College Students' Perception of the Research Structuring Method and Their Adoption: Using Rodgers' Diffusion of Innovation Theory

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Abstract: Writing as a communication tool plays a vital role in students' succeeding in today's world. Recognizing this vital role, many universities and professors have emphasized the importance of excellent writing. When it comes to research paper writing, however, too much emphasis on the research aspect could jeopardize the entire writing process since writing a coherent and emphatic article is a daunting task, let alone understanding the discipline and fill the research gap. The author introduced a research structuring method to students. They were strongly encouraged to write one of three software programs -- Microsoft Word, X-Mind, or MindNode-- to organize the summaries they made while reading research source articles. In a survey with 68 senior seminar students in five classes over three semesters, the author found that a majority of students had written a research paper before coming to the senior seminar class, but their preparation should have much room for improvement. The majority (69.0%) of students were favorable toward the new method for structuring ideas, but their adoption rate was lower than this favor rate. The lower adoption rate was analyzed based on Rogers' diffusion of innovation theory, mainly focusing on four attributes of relative advantage, compatibility, complexity, and observability, excluding trialability.

Keywords: vital role of writing; research structuring method; diffusion of innovation; Rogers; research vs. writing

I. Introduction

Writing plays a vital role in succeeding nowadays even for careers that are not designed for professional writers. Whether students want to be lawyers, salespeople or other jobs, strong writing skills are necessary. Since personal and business transactions are increasingly moving to the online world, writing skills will grow important. Excellent writing skills will lead to efficient, effective, and credible communication, and even self-improvement through organizing scattered thoughts and ideas to a higher level (Laurinavicius, 2016).

Communication is one of the skills employers want from their new hires. Since face-to-face contact is increasingly being replaced with online communication, the latter grows important (Emma 2018). Individuals spend much time at work communicating with others via written

communications like emails, notes, letters, or social media. Better writing results in more credibility than bad one (Laurinavicius, 2016).

The importance of writing is also recognized by the academia, too. Davenport, a public relation firm's president and CEO and a faculty member with Purdue's Brian Lamb School of Communication, emphasized the importance of writing with an example: just wrong dates in an ad cost her company over $250,000 for reprinting (Davenport, n.d.).

Responding to the need for strong writing skills, many universities have emphasized writing. They began to "make the writing process a priority at all levels of instruction and across the curriculum." Students are "encouraged to produce and refine various forms of writing for different audiences in different disciplines. When USA News and World Report surveyed college presidents and others from more than 1,500 schools to find out institutions with "stellar examples of writing" in 2017, Elon University, where the author is teaching, ranked first ("2018 Writing in the Disciplines | US News Rankings," n.d.). Elon's excellence is due to the university's efforts along its five-year Writing Excellence Initiative ending 2018(dcooper13, 2014). Elon compiled writing objectives from its different disciplines; more than a half faculty created assignments to address a real or imagined audience, about a half of permanent faculty and 113 staff members and administrators participated in WEI-related activities; and the writing center consulted over 13,000 times. For example, student consultants met with 40% of first-year students in the 2016-17 academic year ("Accomplishments," n.d.).

It is not easy to enhance the general writing skills for students. When it comes to research writing for them, it is a daunting task even though the research process is worthwhile. Writing for research can instill an inquisitive mind, which can be utilized to solve problems on the job, cultivating a spirit of inquiry, which is the vital part of the academia (Brent 2017, p. 335). One of the methods for enhancing student writing skills can be relying on a new approach. The author adopted a new writing method and tested whether it can work for students.

II. Literature Review

Writing literature review is not straight-forward. After analyzing the methodologies of multiple studies based on an analytical frame of Search, Appraisal, Synthesis, and Analysis (SALSA), Grant and Booth (2009) identified 14 different review types: critical review, literature

review, mapping review/systematic map, meta-analysis, mixed studies review/mixed methods review, overview, qualitative systematic review/qualitative evidence synthesis, rapid review, scoping review, state-of-art review, systematic review, systematic search and review, systematized review, and umbrella review. Few of these types are explicitly delineated and separated from other types. Any of these 14 reviews are also not perfect, having its strengths and weaknesses. While considering the time and resources available, and the nature of research questions under investigation, researchers need to decide on the type of literature review that is fit for purpose, not against a single 'gold standard' of what a review should or should not be" (2009, p. 105).

A journal article for librarians like the one above can go to this level of minutiae about the different types of reviews. However, researchers are much more straightforward, generally emphasizing two things in research: understanding the body of knowledge and fill an existing research gap. To do excellent research, researchers must understand how their new research fits into the existing body of knowledge and show that their research contributes to the field of their interest (Huff 2009; Maxwell 2013).

To reach this level of understanding, researchers must spend years becoming familiar with the domain of their discipline. They also should be alert to new findings and developments, monitoring recently published journal articles and attending conferences in their discipline. To navigate the enormous amount of information is a daunting task. Even doctoral students can feel as if they were lost in a forest of information during their dissertation process (Rudestam & Newton, 2015, p. 3).

Undergraduate students in the real world are not able to do the same level of research expected from traditional scholars. While their professors mention that the goal of the research is identifying research gaps and addressing them, undergraduate students are often realistic and quite concerned about completing their research paper within a limited time, a semester. They often limit their study to a summary of others' research as secondary sources. Even when they can go one step further to collect their data for their primary research, students still need to organize these source notes in a logical and emphatic manner. To do this well, students have to analyze the notes they took while reading research papers and organize them for a smooth flow of ideas.

Expert researchers' advice below will not help for colleges students who are still inexperienced researchers. McFeeters writes, "Start with a general topic and read until you come up with a question. Deciding on a question is perhaps the most critical step. The question must be unique enough to spur an interesting argument, but still adequately answerable" with the sources a researcher can access. However, most students would not spend time reading enough material to narrow down their topic to a specific one; nor is they capable of whether their reading can adequately answer their question. Thus, they would inevitably ask for the precise steps they have to take instead.

One textbook on writing a research paper for undergraduate students suggests step-by-step advice for transforming the notes into a rough draft by formulating a thesis, picking notes that are relevant to the thesis; organizing notes; and writing an outline. However, unity, coherence, and emphasis should be simultaneously considered in organizing the paper (Winkler & Metherell, 2012, Chap. 7).

This suggestion is not still concrete enough for college students. Interestingly, more concrete steps have been developed for pre-college education programs. Based on literature review, a group of scholars have found "that computer-based concept mapping can serve as a cognitive tool that enhances students thinking, develops students' problem-solving and reasoning skills, and helps to transfer these skills to a set of similar problems" (Lin, Strickland, Ray, & Denner, 2004). Based on these findings, they experimented with eighth-grade students to see whether a group of students can do better in prewriting preparation when they draw a concept map using Inspiration software in comparison with another group relying on the paper-and-pencil method. Both groups used the same template, which has a structure of the introduction as an attention getter, followed by a thesis or opinion statement, three reasons for the statement that are supported by two examples or two pieces of evidence each, and the conclusion. The researchers found that the experimental group who wrote an essay with the software generated more ideas and scored higher on the quality of their concept maps at the prewriting stage in comparison with the control group who drew a concept map with the paper-and-pencil method (2004).

Some teachers even took one step further by providing graphic organizers in the writing steps. After examining past research, one researcher found that graphic organizers aid students with learning disabilities in "organizing thoughts, brainstorming ideas, and linking information

learned from literature to prior schema," but its impact on organizational skills in writing has been minimally studied with some groups like high school students (Brown, 2011). Regan et al. (2018) tested to see whether mobile-based graphic organizers (MOGO) can help 7th-grade students in the writing process. They found the MOGO enhanced the holistic quality of students' writing and increased the use of transition words in comparison with the control group without the MOGO. Students and teachers who used MOGO also had favorable opinions of the method.

Modeling after conceptual maps and graphic organizers, the author introduced students to a research structuring method to help them systematically analyze their writing, especially their literature review. In the structuring method, students were asked to deeply think about the content of each source article by writing a few relevant keywords. Students were asked to organize and reorganize the summaries of sources based on their corresponding keywords for a smooth flow and emphatic impact in the context of the entire research paper. Since many students were visual learners, this method introduced visual design they could use to their advantage. This structuring method was also used to organize source articles in PDF by linking them to their research paper for easy retrieval later.

To assess students' attitudes toward the new method, the author adopted Rogers' (1995) diffusion of innovation theory. This theory can help the author better understand the adoption of a writing tool in the classroom since the theory focuses on the diffusion of various kinds of innovations including new technology or method. According to Rogers (1995), "An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 11). Adoption of a new idea, even when it has many obvious advantages, is not easily done. The success of adoption or the adoption speed, according to Rogers, is determined by how adopters perceive five important elements. They are the attributes of innovations: 1) relative advantage, 2) compatibility with "the existing values, past experiences, and needs of potential adopters" (p. 250), 3) complexity, 4) trialability, and 5) observability or visibility to others (chap. 6).

The Purpose of Research

Based on the author's experience over many years as a senior seminar teacher and the editor of a journal for student research papers, the author found that students often encounter difficulties in structuring their ideas, even when their ideas and sources of data are superb. Some of them haphazardly placed summaries of source articles so that the author had to spend much

time figuring out what they intended to convey. To test whether this structuring method can help students write their research paper more effectively, the author experimented with his five senior seminar classes over three semesters. He implemented the method using three different software programs: Microsoft Word, XMind, and MindNode. Although students were strongly encouraged to use the new method throughout the semester, this research focused on students' use mainly when they wrote a literature review.

Research Questions

In this paper, the following three questions were asked:

- RQ1: What kind of experiences did they bring to the senior seminar class?
- RQ2: What kind of perceptions did they have of the new research structuring method?
- RQ3: Why did they adopt the new writing method or not?

III. Research Methods

Many methods can be used to study research process. Detailed process logs, think-aloud protocols, textual analyses, or screen-capture of screens can all illustrate an individual's writing process. To understand students' perception, researchers must study how they understand the research process rather than observing them (Brent 2017, p. 338). Thus, this study used the survey method.

In fall 2016, 12 students in a COM495 senior seminar[1]class, which will be called Class A for this paper, used Microsoft Word to analyze their summaries of sources and reorganize them into a logical and emphatic manner. They were asked to find three or four sections under the literature review and write their section titles, as shown by the circled 1 in Appendix I. All summaries are placed under one of the sections, and each summary should be preceded by a few keywords (refer to the circled 2). For a smooth flow of ideas, students were asked to write transitions as needed (refer to the circled 3). As a method of organizing source articles in PDF form, they were asked to attach them as a link to the corresponding citation in text or in the bibliography (refer to the circled 4). Sixteen students in another class in fall 2016, Class B, used XMind, a mind-mapping software program. This program allows users to create nodes and child nodes to accommodate a few words either by clicking the tab key or the return key depending on

[1] The course's official title is Great Ideas: Issues and Research.

where the cursor is active. Students were asked to write section titles, subsection titles, or theme keywords that represent each article (refer to the circled 1 in Appendix II). The summary of each article itself can be written in a notes pane (refer to the circled 2); articles in PDF can be attached to each summary (refer to the circled 3). Students could export the entire mind map into a text file with a free version or into a Word file with a paid version. All nodes and child nodes can be reorganized by dragging and dropping them to an appropriate place.

In spring 2017, 13 students in COM495 students, Class C, used MindNode, another mind-mapping tool, which has the same features as XMind (refer to the circled 1, 2, 3 in Appendix III). MindNode has one useful feature that automatically converts a mind node map into a linear text with the aid of Marked 2, another software program. With these programs, students can access their paper in a linear format as well as in a structured map format. Students were strongly advised to purchase them before their trial period ends.

In fall 2017, 27 students in two more sections of COM495 students, which will be called Class D hereafter, were introduced to MindNode. However, a newly updated version of MindNode required a newer version of a Mac OS, to which some of the students could not upgrade their old operating system because their computer was not powerful enough. Other students used a PC computer or a Chrome book, so they were introduced to other programs like XMind or iThoughtsX. Because of this hitch, the author did not make use of these programs as mandatory.

At the end of the three semesters, students were given an online survey to collect their observations and thoughts on the new method.

IV. Findings and Analysis

Writing experience before taking the class

Level of experience: Among 68 survey participants, 42 (61.8%) of students indicated that they had research paper writing experience at the same level as what the senior seminar paper requires.

Table 1. Research paper writing experience at the same level as the senior seminar paper

The same level of Experience	No.	%

Yes	42	61.8%
No	25	36.8%
no answer	1	1.4%

Notetaking methods: Students used an average of 1.7 methods. Most of the students used either an annotated bibliography on a computer (64.7%) or a notepad to take notes (47.8%). Fourteen students (20.9%) directly write a research paper without taking notes, sometimes or always. Out of 17 (25.4%) students who chose other methods, 10 (14.7%) highlighted source articles after printing them out and took notes on them.

Table 2. Methods of Taking Notes

Methods of Taking Notes	No.	%
1) Write an annotated bibliography on a computer	44	64.7
2) Take notes on a notepad	32	47.8
3) Write no notes since you just read research papers and start to write ideas in your research paper	14	20.9
4) Write notes on index notes cards	6	8.8
5) Use other methods	17	25.4
Total	113	168.7

Notes. The total number of students was 68. One student did not answer this question.
The total is more than 100% because some students used multiple methods.

Organizing ideas: Students used an average of 2.6 methods to organize ideas. The most popular method was computer outlining (67.6%), followed by cutting/pasting (45.6%), mental juggling (45.6%), outlining on paper (45.6%), scribbling on paper (30.9%), etc.

Table 3. Methods of Organizing Ideas

Structure/Group/Rearrange	Students No.	%
1) Write an outline on computer before writing	46	67.6
2) Cut and paste pieces of information while writing on a computer	31	45.6
3) Juggle ideas mentally before writing	31	45.6
4) Write an outline on paper before writing	31	45.6
5) Brainstorm by scribbling ideas on paper	21	30.9

6) Use a Mind map or a concept map	8	11.8
7) Conduct free writing before writing	4	5.9
8) Shuffle index note cards to reorganize ideas	1	1.5
9) Other methods	1	1.5
Total	174	255.9

Students' adoption of structured writing in COM495 class

Students were asked to write a summary of each article and write a few theme keywords for each article. They were asked to pigeonhole each into one of three or four sections under the literature review. They arranged summaries under each section for unity and coherence, while adding transitions as needed.

When asked how to evaluate this method as a research tool, the majority of people chose either "very useful" or "somewhat useful" (40 out 58 students, 69.0%) (see Table 4).

Table 4. Assessment of Each as a Research Tool

	Text App	Xmind	MindNode 1	MindNode 2	Total*
Very useful	4	2	5	3	14 (24.1%)
Somewhat useful	8	5	5	8	26 (44.8%)
Not sure	0	3	1	3	7 (12.1%)
Somewhat useless	0	4	1	3	8 (13.8%)
Very useless	0	2	1	0	3 (5.2%)
No answer	0	0	0	10	10

*The percentage of row totals was calculated after excluding the category of "No answer."

Even though 69.0% of students expressed a favorable view of the new method, their adoption rate during the semester was not as high. Only 25 (40.3%) out of 62 students who answered indicated that they used the tool to organize their ideas.

Table 5. Adoption of the Experimental Method for Structuring Ideas

	Notes App	XMind	MindNode old	MindNode new	Row total*
Yes	5	5	7	8	25 (40.3%)
No	7	10	6	14	37 (59.7%)
Col. total	12	15	13	22	62 (100%)

There was not much difference between experienced and less experienced writers. Those who had previous experience writing a research paper at the same level as required by the COM495 class adopted at the level of 39.5%, while those without the same level of experience reached 41.7%. The difference between these two groups was not statistically different.

Table 6. Adoption of the Method for Organization by Research Experience

	Adoption for organizing	No adoption for organizing	Row_totals
Experience_yes	15 (39.5%)	23 (60.5%)	38
Experience_no	10 (41.7%)	14 (58.3%)	24
Col. totals	25(40.3%)	37(59.7%)	62

When asked whether they used the method to attach source articles, 30 out 62 (48.4%) used attachment while the rest of 32 did not use this feature, a little higher than the rate of adoption for organizing summaries. When these 32 students were asked how to evaluate the new method for organizing source articles, 67.9% of students thought the method as “very useful” or “somewhat useful.”

When asked whether they might use the method in the future, the students’ adoption intention was a little lower. The percentage of those who indicated that they are “very likely” or “somewhat likely” to adopt this method in the future dropped to 36.2% (see Table 7).

Table 7. Students’ Intention to Use the New Method

Category	Very likely	Somewhat likely	Not sure	Somewhat unlikely	Very unlikely	Total
No. (%)	5 (8.6%)	16 (27.6%)	17 (29.3%)	5 (8.6%)	15 (25.9%)	58 (100%)

Reasons for adopting or bypassing the new method

Before deciding whether to adopt an innovation, individuals assess its five attributes, according to Rogers (1995). Among the five attributes, triability would not be an issue since college students experimented with the tool throughout the semester. Thus, this study focused on the remaining four attributes of advantages, compatibility, complexity, and observability.

1) **Relative advantage**: When asked how they compare the structuring method with other methods they used in the past, 27 of 60 (45%) indicated that this new method is "far better" or "somewhat better" than others.

2) **Compatibility**: To measure the compatibility of the new method, students were asked how this method is similar to or different from other methods. "Very similar" and "somewhat similar" were chosen by 30.5% of students.

3) **Complexity**: To measure the complexity of the new method, students were asked about the difficulty of this method. "Very easy" and "somewhat easy" accounted for 47.6% of the students' responses. While the new method differed from what they had used in the past, the students didn't think it was difficult, just different.

Table 8. Attitudes toward Advantage, Compatibility, and Complexity of the New Method

Relative Advantage		Compatibility		Complexity	
Category	No. (%)	Category	No. (%)	Category	No. (%)
Far better	6 (10.0%)	Very similar	3 (5.1%)	Very easy	10 (16.9%)
Somewhat better	21 (35.0%)	Somewhat similar	15 (25.4%)	Somewhat easy	24 (40.7%)
Not sure	20 (33.3%)	Not sure	10 (16.9%)	Not sure	4 (6.8%)
Somewhat worse	11 (18.3%)	Somewhat different	18 (30.5%)	Somewhat difficult	17 (28.8%)
Far worse	2 (3.3%)	Very different	13 (22.0%)	Very difficult	4 (6.8%)
Total	60 (99.9%)	Total	59 (99.9%)	Total	59 (100%)

To better understand the complexity of the new method, students were offered an open-ended question about the difficulties they encountered while trying the new method.

New organization method: Among 68 students, 43 students answered the question. Among those who answered, 12 mentioned the new organization method was too daunting and unnecessarily complicated and even hampered their natural writing process. Some of the comments were placed below:

• It was hard to know where to put each idea when organizing them. I am not as organized as the method demands. Breaking up the paragraphs into too many sections and transitions
• It just does not let thoughts come out as naturally.
• Was more complicated than what it was worth
• I am not an analytical person, it was too complicated and confusing for me
• I'm not an analytic person. I'm a writer. I'm messy, sometimes unorganized, but I am always able to pull my thoughts together for a final product. After four years of undergraduate college, I understand how I work best, and MindNode did not serve much of a purpose for the work I was doing.
• It felt like more work than what I was getting out of it, almost like an unnecessary step

The value of the method, however, seemed to dawn on a few students as shown by their remarks below:

• Usually I just write and edit as I go, but I felt like I needed to be much more organized with this writing.
• Initially I found it difficult to break down my thoughts into sections.
• Subsection headers can be very specific and confusing at times but for the most part they are helpful.

A few students even seemed to adopt the new method.

• Took time to get use to
• Different way to think, it takes time to adapt to this way or organizing ideas

Program itself: Nine students could not use the method to its full potential because they relied on a free version. For example, students could export their writing to text, not Microsoft Word with the free version of XMind; MindNode required another software program, Marked 2, for an automatic linear display of a MindNode map. The latter also allowed only a maximum of 10 nodes.

Computer power: 5 out of 68 students mentioned their computer problem, such as the application being slow on the computer; their computer freezing, or their computer not having enough room to run the program.

Computer skills: 2 students indicated that their computer skills were their problem, such as juggling different programs and downloading and starting the program.

4) **Observability**: The author showed students in class mostly how to use the new method in terms of technical standpoints. Showing how to apply the new method to real cases could have helped students appreciate the method. Thus, the survey asked whether they would like to observe how other students used the method through samples, or whether they would like the instructor to guide them while they were using the method. Students would "very likely" or "somewhat likely" understand the merits of the method if examples were shown (74.6%) or if a hands-on guide was offered (43.7%) (see Table 9).

Table 9. Effects of Samples or Hands-on Guide

Samples		Guide	
Category	No. (%)	Category	No. (%)
Very likely	22 (37.3%)	Very likely	14 (23.7%)
Somewhat likely	22 (37.3%)	Somewhat likely	13 (22.0%)
Not sure	7 (11.9%)	Not sure	17 (28.8%)
Somewhat unlikely	4 (6.8%)	Somewhat unlikely	10 (16.9%)
Very unlikely	4 (6.8%)	Very unlikely	5 (8.5%)
Total	59 (100.1%)	Total	59 (99.9%)

V. Conclusion and Implications

Rather than taking the procrustean approach, college teachers need to be flexible to accommodate diverse needs of students. There is no right or wrong way of doing literature review. Depending on students' eagerness to do research, their expertise, which generally depends on their class rank, the time available to them, and the instructor's goal of research, it should be adjusted. Whatever is the goal of the research, however, they need be written well since writing is important in students' future career.

The structuring method is needed by many students, who have problems with unity and coherence in their writing and organizing source materials. The usefulness of the new method was noticed by 69.0% of the students who answered the survey. Its adoption rate was, however, low for the structuring of ideas (40.3%), organizing source materials (48.4%), and their future use of the method (36.2%).

The attributes that Rogers mentioned would explain the lower adoption rate, now and in the future. Students have adopted and used methods over many years even though theirs were ineffective. For example, some students wrote a research paper without even taking notes; others juggled ideas mentally before writing.

The senior seminar class is taken by senior students, who are thinking about the time after graduation. They would not jump to a new idea and be ready to change their habit of writing style when they are concerned about the completion of a research paper. Many would only see the new method as a hindrance to their way of writing.

Some students saw the value of the method. Other students could tend to be more open-minded toward the new method. Even these students could feel frustrated when the new method did not work as explained due to technical issues like the computer power and the limitations of free programs.

A new writing method requires a change to students' habit of mind, spending sufficient time understanding the content of each article thoroughly, tagging a few theme keywords on each summary, and finding its proper place in the context of the whole article.

It could be instituted during the students' freshman year when they are more impressionable and open-minded to a new method. If this method can be only introduced in the senior year, like in the senior seminar class, a lab providing necessary software programs should

be used for instruction. If this kind of lab is not available, the method can be suggested as an option for students, or a tool for professors when they show how to organize or reorganize students' paper rather than tell it.

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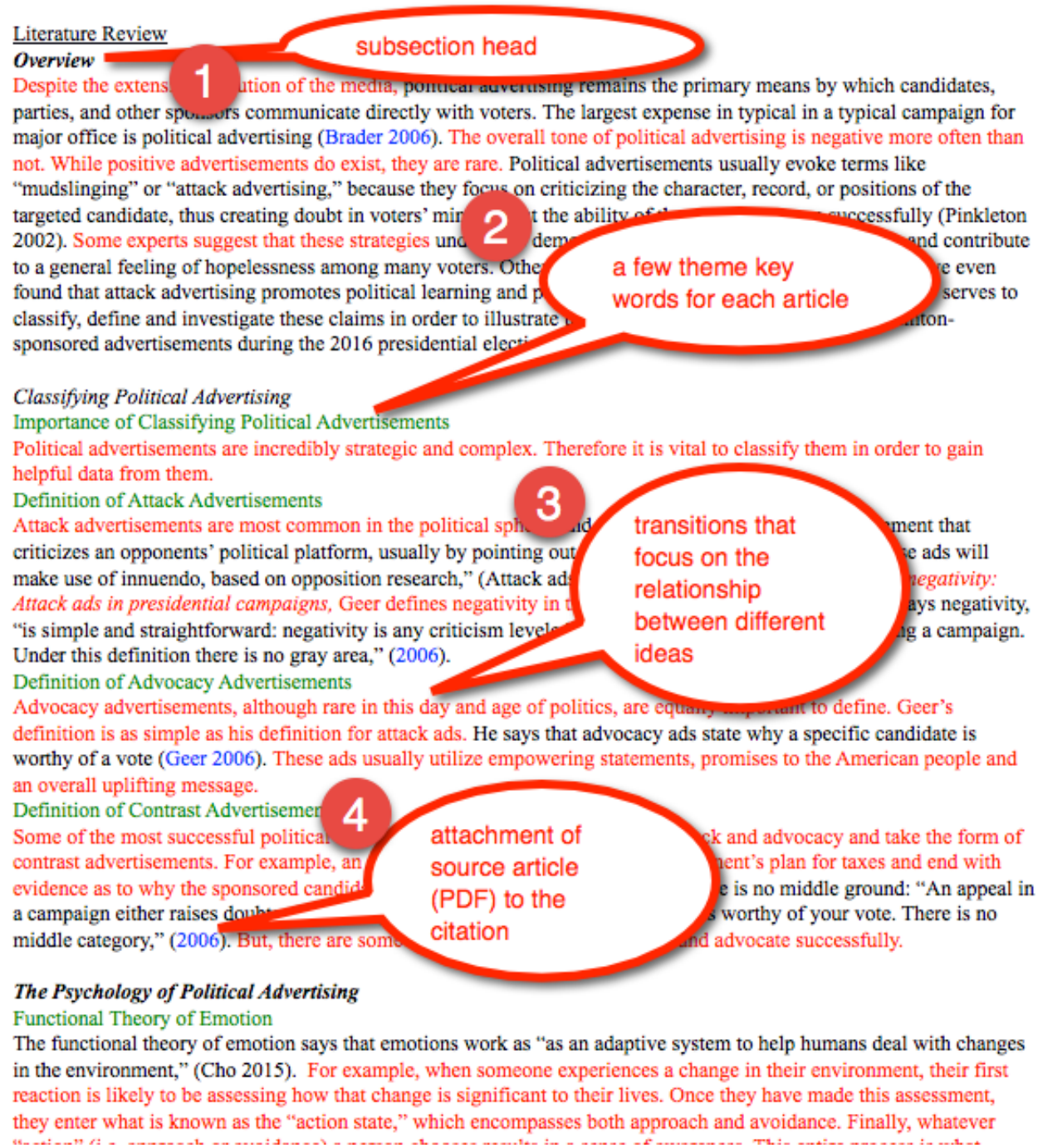
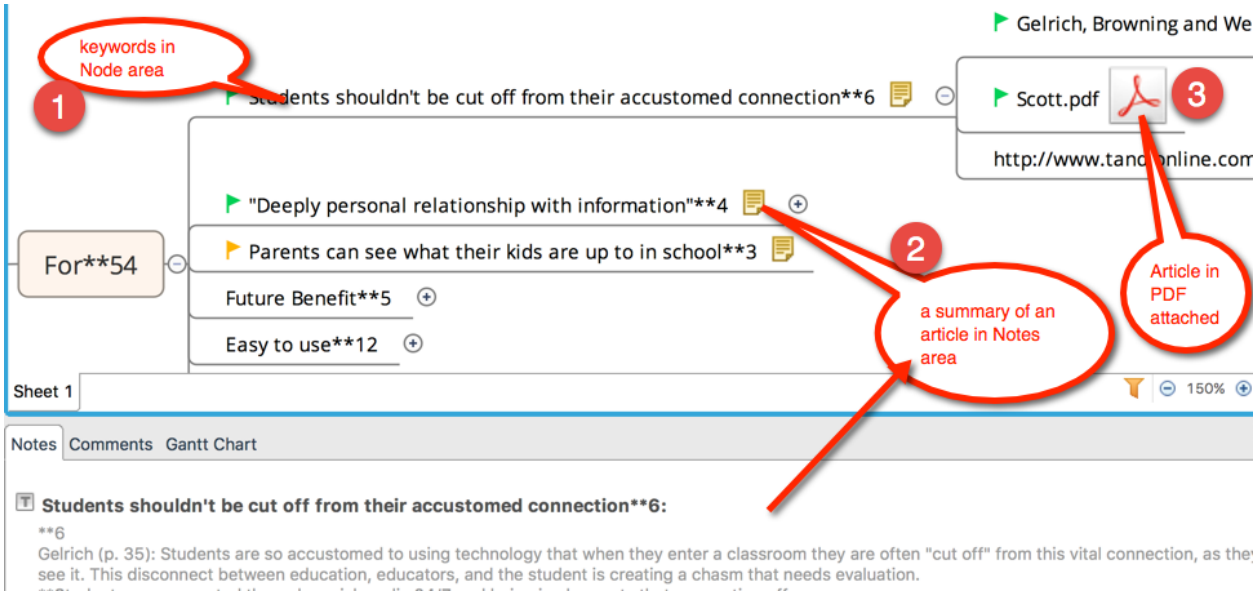
Appendix I.
Restructuring literature review on traditional text processing software Microsoft Word.



Appendix II.

Restructuring literature review on XMind



Appendix III.
Restructuring literature review on MindNode