

## Critical Thinking: Teaching and Assessing an Elusive Educational Outcome

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Critical thinking has long been considered an important educational objective. The Association of American Colleges and Universities (AAC&U) identifies critical thinking as an essential learning outcome. The University of Wisconsin System includes critical thinking as a shared learning goal for baccalaureate students. Our home institution, the University of Wisconsin-Stevens Point, highlights critical thinking as an aim of its General Education Program. We have no doubt that a similar commitment to critical thinking can be found at virtually all institutions of higher learning.

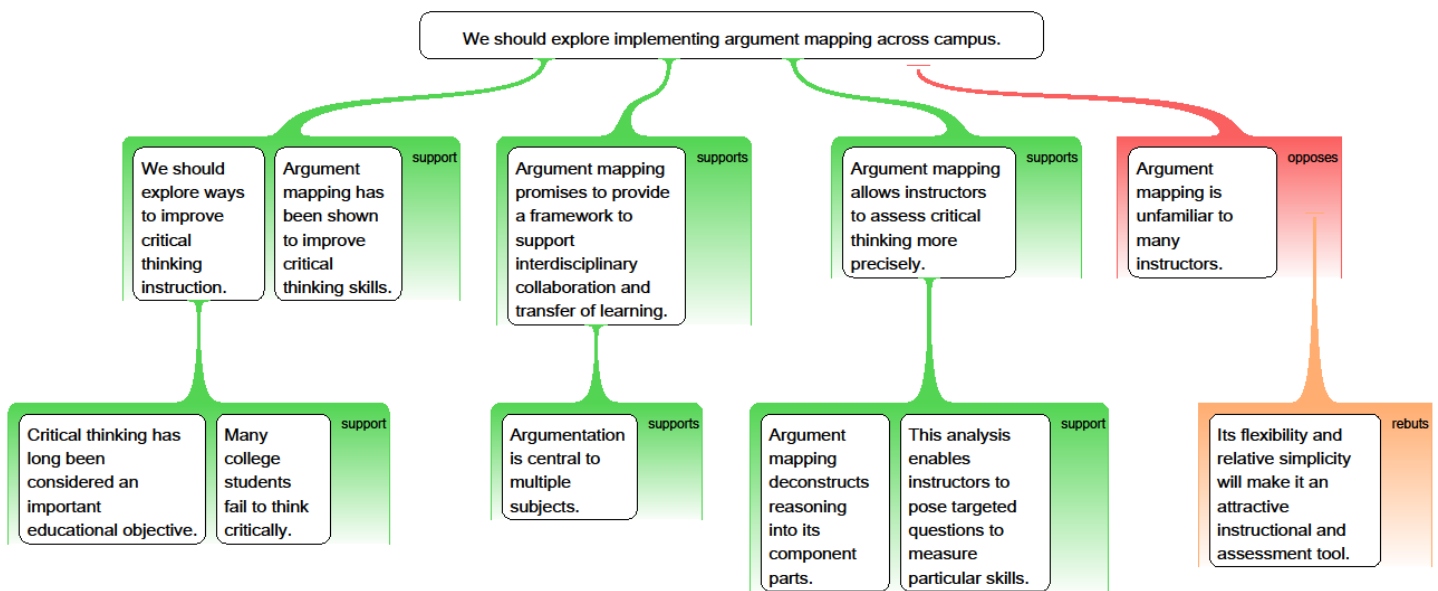
The intention to promote critical thinking notwithstanding, there is evidence to indicate that many college students fail to think critically. Arum and Roksa (2011) have famously argued that students do not make significant gains in critical thinking skills over the course of their college careers. Larson et al. (2004) note that students have difficulty correctly identifying the main conclusion and supporting reasons when presented with an argument. Davies (2008) has observed that even graduate students experience difficulty constructing arguments, a difficulty that he traces to a weak understanding of inferences. Anecdotally, many of our colleagues, both at our own institution and elsewhere, note that students are less interested in exploring multiple viewpoints than in having the “right answer” and, perhaps because of this, tend to read for information without attending to the reasoning.

Motivated by the difficulty of achieving key critical thinking learning outcomes, and with the support of the University of Wisconsin’s Office of Professional and Instructional Development, an interdisciplinary team of instructors at the University of Wisconsin-Stevens Point convened in the Summer of 2015 to explore the potential of argument mapping as a unifying framework for critical thinking instruction and assessment across campus. We selected argument mapping for multiple reasons. Mapping has been used successfully in our critical thinking course and there is a body of literature supporting its effectiveness (e.g. Carrington, M., et al., 2011; Harrell, 2012; van Gelder et al., 2004). Given the centrality of argumentation to multiple subjects, argument mapping promises to provide a framework to support interdisciplinary collaboration and transfer of learning. Finally, and most relevant to the present discussion, argument mapping allows instructors to assess critical thinking more precisely because it deconstructs reasoning into its components parts and because this analysis enables instructors to pose targeted questions to measure particular skills. Although argument mapping is unfamiliar to many instructors, we are confident that its flexibility and relative simplicity will make it an attractive instructional and assessment tool.

In the following section, we introduce the concept of argument mapping. We then turn to the role of argument mapping in assessment, and we conclude with our next steps.

### Argument Mapping

The previous section contained an argument in standard prose, the only format in which most of our students have ever encountered reasoning. Mapped, the argument might look like this:



(This map was constructed with Rationale, <https://www.rationaleonline.com/> , but no software is necessary to generate critical thinking gains (Harrell, 2008).)

Advantages of a graphical representation of reasoning are apparent. The map, unlike the narrative passage, clearly discloses the overall structure of the argument. We can see three independent lines of reasoning in support of the conclusion, followed by an objection and a rebuttal. The map, unlike the narrative passage, plainly identifies the claims that compose the argument and visibly represents the relationship between the claims. We can discern, for example, that “Critical thinking has long been considered an important educational objective” connects to “Many college students fail to think critically,” to support “We should explore ways to improve critical thinking instruction.”

An appreciation of the roles played by the ideas and the connections between these ideas can, in turn, direct the reader to pose relevant critical thinking questions. Turning our attention to the second line of reasoning, for instance, we see that “Argumentation is central to multiple subjects,” is taken as an assumption unsupported by additional claims in the argument. We can, therefore, properly ask if this assertion is true and, if it isn’t, we can reject it outright. In contrast, “Argument mapping promises to provide a framework to support interdisciplinary collaboration and transfer of learning,” is not being taken for granted but is, instead, presented as supported by the assertion that argumentation is central to multiple subjects. Consequently, if we wish to reject the value of argument mapping as a platform for collaboration and transfer of learning, we must turn our attention to the reasoning in support of this claim by denying the assumption from which it allegedly follows or by questioning the strength of the inference between the assumption and the claim under consideration.

Finally, by clearly displaying roles played by each component of the argument, an argument map can help us determine the overall effect of an objection. In this case, for example, rejecting the claim that argumentation is central to multiple subjects would be sufficient to undermine the second line of reasoning, but it would not be enough to defeat the argument as a whole because two other lines remain to support the conclusion.

## Critical Thinking Assessment

Because argument mapping reinforces the importance of detecting the roles played by each idea in an argument and encourages the development of specific evaluative strategies, we have used it to identify a core set of measurable critical thinking abilities that span multiple disciplines, including:

1. identifying the main conclusion of an argument regardless of its position within a narrative passage;
2. determining whether an idea is being given as a reason to believe the conclusion or, instead, serves a primarily rhetorical purpose;
3. identifying the relationship between ideas in an argument (e.g. whether one idea is being given as a reason to believe the other or whether they both work together to support a third idea);
4. distinguishing between different lines of reasoning in an argument;
5. evaluating assertions that are being taken for granted by an argument;
6. weighing the strength of the reasoning (or inferential connections) in an argument;
7. formulating conclusions of one's own;
8. mapping an argument for one's conclusion; and
9. communicating one's argument in a way that would make it easy for others to follow.

The work on our campus to date has focused primarily upon deepening our capacity to use argument mapping across the curriculum, but preliminary assessment measures are enlightening. In particular, a pretest administered in our required introductory communication class demonstrated that students find it much more difficult to identify conclusions positioned at the beginning of a passage (with only 49.62% of 651 students able to do so) than they do conclusions positioned at the end of a passage (with 81.79% of 648 students able to do so). Not only does this echo the findings reported in the literature (Larson et al., 2004) but it reinforces our suspicion that, lacking any well-defined way to conceptualize argument structure, students fall back upon narrative order. We hope that instruction in argument mapping will remediate this difficulty.

Instructors who have participated in argument mapping workshops during the 2016-2017 academic year report that the introduction of argument mapping has resulted in improved embedded assessment measures. The use of argument mapping in an animal physiology class helped students to eliminate circular reasoning. In a library resources course, argument mapping was effectively employed to help students locate reliable sources. Instructors in a variety of disciplines mapped arguments for students to facilitate the comprehension of course material and required students to map their arguments – sometimes with the aid of a template – before writing presentations or term papers.

## Next Steps

Our work over the past two years has reinforced our conviction that students need intentional critical thinking instruction, that argument mapping provides a framework to identify a cross-disciplinary set of critical thinking strategies, that the use of argument mapping serves as a flexible platform for the development of effective instructional methods, that the conceptual clarity provided by argument mapping enables instructors to

construct useful assessment tools, and that the ability to target specific critical thinking skills in multiple courses will enable us to meaningfully aggregate these assessment results across the curriculum.

The upcoming academic year will see an increased focus upon argument mapping on campus, with continued opportunities for professional development and, now that we have a group of faculty familiar with the method, the intentional development of instructional and assessment tools for use in multiple disciplines and at a variety of developmental levels. Readers who would like to explore the use of argument mapping at their institution, and perhaps work with us as we create and implement materials, are encouraged to contact the authors by emailing Dona Warren at [dwarren@uwsp.edu](mailto:dwarren@uwsp.edu).

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