Why I Evangelize for thinkARGUMENTS Gary Comstock¹

Abstract

I describe, and advocate for, an online critical thinking and civil discourse class, thinkARGUMENTS. Using Argument Mapping and Mastery Learning pedagogy, the \$25 course teaches students the cognitive skills essential to critical thinking and civil discourse. I explain why I require the course of all my undergraduate students.

Bullet points

- Critical thinking and civil discourse are the two skills most valued by hiring managers.
- 49% of all college graduates are not proficient in critical thinking.
- thinkARGUMENTS is an effective, low-cost way to teach critical thinking.

Critical thinking among NC State Honors students: Percentage change from beginning to end of first year		
No intervention		-2%
Intervention 1	thinkARGUMENTS	+6%
Intervention 2	thinkARGUMENTS + one face-to-face course	+16%

• These are significant effects in an area in which it is hard to move the needle.

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¹ I receive no funding from the course's nonprofit sponsor, thinkerANALYTIX, was not asked by them to write this paper, and have had no correspondence with them about it.

Introduction

After 40 years teaching in land-grant universities, I plan to retire in the next few years. In my remaining time, I want to try to help address the central problem in university education. Almost half of all college students show no improvement in their critical thinking (CT) skills by the end of their college education (I supply references below). 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 15 years. Until a few years ago I used an online resource called Rationale. Rationale introduced me to argument mapping and served my purposes well. However, once my department chair put me on to thinkARGUMENTS (formerly known as How We Argue) 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.

Many of my colleagues want to do a better job teaching CT, but they're not aware of tA. In the few months that I've been reaching out to NC State colleagues, five have already adopted tA. They come from across the campus: Biology, Biotechnology, Science, Technology, and Society. No instructor who has taken a serious look at tA has not adopted it.

I'd like, eventually, to see all students here at NC State 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.²

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 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

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² HERI. (2009). The American College Teacher: National Norms for 2007–2008. Los Angeles: Higher Education Research Institute, University of California.

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.³

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 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:

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³ 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.

- 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.^{4.5} Argument mapping has also been shown to improve student writing⁶ and decrease political polarization in classrooms.⁷ 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.

⁴ 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.

⁵ See Hidalgo, J. "How to Reason Better: An Evidence-Based Guide to Learning Critical Thinking" Prospectus, as submitted to Routledge Press.

⁶ 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.

⁷ Cullen, S., & Sharma, V. Short report on initial political polarization/argument visualization study.

- 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.

Deduction Junction

Deduction Junction enables students to reveal the structures of argumentative texts by identifying missing premises, a very difficult skill to learn. Once learned, however, Deduction Junction not only brings confidence that one can spot suppressed claims. It also brings a more charitable, as well as more critical, attitude towards one's interlocutors. Deduction Junction shows students how to create two simple, valid, deductive arguments for each contention they identify. This step strikes some Logic instructors as counterintuitive. Most arguments "in the wild," it seems, are not deductive; they seem to be inductive. Why force students to find deductive arguments where they are not to be found? Why not teach a skill like "Mirror Induction," in which a student learns to reflect the way an argument is actually presented?

It seems to be the case that argumentative essays typically argue inferentially, using a loose, probabilistic strategy. Nonetheless, requiring students to create tight, valid, deductive arguments helps them look beneath an argument's surface by giving them a method for finding enthymemes. The benefits are straightforward. First, once a student knows how to compose a valid argument for someone's claim, they can more easily spot the weaknesses in that person's argument. Second, after a student comes to understand how deductive arguments work, they can understand the more arcane operations of inductive arguments.

Discovering Deduction is hard work, but it is a skill that can be taught. Before I, Comstock, developed Deduction Junction, I struggled to get my students to articulate even one valid deductive argument. Whether in oral discussion or in written papers, even philosophy majors could not exhibit the skill. The reason was not because they had not learned basic rules of informal logic, nor because they had not been exposed to examples of valid and invalid arguments. They had. They had not been exposed to a method by which they could figure out which premises were explicit and which premises were hidden. The situation changed after I started teaching this method. Now, it is the rare student who cannot articulate at least two valid arguments for the contention of the argumentative essays I assign them.

What is going on here? Professor 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.

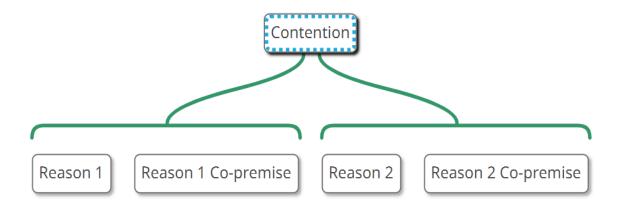
We have described three of our four techniques. The last strategy gives students a template with which to approach new arguments, intending to build their confidence that they can evaluate newly assigned essays on their own.

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.

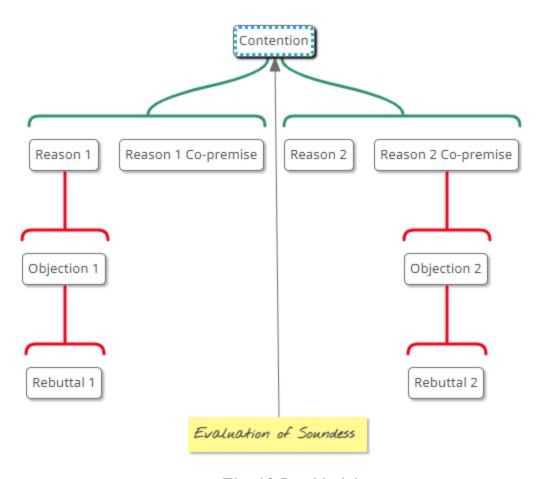
A. Identify the argument's contention.

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 *ThinkARGUMENTS*, 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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