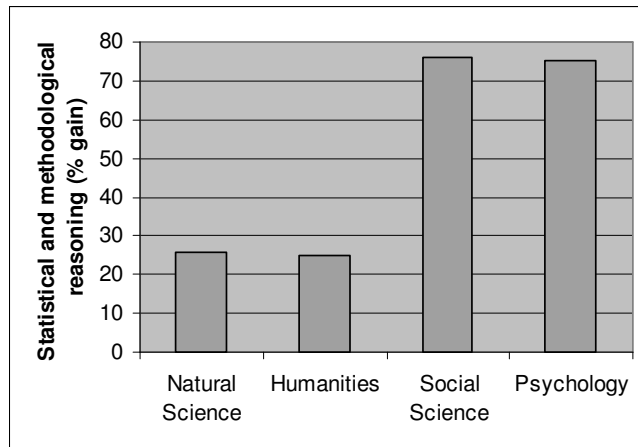
1. A university education is associated with better informal reasoning (Kuhn 1991)
2. Estimated that the first three years of university provide an improvement of about 0.55 standard deviations, or 20 percentile points in critical thinking (Pascarella & Terenzini, 2005)

3. Can informal logic be improved by teaching?

3. Cross-sectional and longitudinal studies have shown that university level teaching can lead to improvements in specific reasoning skills, though the effects are not uniform across disciplines. (Lehman & Nisbett, 1990)

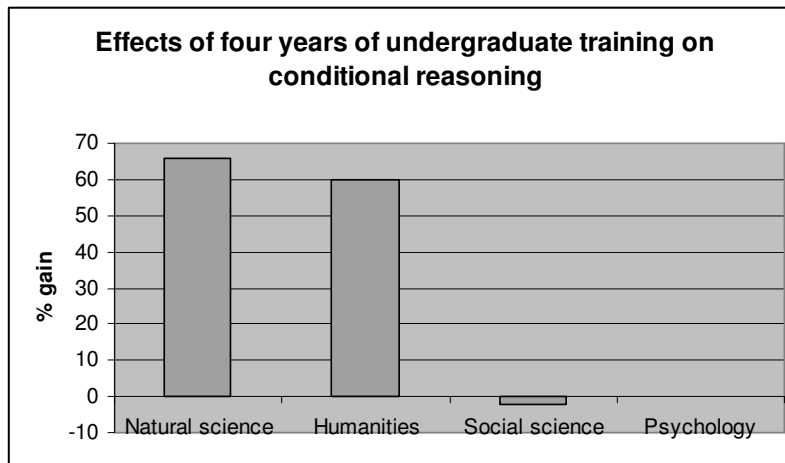
3. Can informal logic be improved by teaching?

Four years of undergraduate training in social science subjects lead to large improvements in statistical and methodological reasoning (70%) compared to natural science and humanities subjects (25%). (Lehman & Nisbett, 1990)



3. Can informal logic be improved by teaching?

Four years of undergraduate training in natural science or humanities subjects leads to improvement in conditional reasoning (60%) compared to social sciences or psychology (0%). (Lehman & Nisbett, 1990)



3. Can informal logic be improved by teaching?

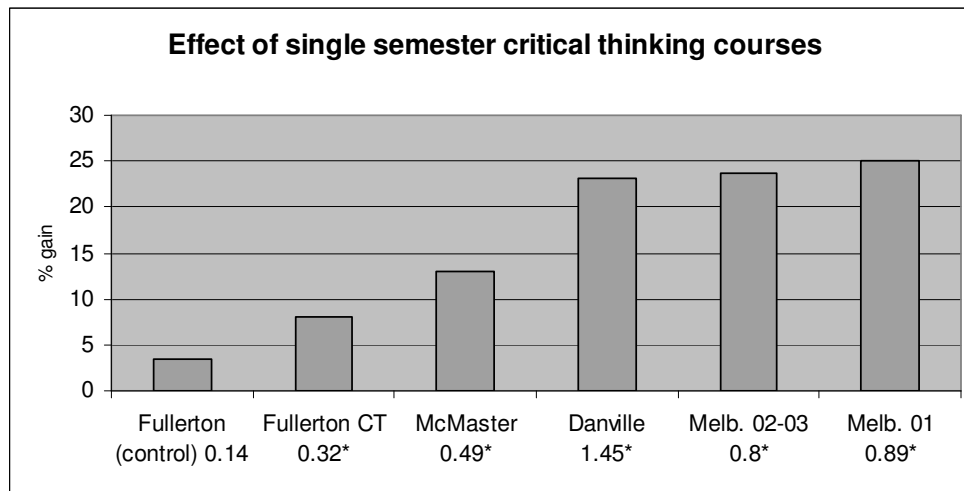
Dedicated critical thinking courses

1. A review of 27 studies of college courses designed to enhance informal reasoning found no evidence that specific courses or instructional techniques lead to any improvement. (McMillan 1987)

See also (Pascarella and Teremzini 1991, 2005, McKeachie et. al 1986.)

3. Can informal logic be improved by teaching?

2. More recent studies suggest that some critical thinking courses *do* work.



4. The Monash Critical Thinking Study

Started work in 2004, due to end June 2006.

Aims:

- To investigate the factors that effect improvements in critical thinking
- To discover what methods of teaching critical thinking lead to some improvement

Specific methods and techniques:

1. Argument mapping
2. Actively Open-Minded Thinking
3. Peer-instruction

4. The Monash Critical Thinking Study

Methodology

- Single semester critical thinking course: PHL-1030: *Thinking: Analysing arguments.*
- Students are pre-tested and post-tested using two different measures:
 - California Critical Thinking Skills Test (CCTST)
 - Critical Thinking section of the Graduate Skills Assessment (GSA)
- The course runs in both semesters and the teaching methodology varied each time.
- A control group of students in other first year philosophy subjects are also pre- and post-tested.
- Lectures stay the same, instruction is varied in the tutorials.

5. Argument Mapping with Automated Feedback

The Quality Practice Hypothesis: Acquiring expertise in critical thinking, as in other areas, requires large amounts of *deliberate practice*.

Deliberate practice must be:

1. Motivated
2. Guided
3. Scaffolded
4. Graduated
5. Feedback provided

The use of computer software helps to achieve this, without expensive one-on-one tutoring.

Question: Can feedback be automated?

5. Argument Mapping with Automated Feedback

Question 3

When prisoners under sentence of death are given the choice between life in prison and execution, 99 per cent of them choose life imprisonment. This shows that they fear death more than they fear life imprisonment. Since one is most deterred by what one fears, it is evident that the threat of the death penalty is more likely to deter potential murderers than the threat of life imprisonment.

Conclusion	Add premise	Co-premise
Conclusion indicator	Premise indicator	Assumption
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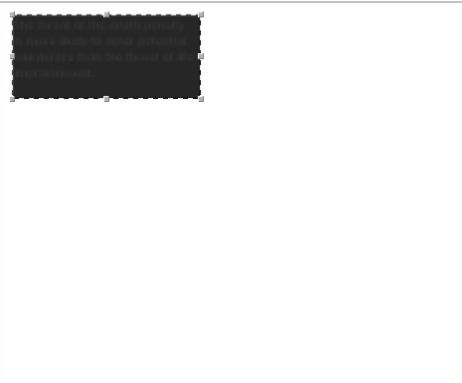
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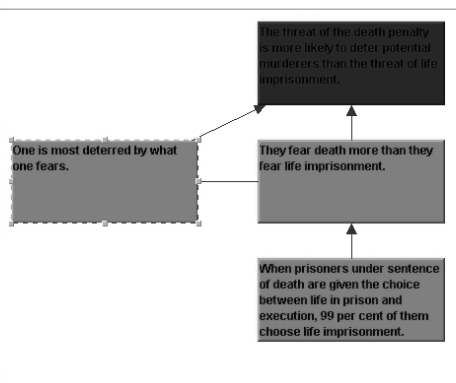
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5. Argument Mapping with Automated Feedback

Question 5

Water: **Although cigarette smoking is legal, it should be banned on all airline flights. Cigarette smoking in the confines of an aircraft exposes nonsmokers to harmful secondhand smoke that they cannot avoid.**

Although cigarette smoking is legal, it should be banned on all airline flights.

Cigarette smoking in the confines of an aircraft exposes nonsmokers to harmful secondhand smoke that they cannot avoid.

Conclusion Add premise Co-premise

Conclusion indicator Premise indicator Assumption

Add Assumption

Please select the assumption

A	People should be prohibited from engaging in an otherwise legal activity in which that activity would unavoidably expose others to harm.
B	An activity should be banned only if most situations in which that activity would inevitably expose others to harm.
C	A legal activity that has the potential for causing harm to others should be modified in those situations to render it harmless.
D	People who regularly engage in an activity that has the potential for causing harm to others should be prohibited from engaging in that activity.

OK Cancel

[Next Question](#)

5. Argument Mapping with Automated Feedback

Magazine article: **Punishment for crimes is justified if it actually deters people from committing them. But a great deal of carefully assembled and analyzed empirical data show clearly that punishment is not a deterrent. So punishment is never justified.**

Punishment for crimes is justified if it actually deters people from committing them.

A great deal of carefully assembled and analyzed empirical data show clearly that punishment is not a deterrent.

Punishment is never justified.

Conclusion Add premise Co-premise

Conclusion indicator Premise indicator Assumption

The reasoning in the magazine article's argument is flawed because the argument

- (A) depends on data that there is reason to suspect may be biased
- (B) mistakenly allows the key term 'punishment' to shift in meaning
- (C) mistakes being sufficient to justify punishment for being required to justify it
- (D) ignores the problem of mistakenly punishing the innocent
- (E) attempts to be more precise than its subject matter properly allows

Incorrect.

5. Argument Mapping with Automated Feedback

1. Students spent approximately 30-40 minutes each week on these exercises.
2. Made available on the WebCT website for the course
3. Students could complete exercises at home if they did not finish them in class.

5. Argument Mapping with Automated Feedback

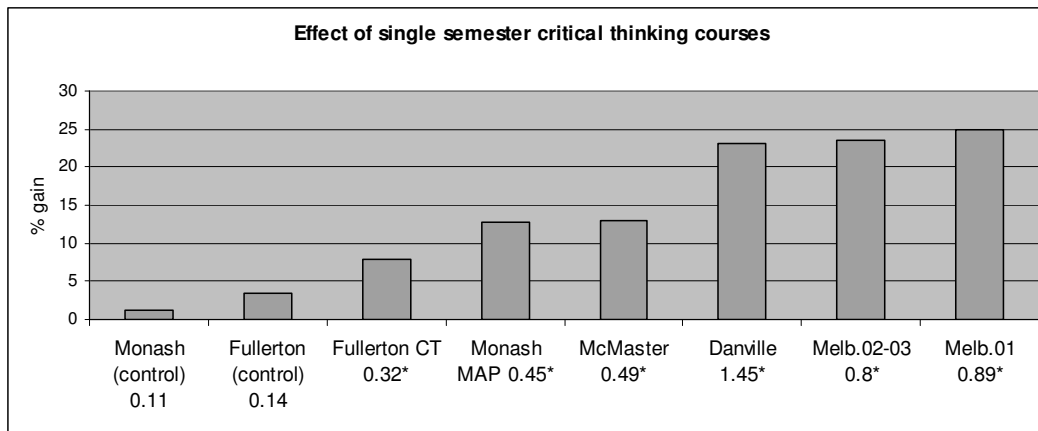
Results

Students showed statistically significant improvement in critical thinking scores.

Average improvement: 14%.

Effect size: **0.45** standard deviations. ($n = 43$)

5. Argument Mapping with Automated Feedback



5. Argument Mapping with Automated Feedback

Possible future R&D

1. Better integration with other course materials
2. Making the feedback more informative
3. Throwing away the scaffolding – allowing for free form exercises with model solutions
4. Argument evaluation
5. Hypothetical arguments – inferences that discharge assumptions

6. Actively Open-Minded Thinking (AOMT)

AOMT is “the willingness to search actively for evidence against one’s favoured beliefs, plans or goals and to weigh such evidence fairly when it is available” (Baron 2002)

There is a great deal of evidence that AOMT is not widespread in the general population.

In particular, evidence for widespread confirmation bias or “myside” bias.

People tend to overestimate arguments for claims they already accept and underestimate arguments against claims they accept.

AOMT is the disposition and ability to avoid myside bias.

6. An illustration of myside bias

Which of these arguments are valid?

1. All things with four legs are dangerous. Poodles are not dangerous. Therefore, poodles do not have four legs.
2. All mammals walk. Whales are mammals. Therefore, whales walk.
3. All African countries are hot. Canada is not an African country. Therefore, Canada is not hot.
4. All things that are alive drink water. Televisions do not drink water. Therefore, televisions are not alive.
5. All nuts can be eaten. Rocks cannot be eaten. Therefore, rocks are not nuts.
6. All things made of wood can be used as fuel. Petrol is not made of wood. Therefore, Petrol cannot be used as fuel.

6. An illustration of myside bias

Which of these arguments are valid?

- | | |
|---|--|
| ✓ All things with four legs are dangerous. Poodles are not dangerous. Therefore, poodles do not have four legs. | ✓ All things that are alive drink water. Televisions do not drink water. Therefore, televisions are not alive. |
| ✓ All mammals walk. Whales are mammals. Therefore, whales walk. | ✓ All nuts can be eaten. Rocks cannot be eaten. Therefore, rocks are not nuts. |
| ✗ All African countries are hot. Canada is not an African country. Therefore, Canada is not hot. | ✗ All things made of wood can be used as fuel. Petrol is not made of wood. Therefore, Petrol cannot be used as fuel. |

The arguments in the first column are all either valid arguments with false conclusions or invalid arguments with true conclusions.

People are more likely to make a mistake on the arguments in the first column than on the arguments in the second column. (Valid arguments with true conclusions, or invalid arguments with false conclusions).

6. Actively Open-Minded Thinking (AOMT)

What factors affect individual differences in AOMT?

1. Some evidence that cognitive ability (general intelligence) is positively correlated with AOMT.
2. Also evidence that certain attitudes to thinking, or thinking dispositions are also positively correlated with AOMT.

6. Actively Open-Minded Thinking (AOMT)

Thinking Dispositions Questionnaire

1. There is nothing wrong with being undecided about many issues.
2. Difficulties can usually be overcome by thinking about a problem, rather than waiting for good fortune.
3. Changing your mind is a sign of weakness.
4. Intuition is the best guide to making many decisions.

Studies have shown that people who agree with statements like 1-2 and disagree with statements like 3-4 perform much better on a wide variety of reasoning tasks and are less prone to myside and other biases.

(Stanovich and West, 1997, 1998)

6. Actively Open-Minded Thinking (AOMT)

Perhaps people do not reason well because they are not disposed to.

Two questions:

1. Does specific instruction aimed at improving AOMT abilities and attitudes lead to an improvement in critical thinking?
2. Are AOMT attitudes associated with performance and gains on critical thinking tests?

6. Actively Open-Minded Thinking (AOMT)

AOMT teaching strategies

1. Students were taught about some of the empirical evidence for myside bias and the evidence that AOMT reduces bias and improves thinking.
2. Exercises that focus on the ability of students to find alternative explanations or counter-evidence for a given claim.
3. Students taught that good arguments must take into account all the relevant evidence and counter-arguments or possible objections to the reasoning or premises.
4. Exercises in which students must criticise arguments in support of their own position on the topic under discussion and suggest evidence or arguments against their position.
5. Exercises in which students are instructed not just to pick the answer, but to actively look for evidence against their choice, by carefully considering the alternatives.

6. Actively Open-Minded Thinking (AOMT)

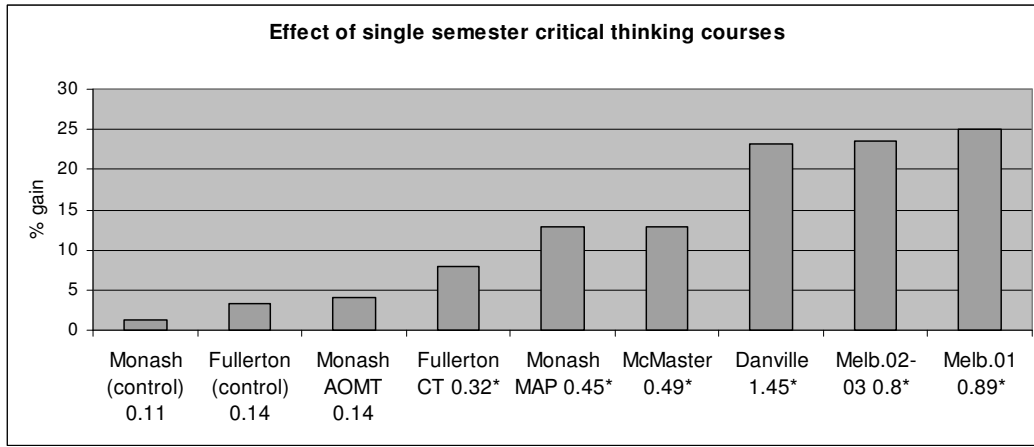
Results

1. Students showed no statistically significant improvement in critical thinking scores.

Average improvement: 7%.

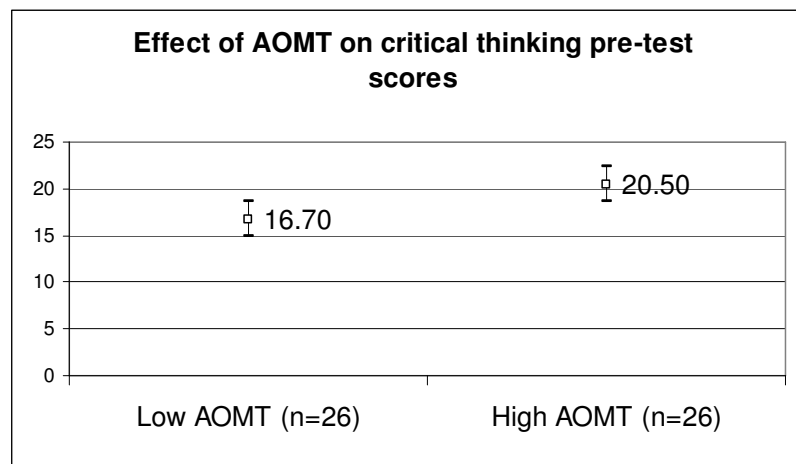
Effect size: **0.14** standard deviations. ($n = 49$)

6. Actively Open-Minded Thinking (AOMT)



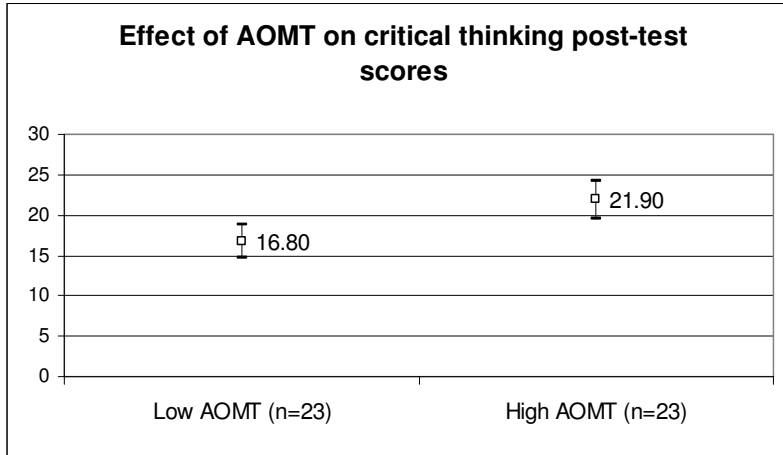
6. Actively Open-Minded Thinking (AOMT)

- There was a significant correlation between open-minded attitudes and critical thinking test scores.



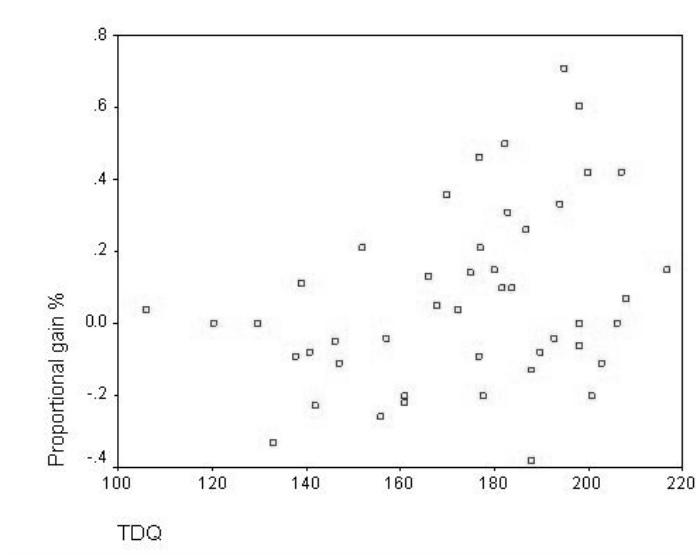
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2. There was a significant correlation between open-minded attitudes and critical thinking test scores.



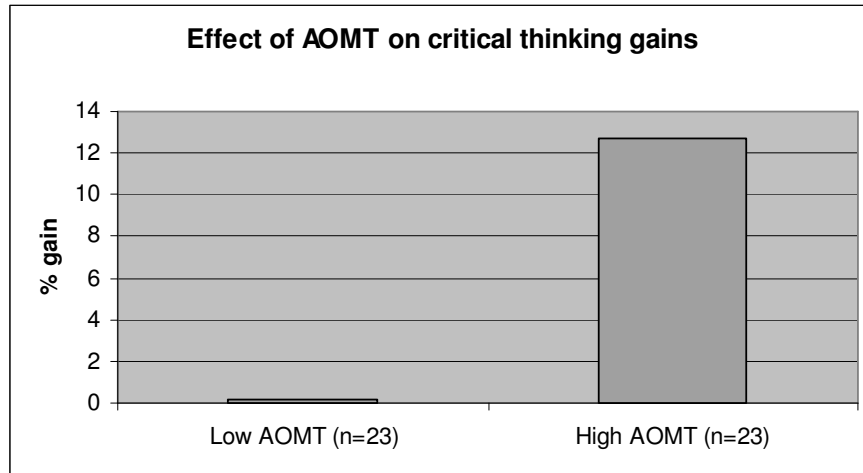
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3. There was a significant correlation between open-minded attitudes and *improvement* in critical thinking. ($r = 0.33$, $n = 46$).



6. Actively Open-Minded Thinking (AOMT)

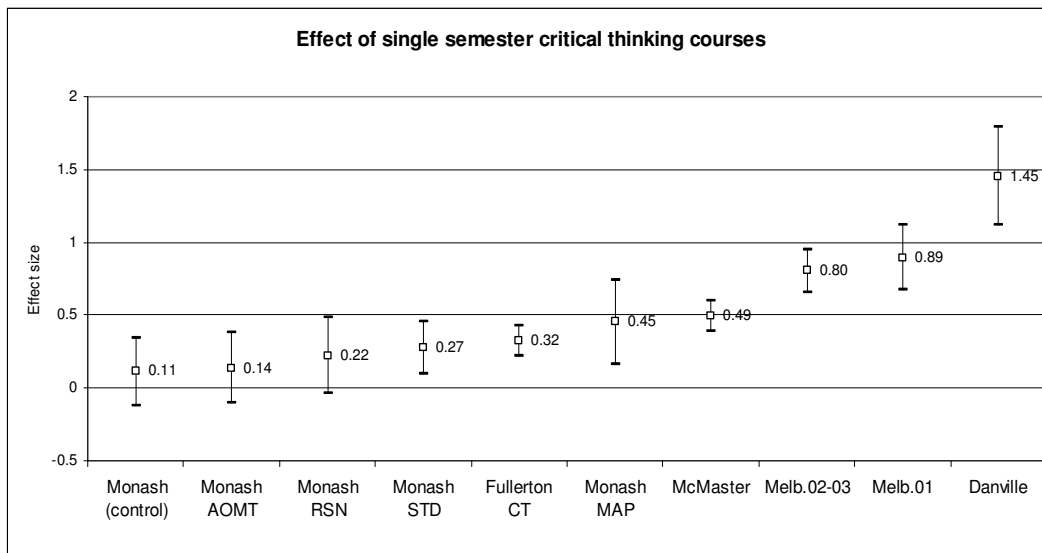
3. There was a significant correlation between open-minded attitudes and *improvement* in critical thinking. ($r = 0.33$, $n = 46$).



7. Conclusions

1. Improving informal reasoning is difficult (especially in a single semester), but not impossible.
2. Computer-assisted exercises and feedback seem to work.
3. Increasing open-minded attitudes *might* help.

7. Conclusions



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