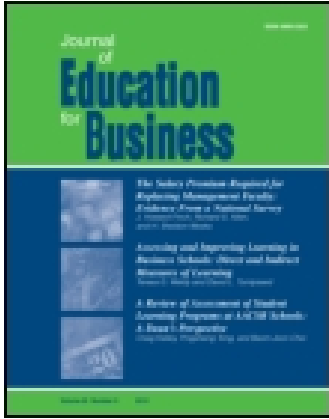


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David W. Kunsch<sup>a</sup>, Karin Schnarr<sup>b</sup> & Russell van Tyle<sup>a</sup>

<sup>a</sup> St. John Fisher College, Rochester, New York, USA

<sup>b</sup> Wilfrid Laurier University, Waterloo, Ontario, Canada

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# The Use of Argument Mapping to Enhance Critical Thinking Skills in Business Education

David W. Kunsch

*St. John Fisher College, Rochester, New York, USA*

Karin Schnarr

*Wilfrid Laurier University, Waterloo, Ontario, Canada*

Russell van Tyle

*St. John Fisher College, Rochester, New York, USA*

Complex business problems require enhanced critical thinking skills. In a dedicated, in-person critical thinking class, argument mapping techniques were used in conjunction with business and nonbusiness case studies to build the critical thinking skills of a group of master of business administration students. Results demonstrated that the critical thinking ability of the student sample improved significantly. The use of argument mapping techniques may be a useful tool to assist practitioners in business settings with complex decision making.

**Keywords:** argument mapping, critical thinking, decision making, MBA

Across all academic disciplines, the ability to engage in critical thinking has been recognized as a required result of a postsecondary education (Behar-Horenstein & Niu, 2011; Morlino, 2012; van Gelder, 2005). Higher education has accepted this imperative and has responded by integrating critical thinking training into existing coursework, often in subtle ways (Blue, Taylor, & Yarrison-Rice, 2008; Celly, 2007; Crenshaw, Hale, & Harper, 2011; Weast, 1996). In business education, the need for and appreciation of critical thinking skills has been acknowledged; however, they have been found to be lacking (Anderson & Reid, 2013; Jance & Morgan, 2013; Pithers & Soden, 2007). This gap in learning has direct implications for business practice in the real world (Halpern, 1998), given that critical thinking provides a framework that can be used by business practitioners to approach challenging problems.

Many of the important questions that will face a manager in the current business environment will not be questions solvable with a rote answer. Business practitioners

will increasingly encounter problems that are sometimes referred to as messy problems (Carrithers, Ling, & Bean, 2008). Messy problems are those that are complex and often include regulatory, community, moral, and financial aspects. They involve no set answer, can cover any topic and require critical thinking skills to formulate potential solutions. In addition, business decisions are being made in an environment where more and more data are available; however, its quality must be assessed, and often very quickly. Increasingly, business managers and executives will need to employ critical thinking skills to be able to analyze and evaluate copious amounts of data to make successful decisions (Behar-Horenstein & Niu, 2011; Halpern, 1998).

While business schools have approached the teaching of critical thinking skills in a number of ways, there is limited research looking at the efficacy of specific techniques. This paper aims to help address that gap by examining whether improvements in critical thinking can be driven through the practice of argument mapping. To do so, we respond to the call for business scholars to employ a pretest and posttest experimental design (Bycio & Allen, 2009). Changes in the critical thinking skills of master of business administration (MBA) students were measured at the beginning and end of a course in critical thinking delivered in a business context

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Correspondence should be addressed to David W. Kunsch, St. John Fisher College, School of Business, 3690 East Avenue, Rochester, NY 14618, USA. E-mail: dkunsch@sjfc.edu

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at a North American business school. The course used argument mapping as the primary methodology to teach critical thinking skills.

We first define critical thinking and place critical thinking skills development in the context of the business education literature. We then lay out the pedagogy behind this study, followed by a detailed description of the method employed. Results are then presented and we conclude by discussing how this study may strengthen current business education and business practices, while noting the limitation of this work.

### Critical Thinking

There are a breadth of definitions of critical thinking, including the simple definition of the perfection of thought (Lai, 2011) as well as the cerebral concept of learning to learn (Pithers & Soden, 2007) and the very practical of the ability to “establish clear and logical connections between beginning premises, relevant facts, and warranted conclusions” (French & Tracey, 2010, p. 2). For the purposes of this study, we use the definition of critical thinking put forward by Facione (2013) who considered it to be “purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, methodological, criteriological, or conceptual considerations upon which that judgment is based” (p. 2). This definition was used because it is closely aligned with the elements measured by Insight’s (2013) Business Critical Thinking Skills Test (BCTST). The BCTST is used in this study to test for changes in the critical thinking skills in the sample.

### Pedagogical Approaches to Critical Thinking in Business Education

While critical thinking has long been a focus of philosophy educations (Lai, 2011), it is increasingly being incorporated into other academic disciplines including business (Anderson & Reid, 2013; Jance & Morgan, 2013; Morlino, 2012; Pithers & Soden, 2007). Using Ennis’s (1989) typology, there are four mechanisms through which this has been accomplished. The general approach consists of a class dedicated specifically to critical thinking. In the infusion approach, students are knowingly taught critical thinking within an existing subject. The immersion approach mirrors the infusion approach by embedding critical thinking teaching into an existing subject; however, students are not made aware that they are being taught to think critically. Finally, in the mixed approach, critical thinking is taught in a general course and students are then asked to apply it to their specific subject areas (Behar-Horenstein & Niu, 2011; Crenshaw et al., 2011), while the most common approaches for including critical thinking in business education are the immersion approach (Anderson & Reid, 2013; Carlson,

2013; Carrington, Chen, Davies, Kaur, & Neville, 2011; McBride, Hannon, & Burns, 2005) and the infusion approach (Brumagim & Cann, 2012; Carrithers et al., 2008; Celly, 2007; Morlino, 2012). The mixed approach has also been used (Reid & Anderson, 2012).

## METHOD

This study follows the mixed approach to critical thinking development in business education as used by Reid and Anderson (2012). While a specific business subject outside of critical thinking was not taught (i.e., strategy, marketing, or operations), most of the examples, assignments, cases, and argument maps were related to business contexts. A semester-long, stand-alone course in critical thinking was created where the case analysis and examples used were all related to business. To teach and develop critical thinking skills, computer-assisted mapping was used, as it has been shown to be effective (Carrington et al., 2011).

### Computer-Assisted Argument Mapping

This study used computer-assisted argument mapping (also sometimes termed *scaffolding*) as the students’ primary expression of critical thinking throughout the course. As noted by Davies (2011),

Argument mapping is concerned with explicating the inferential structure of arguments. Whereas images and topics are the main feature of associative connections in mind maps, and concepts are the main relationships in concept maps, inferences between whole propositions are the key feature of argument maps. (p. 286)

Research has demonstrated that argument mapping has been shown to help drive significant improvements in critical thinking by students (Carrington et al., 2011; Dwyer, Hogan, & Stewart, 2012, 2013; Harrell, 2011; Renton & Macintosh, 2007; van Gelder, 2005). Argument mapping taps into visual learning, a method that assists many students in comprehending advanced topics.

Computer-assisted argument mapping uses software that allows any argument to be graphically represented, edited, and viewed by the student and their peers. Students are able to construct an argument by dragging and dropping icons that represent specific argument characteristics (i.e., premise, pro, con, or rebuttal) and write in their comments as to what the argument characteristic is describing. There are additional icons that help describe the argument such as notes, the sources of data, and strength of the sources of data.

There are a number of argument mapping software programs available (Butchart et al., 2009; Davies, 2009); however, the two tools that were used for mapping in this study

were bCisive and Rationale, both produced by Austhink (Amsterdam, The Netherlands). Rationale was a good software tool for demonstrating and working with the basics of argument mapping. The students moved to bCisive later in the semester as bCisive was a better tool to analyze business cases and present them in a business context to an audience. This was due to the ability of the bCisive software to conduct more complex analyses, be more compatible with presentation formats such as PowerPoint (Microsoft, Seattle, WA) and be able to convert the argument maps to Word (Microsoft, Seattle, WA) documents.

Figure 1 provides a template from Rationale demonstrating how different parts of an argument can be organized. It illustrates how shapes and colors are used to identify distinctive parts of the argument.

Figure 2 provides an example of the structure for an argument map created for a simple management decision.

Figure 3 provides an example of the structure of a moderately complex management decision derived from a business case. We include this figure to provide a visual example of the overall structure of a more complex argument; the intent of including it is not to be able to read the text of the figure itself. The structure of the argument map is roughly pyramidal, which is consistent with most argument maps; there are many facts, opinions and information sources at the bottom of the map, all building to support or refute inferences and main contentions at the peak.

Course Design

The critical thinking classes were held Tuesday and Thursday nights for 4 hr (6–10 pm) for a period of six weeks in the summer of 2013 in a liberal arts college in the

Northeastern United States. The instructor sought to make the course as experiential as possible. Experiential learning has been found to be effective in developing critical thinking skills in business students (McBride et al., 2005). The first 3 weeks (six classes) focused on everyday issues for analysis, sometimes of the students’ choosing. This was done to ensure that the basics of argument mapping would be applied to topics very familiar to the students. In the last three weeks of the course (six classes), the mapping arguments were applied to open-ended business case studies in order to foster critical thinking skills in management contexts (McEwen, 1994).

Each class commenced with a lecture by the course instructor about a new aspect of critical thinking that lasted approximately 30–45 min. The lecture would consist of basic course housekeeping and a short lesson in critical thinking. While the purpose of the class was largely to develop and practice critical thinking skills, it was recognized that “beyond a certain point, improvement demands acquiring some theory” (van Gelder, 2005, p. 44). Subjects such as fallacies and cognitive bias were discussed. While teaching some of the theory was important, by design this was not a philosophy class; topics such as metacognition and taxonomy were intentionally avoided.

The initial lecture was followed by an hour of in-class mapping practice that allowed for the direct application of the new knowledge. After the in-class mapping practice, there was a discussion of approximately half an hour, which allowed for a discussion and comparison of the maps as well as additional instruction related to that class’ teaching goals. The remaining time was allocated to additional mapping practice to ensure the key lessons were internalized. The repetition of mapping assignments was intentional. It

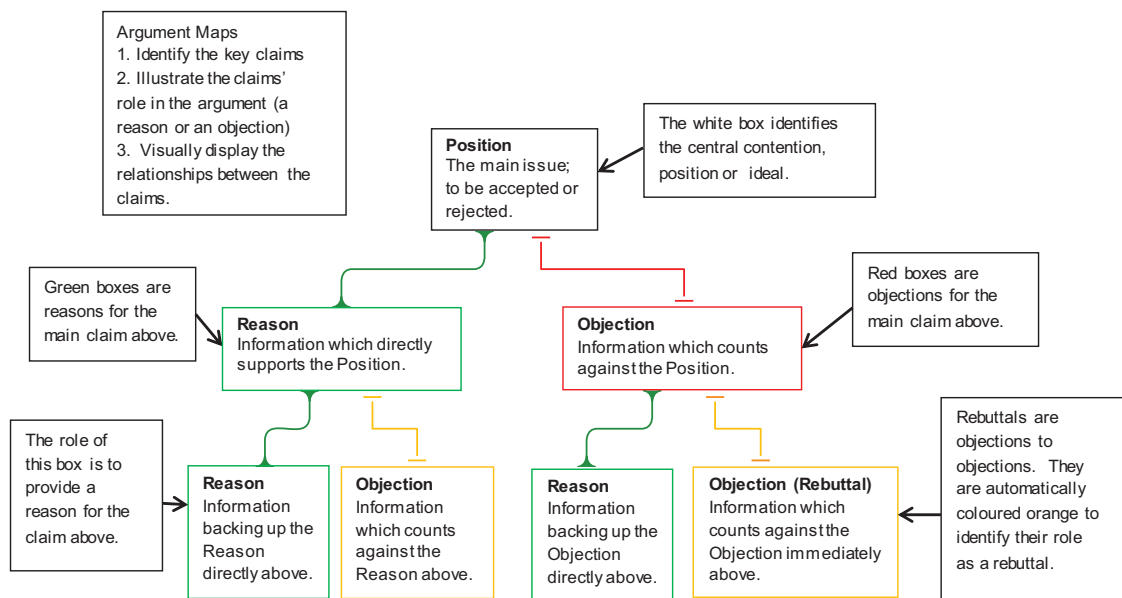


FIGURE 1 Rationale template for argument organization.

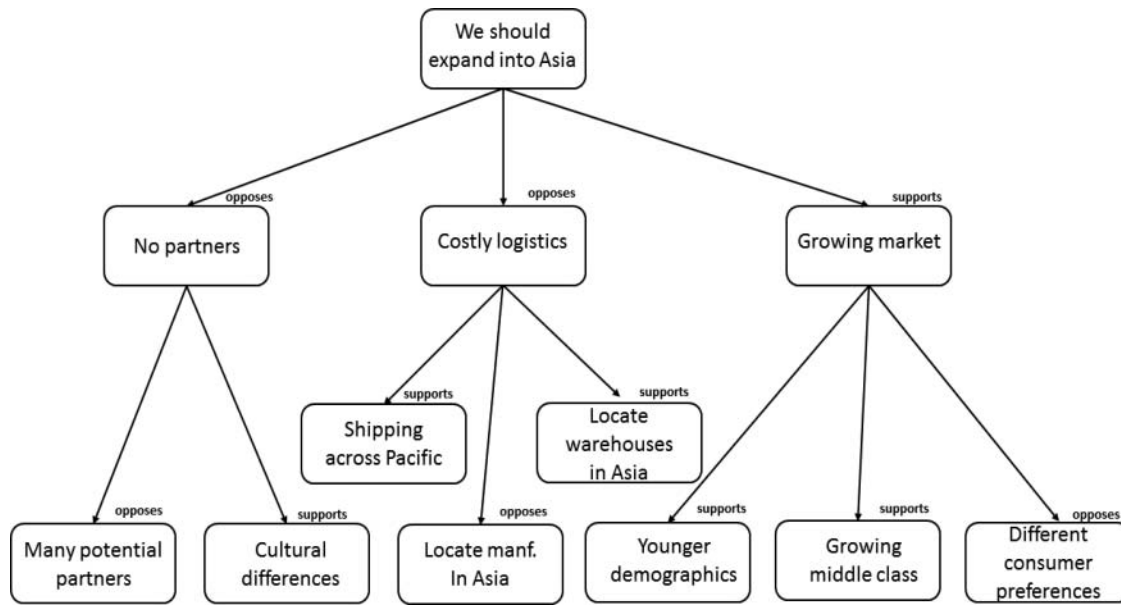


FIGURE 2 Simple argument map for a management decision.

allowed for each stage of the mapping methodology to be completely understood conceptually and in its application before progressing to the next level of complexity (van Gelder, Bissett, & Cumming, 2004). The early mapping exercises were simple and numerous; in the first two sessions there would perhaps be up to 20 mapping exercises (including those that may have been done as homework). The classes took place in a room equipped with computers.

Throughout the mapping exercises, there was face-to-face teaching and mentoring by the instructor.

### Argument Mapping Skills Development

The practice of argument mapping started at a basic level involving simple arguments with two or three supportive or rebutting concepts. This was followed by the instructor

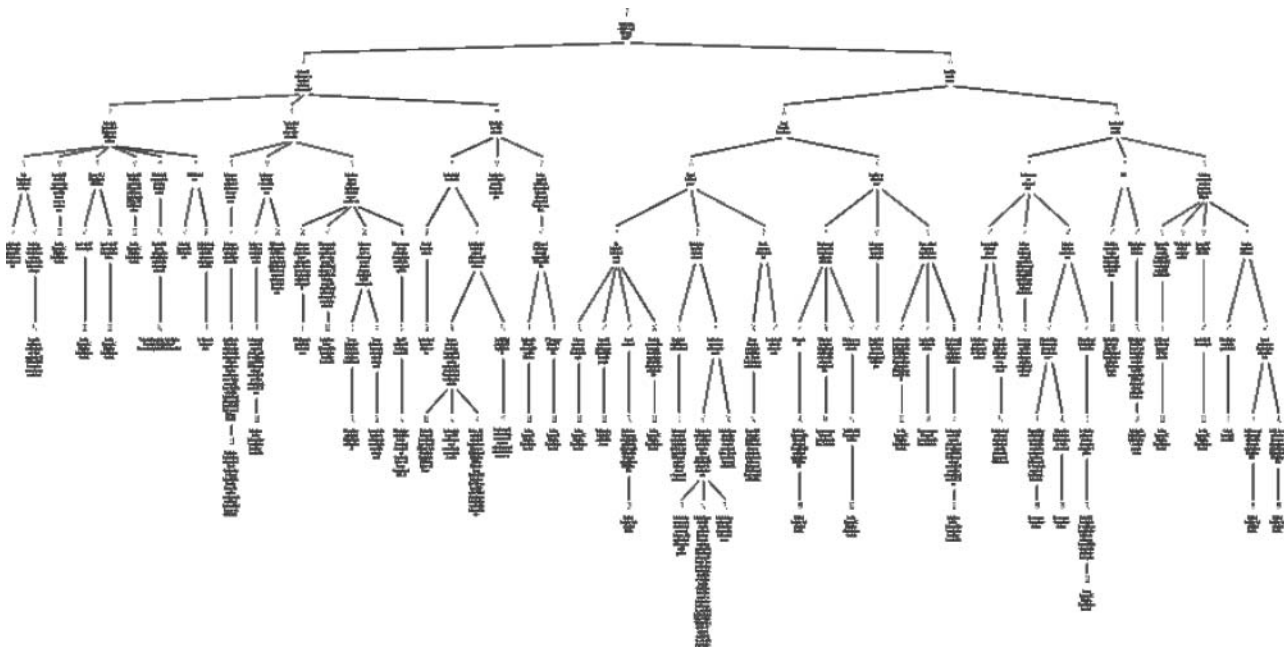


FIGURE 3 Example of the structure of a complex argument map.

asking the class to map out other writers' arguments. As an example, students were asked to take a *Wall Street Journal* editorial and identify the major arguments and map them. As the course progressed, the articles became longer and the arguments that the students were asked to map became more complicated; the main argument were increasingly hidden in the body of the article rather than at the top of the introductory paragraph. These mapping situations covered the first two classes.

Classes 3 and 4 were spent providing the students with more complex arguments to map and teaching them evaluation techniques to determine whether the arguments were strong or weak, substantiated or not. These classes were designed to move students beyond the technical skill of building argument maps and assist them in critically assessing arguments and their supports so that they could determine, based on the merits of the arguments, whether the right answer had been achieved. Students were guided through the complexities of arguments including understanding the basis for the argument, structuring the argument, analyzing the various supports of the argument, and evaluating the veracity of the argument.

In classes 5 and 6, the students were able to pick topics of their own to construct, analyze, and evaluate; students were encouraged to apply reasoning skills to develop their own arguments. The subject matter of the topics the students chose was approved by the instructor based on two criteria: topics had to be broad and deep enough to provide for complexity in the argument itself, and there had to be at least two positions that could be taken on the particular issue. Students were required to do research in order to populate their argument maps (i.e., facts, opinions, and common knowledge) so that an assessment of the strengths of each position could be performed. Topics included the success of the Iraq war, immigration solutions in the United States, the death penalty, and the proper role of government.

The point of these exercises was for the students to choose and in many cases be personally invested in the scenario. As an example, one student had a serious medical condition that had several potential courses of action for which he devised an argument helping to determine the course best suited to him. The majority of students went into the exercise with preconceived notions of the right answer. This exercise forced them to construct an alternative argument from their preconceived one, weigh the two, and decide which one was stronger. This format was used intentionally to force students to practice the skill of critical thinking across disciplines and contexts (Halpern, 1998).

The final set of five classes was spent on business case review, mapping, and decision making. Cases were primarily taken from Ivey Publishing, with two additional cases taken from Harvard Business Publishing. As this was a business course, one of the objects was for the students to make decisions based on business situations where they

needed to collect and analyze data, evaluate arguments on all sides and come up with a solution to the management challenge. Only information from the cases was allowed to be used and it was expected that the students would come up with a decision supported by the logic of critical thinking. While students assigned different weights to decision criteria allowing for the possibility of different conclusions, the expectation remained that the conclusion they reached related to the appropriate management decisions had to be based on a logically solid framework and idea progression (Pithers & Soden, 2007).

There were two cases assigned for each of the last five classes. During this phase of the course, the instructor took more of a facilitator and coaching role to overcome any perception that critical thinking is solely the lecturer's job (Pithers & Soden, 2007). Students were also encouraged to help each other out in any questions they had regarding mapping; this was facilitated in classes nine to eleven where students were placed in groups of two or three to perform the case analysis. Working in groups allows students to explore and question their own skills, develop new perspectives and fill in the gaps of their knowledge (Renig, Horowitz, & Whittenburg, 2011; Webb, Farivar, & Mastergeorge, 2002). This perspective is not without controversy (Bacon, 2011). However, given that the analysis of business problems often occurs through group collaboration in business environments, it was deemed appropriate to have the students become comfortable practicing critical thinking in groups.

To ensure student learning was being conducted accurately, the argument mapping completed on the second case of each class was submitted to the instructor for review. The instructor would evaluate the argument map and provide comments back to the student (or group in later classes) on areas for improvement for subsequent maps. This feedback was considered important (Butchart et al., 2009) as it was deemed to "allow the instructor to provide selective hints or questions that direct student thinking into new areas and provide perspectives for critical thinking that he/she alone might not have pursued" (Biloslovo & Bulut, n.d., p. 9). This approach, although time consuming, also aids in developing the students' metacognitive awareness of their own thinking (Pithers & Soden, 2007). Fully reviewing and commenting on each map took about 30–45 min for the instructor.

The culmination of the critical thinking skills course was in the final assignment. Students were placed into groups of three to map a real-world business situation selected by the students. The business case they chose had to be agreed to by the professor and there clearly had to be an issue that was unresolved by the company. Many of the cases selected by the students pertained to growth options for various publicly listed companies. The students had access to all publicly available information for which to construct their maps, weigh the arguments, and come to a conclusion.

Students were given time during classes nine to eleven to work on the assignment; however, groups were also expected to conduct significant research and complete the assignment outside of class.

While the final project required students to make a management decision related to their business case, they were not being judged on the decision itself, which would have been the case in subject-related business courses. Instead, they were evaluated on the critical thinking process, evidenced in the argument mapping that framed the development of the recommended decision. The assumption was that if critical thinking skills were applied appropriately, then a tangible, actionable business decision would follow as a matter of course.

### Evaluation of Critical Thinking Skills Development

The research question examined in this study was whether argument mapping could be used to enhance critical thinking skills in a business education context. The progress in critical thinking of the students was measured through the BCTST produced by Insight Assessment. The test “is designed to evaluate the critical thinking skills of MBA students, undergraduate business students and working professionals” (Insight, 2013, p. 13). Insight Assessment also created the California Critical Thinking Skills Test, which has also been used in education research (Behar-Horenstein & Niu, 2011; Deal & Pittman, 2009; Morlino, 2012). The BCTST and the California Critical Thinking Skills Test both measure the same attributes of critical thinking and use similar questions; however, given that the BCTST is business related instead of focused on general life situations it was deemed more appropriate for this study.

The BCTST consists of 35 questions and provides the test takers with 50 min to complete the test. Scores are broken out by raw score, percentile versus the universe of test takers (we selected the universe to be the category “MBAs students or executives”), and the correct number of questions in each of five critical thinking subcategories (analysis, inference, evaluation, induction, and deduction). We used the total raw scores and the percentile scores of each student as the primary measurement as this was the most easily conceptualized data result.

There were two groups of MBA students who took the BCTST: the MBA students enrolled in the critical thinking course which was offered as an MBA elective ( $n = 24$ ); and, a control group of MBA students from the same institution who were not enrolled in the critical thinking class ( $n = 12$ ). In both cases, participation was voluntary and anonymous, and the costs of the test were independently funded by a grant from the school. Both groups were given the same pre- and posttest. The BCTST was administered to the in-class students as the first task of the first class and then as the last task of the last class. In this group, 24 students completed the pretest and 19 students completed the

posttest. The control group received the pre- and posttest within a week of the intervention group. There were 12 students in the control group that took the pretest and nine that took the posttest. Unlike Morino (2012), we elected to posttest the control group as well to minimize the chance that there was an exogenous influence on critical thinking skills.

## RESULTS

All results were calculated in SPSS using  $t$ -tests to test differences in groups using a pre–post design. By utilizing a control group, confounding factors are minimized. This allowed us to better isolate the effects of the course using argument mapping to foster the students’ critical thinking as measured by the BCTST test.

Overall, the intervention group experienced significantly increased scores in the posttest ( $M = 22.47$ ,  $SE = 1.181$ ) compared to the pretest ( $M = 20.84$ ,  $SE = 1.012$ ),  $t(18) = -2.382$ ,  $p = .028$ ,  $r = .49$  when measuring raw scores. We also found a similar result in the intervention group when scoring the test in percentiles, posttest ( $M = 59$ ,  $SE = 6.066$ ), versus pretest ( $M = 50.89$ ,  $SE = 6.133$ ),  $t(18) = -2.053$ ,  $p = .058$ ,  $r = .43$ .

As theorized, the control group did not experience statistically increased scores in the posttest ( $M = 23.5714$ ,  $SE = 0.685$ ) as compared to the pretest ( $M = 23.2857$ ,  $SE = 1.149$ ),  $t(8) = -0.471$ ,  $p = .654$ , when measuring raw scores. We also found a similar nonsignificant result in the control group when scoring in percentiles, posttest ( $M = 68.5714$ ,  $SE = 3.847$ ), versus the pretest ( $M = 65.57$ ,  $SE = 6.71$ ),  $t(8) = -0.817$ ,  $p = .445$ .

As noted, the BCTST test provides five subcategories of questions: analysis, inference, evaluation, induction, and deduction. In the intervention group, there were two subcategories in the critical thinking tests where improvement was significantly shown: inference (where an individual draws conclusions from reason and evidence) and deduction (where rules, operating conditions, core beliefs, values, and policies completely determine the decision in precisely defined contexts; Insight, 2013). For inference, the score was significantly increased in the posttest ( $M = 8.842$ ,  $SE = .622$ ), versus the pretest ( $M = 7.63$ ,  $SE = .531$ ),  $t(18) = -2.863$ ,  $p = .010$ ,  $r = .56$  when measuring raw scores. For deduction, the score somewhat significantly increased in the posttest ( $M = 9.00$ ,  $SE = 0.667$ ), versus the pretest ( $M = 7.947$ ,  $SE = 0.590$ ),  $t(18) = -1.998$ ,  $p = .061$ ,  $r = .43$  when measuring raw scores. Percentile scores are not available for the subcategories of the BCTST.

Based upon these results, we suggest there is a substantive and significant finding that the posttest results were greater than the pretest results for the overall test for the intervention group. In the control group we saw no significant changes. This suggests that the use of the argument mapping methodology in a business context was successful

in improving the critical thinking skills of business students. In addition, we noted a large and substantive and significant improvement in the intervention group for the inference subcategory.

## DISCUSSION

This study used the context of a critical thinking course designed to teach critical thinking and decision making to MBA students at a liberal arts college in the Northeast United States. Its goal was to determine whether argument mapping is a successful methodology to improve critical thinking skills in a business context. We tested this methodology as Metcalfe and Sastrowardoyo (2013) suggest that critical thinking skills developed through argument mapping may assist in the conceptualization of complex projects and are important in an increasingly complicated business environment. While critical thinking skills are often embedded almost unconsciously in business education, this study created a context where they were the explicit focus of the course and positioned within examples and case studies from business. Comments from the students at the conclusion of the study suggests that using business cases as a frame for teaching critical thinking skills and giving students practice repeatedly applying critical thinking skills to business situations will more easily allow the students to translate these new or enhanced critical thinking skills into their professional roles in management.

From a pedagogical perspective, students valued the high level of interaction between the instructor and the students as well as the feedback from the instructor throughout the course. The instructor could see the students improve based on the feedback. This was especially helpful in the first half of the course when the students were learning the basics of critical thinking and the mechanics around argument mapping. It was also important for the students select their own topics to analyze and evaluate as the critical thinking was then in a subject area in which they had an interest and was directly applicable to their existing or aspirational role in business.

There were a number of limitations in this study. From a course-delivery perspective, the intensity of the course was something that may or may not have been positive. This course was delivered in-class in a condensed six-week summer session in which 4-hr classes were held twice a week (Tuesdays and Thursdays). From both the instructor's and the students' perspectives, the short time frame between the Tuesday and the Thursday classes was suboptimal. As an example, as the course progressed and the assignments became more complex, the length of time required to complete the assignment from a student perspective and then assess and comment on each student's map from an instructor

perspective was difficult to achieve between the Tuesday and Thursday class. This caused some frustration among some students as they felt feedback on the maps created on Tuesdays would have been helpful before approaching the assignment due on Thursdays. It should be noted that many of the students worked during the day. This course and the inherent learning may be more effective if at least two days are reserved between classes for students to perform the assignments and for instructors to provide feedback.

The course design was intended to have course participants spend 3–4 hr at a time doing critical thinking. Students developed at different paces. Having a number of examples to work through in class let those who progressed more quickly stay engaged and allowed those that were a little slower to work through the problem sets in a way in which understanding was achieved. It was clear that the students were mentally tired after each class. It is recommended for future course design that there be far more exercises available than one may think is necessary to accommodate the average student and that the in-class critical thinking time be limited to three hours.

There were also limitations related to the administration of the BCTST, particularly student motivation in taking the test (Morlino, 2012), potentially the short timeframe of the course (six weeks) in which to note a change in critical thinking skills, and the formal nature of the test taking in the subjects (in class) versus the informal test taking of the control group (not in a class). To more stringently control for endogeneity, future researchers should collect additional background and demographic information to limit the possibility of other confounding variables, thereby helping to confirm that the results achieved in this study were primarily attributable to the effect of the critical thinking class (Bycio & Allen, 2009; Morlino, 2012).

This study demonstrates that teaching critical thinking skills through argument mapping applied to management cases can be successful in a business context. Replicating these results in other contexts would require an exposure to intense critical thinking teaching in condensed timeframes, very timely and relevant feedback to students, problem sets that become increasingly complex, problem sets with contexts students can identify with and be intellectually and emotionally connected to, and argument mapping as a medium through which to visualize, analyze, and evaluate critical thinking and decision making. Perhaps the most significant result from this study was the overwhelmingly positive feedback received from students about this learning methodology. Students felt that the critical thinking skills would be valuable professionally in their business careers and that the critical thinking skills they learned would benefit them personally and be very applicable in their everyday lives.



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