# Why I Evangelize for ThinkArguments

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## Abstract

I describe ThinkArguments, an online course in critical thinking, and urge its adoption. The class uses two research-based pedagogical tools, Argument Mapping and Mastery Learning, to teach students the cognitive skills necessary to think for themselves. I explain why I require the course of all my undergraduates. Critical thinking (CT) is the mark of an educated citizen and one of the skills most valued by hiring manager. But half of all college students graduate without proficiency in CT. ThinkArguments is an effective, low-cost solution. Preliminary unpublished results of an experiment at North Carolina State University suggest that students who complete ThinkArguments (TA) raise their critical thinking skills by almost a full letter grade. Students who take TA and one face-to-face critical thinking course improve by two letter grades. These are significant effects in an area in which it is hard to move the needle, and strong evidence that TA works.

## Introduction

After 40 years teaching in land-grant universities, I planned to wrap up some research projects and retire in a few years. Those plans changed dramatically when I began reading reports that students were graduating from college without the ability to think for themselves. Studies using the Collegiate Learning Assessment (CLA+) and related instruments show that large numbers of graduates cannot reliably identify an author's main claim, reconstruct the reasons offered in support of it, or decide whether those reasons justify the conclusion . They struggle to distinguish evidence from assertions, and strong objections from mere disagreements. Having devoted my entire professional life to higher education, I found these reports deflating. The institution to which I have dedicated my efforts has apparently failed in what I regard as its central mission.

So, rather than finish a few papers and a book that will not be read by anyone, I decided that I would, in the time I have left, try to address the problem. The problem is serious. More than one large study shows almost half of all college students show no

improvement in their critical thinking (CT) skills by the end of their college education. More than half are afraid to voice their opinion if they believe they are in the presence of someone who disagrees with them. This is as true of students graduating from prestigious universities as it is of students at under-resourced institutions.

I have been teaching CT explicitly for ten years. Until a few years ago I used an online resource called Rationale because it introduced me to argument mapping. It served my purposes well. However, my department chair suggested I look at *ThinkArguments* (formerly known as How We Argue) and I switched to it immediately. ThinkArguments (tA) does everything Rationale does, and much more. It uses Mastery Learning, an incredibly powerful tool. It gives students premises and teaches them how to re-arrange them into valid arguments. It makes provocative claims and requires students to come up with arguments for and against them. My students speak to each other in a more civil way and produce papers with far superior arguments. For these reasons, I have integrated tA, a 10 hour commitment for students, in all my undergraduate classes.

Full disclosure. After hearing of my enthusiasm, TA invited me to join a committee to suggest improvements to their lessons. I happily obliged. More recently, they invited me to author a lesson and I produced Assumptions. You will find it on the TA website offered on a trial basis as an alternative pathway through the course. However, I receive no funding from TA, was not asked by them to write this paper, and have had no correspondence with them about it.

Many of my colleagues want to do a better job teaching CT, but they're not aware of TA. At my suggestion, more than a dozen instructors have taken a serious look at TA, and, to my knowledge, all of them decided to integrate it into their courses. At North Carolina State, TA is now assigned in courses in Anthropology, Biology, Biotechnology, Psychology, Communications, Honors, Life Sciences, Philosophy, Political Science, Sociology, and Science, Technology, and Society.

I hope, one day, that all NC State undergraduates will have tA under their belt by the end of their second year. Here's more detail.

**1. The Problem**

The problem is that universities lack an online course to teach critical thinking across the curriculum. The problem is serious. *Half* of college graduates are not proficient in critical thinking.

The problem stems, in part, from social tensions between increasingly polarized enclaves of citizens. The spreading intolerance of others poses a significant threat to democracies worldwide. While it is the mission of universities to teach critical thinking, promote free speech, and nurture habits of civil discourse, universities are not delivering. Research shows that universities have unacceptably high rates of graduates who are not able to identify an author's main claims, or articulate the reasons authors offer for their views.

The problem *is* serious. Too many graduates lack the skills to know how to decide for themselves whether to believe an argument. For example, (Van Damme and Zahner 2022) report that 49% of college graduates are unable to meet basic standards of critical thought. After administering the Collegiate Learning Assessment (CLA+) tool to more than one hundred thousand graduates worldwide, they sorted each graduate's critical thinking skills into one of 5 levels: Developing, Emerging, Proficient, Accomplished, or Advanced. Among the students tested, 17% of graduates were in Developing, the lowest category. An additional 32% were in Emerging, the second lowest category (Table 5.5. Mastery level, by class, Van Damme and Zahner, 2022). To summarize their findings, they wrote that "… with half of exiting students performing at the two lowest levels, only half of college students place in the top three levels…"

Faculty and administrators recognize the problem. While increasing numbers of graduates have the technical skills required for entry level jobs, they do not have the insight or creativity that leads to mature cultural sensibilities and a passion for lifelong learning. Yet 99 percent of college faculty agree that critical thinking is an important goal of undergraduate education, and they include those students in STEM and business disciplines in their assessment.[1]

Hiring managers agree. A 2018 Hart Research Associated survey of 500 business executives revealed that 78% identify critical thinking/analytic reasoning as the second most valuable skill an applicant to their organization can possess (Association of American Colleges and Universities 2018). The number one skill is verbal

[1] HERI. (2009). The American College Teacher: National Norms for 2007–2008. Los Angeles: Higher Education Research Institute, University of California.

communication and civil discourse. Hiring managers also reported, surprisingly, that only 34% of college graduates can think critically (Association of American Colleges and Universities 2018; cf. Dumitru and Halpern 2023). The critical thinking deficit has troubling practical implications for employers because it compromises the quality of business decision-making by making it harder to correct for cognitive biases and heuristics (Skrzek-Lubasińska and Malik 2023).

With little evidence that a four-year degree ensures a critical thinker, and with a mandate to prepare the nation's future workforce with the skills required in an increasingly competitive global environment, universities now search for a fix.[2]

For help, one might turn to the Philosophy Department because analyzing arguments is philosophers' stock-in-trade. However, the Philosophy faculty are too few to handle the numbers of students needing assistance, and the number of students enrolling in philosophy—or any of the humanities—is shrinking. Meanwhile, the size of the problem grows larger and more concerning, because lack of access to critical thinking instruction disproportionately affects students from under-represented groups. There are many reasons–and not only those related to diversity, equity, and inclusion–that faculty and administrators university-wide search for a solution.

## 2. The Solution

The solution is not another course designed for traditional Philosophy or Logic classes. The solution must be online, interactive, research-based, and massively scalable. It must be capable of being taught by instructors not trained as professional philosophers. It must be useful for students lacking instructors.

That solution is *ThinkARGUMENTS*. *ThinkARGUMENTS* is not a traditional course based on a textbook. Fully online, it saves students the costs of a printed volume. Based on decades of pedagogical research, *tA* consists of dozens of lessons and a data bank of thousands of exercises. The lessons and quizzes, presented in step-wise fashion, systematically produce the skills necessary for critical thinking. Another virtue of being online? tA is scalable, usable by instructors across the university. It has already been integrated into the required curricula of disciplines as varied as Biotechnology; History; Science, Technology and Society; Religious Studies, Languages and Literatures; as well as Philosophy. However, because tA assumes no philosophical

[2] van Gelder, T. (2015). Using argument mapping to improve critical thinking skills. In *The Palgrave handbook of critical thinking in higher education* (pp. 183-192). Palgrave Macmillan, New York.

knowledge or background, it meets the universities' need for a tool that can be picked up by students in any field.

While an exact definition for critical thinking is contested, almost all discussions recognize five cognitive skills as essential:

A. Ability to identify the contention of a speaker or text;
B. Capacity to discover a valid argument for the contention;
C. Skill in articulating objections to the argument;
D. Ability to offer rebuttals to the objections; and
E. Ability to decide for oneself whether the argument is sound.

Research shows that acquiring these skills takes practice, the ability to diagram a text's logic, the capacity to identify an author's hidden premises, and the know-how to link objections to their rebuttals. *ThinkARGUMENTS* teaches these skills using four innovative techniques. The pedagogical method called *Mastery Learning* provides the practice. *Argument Mapping* provides the visual diagramming needed to display logical relations. *Deduction Junction* provides the method to find hidden premises. And the *10 Box Model* provides the template students need to be confident they can evaluate complex arguments they have not yet encountered. We now describe these techniques.

## 3. Research Based Methods

### *Argument Mapping*

*ThinkARGUMENTS* teaches argument mapping, a procedure that visually represents the connections between claims and premises that support them. Research shows that argument mapping dramatically impacts students' cognitive skills, leading to large and generalized improvements in analytical reasoning.[3,4] Argument mapping has also been shown to improve student writing[5] and decrease political polarization in classrooms.[6]

[3] Cullen, S., Fan, J., et al. (2018). Improving analytical reasoning and argument understanding: a quasi-experimental field study of argument visualization. *Science of Learning*, *3*(1), 1-6.
[4] See Hidalgo, J. "*How to Reason Better: An Evidence-Based Guide to Learning Critical Thinking*" Prospectus, as submitted to Routledge Press.
[5] Harrell, M., & Wetzel, D. (2015). Using argument diagramming to teach critical thinking in a first-year writing course. In *The Palgrave handbook of critical thinking in higher education* (pp. 213-232). Palgrave Macmillan, New York.
[6] Cullen, S., & Sharma, V. Short report on initial political polarization/argument visualization study.

For example, Van Gelder (2015) finds that students who receive high intensity instruction in argument mapping improve their critical thinking skills by 85%. Harrell finds the technique especially effective with low-achieving students (Harrell 2011).

Additional studies lend credence to the claim.

- Thomason et al. find a 0.75 standard deviation effect per semester when argument mapping is used to teach critical thinking.
- Cullen and Sharma find that argument mapping substantially decreases cognitive burden associated with argument comprehension and reduces susceptibility to confirmation bias.(Cullen and Sharma, n.d.)
- Cullen (Cullen et al. 2018) concludes that students using argument mapping showed substantial improvement on LSAT Logical Reasoning test forms ($d = .71$, $p < .001$) and "large differences in favor of seminar students ($d = 0.87$, $p = .005$)" on their final essays. "Seminar students understood the arguments better, and their essays were more accurate and effectively structured."
- van der Brugge finds that the improvements "transfer to situations in which one is not mapping," the conclusion of multi-year projects at Melbourne and Princeton.
- Fan et al. find that "the argumentative essays produced by the students in the argument map writing group were superior to those written by students in the other two.
- Improved reasoning skills in scientific (Murungi and Hirschheim 2022) and mathematical (Indrawatiningsih et al. 2020) domains
- Student essays show improvement (Cullen et al. 2018; Robillos 2021)
- More civil discourse about controversial moral issues (Kaeppel 2021)
- Student retention of course content improves (Eftekhari and Sotoudehnama 2018)

These results provide faculty and administrators with a way forward. Upper secondary school and undergraduate students must read, analyze, and generate original arguments about course texts in the form of class discussions and essays. The problem is that few students receive explicit instruction in argument evaluation and construction. Argument mapping supplies the tools and shared language students need to produce precise written assignments and nuanced classroom discussions.

Why is argument mapping so effective? When students “map” an argument, they have to make several decisions about how to represent the logical connections between the claims an author makes and the author’s ultimate conclusion. They must organize the

argument's claims into an accurate hierarchical structure. One way of describing this is to say that students need to develop a sort of "x-ray vision," such that they can "see through" the prose to the underlying structure of an argument, a structure which is best represented visually.

(Dwyer, Hogan, and Stewart 2012; 2014) offer three hypotheses for why argument mapping works. First, it draws on domain-general and intuitive Gestalt-like reasoning processes. Second, it activates the visual modality, allowing more cognitive resources to be devoted to parsing logical relationships. Third, the hierarchical picture portrayed in a map facilitates memorializing argument structures.

In addition to argument mapping, *ThinkARGUMENTS* employs two innovations intended to meet beginning students where they are. We now turn to the first one.

### *Mastery Learning*

Mastery Learning is a thoroughly-researched pedagogy that ensures students learn at their own pace as they work through hundreds of practice exercises to develop their skills. It is a style of teaching committed to the idea that students will learn reasoning skills best if they are allowed to proceed at their own pace, have mistakes corrected immediately after they are made, and have clear standards about when they have mastered a skill. In Mastery Learning, students go at their own pace and have practice exercises designed to help them acquire well-defined cognitive skills in a step-by-step fashion. Their answers to the practice exercises give them immediate, targeted feedback about their mistakes. The practice exercises function both as diagnostic tools and as formative tests of progress. In Mastery Learning, students also receive continuous motivational support from encouraging, upbeat video lectures.

With Mastery Learning, almost all English-reading students, no matter the amount of background knowledge, will be able to master the 5 skills we teach. To help them do that, we've built in (literally) thousands of practice exercises for them to use. The video lectures remind them, over and over, that the only way they can master new skills is by practicing. They wouldn't expect to be a great basketball player, or a concert pianist, we say, without any practice. Same goes for argumentation skills.

### *Systematic Empathy*

To understand an opponent's view, students must control their emotions. We teach them to do this by forcing them to slow down, to create a valid argument for their opponent's view, and not to discuss the truth of their opponent's premises until they have first created a plausible argue for the other side. This strategy empowers the student to step back from their intuitive opposition to other views, to shift their perspective on an issue, and to redraft the way they understand views that conflict with their own.

What comes after ThinkARGUMENTS? In How We Evaluate, we teach two additional techniques.

***Discover Deduction***

Discover Deduction is a pedagogical method that teaches students to construct valid deductive arguments when given conclusions and reasons. This is not an easy skill to learn but it can be taught. Once learned, the ability to form deductive arguments brings confidence that one can create solid arguments by spotting suppressed claims. It is often accompanied by a more charitable attitude towards one's interlocutors, too. For students who know what is going on beneath the surface of an argument tend to be more understanding with those struggling to figure out how the argument goes.

Why teach students to create valid deductive arguments? This step strikes some Logic instructors as counterintuitive. Most arguments "in the wild," it seems, are not deductive; they seem to be inductive. Why encourage students to look for deduction where it typically is not found? Shouldn't we instead teach students to look for induction since that is the form most arguments assume?

It's true that, outside the Logic classroom, arguments almost always proceed inferentially, using a loose, probabilistic strategy. This fact suggests that students should be taught their way around induction. But teaching students to create tight, valid arguments helps them look beneath an argument's surface by giving them a method for finding enthymemes. Two benefits are apparent. First, when students know how to compose valid arguments for a conclusion, they are better positioned to spot weaknesses in arguments offered for that conclusion. Second, after students come to understand how deductive arguments work, they can understand the more arcane operations of inductive arguments.

Discovering Deduction is hard work. Whether in oral discussion or in written papers, even philosophy majors fail to exhibit the skill. The reason is not because they have not

learned basic rules of informal logic, nor because they have not been exposed to examples of valid and invalid arguments. The reason is that they have not been taught a method by which to figure out an argument's hidden premise. I have seen the method work in my students. After I began teaching Discover Deduction, I realized that almost all of my students, including those from under-resourced backgrounds, were able to create valid arguments when given a conclusion and a premise.

What is going on here? David Austin's remarks are illuminating.

> When arguments are given, deductive arguments with missing premises or missing qualifications seem relatively common. Maybe most arguments in the wild look inductive because they contain a premise of the form "Fs are Gs" with a missing quantifier; "All Fs are Gs" is false; and it takes work to find a plausible restriction - "All F's that are H's are Gs" - so the fall-back is "Almost all Fs (that I care about, or that tend to show up in news stories or protest marches or ...) are Gs," which suggests that inductive reasoning is intended. It's also not unusual for some one or more premises in a deductive argument to be given inductive support (when any argument is offered). Inductive reasoning may also show up as a way of avoiding the work that a deductive argument would require:
>
> > "P, Q, R. Therefore, S"
>
> But S doesn't follow from P, Q and R and all of P, Q and R are false.
>
> "Me and my people are good people and we are convinced that S is true. My people are just about always correct. So, it is practically certain that S is true. So we don't need to argue for S. And you're probably not a good person if you doubt S" (D. Austin, personal correspondence, 21 June 2021, quoted with permission).

The sciences have their methods, and science instructors teach them in introductory science courses. Critical thinking has a method, too, and it should be available to all students.

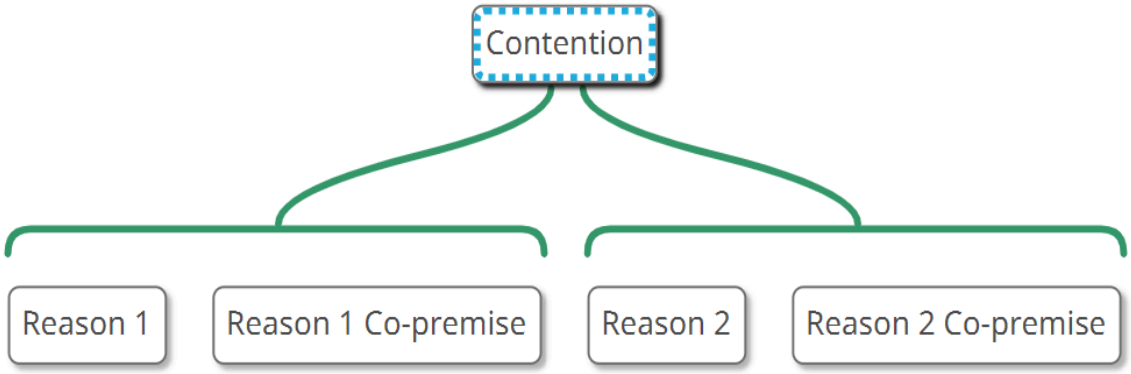
We have described three of our four techniques. The last strategy gives students a template with which to approach new arguments, intending to build their confidence that they can evaluate newly assigned essays on their own.

**The 10 Box Model**

tA teaches students that almost every argument shares certain core elements: a claim, at least two reasons for it, and rebuttals to objections raised against those reasons. The 10 Box Model captures this structure and emboldens students to approach new arguments confident that they can figure out its structure. Using the 10 Box Model and following our guidelines, students successfully produce visualizations of arguments they have not previously encountered. Here is the Model.

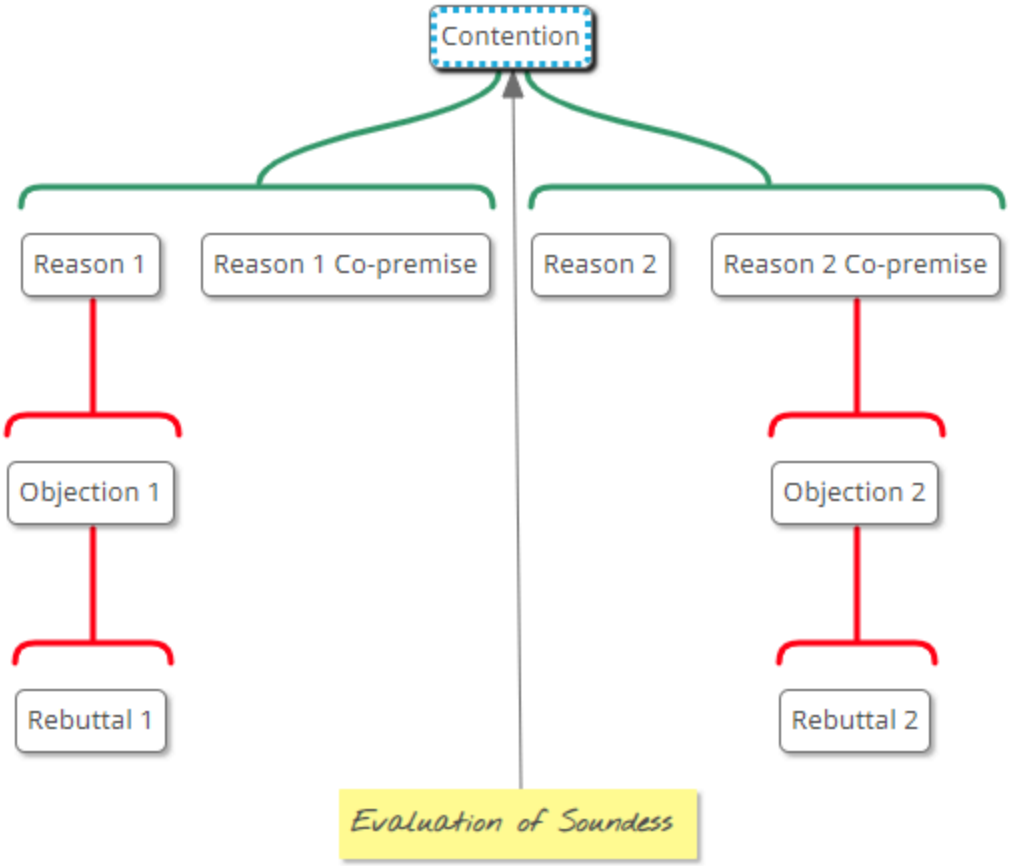
A. Identify the argument's contention.

B. Produce two valid deductive arguments for the essay's contention. Ensure that your premises are true to the author's intention, complete and grammatically correct single sentences, and as simply and as generally stated as possible. Place the two arguments in a map with the following structure.




C. Raise one objection against Reason #1 and place it below Reason #1. Raise one objection against Reason #2 Co-premise and place it below Reason #2 Co-premise. The objections can come from the essay, from an opposing essay, or from your own reflections. Again, use only one sentence per box. State the objection in as simple language as possible.

D. Respond to Objection #1 with Rebuttal #1, and respond to Objection #2 with Rebuttal #2, as shown on the next page.




**The 10 Box Model**

E. Finally, evaluate the argument for soundness. A sound argument is a valid argument in which all of the premises are true.

With this model in mind, students have an organizational structure they can apply to almost any argument. By giving them a mental picture of the elements they should look for, they not only are more successful in diagramming arguments. They are also more self-assured in their understanding and, consequently, more disposed to be charitable in discussing opponents' objections.

By the time students finish *ESSAYS*, they will have mapped and evaluated the arguments of 9 essays arguing both sides of four of society's most controversial questions: *abortion*, *whether God exists*, *animal rights*, and *physician assisted suicide*. In this way, *ThinkARGUMENTS* not only teaches critical thinking, it teaches critical thinking about some of the questions that most divide us. The target essays are:

1. Judith Jarvis Thomson, “A Defense of Abortion”
2. Don Marquis, “An Argument that Abortion is Wrong”
3. Tom Regan, “The Moral Basis of Vegetarianism”
4. Carl Cohen, “The Case for the Use of Animals in Biomedical Research”
5. Goetz and Taliaferro, “An Argument for Theism from Free Will”
6. Andrew Melnyk, “Why the Argument for Theism from Free Will Fails”
7. G. See, “An Argument for Physician Assisted Suicide”
8. G. See, “An Argument against Physician Assisted Suicide”
9. G. See, “Gamer Monkeys”

If you’re interested in learning more, please reach out to me (gcomstock@ncsu.edu). I’d love to hear from you.

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