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# Concept Mapping and Reading Comprehension

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**ABSTRACT**

This paper describes a concept mapping teaching exercise that was implemented in different stages at both the graduate and undergraduate level. First, a small group of graduate students worked to construct a concept map that illustrated the connections between published work as they prepared to take their qualifying examinations. A similar assignment—visually depicting connections between course readings—was implemented between the midterm and final exam in a large-section online undergraduate course. In the undergraduate course, there was noticeable improvement between midterm and final essay responses in which students compared and contrasted readings, and students reported perceptions of it as a valuable exercise. Structured interviews with both undergraduate and graduate students further confirm that concept mapping can improve learning outcomes at both levels of instruction. The project reveals important differences in the way that both sets of students approach relational exercises involving readings and suggests ways of using concept mapping to enhance students' retention of the material.

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## Introduction

Active learning strategies, which require students to conduct self-directed learning, are increasingly popular as a way to engage students and improve learning outcomes. One relatively low-cost approach to this is through concept mapping, or the creation of a diagram that depicts the relationship between concepts through nodes and linkages. Numerous studies suggest that concept mapping is valuable for improving learning outcomes in a variety of contexts. Within political science, scholars note that concept mapping is an active-learning technique that substantially improves students' understanding of the linkages between items and their retention of the material (Chamberlain 2015; Collins and Nyenhuis 2021). The most common examples of concept maps organize concepts in relation to one another. However, the approach is also potentially useful for helping students to better understand not just the relations between *concepts*, but between readings. This is important for different degrees of tertiary education: undergraduates may have trouble grasping the shared goals of seemingly different research articles, and graduate programs often require students to pass a comprehensive exam

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demonstrating an understanding of a large amount of literature (Machado and Carvalho 2020).

This paper describes an exercise carried out at both levels in different stages over a two-year period to assess how students connect assigned readings to each other and whether depicting their relationships through concept maps improved their ability to retain information. At the graduate level, students successfully performed well on qualifying exams and attributed their success in part to the project. Undergraduates showed noticeable improvement between a pretreatment and post-treatment assessment. In both surveys and structured interviews, participants described the concept mapping exercise as an effective active learning tool for helping them to understand complex material—in this case, the relationship between different studies.

The results show considerable potential for concept mapping to help both graduate and undergraduate students understand important connections and debates in the discipline, albeit in different ways. This represents its additional value as a concept-relational tool in political science (Chamberlain 2015; Collins and Nyenhuis 2021). Perhaps more importantly, however, this project elucidates differences in the ways that graduate and undergraduate students approach concept mapping and ways that such a map could be useful for instruction. In the following section, we discuss the motivation behind the teaching exercise, describe the participant groups and the assignment, and overview the results. Among other valuable conclusions, the outputs and subsequent discussions highlight the flexibility of concept mapping as a relational tool that can be used to enhance instruction on readings and the broader literature at multiple levels.

## Motivation

Learning to effectively read and comprehend research papers is a central element of political science instruction, especially in upper-level courses. Undergraduate students are often introduced to work that addresses important themes in the discipline and illustrates the ways that scholars seek to understand and characterize them. This serves both to define and stimulate thought on specific concepts and to demonstrate how they have been measured and studied. Assigning examples of published research is also helpful as a guide for teaching students how to do their own research. For example, an instructor in a comparative politics course might assign to students an empirical paper on civil conflict to introduce the concept and to create opportunities to discuss the challenges of measuring and analyzing it. Making sense of the complex writing and jargon-laced language of academic work, and understanding the research designs and sophisticated techniques used to analyze cases, however, can be especially difficult for students seeing such work for the first time.

Beyond figuring out what a particular study does and what it means, it can be especially difficult for undergraduates to grasp its connection to other readings that may take different approaches to answering similar questions. A central challenge for undergraduate instructors incorporating published research in their curriculum is helping students understand the ways they tie together and how they depict applied research in political science. Students' concerns with grasping and committing to memory aspects of each paper can preclude them from focusing on what their contributions mean for

the discipline more generally. Assessments of undergraduate understanding of academic writing often involve "literature reviews" that occur at the start of research projects or essay questions on exams asking them to compare and contrast the readings introduced in the course. In both cases, students may be inclined to provide cursory summaries of the material without linking them together in a more substantive way.

A similar problem also exists at the graduate level, albeit on a grander scale. Masters and Ph.D. students are often required to complete written exams toward the end of their coursework, as a means of determining the extent to which they retained and understood the material they learned in their courses and their readiness for building on the literature to conduct research of their own. The Department of Political Science at the University of South Carolina— like those in many other universities—requires students to take qualifying exams as part of the Ph.D. track. The candidacy exam asks students to answer several broad questions about the discipline by synthesizing the contributions of extant research and demonstrating the capacity to advance work on the topic. Preparing for the exam questions—which are not known in advance—typically involves reviewing a substantial number of references to literature covered in the first three years of the program and considering how they link together. Though each student has a faculty advisor, and although the department regularly offers professionalization "seminars" designed to offer guidance, students are normally left to prepare for comprehensive exams on their own and receive little direction in how best to do so.

By far, the most common form of response on these written exams is a broad listing of various readings that may or may not be pertinent to the question, as the student tries to recall as much of what they read as possible to demonstrate that they know material. While it might suffice as a passing answer, it tends to fall short of the objectives of the exercise, which is to demonstrate the student's ability to use critical and independent thinking to evaluate and defend propositions and to identify next steps for research on the topic. Although graduate students have a much better understanding of concepts and theories and ways of testing arguments, the pressure to demonstrate *comprehensive knowledge* can result in a superficial treatment of specific works that ignores how they speak to one another and what that means. Thus, both undergraduate and graduate students struggle with understanding (and demonstrating that they understand) the connections between published material as they inevitably prioritize memorization over integration.

## Foundations

Scholars have focused on *active learning strategies* in recent decades, which engage students in the learning process to encourage them to internalize and comprehend the knowledge they acquire (Birenbaum and Amdur 1999; Prince 2004; McCarthy and Anderson 1999). While traditional teaching formats place students in the role of passive learners in the classroom, with instructors providing knowledge through lectures, active learning strategies require students to interact with their instructor and with one another (McCarthy and Anderson 1999). A critical difference between formats is in the extent to which they promote *rote learning*, where the learner arbitrarily and non-substantively adds information to what they already know, and *meaningful learning*, in

which the learner actively chooses to integrate the new information (Ausubel 1963; Novak 2002). Several different cognitive processes can occur during meaningful learning, including *progressive differentiation* and *subsumption*—when new concepts and propositions that are added help to refine the meaning of existing ones—, *superordinate learning*, or the recognition that several concepts are subconcepts of a more inclusive concept, and *integrative reconciliation*, in which concepts in different domains are recognized as similar and related or different and unrelated (Ausubel 1963; Novak 2002). A variety of teaching styles can be used encourage active learning. Meta-cognitive strategies, for example, enable students to monitor, reflect on, and evaluate their own learning (Lusk 2016). Killian and Bastas (2015) show that students who participate in team-based learning have more positive attitudes toward the discipline while performing equally well on exams as students who participate in lecture-based learning. Several studies have also investigated the active-learning potential of various teaching methods, such as simulations (Shellman and Turan 2006; Deejay, Rublee, and Zech 2019; Hunt 2019; Perry and Robichaud 2020), debates (Oros 2007; Wilson, Pollock, and Hamann 2007; Mumtaz and Latif 2017), research activity, visualization using data or video production (Henshaw and Meinke 2018; Florez-Morris and Tafur 2010), essay writing (Murphy 2017), concept mapping (Collins and Nyenhuis 2021; Chamberlain 2015) and their combinations (Hendrickson 2021).

In particular, the practice of illustrating connections between ideas provides an opportunity for students to actively combine new ideas with previously acquired information and assess their relation to one another. By explicitly drawing out ideas, students engage with these processes to reach a final product, "discovering" them on their own, for which visual representation should both make material easier to recall and accommodate new ideas (Ausubel 1963).

Building on the insights of Ausubel (1963) concerning learning and material retention, the work by Novak and Cañas (2008) aimed to represent conceptual understanding in the form of a *concept map* to understand changes in students' knowledge structures as new concepts were added. Concept maps entail linking together concepts to illustrate how they are related (or different) and using linking words or phrases to specify the relationship. It serves as a visual representation of how a student's knowledge is organized. By requiring students to self-assess what concepts mean and how they are related, it is also a potentially powerful tool for creating meaningful learning, since subsumption, superordinate classification, and integrative reconciliation occur as students organize their thoughts. According to Novak and Cañas (2008), organizing concepts into a framework also helps to make them applicable to other contexts, as new information can then be added to the framework and/or the framework reorganized.

Teachers and practitioners have recommended using concept mapping to promote meaningful learning (Hay, Kinchin, and Lygo-Baker 2008; Machado and Carvalho 2020). The underlying logic for teaching through mapping is that by representing concepts as a visual relationship, students are able to better understand the relationships between concepts and the place of each concept within the larger framework (Daley et al. 1999; Davies 2011). Among applications that used concept mapping in political science, students self-reported a positive impact on text comprehension and learning (Chamberlain 2015). Elsewhere, a quasi-experimental design that used concept mapping

as a treatment in one section of an introductory course showed a much higher retention of material (Collins and Nyenhuis 2021).

Despite the value of existing studies for explicating how concept mapping can enhance students' understanding of conceptual relationships in political science, it not entirely clear how the approach can help with understanding the connections between the readings from which the concepts are derived. Moreover, the approach has rarely been applied to graduate students, nor have the differences in how concept mapping affects meaningful learning among undergraduates and graduates been considered. One exception is a study that describes the use of concept mapping to structure small-scale literature reviews in a pre-service teacher education course (Marin 2021). Daley (2010) also discusses using concept mapping to map readings in graduate education. In the following section, we outline an approach that used concept mapping at both the undergraduate and graduate level to assess the extent to which students understood the connections between academic publications in political science.

## Design

With the support of a teaching grant from the Incubator for Teaching Innovation in the College of Arts and Sciences at the University of South Carolina, the project assessed the potential for a concept-mapping assignment to improve students' reading comprehension and compared differences in student performance at the graduate and undergraduate level.[1] The exercise started with the goal of working with graduate students to develop concept maps that demonstrate the interconnectedness of concepts and readings. In Spring 2020, a third-year graduate student had begun organizing a weekly reading group for graduate students who were interested in comparative politics as a way of preparing for third-year comprehensive exams. The group regularly read and discussed formative works in the subdiscipline, with students keeping each other accountable for reading. Although a few graduate students participated intermittently, three in particular were consistently involved: a third-year, second-year, and first-year student, all of whom were considering specializing in comparative politics.[2] Inspired by previous experience teaching a comparative politics pro-seminar in which the class worked as a group to organize readings in a map, the lead author proposed a project that drew on the core participants of the comparative politics reading group.

During Fall 2020, the core participants of the reading group and one additional student who was briefly involved continued to meet as before, but this time with a greater focus on synthesizing the material.[3] The task that they were assigned was to create a visual depiction of a pre-defined set of readings, with the aim of helping them to better articulate important theoretical and methodological connections between foundational works when they answered questions in the comprehensive exam. The readings were chosen by the group leader, who compiled a reading list of canonical works based on department syllabi and syllabi from other universities. Group members read articles and book chapters and discussed ways to connect them together. At weekly meetings, the pairs compared their strategies for mapping the readings and tried to reach agreement on the most appropriate framework. During this time, the group members agreed to keep anonymized notes on their reflections about the project and associated frustrations.

The instructor met with the group on separate occasions and talked with them about the challenges that they faced.

The purpose of the weekly meetings—and the anticipated output—was to incentivize and institutionalize study sessions in which graduate students concentrated on making linkages between readings. From the beginning, however, the instructor provided no guidance on how to organize them. At this stage, the question was whether students *could* independently construct frameworks that represented their understanding of how the material fit together and what the process entailed. As compensation for their efforts, each student received funds to support conference travel and research activities. The learning objectives of the graduate portion of the project are illustrated by the right triangle in Figure 1, which is arranged from the more immediate/likely outcome to the more remote/less likely outcome. Regardless of the final product, the process would provide a valuable learning experience that might result in successful performance on the comprehensive exam. By constructing a visual framework that organized the readings, one hope was that it might improve group members' ability to teach on those concepts in the classroom. The most distant and least obvious outcome was the successful construction of a map that brought all of the readings together.

The Spring 2021 semester allowed the team to explore a similar exercise in a 238-student, undergraduate-level class that met synchronously online (*POLI 101, Introduction to Global Politics*). While working on the group project, three of the four graduate students also served as teaching assistants in the course. The class was made up of roughly 32 percent freshman, 39 percent sophomore, 19 percent junior, and 10 percent senior students. About 37 percent had declared a political science-oriented major—political science, international studies, or global studies—, not counting secondary majors (see Figures A1 and A2 in the Appendix).

The class, which met three times per week, was organized thematically, with each week covering a specific topic (e.g., economic development, democracy and human rights, civil war and terrorism). On Mondays and Wednesdays, students virtually

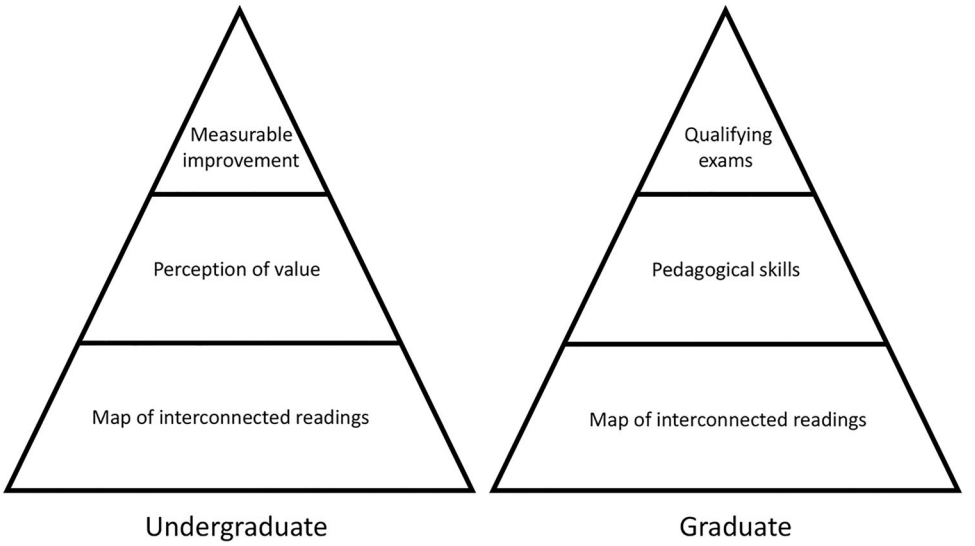


**Figure 1.** Anticipated observable outcomes for determining effectiveness of the exercise.

attended class, in which the instructor lectured on core concepts and how they related to political science. Every Friday, two teaching assistants led separate breakout sessions on two articles that they chose to represent research on that topic. The undergraduate students could choose which of the sessions they attended but were expected to read and submit notes on the two articles beforehand. This gave the graduate students the opportunity to teach from articles they had read, while also giving undergraduates the freedom to choose between different readings based on their interests. In all, the undergraduates were able to choose between two different breakout sessions for each of eleven weeks, over which forty-four articles were reviewed.

Assessing undergraduates' comprehension of the readings—and the potential for concept mapping to improve it—involved two tasks. The first was to have students respond to two essay questions on the midterm and final exam that asked them to compare and contrast the readings.[4] The second was to have students independently construct a concept map to represent relationships between the readings. The prompt required students to visually depict the connections between 15 of the readings and to include a written justification (prompt listed in the Appendix). This assignment was worth 15 percent of their grade and went along with a group-based research assignment (separately worth 20 percent) that took the place of a more traditional research paper. Because it was a 101-level course, this seemed appropriate for helping to develop the skills necessary to review literature and conduct and analyze data without requiring students to independently produce research papers.

The concept map assignment was introduced only after the midterm, allowing a comparison of the quality of essays before the assignment to their quality after the assignment (the final exam). As with the graduate students, the prompt was purposefully (relatively) unstructured to give students the freedom to explore ways of conveying connections and to get a sense of how they organized items. On the final exam, students were also asked optional survey questions (for extra credit) on their perceived effectiveness of the concept map exercise. The learning objectives of the undergraduate portion of the project are illustrated by the left triangle in Figure 1. The most immediate indicator of effectiveness would be measurable improvement on the final exam essays associated with the successful completion of the concept map exercise; the second would be evidence that students perceived it as valuable for understanding the readings, and the third, most remote indicator would be the map itself.[5]

Given that the goal was to see *how* students mapped concepts, there was less control over the type of map that would emerge. However, to ensure greater reflection on the relationships, undergraduates were required to submit a written justification of the concept map that explained the connections. Thus, verbal representations of the relationships between concepts—a crucial difference between *concept maps* and *mind maps*—were made optional but replaced by a written summation. The exercise followed many of the practical recommendations of Kinchin (2014), such as using it in situations where assessment focuses on meaningful learning rather than memorization and recall, justifying the degree of freedom in the assignment, and combining it with other learning strategies. In this case, both the graduates and undergraduates were explicitly informed of the exploratory nature of the assignment, and the mapping exercise was accompanied by a written depiction and justification of the framework. For undergraduates, this took the form of a

written explanation of the map and the essay portion of the exam; for graduate students, it was presumed to be their responses on the qualifying exam.

There were several different observables that were expected to result from the project that, taken together, would provide insights into the value of concept mapping for reading comprehension for undergraduate and graduate students. The graduate portion included the notes and sketches that they made while brainstorming and the resulting maps, as well as structured interviews with each of the graduate students. The undergraduate portion included the essay grades before and after the concept map assignment, the concept maps and justifications that students created, survey responses, and structured interviews with some of the best-performing students after the conclusion of the course.

## Results

### *Graduate*

The graduate student group compiled a list of almost 250 readings based on comprehensive exam guides for comparative politics, which constituted the basis for creating concept maps. The scant instruction that students received left them to engage in a process of discovery, during which they tried and failed to create a cohesive draft. At first, the students worked in pairs to construct concept maps for assigned sets of citations related to a particular topic in comparative politics. The pairs quickly found that their drafts conflicted with one another, in part because each individual focused on arranging the readings spatially based on different aspects. This made it especially difficult for the group to agree on a version that represented their individual understandings of how the readings fit together. The initial maps that the students created did not capture the full range of readings, nor did they provide the sort of unifying framework the students were looking for. After multiple false starts, the graduate students determined that coding readings by particular sub-concepts—using common terms to classify different features—supported the creation of a database of terms that they could search and allowed them to map readings across multiple shared qualities. These labels covered methodological approaches, relevant actors, and dominant subject matters explored in the pieces. Still, the variety of potential attributes on which readings could be matched made it difficult to create one conclusive map. Arranging readings based on their theoretical orientations, for example, might look very different than how they would be arranged based on their methodological approaches.

Toward the end of the process, the group—with eventual guidance from the faculty member—tried alternative approaches. The first was to create "sub-concept maps" that focused on arranging readings within a particular topic (e.g., economic development). The second was to spatially illustrate the *attributes* that students had identified instead of the readings. Under this framework, a given reading would be represented by multiple nodes (see Figure A9 in the Appendix for an example). Doing it in this way helped to flesh out the major elements of particular research agendas to which different readings contributed. The topic of the concept map that emerged from that discussion was purposefully chosen so that it could be used in a graduate course the instructor was teaching at the time.

Throughout the course of this process, each of the three graduate students involved in this project took comprehensive exams in comparative politics. All three successfully passed their exams. Their successes and their perceptions that it was partly attributable to the concept mapping exercise encouraged students to explore expanding this process of reading, labeling, and *mapping* to subfields outside of comparative politics. The project spurred interest from students in other subfields, who attempted similar projects.

While the graduate students reported feeling overwhelmed by the initial process of mapping readings, in post-project interviews they all highlighted that if more direction had been provided, they felt as though they would be *less* familiar with the materials and that there would have been less innovation and discovery throughout. In addition, the graduate students conveyed that this process took them from being graduate students to *actual comparativists*. Distilling the findings of so many papers and exploring their commonalities, cleavages, and through-lines forced students to approach the mapping process from a broader perspective.

Common among the students' responses was how much more dynamic this process was than traditional seminar classes, with one noting that "as useful as it is to consume information, you do not get a mastery of it until you can discuss it." Occurring as it did in the middle of the COVID-19 pandemic, when in-person interaction was not possible, the three graduate participants noted that their meetings helped supplement classes where the dynamic, small group discussions that they normally would have had were complicated by online learning. Another student appreciated how it encouraged thinking beyond individual models and advances in the field and identifying unifying themes, something they said would be helpful toward developing syllabi and preparing classes in the future.

Though the process could be frustrating for the graduate participants, working through those frustrations led to a better understanding of the subfield and of scientific inquiry more generally. Two features of their efforts—the fact that they were covering a far larger body of work than any class could cover, and that they did so collaboratively, are salient in highlighting why this exercise was successful. The large breadth of their inquiry necessitated different students to cover different readings, forcing students to find and communicate the key takeaways from different readings. This practice was a good pedagogical act itself, but by attempting to synthesize several dozen pieces as opposed to a few texts permitted students to take a broader view, a helpful supplement to the close reading and critiquing that typically occurs in classes.

Collaboration was also essential. The students had to coordinate and hold each other accountable across several semesters, which not only developed essential team skills but provided an environment where they could be comfortable brainstorming and sharing ideas. This can be very helpful for students that may be reticent in more "high stakes" classroom settings and gets students comfortable sharing their opinions about potentially dense and complex material. The flexible, student-driven approach described here also accommodated different learning styles.

Finally, all of the students indicated that the exercise made their comprehensive exams much less daunting, with one student reporting using the progress from the concept mapping exercise to help organize their responses. When the project started, one student was about to take their comprehensive exams, one student was a semester away,

and one still had three semesters to go. Each of them indicated that the concept-mapping exercise was helpful but suggested that the longer they had working on the project before their exams, the more it might have helped them both prepare for and not be overwhelmed by their exams. This points to how such long-term, macro-view, collaborative projects can accrue benefits over time, even if the short term does not appear productive. It also highlights the utility of engaging in this sort of exercise as early as possible in graduate school.

### Undergraduate

About 195 of the 212 remaining students in the undergraduate class completed the assignment, submitting a concept map in which readings were organized around a particular topic. The distribution of grades for the concept map submissions ranged between 17 and 100, with a median grade of 87 and a mean of 85 (see Figure A3 in the Appendix). When the lowest grade is dropped, the range is between 50 and 100, with the same median and mean. Figure A4 in the Appendix shows the frequency of the central themes when they are sorted into different topic areas.

Overall, around 25 percent of the maps that students generated failed to demonstrate an ability to identify a substantive connection between the readings (colored gray in Figure A4, Appendix). Roughly ten percent of the submissions were not clearly organized—either mixing themes together or were unclear. Eight percent has as the central theme "issues" or "topics" or attempted to differentiate the readings based on the sample or type of analysis, while seven percent had organizing themes that the instructor deemed too general (e.g., "economics" or "politics"). The other 75 percent were centralized around a substantive topic. The top four central themes, which made up half of the concept map submissions, were *Democracy*, *Globalization*, *Conflict*, and *Development*. However, other themes included topics such as *Injustice*, *Colonization*, *Identity/Culture*, and *Actor motivations and behaviors* (see Figure A4, Appendix). A majority of the students, therefore, were able to successfully identify a substantive central theme around which readings could be organized. Figures A5 through A7 in the Appendix, show examples of some of the highest graded submissions.

### Pre-/post-assignment essay grades

Figure 2 illustrates the distribution of grades for essay responses on the midterm and final exam, according to whether the student completed the concept map assignment. A t-test of the essay grades by exam is significant below a one-percent probability of error, with students overall performing better on the final exam essays.[6] T-tests for both midterm and final essay grades by whether the student completed the assignment are also both statistically significant (below 2.3 and 1.2 percent probability of error, respectively). Thus, students who completed the assignment did significantly better on the final exam essay, but were also more likely to do better on the midterm exam essays. A t-test of the difference between the final and midterm essay grades by whether the student completed the assignment is not statistically significant, however.

Examining the results by grader—who graded essays for the same student for both the midterm and final exams—, the relationship between the concept map grade and

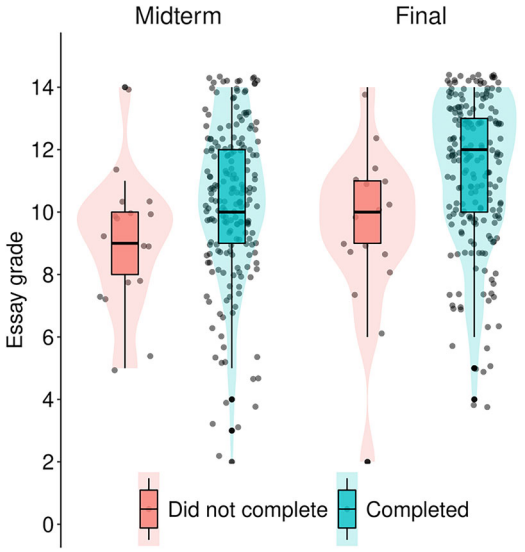


**Figure 2.** Difference in final and midterm essay grades.

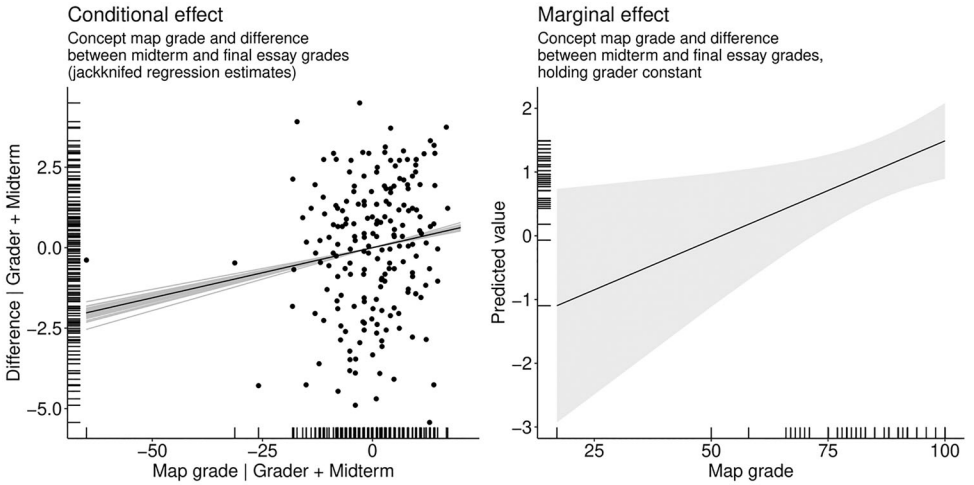


**Figure 3.** Relationship between concept map grade and improvement in essay response.

the final exam essay is statistically significant for two of the four teaching assistants. On its own (or with graders included, or by grader), the map grade (or whether the student completed the concept map assignment) is not a significant predictor of the difference between the midterm and final essay quality. It is, however, when the midterm essay grade is accounted for. This is illustrated by Figure 3, which shows the conditional and marginal effects on the difference in essay performance when controlling for how well a student did on the midterm and who graded the exam. How well students performed on Readings Days—the quality of their notes—is not strongly related to the difference in essay responses, nor are student perceptions about the helpfulness of the exercise. Student performance on the multiple-choice section of the final is, however,

significantly related and diminishes the strength of the relationship associated with the concept map grade. These results are the same whether using the assignment score or a binary indicator of whether the student completed the assignment.

Taken together, this suggests that the potential impact of the concept map exercise on improvement in students' essay responses is not noticeable across students until their performance *prior* to the assignment is considered. Controlling for how well students were able to compare and contrast the readings before the concept map assignment was implemented, those who did better on the assignment saw a significant improvement on their essay grades. The mean and median difference in essay grades between exams was 0.85 and 1 point, which represents an improvement between 6 and 7 percent on that portion of the exam.

### Survey results

The final exam included three optional survey questions with the following note: "This question is optional and is worth 1 extra credit point on the exam. Please answer truthfully; you will not be penalized for your response." The first question asked whether the readings assignment (concept map) was helpful for developing an understanding of the similarities and differences between articles or for preparing students to answer the essay portion of the exam. Of the 200 students who responded to the question, 169 (85 percent) said yes. Figure 4 shows the student responses for the other two questions. Nearly 57 percent of respondents (108 of 190) indicated that the readings assignment was "helpful" or "very helpful," and 66 percent (125/189) responded that they consulted the readings "a lot" to construct the concept map. Student responses seem to suggest that the assignment encouraged them to engage more with the readings and that they perceived it as helpful for understanding the connections between them.

### Structured interviews

The following semester—after final grades had been processed—several students were contacted who had either done very well on the concept map assignment, or who

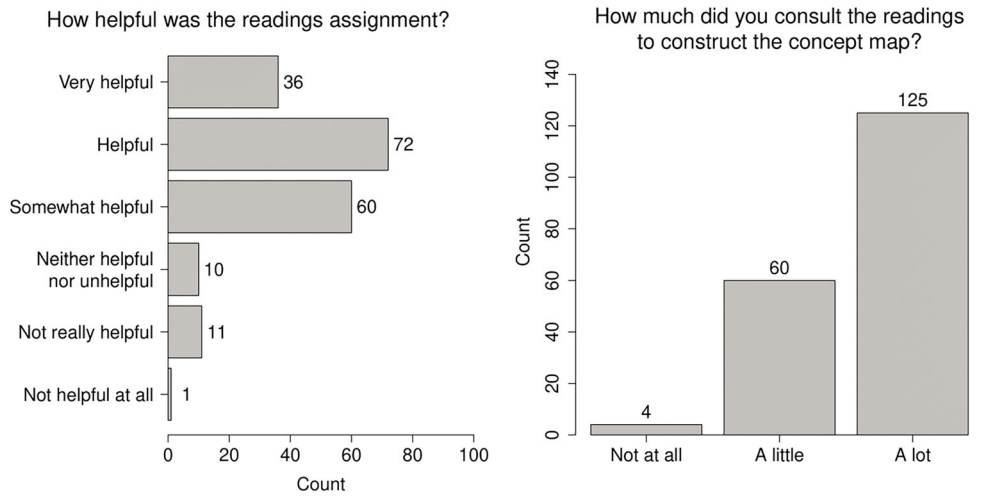


**Figure 4.** Survey responses on concept map effectiveness.

indicated that they found it especially helpful, to better understand the ways in which the assignment helped them to understand the readings. The decision to focus only on those who did well on the assignment or who found it useful, rather than talking with those who did not do well or did not find it useful, was due to the expectation that it would have been difficult to distinguish whether a respondent found the exercise difficult or did not put in effort, and whether dissatisfaction with it was because of the assignment or their grade on the assignment. This is not to say that similar interviews with students who did not find the exercise useful would have been completely uninformative. Selecting on students who did well was meant to control for the fact that they had clearly put in the effort, whether or not they found the exercise useful or struggled with it; identifying poor-performing students who struggled with it despite putting in the effort would have been more difficult.

Of those who were interviewed, several students stated that they had never done an assignment like this. One initially struggled with the readings, finding the language "unnecessarily complicated." By starting with a central point and going through their notes, the map forced them to understand at least some of what the readings were aiming to accomplish. Although they learned from reading the material, respondents indicated that they gained from having to purposely make connections between them. According to the student (a sophomore business major)—"now I 'have to'; I can't 'kind of' understand." For one respondent, the easiest part was selecting the readings; they started with the ones that they enjoyed the most and worked backwards from the readings to the overarching theme. One student, a fifth-year student in international studies, had had previous experience reading articles, and used a forward approach—selecting a topic and then identifying connections between readings.

Among the biggest challenges that respondents noted was having to restart or reorganize the readings, and questioning the maps that they had constructed. They described finding some connections between readings but then being unable to connect them to the larger map. Another mentioned that it was hard to identify the conceptual categories that linked readings together and to articulate their justification ("you would have to be in my head to see the picture"), although they said that being required to justify the connections in writing was the best part of the assignment. For another student, the worst part of the assignment was having to reread the readings to look for specific details. They noted that they imagined that the biggest criticism of the class held by others was over the workload created by having to reread the articles, stating that it would not be possible for a student to "skate by."

According to the respondents, the concept map exercise was good because if they did not understand the reading, they could not map connections. A common response was that it would have been possible for students to "doze off" during lectures on the readings or to skim them in preparation, but that the assignment forced a deeper engagement with the material. According to one student, "it really makes you think about the main ideas and understand them better," a sentiment that every respondent expressed. To this end, students found the assignment particularly useful for an online class format, inasmuch as it helped to ensure that students spent time engaging with the readings on their own time. One student said that they struggled to grasp material in the

online class, and that being required to spend extended time with the readings—forcing them to "do it myself"—was helpful for overcoming that problem.

Perhaps the most convincing evidence that the concept map exercise helped students to understand the connections between readings was one student's response to the question of whether they were prepared to compare and contrast readings on the final exam: "definitely—I had spent hours doing that." One student said that they had to do a similar assignment (finding connections) in a subsequent upper-level class and that practicing finding connections between the readings gave them an advantage over others in discussions in their future classes. Another respondent stated that the assignment "reinforces a necessary skill" in their major—the need to apply what they read—and recommended using it to teach first-year students. When asked if there was anything else to know about the assignment, one student reiterated that it was "definitely a challenge" but that it encouraged critical thinking that was valuable for the major.

## Concluding thoughts

At the start of the project, the hope was that the exercise would ultimately yield a map that linked together readings by locating them near conceptual nodes. The instructor even anticipated turning it into a virtual resource, potentially linking the undergraduate and graduate portions together and allowing the viewer to click on citation-nodes to access overviews for each reading. The interactive resource would be valuable for future students progressing through the program and something to which they could further contribute and expand. That proved to be somewhat too optimistic as a hoped-for outcome for the period of time over which this exercise occurred, however. Nevertheless, the materials that the project generated, and the insights from efforts to build a unified product, lend themselves to the future development of teaching tools based on this exercise. The project took on a life of its own but yielded surprising benefits that affected how the authors approach conceptual instruction. Shortly after starting the project, it became clear that the *process* of trying to build concept maps to tie readings together was more important than the resulting product. First, the process of engaging both graduate and undergraduate students in the same exercise provided valuable insight into the differences into how both sets of students approach readings. Undergraduates expected there to be one or a few major concepts that connected the articles, *despite* the fact that the readings for each week were on distinctly different themes. Their outputs tended to more closely resemble *mind maps*, in which items flow from a central concept.[7] However, as a first pass at observing how students organize and represent readings, the "mind map" format offered a high level of generality that lends itself to a more detailed depiction of how the concepts that the readings touch on relate to one another (Davies 2011). The challenge with working with undergraduates on this exercise thus involved teaching them how to disaggregate the parts of a research paper (e.g., its motivating questions, theory, research design, and findings) and using them as a basis for identifying what it shares with other readings. It is effective both for instructing students how to read and comprehend academic work, but also for imparting a broader sense of the shared goals of empirical papers that seemingly address very different things. Requiring students to supplement the map with a written explanation also helps

students to clarify the linkages between concepts and the structure of those relationships (Butcher 2022).

In contrast to how undergraduates approached the task, the graduate assistants did so in a much more "data-driven" way. Having become accustomed to scrutinizing the various pieces of a research paper, they sought to identify and classify the attributes associated with each section—was this paper qualitative, or quantitative? Did it use formal models, regressions, or case studies? Partway through the project, the students had to be encouraged to move away from creating a spreadsheet of attributes and to spend time thinking about how they fit together. This exemplifies one of the central problems that graduate students have when taking written qualifying exams, which is the lack of attention to synthesis and to describing the connective tissue that undergirds theory building in the discipline. For the graduate assistants, one central issue that they had was that there were many different ways to compare and contrast the readings, which complicated the task of visualizing the connections between them. This led to a discussion about the ways that one might relate them to one another and to an attempt to use concept mapping to elaborate the contours of a particular research program.

Though the graduate group did not ultimately place readings on one large map, the process of trying to do so facilitated fruitful discussions both about what sorts of comparisons one aims to make in describing "the literature" and how to characterize a particular area of research. In a graduate course on authoritarianism and democratization, the instructor asked students to identify the nodes represented by various readings and to help refine the map by adding features (see Figure A9, Appendix). This way of "placing" readings on the map elucidated the various ways that students could compare readings and features that different course readings shared. It was also a valuable resource for helping students see the "bigger picture" in the substantive course, as they were able to refer back to the map. This changed the instructor's understanding of how concept maps could be used to identify the connections between readings and has become something they now integrate into the classroom.

It is important to note that we do not have a reliable control group of graduate students who took their exams without participating in the assignment. Unlike Collins and Nyenhuis (2021), we also did not have a section of undergraduates that did not use concept maps that we could compare the results against. The absence of a control weakens the conclusion that it actually improved students' performance. Taken together, however, the combination of measured improvement between exams, students' responses about the value of the assignment, and their final products provide considerable support for concluding that it was a worthwhile active-learning exercise. Whether or not it led to real improvements in students' ability to identify and express the connections between academic readings, it represented an alternative assessment tool that successfully encouraged critical engagement with the material. This emphasizes one valuable aspect of the assignment, which was that it helped to ensure that students thoroughly read the material and hold them accountable with little oversight from the instructor.

The differences between the types of output that graduate and undergraduate students created when given a similar task also underscores the advantage of encouraging in-class interactions between them over reading comprehension. The viewpoints represented in

the maps suggests ways of combining them to enhance teaching effectiveness. Graduate teaching assistants may be particularly effective at helping undergraduates to break an article down into its constituent parts, while the challenge of introducing and explaining readings to undergraduates can be used to help graduate students think more thematically about them and how they relate to other readings. It is not clear how the effectiveness of the exercise might differ in the classroom as opposed to the delivery format used during the pandemic, nor what alternative assessments it might serve as a substitute for. However, the challenge of spatially representing the connections between assigned readings lends itself to in-class discussions and collaborations that should build on and connect together the published works used to exemplify political science research at both levels. Future extensions might consider comparing the effectiveness of this approach against more traditional teaching methods used to help students understand academic readings. The process of teaching students how to do it can help to break down some of those previously learned practices, encourage active, accountable learning, and prepare students to understand difficult material. It is also useful as an alternative assessment that can promote more equitable representation in the classroom (Maker and Zimmerman 2020).

## Notes

1. The Appendix contains demographic information about the undergraduate and graduate student population at the University of South Carolina and in the Department of Political Science.
2. The three students consisted of one self-identified female and two male students, of which one was an international and two were non-international students.
3. The additional student was a first-year student (female, non-international) who was interested in taking comparative politics as a second-field specialization. They did not continue to work on the mapping project following the conclusion of the semester.
4. "[I]dentify and describe one way in which the readings are similar (/different). This can include research questions, arguments and theories, type of analysis, sample focus, or findings. Use three of the articles as examples and discuss what they have in common. Be sure to identify the three articles by either the titles or the authors."
5. Because the purpose of the assignment was educational and did not collect data that were intended for publication or dissemination, it was deemed to not require approval by a Human Subjects Review board (e.g. IRB). However, the outline of a pre-implementation plan was submitted to the Incubator for Teaching Innovation and presented to a collegiate working group in advance. Additional safeguards were put in place that included fully explaining the assignment to students; asking consent to use any included materials; making survey questions optional and/or asking them after exams; and delegating the task of grading essays to ensure that they were not influenced by survey responses.
6. Figure A8 in the Appendix shows the overall difference between midterm and final essay responses.
7. For a description of the differences between mind maps, concept maps, and argument maps, see Davies (2011).

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## Appendix

### *Demographic information*

The University of South Carolina is a large state school, with approximately 27,280 undergraduate and 6,466 graduate students in the Fall 2022 academic term. As of Fall 2022, roughly 17 percent of students identified as first-generation students; 70 percent of the student population identified as White, while 10 percent and 5 percent identified as Black and Hispanic, respectively.[8] Of these students, approximately 5 percent are nonresident aliens. Within the political science department, approximately 69 percent of graduate students identify as White, 23 percent Asian, and 8 percent Black. One-third of students are nonresident aliens, and one-third of the graduate population self-identifies as female, with the remaining students identifying as male. Of graduate students still active in the program, 40 percent have passed their comprehensive examinations.

### *Prompt for undergraduate assignment*

"Working individually, students should select 15 readings from the Readings Days reading list and visually represent relationships between them in the form of a concept map that conveys some of the readings as being more similar to and others as being more different from each other. The illustration should compare the readings on at least one attribute and include at least three levels of differentiation.

There are no stipulations concerning how students compare the readings or the format of the final product. Students may choose to organize readings around different attributes such as themes, approaches, methods, or sample focus. The concept map should make it clear which attribute or concept connects them (given by ovals in the example below). The readings (given by clouds in the example below) should be indicated using in-text citation style (e.g., Collins and Nyenhuis 2021). Students are free to add descriptions.

The submission needs to include a bibliography in Chicago-style format that lists the readings included in the concept map in alphabetical order (Note that the citations are available in the readings list provided online). The submission should also include a brief justification of the way in which the readings were arranged in the concept map and what relevance this has for the study of political science, explaining how the similarities/differences between the readings led to the creation of the illustration and why they are important."

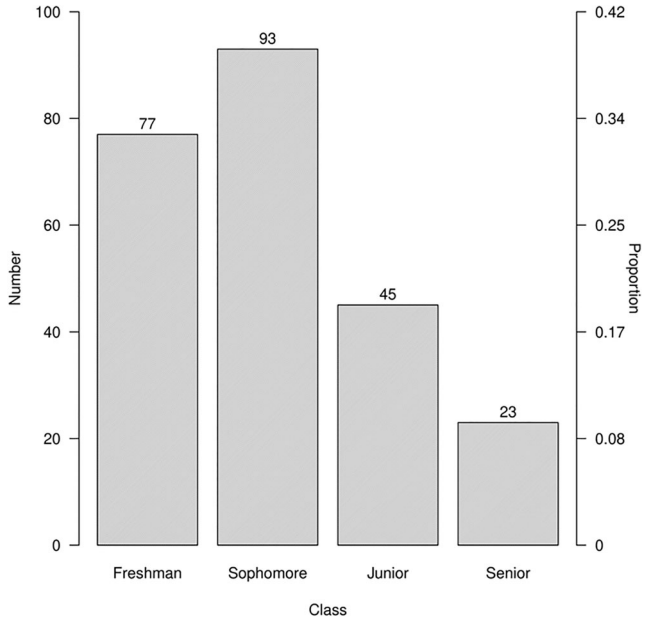


**Figure A1.** Undergraduate breakdown by class.

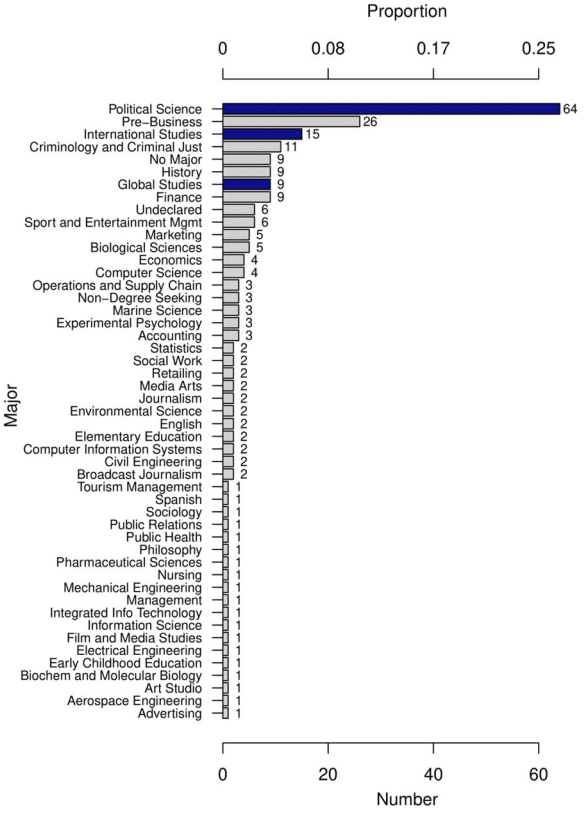


**Figure A2.** Undergraduate breakdown by major.

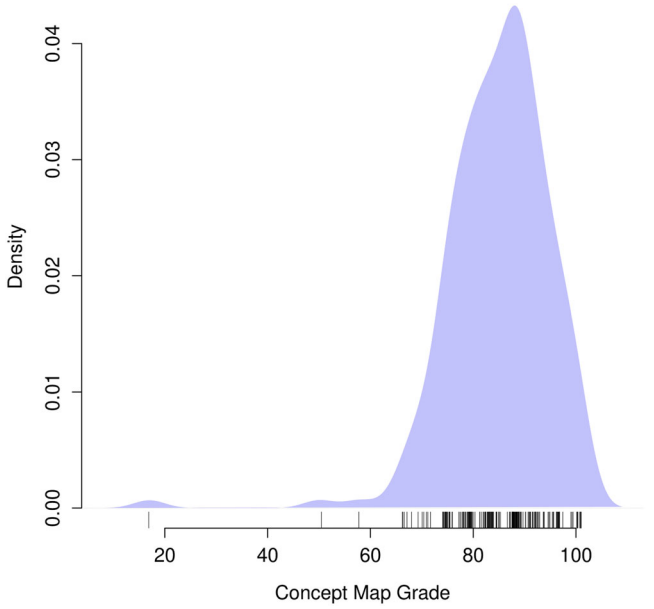


**Figure A3.** Concept map grade.

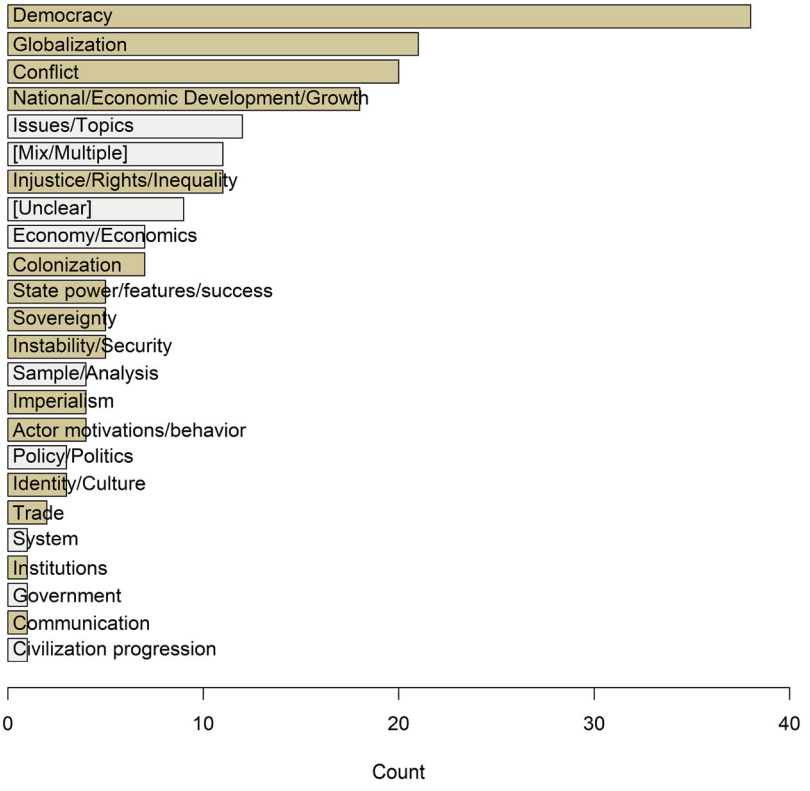


**Figure A4.** Concept map topics, sorted by group.

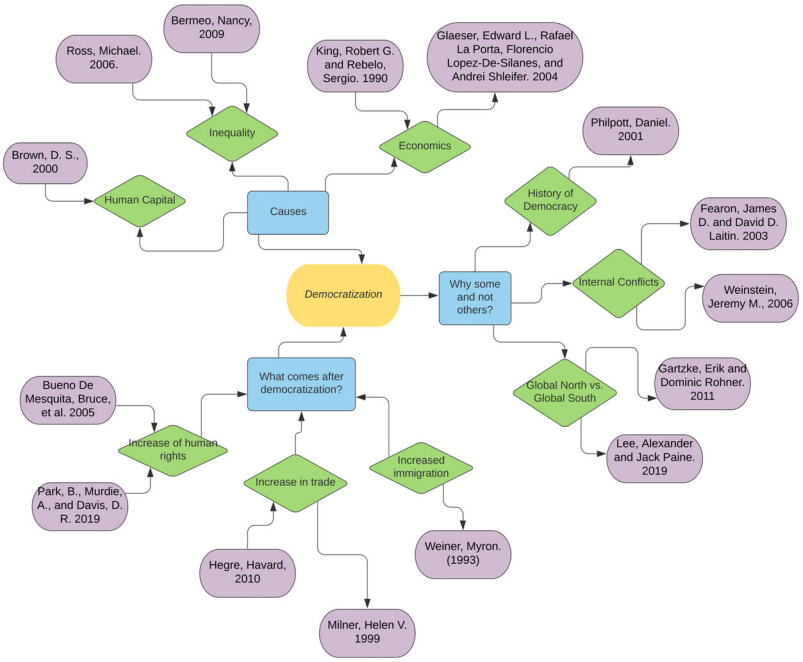


**Figure A5.** Example undergraduate submission 1.

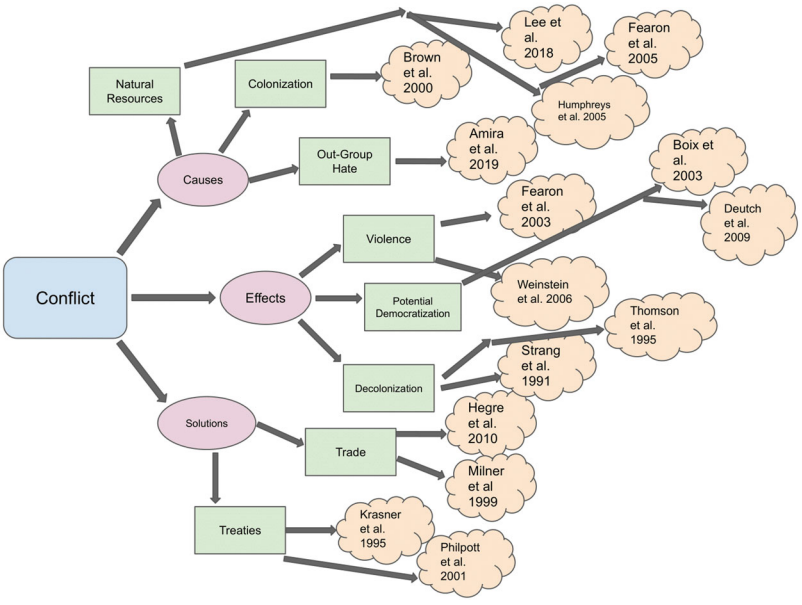


**Figure A6.** Example undergraduate submission 2.

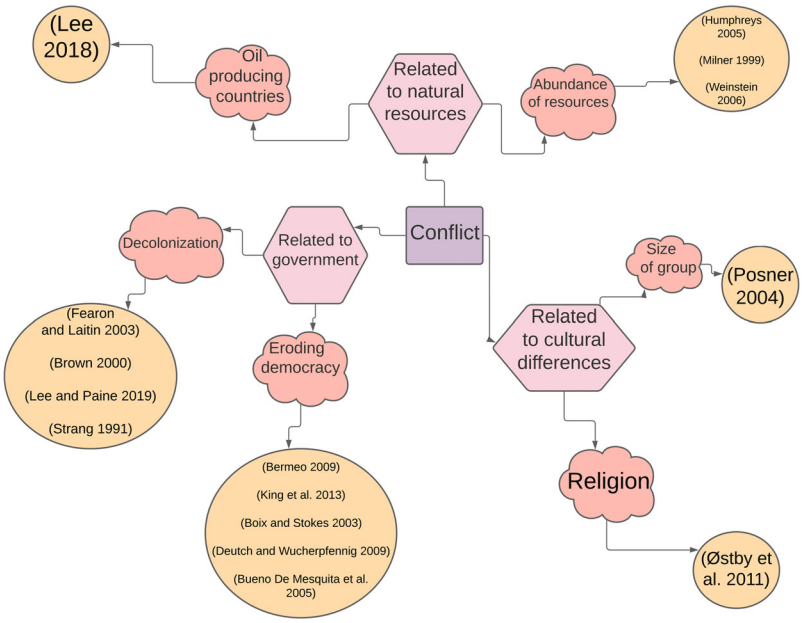


**Figure A7.** Example undergraduate submission 3.

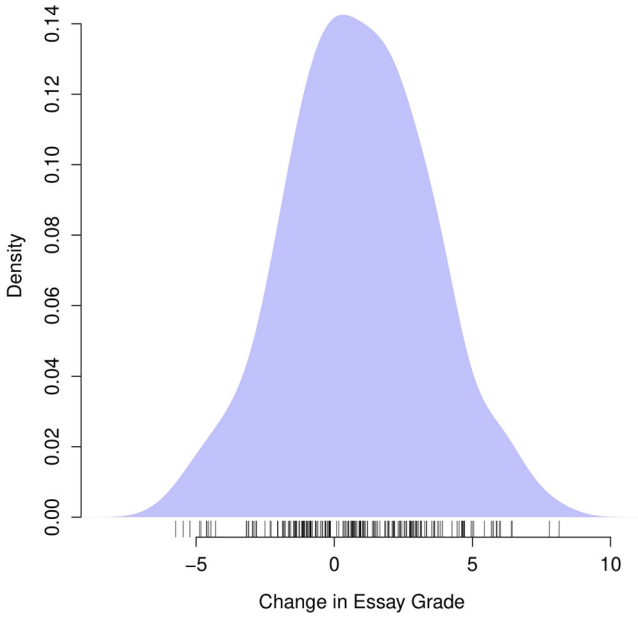


**Figure A8.** Difference in final and midterm essay responses.

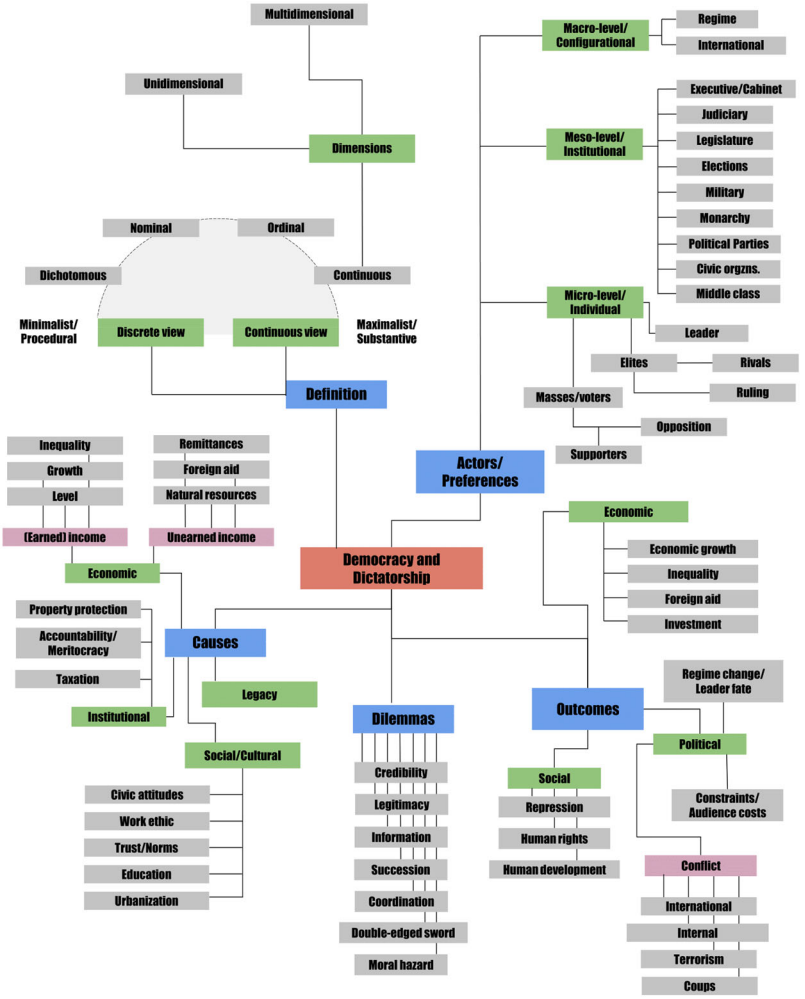


**Figure A9.** Draft concept map for class on dictatorship and democracy.