The Effects of Online Mind Mapping on the Cognitive Outcomes of Students and Their Perceptions in the Collaborative Prewriting Stage

Yen Thanh Hai Duong
THE EFFECTS OF ONLINE MIND MAPPING ON THE COGNITIVE OUTCOMES OF STUDENTS AND THEIR PERCEPTIONS IN THE COLLABORATIVE PREWRITING STAGE

A Dissertation Presented
to
The Faculty of the School of Education
Learning and Instruction Department

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

by
Yen Duong
San Francisco
May 2024
THE UNIVERSITY OF SAN FRANSCISCO

Dissertation Abstract

The Effects of Online Mind Mapping on the Cognitive Outcomes of Students and Their Perceptions in the Collaborative Prewriting Stage

In language acquisition, writing is the most challenging skill that English learners must master. Students often struggle at the beginning of their writing process with idea generation. Due to students’ low academic achievement and their struggles, online mind mapping is suggested as a useful tool to support language students’ brainstorming and idea organization during the writing process.

The purpose of this mixed-method study was to investigate how online mind mapping can help students collaboratively brainstorm and organize their ideas during the prewriting process. This study focused on the effects of online mind-mapping intervention on student academic writing performance and perceptions in a Read-Think-Write 2 class at FPT University, a private university in Southern Vietnam. In the study, the independent variable was online mind mapping, and the dependent variables were student idea elaboration and organization. For the treatment group, mind mapping was part of instruction for the course. Data collection included a presurvey, a questionnaire and a posttest from the mind-mapping training session, class assignments, a coursework inventory, and the final writing exam grades from their previous ERW411 class.

Findings from this study indicated that there was a statistically significant relationship between student understanding of online mind mapping and their brainstorming and organization. The results also revealed that there were no statistically significant differences in idea elaboration and organization between the two groups, but the mean for students from the
treatment group were slightly higher than the ones from the control group. Students from both
groups agreed that the coursework was somewhat interesting and useful, and they believed that
they could succeed in the course. Eighty percent of interviewed students shared their positive
attitudes toward the effects of online mind mapping in the prewriting process, whereas all of
them expressed a desire to continue using online mind mapping in future courses.

This study provided an evidence-based framework for implementing technology-
assisted tools, namely online mind mapping, into language acquisition. Educational practitioners
should enable more instructional technologies to support language teaching. Additional research
with a larger number of participants in different educational settings would further expand the
findings with more effective instructional strategies for teaching and learning.
SIGNATURE PAGE

This dissertation written under the direction of the candidate’s dissertation committee and approved by the members of the committee, has been presented to and accepted by the Faculty of the School of Education in partial fulfillment of the requirements for the degree of Doctor of Education. The content and research methodologies presented in this study represent the work of the candidate alone.

Yen Duong          May 6, 2024
Candidate

Dissertation Committee

Dr. Patricia Busk         May 6, 2024
Chairperson

Dr. Helen Maniates         May 6, 2024
Committee Member

Dr. Devanshi Unadkat       May 6, 2024
Committee Member
ACKNOWLEDGEMENTS

I extend my heartfelt gratitude to those who have supported me during my doctoral program at the University of San Francisco: my family, professors, friends, coworkers, and relatives.

Firstly, I would like to acknowledge my chairperson, Dr. Patricia Busk, for her unwavering support, invaluable guidance, and insightful feedback throughout my dissertation journey. Her research experience and constructive feedback have helped shape the direction and quality of this work. She has been with me to go through all the challenges I have encountered while writing this dissertation. She sacrificed her time, including holidays and weekends, to guide and help me finish my work. She is one of the best professors I have had the pleasure of working with during my time here. I deeply appreciate Dr. Busk for all her assistance. She has been a fantastic role model and advisor, and I can only hope to be as amazing toward my future students.

I am deeply thankful to my committee members, Dr. Helen Maniates and Dr. Devanshi Unadkat, for their valuable input, constructive criticism, and scholarly contributions. Detailed feedback from Dr. Maniates and suggested sources from Dr. Unadkat have enriched this study and broadened my understanding of the subject matter.

Special thanks go to my former Dean of English Department, Ms. Thuyet Dang, and all students from two ERW421 classes at the FPT University for their participation in my research during the Spring 2024 semester. I am grateful for the assistance of Ms. Thuyet regardless of time zone difference and time limit. Although she was busy managing the department and teaching her own classes, she was willing to explore the application of Mindomo mind mapping so that she could provide her students with constructive feedback throughout the research process.
My sincere appreciation also goes to my relatives and friends: my aunt Hanh Nguyen, priest Paul Tan Pham, Ngan Nguyen, and three dearest friends: Hung Truong ¹, Hoa Tran, and Hung Truong ². Their support has been a source of motivation and inspiration throughout this academic journey. I would have never started this journey without Hung Truong ¹’s encouragement. He encouraged me to fulfill my dream and supported me throughout the process. I will also never forget the spiritual and financial support from Hoa Tran, who has supported me from my first day in California. She is my soul sister, and she was beside me whenever I felt homesick. She spoiled me with my favorite food and chocolate as an encouragement to complete my assignments before the deadlines. And I always believe Hung Truong ² is a present that God sent to me during my most challenging time as a doctoral student. He is always there to listen and give me advice. He is also my writing teacher, willing and patient enough to edit my paper without complaint.

Finally, I would like to express my deepest gratitude to my family, especially my parents, my siblings, and my niece, Cola, for their unwavering love, encouragement, and sacrifice. Their daily encouragement and discussions were the most powerful motivation for me to keep moving toward my goal. Their belief in me has been my greatest strength, and I am forever grateful for their support.

This dissertation would not have been possible without the contributions and support of all those mentioned above. Thank you for being part of this journey.
DEDICATION

Life is a miracle. You never know how far you can travel until you begin walking. I have believed. I have kept moving forward. And I have achieved my dream.

To those who have helped me fulfill my dream, especially my parents, I cannot make it without your support and encouragement.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xi</td>
</tr>
<tr>
<td><strong>CHAPTER</strong></td>
<td></td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>1</td>
</tr>
<tr>
<td>Purpose of the Study</td>
<td>3</td>
</tr>
<tr>
<td>Background and Need</td>
<td>4</td>
</tr>
<tr>
<td>Significance of the Study</td>
<td>7</td>
</tr>
<tr>
<td>Theoretical Rationale</td>
<td>8</td>
</tr>
<tr>
<td>Research Questions</td>
<td>10</td>
</tr>
<tr>
<td>II. REVIEW OF THE LITERATURE</td>
<td>11</td>
</tr>
<tr>
<td>Prewriting</td>
<td>11</td>
</tr>
<tr>
<td>Prewriting techniques</td>
<td>12</td>
</tr>
<tr>
<td>Collaborative prewriting</td>
<td>15</td>
</tr>
<tr>
<td>Mind Mapping</td>
<td>16</td>
</tr>
<tr>
<td>Elements of a mind map</td>
<td>17</td>
</tr>
<tr>
<td>Benefits of mind mapping on learning</td>
<td>19</td>
</tr>
<tr>
<td>Online Mind Mapping and its Benefits on Prewriting</td>
<td>23</td>
</tr>
<tr>
<td>Summary</td>
<td>24</td>
</tr>
<tr>
<td>III. THE METHODOLOGY</td>
<td>26</td>
</tr>
<tr>
<td>Research Design</td>
<td>27</td>
</tr>
<tr>
<td>Research Settings</td>
<td>28</td>
</tr>
<tr>
<td>Participants</td>
<td>29</td>
</tr>
<tr>
<td>Protection of Human Subjects</td>
<td>30</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>31</td>
</tr>
<tr>
<td>Presurvey</td>
<td>31</td>
</tr>
<tr>
<td>Questionnaire and posttest</td>
<td>32</td>
</tr>
<tr>
<td>Rubrics</td>
<td>32</td>
</tr>
<tr>
<td>Coursework inventory</td>
<td>33</td>
</tr>
<tr>
<td>Interview questions</td>
<td>35</td>
</tr>
<tr>
<td>Establishing Trustworthiness of Data</td>
<td>35</td>
</tr>
<tr>
<td>Treatment Description</td>
<td>36</td>
</tr>
<tr>
<td>Procedures</td>
<td>36</td>
</tr>
<tr>
<td>Quantitative data collection</td>
<td>37</td>
</tr>
<tr>
<td>Qualitative data collection</td>
<td>37</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>38</td>
</tr>
<tr>
<td>Instructor for the Study</td>
<td>38</td>
</tr>
<tr>
<td>Position of the Researcher</td>
<td>39</td>
</tr>
<tr>
<td>Summary</td>
<td>40</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS continued

IV. THE RESULTS ...............................................................................................................42
   Introduction.....................................................................................................................42
   Research Question 1 .......................................................................................................44
   Research Question 2 .......................................................................................................45
   Research Question 3 .......................................................................................................46
   Research Question 4 .......................................................................................................48
   Research Question 5 .......................................................................................................49
   Summary ........................................................................................................................54

V. SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS ..................................57
   Summary of Study ..........................................................................................................57
   Summary of findings.......................................................................................................58
   Limitations ......................................................................................................................60
   Discussion of Results ......................................................................................................62
   Conclusions .....................................................................................................................69
   Implications for Future Research....................................................................................70
   Implications for Education Practice................................................................................71
   Afterword ........................................................................................................................73

REFERENCES ...........................................................................................................................74

APPENDIXES ............................................................................................................................81

   Appendix A: A Script of The Consent Form .................................................................82
   Appendix B: Department Informed Consent Form .........................................................85
   Appendix C: Course Instructor Informed Consent Form .................................................87
   Appendix D: Students Informed Consent Forms ............................................................89
   Appendix E: Presurvey ...................................................................................................97
   Appendix F: Questionnaire – Mind Mapping (before the training)...............................99
   Appendix G: Posttest – Mind Mapping (after the training).............................................102
   Appendix H: Rubric for Argumentative Essays ..............................................................105
   Appendix I: Rubric for Mind Maps ...............................................................................111
   Appendix J: Modified Coursework Inventories .............................................................113
   Appendix K: Online Interview Questions .....................................................................117
   Appendix L: Training Presentation Slides ....................................................................119
   Appendix M: Mind-Mapping Training Website ............................................................124
   Appendix N: Timeline for the Treatment Group .........................................................128
   Appendix O: An Example of a Mind Map Developed by Students .............................132
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A 4-level Vertical Mind Map</td>
<td>18</td>
</tr>
<tr>
<td>2. Different Colors and Shapes Applied to a Mind Map</td>
<td>19</td>
</tr>
<tr>
<td>3. A Mind Map with an Image and Files Attached</td>
<td>20</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demographic Survey Results for Treatment and Control Group Participants</td>
<td>29</td>
</tr>
<tr>
<td>2. The Modified Coursework Inventory Components and the Definitions</td>
<td>34</td>
</tr>
<tr>
<td>3. Final Writing Exam Grades from the EWR411 Class</td>
<td>43</td>
</tr>
<tr>
<td>4. Descriptive Statistics and Correlations Coefficient for Mind-Mapping Total Score and Students’ Idea Brainstorming and Organization</td>
<td>45</td>
</tr>
<tr>
<td>5. Independent-Samples $t$-Test Results in Idea Elaboration Scores for Control and Treatment Groups</td>
<td>46</td>
</tr>
<tr>
<td>6. Independent-Samples $t$-Test Results in Idea Organization Scores for Control and Treatment Groups</td>
<td>48</td>
</tr>
<tr>
<td>7. Independent-Samples $t$-Test Results in Interest, Success, and Usefulness for Treatment and Control Groups</td>
<td>49</td>
</tr>
<tr>
<td>8. Demographic Characteristics of Individual Interviewees</td>
<td>50</td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION TO THE STUDY

In English language acquisition, writing is often perceived as the greatest challenge for English learners because it requires not only semantic and syntactic mastery but also a thorough thought process in written format; students must decide what to say and then how to arrange their ideas in written form (Ali, 2018; Elahawwa, 2022). Writing becomes an even more laborious task to complete when students must produce integrated essays based on a given text.

To promote students’ writing performance, Mudawy (2019) recommended teachers should apply different techniques and activities in the prewriting stage Mudawy’s research results showed that the participant students produced better pieces of writing after the students were trained to practice brainstorming and had opportunities to read (books or articles), watch (movies or video clips), listen to (a text), and describe (pictures) with content in the assigned writing topics. Realizing the importance of the prewriting stage, Jing (2022) proposed an approach of a mobile-game-based collaborative application to enhance students’ writing skills. Jing’s findings showed that the participants’ writing skills were much improved in terms of organization of content, originality, fluency, and elaboration. Much like prewriting helps students during the writing process, several educators have also applied mind mapping—a means to visualize, present, or share one’s thoughts/ideas using diagrams—as an effective instructional tool to enhance students’ writing.

Originating with Porphyry of Tyros from around 300AD, mind mapping was first popularized by Tony Buzan a British psychology author and television personality. Prior research investigated the effectiveness of mind-mapping-based instruction in educational contexts, but the results have been inconsistent. Applying mind-mapping software weekly in
English as a Foreign Language (EFL) writing classes, the study results of Al-Jarf (2009) showed higher achievements in writing tests for the experimental students’ essay writing after helping students brainstorm, generate ideas, and relate main ideas and supporting details in the prewriting stage. The effectiveness of mind mapping to teach writing skills to participants with different IQ levels was examined, and the study found that the student participants with higher IQ performed better than those with lower IQ levels (Suyanto, 2010). Although some studies (Al-Zyoud et al., 2017; Balim, 2013; Gou et al., 2017; Sesanelvira et al., 2019) have shown that mind mapping had positive effects on academic achievements in various subjects and educational levels, Fesel et al. (2016), D’Antoni et al. (2010), Ningrum et al. (2016), and Kalyanasundaram et al. (2017) found no statistically significant differences between the control and experimental groups. Additionally, there is no evidence that the participants in these previous research studies have received sufficient training in the use of mind mapping before using it.

Although the abovementioned studies focused on the effectiveness of mind mapping individually, mind mapping also can be used collaboratively to generate ideas. Shih et al. (2009) applied GroupMind, a collaborative mind-mapping system, to support participants’ brainstorming within groups about specific set topics. The findings showed that the student groups with GroupMind outperformed those who used a traditional whiteboard in terms of memory recall and idea organization. To enhance distance learning, Bystrova and Larionova (2015) proposed virtual mind mapping as an online environment for students to collaborate while working on team projects and as a way for instructors to supervise the students’ activities. Examining the effect of mind mapping in problem-based learning, Ravindranath et al. (2016) found positive results when supporting medical students’ summary writing with mind mapping.
Not all student participants from Ravindranath et al.’s study, however, agreed that mind mapping promoted students’ problem-based learning (a method requiring students to explore and solve problems on their own) process, so their learning needs should be considered carefully before applying.

As the abovementioned studies demonstrate, the effectiveness of mind mapping has been examined broadly; however, few studies have focused on mind mapping training and how it helps students collaboratively work with their peers to elaborate and organize their ideas in the planning phase of their academic writing process. This study, therefore, will provide the participating students with a mind-mapping training session at the beginning to ensure that the students correctly utilize it. The application of Mindomo mind-mapping software also allows the students to work in pairs during the prewriting stage. Consequently, the purpose of this study is to improve students’ English writing acquisition by utilizing online mind mapping in a collaborative learning environment with training in mind mapping.

**Purpose of the Study**

Academic writing is not just the action of putting words together; it is the process involving multiple tasks such as brainstorming, summarizing, drafting, synthesizing, and revising. However, none of the above studies focused on the application of mind mapping at the undergraduate level in an English as a foreign language (EFL) setting. Furthermore, little documentation can be found that online mapping can be used as a collaborative tool to reduce students’ challenges in their academic-writing process. The purpose of the proposed study was to examine the effects of online mind mapping on students’ prewriting (namely, the elaboration and organization of ideas) and students’ perceptions of online mind mapping in the prewriting stage in a university-level Read-Think-Write 2 class. In particular, the student participants were
expected to complete an online pretraining session via Zoom before the class starts. The online one-hour training session introduced what online mind mapping is and instructed the students how to use mind mapping collaboratively and effectively in the course. The participant students’ prior knowledge and their understanding about online mind mapping were examined through pretest and posttest that have already been attached in the module. The cognitive learning outcomes were measured by ratings of the students’ idea elaboration and organization through their groupwork assignments and the final research paper from both the experimental group and the control group. Therefore, the goals of this study were (a) to prepare the student participants with the use of mind mapping before the registered course and maintain the frequent application of mind mapping in class activities such as note-taking, idea generation, and knowledge organization and (b) to investigate the effect of that preparation on the participants’ cognitive learning outcomes by comparing the outcome differences between two groups. This mixed-method study utilized the questionnaires to gauge the students’ perceptions in how online mind mapping had helped the participant students produce a well-developed research paper at the undergraduate level as well as any concerns or difficulties when working in pairs to write a research paper from both the experimental group and the control group.

Background and Need

Among the most widely spoken language in the world in 2022, English has been ranked at the top with a total number of both native and nonnative speakers, which accounts for approximately 1.5 billion speakers (Statista Search Department, 2022). English has become the dominant language of global communication means and has expanded its influences on educational contexts (Myer, 2015). Many universities in nonnative English-speaking countries have been using materials in English to provide their students with more opportunities to access
the latest or original information. Some of these schools even expect the entire teaching and learning process to be conducted in English. Therefore, students from such universities are expected to obtain a certain level of English skills prior to their participation in some academic subjects. Among the four English skills (reading, listening, speaking, writing), writing is considered as the most difficult one to acquire, resulting in the fact that many English language learners have struggled with their writing tasks even when they have passed the entry language requirements (Al-Gharabally, 2015; Ariyanti et al., 2017; Carson, 2012; Klimova, 2014).

Enhancing students’ academic skills has been a major concern in undergraduate education since 1990s (Belcher & Braine, 1995; Jordan, 1997). To attain high academic achievements, students are expected to complete various tasks and requirements in English, and writing research papers is one of the most crucial academic competencies to gain at school before graduation (Casanave, 2002; Flowerdew, 1999; Paltridge, 1997; Swales & Feak, 2004). In research writing, many students struggle to complete assigned tasks, so they often describe themselves as “bad writers.” In some cases, these struggling students turn in their work late or leave it incomplete (Fernten & Reda, 2011). To improve students’ academic writing competencies, a number of studies have investigated students’ needs, difficulties, as well as writing strategies that have been applied in the classroom (Belcher, 1994; Burrough-Boenisch, 2003; Casanave, 2002; Cho, 2004; Dong, 1996, 1998; Flowerdew & Li, 2007; Hsu, 2009; Kuo, 1998; Li, 2005, 2006; Prior, 1991; Shaw, 1991; Yeh, 2010).

One of the common methods that educators have used to assist students in better overcoming challenges of academic writing is mind mapping as a prewriting strategy. Vijayavalsalan (2016) examined the effectiveness of mind mapping as a strategy to enhance the skills of writing essays of 151 students from the General Education Program at Abu Dhabi
University. The data were collected through a questionnaire to investigate the role of mind mapping in the prewriting brainstorming stage. The findings showed that the participants wrote their essays more effectively with the implementation of mind mapping in the planning step; moreover, the students had more fun and perceived the process as more enjoyable when mind mapping was applied in their writing process. Ilham et al. (2016) studied the effect of mind mapping in writing report text of 50 students of the Department of English at the University of Muhammadiyah Mataram. Pre- and posttests were used as an instrument to collect data, in which the students from both groups were asked to write a report based on a provided topic. The reports were evaluated by the content, vocabulary, language, and mechanics. The findings showed that the students from the treatment group with the mind-mapping technique outperformed those from the control group in writing their reports. Also in 2016, Ningrum et al. conducted an experimental study with 82 students at the State Islamic Studies (STAIN) in Kediri to explore how mind mapping affected the students’ idea development before writing argumentative essays. These student participants were divided into two groups: group 1 with the use of linear notes \((n = 41)\) and group 2 with the use of mind mapping \((n = 41)\). However, Ningrum et al. found no statistically significant difference in the student participants’ idea generation between genders, and among the students’ learning styles as well as between the control and experimental groups.

Kalyanasundaram et al. (2017) studied the effectiveness of mind-mapping techniques in helping students at a medical college in Puducherry, India to retrieve information within 7 days. With the same given passage, sixty-four students joining this pilot study were divided into two groups: the control group used the text reading method, whereas the experimental group was guided by the mind-mapping technique. Both groups used the same given passage. Assessing the students’ knowledge by the predesigned questionnaires at baseline, the study findings revealed
the mean in the mind-map group was statistically significantly greater than the text group, gradually increasing from day one to day 7. The researchers suggested that mind mapping is an effective technique to increase students’ memorization capabilities.

Also interested in the effects of mind mapping, Naghmeh-Abbaspour et al. (2020) conducted a study on English writing acquisition of 30 female intermediate English-language students from an institute in Iran in 2019. The participants were divided randomly into two groups: the control group was taught by the usual training, whereas the experimental group was intervened by mind mapping twice a week. Data were collected based on pretest, during the course, and posttest. The students from both groups received identical writing questions in each test and their answers were reviewed by two teachers. The results indicated that students from the mind-mapping techniques achieved a higher mean on their posttest and provided positive responses to this technique.

**Significance of the Study**

This study is important for three reasons. First, it highlighted the crucial role of online mind mapping in extending the learners’ cognitive load by (a) systemizing the core information, (b) making connections between ideas, and (c) systemizing the core information involved in the academic paper. Images and color-coding in visualization tools like mind-mapping software could stimulate students’ attention, enhance their memorization, and maintain their interest in processing information, even with complicated tasks.

Second, this study extended previous research by providing an online learning training module of mind mapping before the main course. Unlike a normal module, this module not only explained to students what mind mapping is but also would illustrate how they can use mind mapping in practical ways such as taking notes or tracking their research process. Compared
with the traditional instruction method, the students can access this online module at any time, so
it is promising to enhance students’ comprehension and application of mind mapping in writing
their research paper.

Finally, this study reinforced the importance of mind mapping by creating an equitable
learning environment for all students, in which core knowledge has been systemized in a simple
way. The implementation of a pretraining module would help to reduce the teachers’ workload in
class, encouraging them to shift their traditional instruction techniques to accessible alternatives
with the aid of technology.

**Theoretical Rationale**

The idea of mind mapping was based on the cognitive process theory of writing of Hayes
and Flower (1980) and Vygotsky’s (1999) theory about the higher mental development. Hayes
and Flower’s theory focused on four main points: (a) writing is a complex process that includes a
combination of different skills, (b) the organization of writing stages is hierarchical and
embedded in each other, (c) writing is a process guided by goals, and (d) the writers’ goals are
formed by either the task purpose or the knowledge gained through the composing process.
Writing is an integrated skill that requires linguistic proficiency, critical-thinking skills, and
document-management skills (Deane et al., 2014). After generating ideas, a writer needs to
systemize their idea generation to real writing action like drafting in an interconnected order, and
targeted goals will help a writer decide which and how content is displayed. In other words, a
writer must know how to balance skills, hierarchy, goals, and the interplay between task-oriented
and knowledge-driven objectives to produce a well-developed writing product.

In the structure of the writing model, Flower and Hayes (1981) proposed three major
factors involved in the act of writing: (a) the task environment, (b) the writer’s long-term
memory, and (c) the writing process itself. The task environment is related to the rhetorical problem or text product, which are often out of the writer’s control such as the topic of the writing assignment or the audience. The second factor, the writer’s memory, is influenced by the long-term memory of the writer, not only for the assignment topic but also for the audience and writing plans. The last factor, consisting of three smaller stages: planning (prewriting), translating, and reviewing, is actually “a monitor” in the writing process itself. In other words, monitoring the planning, translating, and reviewing will lead to the best written product (Hayes, 2012; Hayes & Flower, 1980). Guided by setting goals in the planning stage, the writer decides a writing structure by stimulating their creative thinking, categorizing their ideas (subordinate vs. superordinate), and intending to present their ideas under text (Badger & White, 2000; Flower & Hayes, 1981; & Lan et al., 2015). Within the writing process, the planning stage is considered as the first and most difficult stage for learners to overcome. Since then, educators have been searching for ways to teach students how to write by focusing on the prewriting stage when designing lesson plans.

In the development theory, Vygotsky (1999) categorized a person’s development into two levels: lower and higher processes. If the lower process refers to a person’s physical growth like walking, the higher one involving “both overlay on and a reorganization of more basic psychological functions” are more likely to be what learners achieve from school, like writing or literacy (Vygotsky, 1997, p.107). In Vygotsky’s point of view, the development of higher process is not just a process of change, it is the mixture of the cultural-historical-social development and individual ones. Therefore, Vygotsky encouraged educators to create more cultural-social activities where learners can develop most when they work, play, and learn together.
Based on the cognitive process theory of writing of Hayes and Flower (1980) and Vygotsky’s development theory (1999), the student’s academic writing process is a complex process which is influenced by the writing topic, the student’s long-term memory, and the writing process itself. This study focused more on the writing process, specifically the prewriting stage, to support the student brainstorming and organization of ideas in a collaborative work through the implementation of online mind mapping.

**Research Questions**

The purpose of the proposed study was to examine the effects of online mind mapping on the cognitive outcomes of students in Read-Think-Write 2 at the FPT University. This study focused on how online mind mapping could help the student participants collaboratively work with their teammates to elaborate and organize their ideas in their writing process. Therefore, the study addressed the following research questions:

1. To what extent was there a statistically significant relationship between the students’ understanding of online mind mapping and their brainstorming and organization for the treatment group?
2. To what extent was there a difference between students’ idea elaboration with and without using online mind mapping in their argumentative papers?
3. To what extent was there a difference between students’ organization of ideas with and without using online mind mapping in their argumentative papers?
4. What were the students’ perceptions of the coursework with and without collaborative online mind mapping?
5. What were treatment students’ perceptions of the effectiveness of collaborative online mind mapping in their writing process?
CHAPTER II

REVIEW OF THE LITERATURE

Promoting writing skills is necessary to tackle students’ difficulties in developing their academic papers. To examine the effects of online mind mapping on the cognitive writing process of students, the following literature review is organized into three main sections: (a) prewriting, (b) mind mapping, and (c) online mind mapping and its benefits on prewriting.

Prewriting

Compared with the other three language skills, writing is the most complicated and difficult for second-language learners to acquire (Nguyen & Nguyen, 2022). Writing is described as a process in which a writer converts their thoughts into a readable text, so it will require a student writer to pay attention to not only higher-level skills such as idea development and organization but also lower-level skills like language proficiency, spelling, or punctuation (Hashempour et al., 2015).

A normal writing process includes three primary stages: prewriting, writing, and rewriting. Prewriting refers to any activities before writing down ideas; putting down those ideas into written form is the actual writing; and double-checking those written ideas is the act of rewriting. Prewriting is defined as a source of composing—a stage of discovery—mostly related to a student writer’s development of ideas, including planning what to write and designing the structure for their written product (Huff & Kline, 1987; Mogahed, 2013; Rohman, 1965). In other words, prewriting helps a student writer develop clarity because good writing is impossible without good thinking. Although prewriting plays a crucial role in generating ideas and producing quality writing products, research has found that prewriting is one of the writing
stages that both teachers and student writers do not pay sufficient attention to or even skip altogether (Affendi et al., 2020; Rohman, 1965; Tompkins, 2001).

Regarding the importance of prewriting, Thorne (1993) suggested that prewriting should be included in the first stage of instruction in fundamental writing classes. Starting to write is always a difficult part, so students should be assisted to solve the problem named “writer’s block” (Hashempour et al., 2015). Through prewriting activities, students will be taught how to think, communicate, collaborate, and take notes on ideas in preparation for the next writing stages. Many researchers encourage teachers to incorporate prewriting activities at the beginning of their class instruction so that student writers can explore topics and practice interpersonal skills like listening and communication before they start with their first draft (Ashwell, 2000; Barnet, 1989; Davis, 2005; Crawford & Smolkbwski, 2008; Mucie, 2002).

**Prewriting techniques**

In the research on the writing process, Baroudy (2008) listed 15 techniques to improve the prewriting stage. Two powerful techniques addressed in this research are brainstorming and scratch outlines.

**Brainstorming**

Popularized in 1953 by Osborn, brainstorming involves thinking and writing down ideas under a variety of forms such as words, phrases, sentences, images, or shapes in a stress-free learning environment (Guy & Wenstrom, 1991). Brainstorming can be used for learners at any level under any circumstance (Buzan, 1993). It is defined as a guiding tool to make writers think and as a powerful tool to make their ideas flow. It allows writers to think freely, generate ideas, and record anything flashing in their mind on paper or any technology-assisted gadgets (Baroudy, 2008). To help learners enhance their creativity, Osborn (1953) listed four primary
rules to follow in any brainstorming session: no criticism, all ideas accepted, no limit of the number of ideas, and building ideas based on others’ suggestions. In other words, all ideas are welcomed during the brainstorming stage.

Brainstorming can happen individually or within groups, but a group of at least two people brainstorming usually brings a more unexpected amount of meaningful information in restricted time than only a person’s thoughts (Koln & Smith, 2011; Messenger & Taylor, 1989; Paulus & Brown, 2003). Group brainstorming activities usually need leading questions for each member to answer. Per each question, every member should provide at least one idea, and a person can share as many different thoughts as possible. Regardless of the form or relevance of contribution, all members’ thoughts will be recorded under a list or a map. In the end, group discussions will finalize one or some viewpoints to continue developing their writing products.

Several previous studies have shown the effectiveness of brainstorming in enhancing students’ motivation and their writing performance. In 2007, 180 students at Jiangxi Normal University in China participated in Rao’s study to investigate the relationship between brainstorming and the participants’ perceptions and writing products. Based on the results of pretest, posttest, and survey, Rao found that brainstorming strategy statistically significantly improved the students’ writing performance in the experimental group, and most learners expressed their positive attitudes toward the application of brainstorming strategy in class. Also in 2007, Shorofat’s study of the application of brainstorming instruction in an Arabic class showed the effect of brainstorming in boosting the student participants’ creative writing skills of content, organization, style, and mechanism.

Brainstorming strategy continued to be an important role in students’ writing development, clearly proved in many further studies. Besides the improvement of writing
products, brainstorming also motivated the student participants, making them more active and responsible for their next writing activities (Fawzi & Hussein, 2013; Maghsoudi & Haririan, 2013; Manouchehry et al., 2014). Brainstorming, however, cannot guarantee an ideal writing product with unity, coherence, and cohesiveness without the appearance of an outline. Applying both brainstorming and idea organization, therefore, will be a promising instructional technique that can improve learners’ writing performance.

Outline and idea organization

Once ideas have been chosen, scratch outline, also known as a system of idea organization, is needed. According to Dhanya and Alamelu (2020), outlining helps learners systemize a formal structure for their current chosen topic. At this point, a student writer will produce a hierarchical plan for a document by examining the appropriacy of the existing ideas in comparison with the provided topic to remove irrelevant items from the list. Outlining also might facilitate students’ thinking to add more related ideas to the list if necessary and decide whether a certain idea is the main point or just a supporting one. Before the actual writing activity, organizing ideas helps a writer estimate the number of main sections or subsections in a writing product as well as improve writing quality in terms of both style and content (Baroudy, 2008; Kellogg, 1990). An outline is also a clear path for student writers to keep moving forward and complete their work with better quality in both content and organization (Hofer, 1998).

Regardless of the apparent benefits in the writing process, few high-school students, either good or poor writers, stated that they had a habit of preparing a written outline during prewriting (Emig, 1971; Kirszner & Mandell, 2011; Silvia, 2018; Stallard, 1974), which is a big concern that most recent studies have focused on to raise the crucial role of outlining in benefiting writing performance. Outlining is the essential target skill that most teachers should
guide their students to achieve besides idea generation. Recent studies have investigated and shown the importance of outlining in the student participants’ writing performance. Kellogg (1990) randomly assigned different writing task demands (drafting without prewriting, prepare an outline first, or visualize their ideas by clustering) to 207 college students at a psychology course. Based on the full 7-point scale, students’ work was examined in both content and style by two judges. After data were collected and analyzed, outlining proved its importance in the overall quality and the fluency of the documents. Those who systematically organized their ideas outperformed in their final writing products than others. Through 8 tests, 21 questionnaires, interviews, pictures, and interactions examined in the prewriting stage in Bui and Le’s study (2018). The findings showed that outlining was a useful tool for generating ideas, and students preferred outlining to depicting in the prewriting stage.

**Collaborative prewriting**

Collaborative learning has recently become an important process in the second-language classroom with the advent of communicative language teaching. In the sociocultural theory, Vygotsky (1978) claimed that communication was essential in the development of human cognition because language and cognition were developed through interactions with others. Interactive communication has created opportunities for idea exchange where students are eager to learn or help their peers in solving a problem together through either internal or external speech. Several previous studies have indicated that collaboration positively affected the accuracy of language outputs. Their findings all revealed that students produced better collaborative texts in both accuracy and content (Fernandez Dobao, 2012; Storch, 2005; Storch & Wigglesworth, 2007; Wigglesworth & Storch, 2009).
As part of collaborative learning, collaborative prewriting also brings similar benefits clearly proven in number recent studies. Collaborative prewriting refers to the situation where student members generate their group ideas and arrange these ideas in a systematic organization through discussions. In an investigation of potential benefits of collaborative prewriting, Higgins, et al. (1992) found that group discussions enhance the quality of the students’ future writing plans. Interested in a comparison among three prewriting conditions: teacher lecture, teacher-led discussion, and student-led discussion, Sweigart’s (1991) research showed a statistically significant relationship between student-led discussion and the quality of students’ writing. Students in the student-led group wrote better themselves than those in other two groups. Unstructured brainstorming groups, however, might have a negative effect, resulting in more confusion and challenges for students in arranging and evaluating ideas before writing than the teacher-led discussion (Shi, 1998). Therefore, guided questions and clear rubrics provided at the beginning may help to prevent confusion and exceed the benefits of collaborative prewriting activities led by students themselves.

**Mind Mapping**

According to Svantesson (1989), mind maps in general terms refer to different types of categories like concept or cognitive maps, semantic mapping, graphic organizers, or thinking links. Buzan (1993) defined mind maps as a visual or graphic platform depicting associations among ideas or concepts. If mind maps are the actual outputs, mind mapping is the process to create outputs. In other words, mind mapping is the act of visualizing someone’s thoughts and ideas through charts or graphic organizers. It also can be seen as the most effective form of visualizing the note-taking strategy to prepare for an essay, a speech, a meeting, or an event
The following subsections will cover two aspects of mind mapping, including elements of a mind map and benefits of mind mapping on learning.

**Elements of a mind map**

Featured like a tree with branches of information, mind maps display both concepts and their relationships in a hierarchical structure (Karim, 2018). A mind map always includes a core node referring to the central topic and various branches representing subtopics or supporting ideas. There are always arrows from the core node to branches or among branches to show their relationships, so a mind map will have at least two levels in its structure. A 4-level mind map in a vertical style is depicted in Figure 1.

Mind maps can be created either by hand, using computer software, or with online software. With software support, it is easier and quicker to create and reorganize topics and subtopics for a mind map (Rhodes, 2013). Rather than only plain text, users of mind-mapping software also can use different colors or shapes to categorize their ideas as shown in Figure 2 or attach images, videos, or files to represent any node within their mind maps as in Figure 3.

**Benefits of mind mapping on learning**

Since the first days of appearance in education, mind mapping has been considered as a favorably useful tool for both teachers and students. Recent studies have shown more details regarding mind-mapping applications on teaching and learning. The apparent benefits of mind mapping are organizing ideas, making connections among ideas, and enhancing memory skills (Adnan et al., 2012; Karim, 2018; McGriff, 2007).
Figure 1. A 4-level vertical mind map
Figure 2. Different colors and shapes applied to a mind map.
Farrand et al. (2002) studied the effectiveness of mind-mapping technique in the improvement of factual recall of a 600-word passage on 50 medical-school sophomores and juniors at the University of London. Based on different study techniques, the participants were divided into two groups: self-selected group and mind-map group. Before answering 3 sets of 15 questions related to the same article, students from both groups were allowed to read the test and take notes by themselves or with a mind map that they created. Farrand et al.’s study found a statistically significant difference in performance between two groups: those were from the
mind-map group recalled better and had more correct answers, on average, than those from the control group.

Focusing on collaborative learning with mind maps, Koznov and Pliskin (2008) conducted a study on the application of the web-based tool Comapping on 200 Software Engineering and students at Saint-Peterburg State University. Comapping use was incorporated in many seminars, and then 30 students used Comapping in their papers and thesis. The study findings showed five positive consequences of Comapping in the participants’ learning process: (a) quickly measure the students’ understanding in different topics, (b) provide immediate collaboration between teacher and students by the Author or Commenter cycle review process, (c) promote the efficiency of paper writing through the tree-like structure, (d) enhance the collaboration among students by sharing their work and receiving peer feedback, and (e) create an online resource of students’ work.

From 2009 to 2010, Suyanto (2010) examined the effectiveness of mind mapping to teach writing skills to 36 students in grade 7 with different IQ levels. Suyanto found that teaching writing with mind mapping is effective for students with high IQs. The introduction of mind mapping into this class showed that students with a higher IQ performed better on their assignments than students with a lower IQ. Ningrum et al. (2016) investigated the utilization of mind mapping as a strategy in generating ideas before writing in two TOEFL classes at the State Islamic Studies in Kediri. The study, however, resulted in no statistically significant difference in idea generation between the control and experimental groups. Additionally, there were no differences regarding the two variables: gender and learning styles in the treatment group result.

Using a qualitative experimental design, Al-Badwoi (2015) conducted a study to examine how Electronic Mind Mapping (EMM) effected the freshmen’ response who were taking the
course ITRDR1101 at the Ibri College of Applied Sciences in Oman. Fifty students, taught by the same teacher, were chosen randomly to participate in this study. The students were categorized into three different groups: self-selected technique \((n = 15)\), pen-based mind mapping \((MM, n = 20)\), and EMM \((n = 15)\). All participants were introduced to the top 10 free applications and Mind Manager on the first day for 45 minutes. On the second day, the students had a chance to outline the lesson content and memorize the main ideas by either their own way, pen-based MM, or EMM. On the third day, these students were asked to answer four open questions regarding the same content they had learned and took notes on previously. The findings showed that most student participants were able to organize the content correctly, but the MM group spent the least amount of time. Additionally, students from the MM group achieved the highest accuracy percentages, accounting for 90 to 100 %.

Wayloyo (2017) conducted a qualitative study with 25 students at grade 11 of a social class of Madrasah Aliyah Negeri 13 Jakarta to examine the implementation of mind mapping in teaching narrative writing. Wayloyo’s findings indicated positive results: the student participants were able to think more creatively, they understood the narrative organization and tense use, and they could decide the story order. In a cognitive approach, Luangkrajang (2022) utilized mind mapping as a technique to assist in promoting a variety of students’ language skills: analysis, organization, collaboration, and creation. A study was conducted on 93 twelfth graders in an English class in Thailand to examine how the students’ understanding of English was affected when incorporating mind mapping in instruction. The research data were collected from unit tests and the students’ opinions were obtained through a questionnaire. The finding revealed that mind mapping resulted in helping the student participants become active learners and enhance essential skills like critical thinking or collaboration.
Online Mind Mapping and its Benefits on Prewriting

Online mind mapping is an efficient means to enhance collaborative work through exchanging ideas through virtual charts or graphic organizers. With technology assistance, learners can create online mind maps, either through their computers or mobile phones. Online mind maps motivate students by their convenience because students easily can style, review, or revise their own mind maps (Karim, 2018). There are many free and paid subscription mind-mapping software available for teaching and learning such as Mindmeister, Mindomo, Bubbl.us, or Feemind. Online mind maps created by collaborative work in the prewriting stage has effected the cognitive writing process of students, promoting their academic writing performance, which has been proved by a variety of the following recent studies.

To encourage more students to use mind mapping in English writing classes, Karim (2018) conducted a study with 25 students in a course named “Integrated Language Skills III” at the MARA University of Technology in Malaysia. The participants were introduced to the online mind-mapping techniques Bubbl.us (https://bubbl.us) before they were asked to create their own mind maps in the prewriting stage. After that, mind maps were shared with the class, and the participants were asked to complete a survey consisting of 17 questions. The study findings showed that 90% of the student participants agreed that online mind mapping was beneficial to their writing acquisition. Seventy percent admitted that their novice writing skills had been enhanced, and more than 80% claimed that their ideas have been improved in quality by the aid of online mind mapping.

Sairo et al. (2021) conducted a study with 33 students to examine the effects of digital mind mapping on writing skills over five sessions divided into two cycles. Data were collected by observation, interviews, and test sheets. In the posttest, the students had 20 minutes to create a digital mind map and 40 minutes to write a paragraph based on a given topic. The assessment
rubric for the test was borrowed from Brown’s (2007) study, and covered five areas: content, organization, vocabulary, and mechanics. The quantitative results indicated that the app Digital Mind Mapping enhanced the participants’ motivation and their writing performance. The average test score of the students increased from 24% on the pretest to 90% on the posttests I and II. The qualitative findings revealed that the students had a positive attitude of using Digital Mind Mapping in their prewriting stage. They stated that Digital Mind Mapping activities guided them to organize ideas and developed their creativity and critical-thinking skills.

**Summary**

Although there are substantial research studies regarding mind mapping on writing performance, the benefits of mind mapping highly depend on how it has been implemented within a course. This literature review has presented definitions and applications of online mind mapping on writing acquisition in different contexts. The first section focuses on prewriting, prewriting techniques, and collaborative prewriting. In detail, it shows the importance of prewriting in learners’ writing performance, the effectiveness of collaborative prewriting in generating ideas and future writing plans (Dhanya & Alamelu, 2020; Fawzi & Hussein, 2013; Fernandez Dobao, 2012; Maghsoudi & Haririan, 2013; Manouchehry et al., 2014; Shorofat, 2007; Storch, 2005; Storch & Wigglesworth, 2007; Wigglesworth & Storch, 2009). The second section provides a definition of mind mapping, featured elements, and its benefits on learning. Numerous previous research has proved how mind mapping has effectively enhanced the process of learning: factual recall, content, language analysis skills (Adnan et al., 2012; Al-Badwoi, 2015; Farrand et al., 2002; Karim, 2018; Koznov & Pliskin, 2008; McGriff, 2007; Suyanto, 2010; Wayloyo, 2017). The final section depicts how online mind mapping has effectively supported prewriting. Most participants in previous research admitted that online mind mapping
has helped them develop ideas in better quality and guided them to organize ideas and developed their creativity and critical-thinking skills (Karim, 2018; Sairo et al., 2021).

This could help to emphasize the importance of mind mapping in education with an encouragement to boost the appearance of mind mapping more often in educational contexts, especially in writing acquisition. There have been no studies, however, solely focused on the effectiveness of online mind mapping on collaborative prewriting in generating and organizing ideas in a writing process. Moreover, previous research showed no proof of whether the participants had been provided sufficient training of how to effectively use online mind mapping to work within groups in the prewriting stage before the research. In this study, therefore, the participants’ prior knowledge was assessed by a pretest, and the students’ understanding of the use of online mind mapping was examined by a posttest before the class starts. All the group mind-mapping activities in the prewriting stage also were tracked by the progress history mechanism feature of the online mind-mapping feature to investigate how the participants’ idea generation and organization have been improved through their collaborative work with online mind mapping.
CHAPTER III

METHODOLOGY

The purpose of the proposed study was to examine the effects of online mind mapping on the cognitive outcomes of students in Read-Think-Write 2 classes at a private university in Southern Vietnam. This study focused on how online mind mapping can help the student participants collaboratively work with their teammates to elaborate and organize their ideas in their argumentative writing process. Therefore, the study addressed the following research questions:

1. To what extent was there a statistically significant relationship between the students’ understanding of online mind mapping and their brainstorming and organization for the treatment group?

2. To what extent was there a difference between students’ idea elaboration with and without using online mind mapping in their argumentative papers?

3. To what extent was there a difference between students’ organization of ideas with and without using online mind mapping in their argumentative papers?

4. What were the students’ perceptions of the coursework with and without collaborative online mind mapping?

5. What were treatment students’ perceptions of the effectiveness of collaborative online mind mapping in their writing process?

In this chapter, the research design started with a restatement of the study goal. The following subsections described the details of the research design and settings, participants, protection of human subjects, instrumentation, establishing trustworthiness of data, treatment
description, procedures, data analysis, limitations, instructor for the study, and position of the researcher.

Research Design

A mixed-methods study was conducted to investigate the relationship between the independent variable (online mind mapping) and the dependent variables (students’ brainstorming and idea organization) in two Read-Think-Write 2 classes in a private university in South Vietnam. One of these two classes included mind mapping as part of the course. The online mind mapping began 4 weeks after the Spring semester started on Jan 2, 2024. At that time, an online training session introduced the students in the treatment group to the online mind-mapping application Mindomo. The instructor monitored the students’ progress and addressed any questions or concerns about the training so that the students were able to carry out the mind-mapping assignments during the next 4 weeks of the course.

A questionnaire and posttest were conducted at the beginning and at the end of the online training session to assess student understanding and application of online mind mapping. To investigate the relationship of the participants’ online mind-mapping use, brainstorm, and organization, a rubric was used to measure the students’ writing assignments with and without mind mapping.

The study was conducted in two Read-Think-Write 2 classes of FPT University during the Spring 2024 semester over a 4-week period. Data collection included a presurvey, a questionnaire and a posttest from the mind-mapping training session, class assignments, a coursework inventory, and the final writing exam grades from the ERW 411 class.


**Research Settings**

The study took place in Read-Think-Write 2 classes at a private university in Southern Vietnam. The university has five campuses across Vietnam, whereas the Southern campus in Ho Chi Minh City has approximately 10,000 undergraduate students enrolling each semester, which is 28.5% of the total university population. Thirteen different undergraduate programs are provided in this campus, including Artificial Intelligence (AI), Business Administration, International Business, Digital Marketing, Software Engineering, Information Assurance, Multimedia Communications, Graphic Design, Hotel Management, Tourism Services and Travel Management, English, Chinese, and Information System. Each program will take a student 4 to 5 years to complete. For those who have not had IELTS 6.0, they will spend their first year on English classes to meet the language-entry requirements because the curriculum for all academic subjects is in English. Students also have opportunities to have foreign semesters and international experience in affiliated universities in Asia and Europe within the program.

This type of Read-Think-Write 2 (ERW421) class is required for junior students to complete as part of their program. The participants took the online training session of mind mapping in week 5 of their ERW421 class. The training session was for the experimental group, and it took about 60 minutes to complete, including both lecturing and practice. Both a questionnaire and a posttest were applied to examine the students’ understanding before and after the training. A questionnaire was conducted at the beginning of the training to examine the students’ demographic information as well as their prior knowledge of mind mapping, and a posttest was conducted at the end of the training to measure their understanding of mind-mapping application. The students had only one attempt for each multiple-choice question. The participants were provided with the time and link to join the training 3 business days before the training session took place.
Participants

The participants in this study were 42 students who are pursuing an undergraduate English degree in a private university in Southern Vietnam. These students are a part of about 100 students who are pursuing an undergraduate degree in English, and they will become English instructors or interpreters after graduation. Of the student participants, 30 students are from the mind-mapping intervention class, and 12 students are from the control group. All the participants are from 20 to 23 years old. Participants are at an upper-intermediate English level, and they all have passed the prerequisite ERW 411 class, which is the Read-Think-Write 1 class. In ERW 411, students were expected to develop critical reading, thinking, and writing skills through interacting with texts across various academic topics. At the beginning of the study, students were asked to read the consent form and type their names if they allowed the researcher to use their information and if they wanted to participate in the interview. The decision to withdraw their consent to participate in the study would not effect their grades in the Read-Think-Write 2 class.

Table 1
Demographic Survey Results for Treatment (n=30) and Control (n=12) Group Participants

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Treatment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18</td>
<td>60</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>36.7</td>
</tr>
<tr>
<td>Trans</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-20</td>
<td>21</td>
<td>70</td>
</tr>
<tr>
<td>21-22</td>
<td>9</td>
<td>30</td>
</tr>
</tbody>
</table>
Protection of Human Subjects

In order for approval from the University of San Francisco’s Institutional Review Board for the Protection of Human Subjects (IRBPHS), a site permission letter was obtained from the management board of the university where the data were collected after they reviewed the instruments and data collection procedure of the proposed study. A consent form was distributed to the student participants in both classes at the beginning of the study (Appendix A). For those who provided permission, their data were used for the research. All the participants were required to sign the consent form to ensure that they all voluntarily participated in the study. There were not any rewards for the participants of the study, but the students gained a better understanding of prewriting and its importance to the writing process. Students should be able to use the skills they learn from this study to improve their writing process for future writing assignments.

After the study ended, students in the control group were able to gain a better understanding of online mind mapping. They also learned how to use online mind mapping to improve their academic writing when they had access to the recording of the mind-mapping training session after week 8. They also had free access to Mindomo mind-mapping software until July 2024.

For students in the treatment group, their participation in the online mind-mapping training session gave them a better understanding of the importance of online mind mapping and how to use online mind mapping to improve their academic writing. They also had free access to Mindomo mind-mapping software until July 2024. This service allowed students access to AI-powered mind-mapping tools to help with their brainstorming and organizing process. Students who volunteer for the interview also received a $20 Tiki gift card.
Data in the study were collected and kept confidentially. The participants’ records of tests, class assignments, and final writing exam grades from class ERW411 were accessible only to the researcher and the class instructor. Students worked in pairs to complete a project, and a random number was assigned to each pair. Only the researcher had a list that contained the numbers and associated students. Data were stored on a computer that is only accessible to the researcher.

**Instrumentation**

There were five instruments that were used in this study: (a) a presurvey, (b) a questionnaire and posttest to examine the students’ understanding of online mind mapping and how to apply it in their studying, (c) a rubric to grade the students’ argumentative writing products – specifically their idea elaboration and idea organization, (d) a rubric for mind maps, (e) a coursework inventory, and (f) interviews with students in the treatment group to understand their perceptions of the effectiveness of collaborative online mind mapping in their argumentative writing process.

**Presurvey**

At the beginning of the study, the students completed a presurvey. The survey consists of two short-answer and three multiple-choice questions. The first three questions focus on the students’ thoughts regarding brainstorming before writing: frequency of brainstorming (never, sometimes, about half the time, and always), the way of brainstorming (individually, within groups, and other), and difficulties that students encountered while brainstorming. Idea organization is addressed in the last two questions regarding the frequency (never, sometimes, about half of the time, most of the time, and always) and the way of organizing ideas (Appendix E).
**Questionnaire and posttest**

Regarding assessment, the questionnaire (Appendix F) includes two sections: demographic background (two questions) and prior knowledge of mind mapping (four questions). The two demographic questions in the multiple-choice form focus on the participants’ age range (18-20; 21-22; 23-25; 26 and above) and their gender identity (female, male, nonbinary, trans, or other). In the second section of the pretest, the participants are asked about their current understanding of mind mapping (not at all, slightly well, moderately well, very well, or extremely well), the point of time they learned or knew about mind mapping, the frequency of using mind mapping in the participants’ studies (never, sometimes, about half the time, most of the time, or always), and difficulties the participants have encountered while using mind mapping. The posttest (Appendix G) consists of five questions in total (three multiple-choice and two short-answer questions). The questions focus on examining theoretical knowledge (questions 1 to 3) and practical knowledge (questions 4 to 5).

**Rubrics for argumentative essays and mind maps**

The online mind-mapping method was implemented into the Read-Think-Write 2 class as a learning strategy for the experimental group. This study examined the students’ project 2, including their argumentative papers and mind maps. Based on the scoring rubric for the assessment of the argumentative essay from Gordon and Iber (2014), the writing rubric for this study was developed, consisting of six parameters: (a) introduction (background and history, define the problem, and thesis statement), (b) main points (body paragraphs and refutation), (c) coherence and cohesion, (d) conclusion, (e) references, and (f) grammar and mechanics (sentence structure, punctuation, and contradiction). These parameters are categorized into five scales (9-10, 7-8, 5-6, 3-4, and 1-2). The instructor gave grades to her students’ writing products.
based on this rubric, and the maximum total score that a student could achieve is 10 points (Appendix H). For mind-mapping analysis, a mind-mapping rubric for this study was developed with five criteria: depth of coverage, central image, ideas with key images, colors, codes, or links (Appendix I). Based on the mind-mapping rubric, students were expected to illustrate connections between ideas, and ideas radiating out from central image (from the most to the least complex). The rubric was adapted from one by Ohassta (2004). The researcher scored a random sample of assignments to establish interrater reliability. The reliability checks were obtained during the grading of each assignment. A review panel, including the course instructor and the researcher, was used for assessing the validity of the rubrics. The review panel evaluated the clarity of the wordiness, parameter division, scaling range, and alignment with the course objectives.

To establish interrater reliability, moreover, two graduate students coded three sets of randomly-selected interviews. The creation of coding was the initial step to establish interrater reliability between the coders and the researcher. The initial coding included two subthemes, benefits and drawbacks of online mind-mapping use during the study, that allowed the coder to compare their work. At the end of the coding process, the method of Miles and Huberman’s (1994) was applied to calculate the reliability with the following formula: reliability = number of agreements/ (number of agreements + disagreements). The value of the coding result was found to be 95%, which is sufficient for multiple coders.

**Coursework inventory**

At the end of the study, the students from both the control and treatment groups were expected to complete a coursework inventory to share their thoughts regarding the class activities and assignments that they worked on during their Read-Think-Write 2 class from weeks 5 to 8.
The coursework inventory was developed based on the MUSIC model of academic motivation that Jones (2009) designed to diagnose the strengths and weaknesses of instruction. The original version of the MUSIC inventory, designed based on a Social-Cognitive Theoretical framework, consists of 24 items that are categorized into five components: (a) empowerment, (b) usefulness, (c) success, (d) interest, and (e) caring. For the English version, Jones and Skaggs (2016) conducted a study of the MUSIC inventory using 338 college students from 221 different courses, including face-to-face, online, and hybrid (face-to-face and online). The result reported excellent Cronbach’s alpha values for empowerment (.91), usefulness (.96), success (.93), interest (.95), and caring (.93). Confirmatory factor analysis for the five subscales produced fit indices within acceptable ranges.

In this study, the modified coursework inventory for both groups focused on three components: usefulness (the coursework is useful to students’ future), success (students can succeed at the coursework), and interest (the instructional methods and coursework are interesting). Built on Qualtrics, an online survey platform, the modified coursework inventory includes 12 questions and space for optional comments for students to complete. Students from the treatment had to answer an additional question about their willingness to apply online mind mapping in their future studies. In the survey, students would choose the most appropriate rating from the provided scale (strongly disagree, disagree, somewhat disagree, somewhat agree, agree, or strongly agree) to address each of the statements and include any additional comments they may have (Appendix G). To obtain a score for each component, an average value for the items in the same components was calculated as shown below:

Usefulness score = \((item\ 2 + item\ 10 + item\ 11 + item\ 12) / 4\)

Success score = \((item\ 5 + item\ 6 + item\ 8 + item\ 9) / 4\)
Interest score = (item 1 + item 3 + item 4 + item 7) / 4

Table 2
The Modified Coursework Inventory Components and the Definitions

<table>
<thead>
<tr>
<th>Components</th>
<th>Definitions</th>
<th>Items Number of Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usefulness</td>
<td>The coursework is useful to his or her future.</td>
<td>2*, 10, 11*, 12*</td>
</tr>
<tr>
<td>Success</td>
<td>He or she can succeed at the coursework.</td>
<td>5, 6*, 8, 9</td>
</tr>
<tr>
<td>Interest</td>
<td>The instructional methods and course are interesting.</td>
<td>1, 3*, 4, 7*</td>
</tr>
</tbody>
</table>

*Note. Adapted from “User guide for assessing the components of the MUSIC ® Model of Motivation,” by Jones (2017). Retrieved from http://www.theMUSICmodel.com. (* the value of the items was stated in a negative form).*

**Interview questions**

A set of three questions were used for qualitative data collection of this study. The questions were to investigate the participants’ perceptions of using online mind mapping in their collaborative prewriting stage regarding both benefits and difficulties. The students were also asked if they would like to use online mind mapping in their future studies. Based on the previous studies on interview protocol, the researcher constructed a 6-step interview protocol, including brief information about the interview, an introduction, an open question, three content questions, probes, and a closing instruction. The interview was conducted individually via Zoom (Appendix K).

**Establishing Trustworthiness of Data**

Based on the six techniques from Carspecken (1996), the researcher applied peer-debriefing and member checking to improve data reliability and validity. For peer-debriefing, two graduate students from the Department of Learning and Instruction at the University of San Francisco were invited to review the transcripts, interview video recording, and merging themes. All discussions between the researcher and these supporting students happened by email and via
Zoom. The interview transcripts and the study’s findings were presented to two graduate students. The supporting students agreed that the themes and subthemes reflected the transcripts and online mind-mapping using experience. For the member-checking process, one of the participants and the course instructor would review the final version of the descriptions, themes, and subthemes.

To verify the validity of the instruments, the researcher assembled an expert panel (the course instructor, a mind-mapping specialist, and the researcher) to review the construct validity. The expert panel evaluated the clarity of wordiness, appropriateness of item responses, use of technical language to verify if the instruments were aligned with the course materials and training objectives. Before the experiment was launched, the researcher conducted a pilot test on five undergraduate students to ensure proper administration. The reliability of the posttests was assessed using Cronbach coefficient alpha after the tests were collected and entered into the database. The Cronbach coefficient alpha value of 0.72 indicated acceptable internal consistency.

**Treatment Description**

The participants joined an online training session about what online mind mapping is and how to use online mind mapping effectively to work in pairs to elaborate and organize their ideas in the academic writing process. On the first day of week 5, the student participants were expected to join a one-hour online session via Zoom to complete the mind-mapping training. A questionnaire and a posttest before and after the training was conducted to examine the students’ mind-mapping understanding and application. Moreover, the participants were required to use online mind mapping to illustrate and organize their ideas in their class project 2. Mind maps were submitted to the course instructor for feedback. In week 8, students were required to write their argumentative essays in pairs whose topics were chosen in week 5. Supporting evidence
from other sources was required in this writing task. The instructor used the same argumentative writing rubric to grade the students’ papers from both the control and treatment groups.

**Procedures**

The study was conducted in two Read-Think-Write 2 classes of FPT University in Spring 2024 during a 4-week period. Data collection included the students’ presurvey, questionnaire and posttest from the online training session, class assignments, coursework inventory, and students’ final writing exam grades from the ERW411 class. Students completed a coursework inventory in week 8 and were asked to volunteer for an interview during week 9.

**Quantitative data collection**

In this study, a presurvey was distributed for both control and treatment groups before the class began to collect their thoughts regarding their brainstorming and organizing ideas in writing. The survey was created in Qualtrics, including three multiple-choice questions and two short-answer questions. The data regarding student participants in the online training session also were collected through the questionnaire and posttest to measure the students’ understanding and assure that they would be able to use collaboratively online mind mapping in their class assignments. Focusing on demographic information and prior knowledge of online mind mapping, the questionnaire consisted of six questions: four multiple-choice questions and two short-answer questions. The posttest has five multiple-choice questions focusing on both theoretical and practical knowledge of mind-mapping applications.

**Qualitative data collection**

To obtain an insight into students’ perspectives of online mind mapping, a semi-structured interview was conducted with five random participants during week 9 of the Spring 2024 semester. Interviews happened individually via Zoom. With two designed themes (benefits
and difficulties when using online mind mapping in the collaborative prewriting stage), the researcher developed two central questions to address the students’ perspectives (Appendix G). At the beginning of the interview, the participants were informed that the meeting would be recorded and transcribed for research purposes, but all the meeting information would be accessible to the researcher and would be completed deleted after the research. Participants were asked to use a pseudonym before recording. A pseudonym was also used in the transcript to protect student identities.

**Data Analysis**

The quantitative data analysis was performed to answer the first three research questions by investigating the participants’ understanding and their collaborative use of online mind mapping (independent variable) on their idea elaboration and idea organization (dependent variables) in their academic writing process. The difference between the control and treatment group also was measured by Cohen’s $d$ (Cohen, 1988). Descriptive statistics (means and standard deviations), independent-samples $t$-test results on the gain values from pretest to posttest, and Cohen’s $d$ are presented in chapter IV of this study.

To answer the last research question, perceptions of the interviewed participants were collected and categorized to examine what the students said about the pros and cons of the online mind-mapping group activities that they applied in their writing process. The participants’ answers were coded into two themes: positive and negative. These themes would allow the researcher to obtain a deeper insight into how the student participants experienced using collaboratively online mind mapping in the academic writing process.
Instructor for the Study

The instructor, Ms. Thuyet, is the Dean of the English Department at the FPT University. She received her Master of Arts in Applied English Linguistics by the University of Victoria, Australia. Her research interests include academic writing, critical reading, and critical-thinking skills. As a language instructor for over 30 years, she has provided various English classes for students at different levels such as communication courses, Toefl iBT, TOEIC, and various writing and reading courses. She has taught the Read-Think-Write 2 class for over 3 years, so she understands the challenges her students experience from the first to the last step of producing an argumentative paper. From her teaching experience, most students participating in the Read-Think-Write 2 have encountered six following difficulties: (a) formulate a broad and complex idea to develop from synthesized sources, (b) provide comprehensive support for the main idea of the essay, (c) provide critical analysis and well-explained evidence, (d) present concise and coherent flow of ideas, (e) write a controversial thesis statement, and (f) present significant counter-argument with convincing analysis and rebuttal with analysis supported by credible sources as evidence. The challenges the students have faced have led the instructor to apply online mind mapping as a supporting tool to improve her students’ writing performance.

Position of the Researcher

As a nonnative English speaker, the researcher understands the language-learning process and how challenging it is from each step of acquiring a foreign language, especially with the writing skill since she was at secondary school. After the completion of her master’s degree in Curriculum and Instruction in 2014, the researcher has become a language instructor at different universities in her home country. When working at the university level, the researcher taught a variety of English classes: General to Academic English from the beginning to advanced levels, whereas Read-Think-Write 2 was one of them. The researcher found that most of the students in
her Read-Think-Write 2 class struggled with their assignment completion. They had difficulties in most of the provided writing research tasks: choosing a topic, pointing out problems, proposing evidence, and discussing results. The researcher’s interest is to look for effective ways to support her struggling students to overcome such issues by utilizing technology through groupwork activities.

Currently working as a technology trainer for the Department of Instructional Technology Training at the university where she is also pursuing a Doctor of Education degree in Learning and Instruction, the researcher has opportunities to experience different technology software and tools that can support effectively teaching and learning activities. Her research area includes Cognitive Theory of Multimedia, Motivational Design, and Gamified Learning. Her previous studies focused on methods of enhancing EFL students’ motivation in the first few “golden minutes” presented at the International TESOL Conference – Promoting Effective Change in the Language Classroom in Vietnam and online peer feedback and critical thinking skills presented in the 4th International Conference on Computer Science and Technologies in Education (CSTE). Her current studies are to examine the effects of ChatGPT use in learning activities and an insight on creating inclusive learning contexts for kindergarten through grade 12 students with developmental delays in Vietnam.

With academic background and professional experience, the researcher is qualified for conducting this study.

**Summary**

The effects of the online mind-mapping method on students’ learning and perceptions were investigated. The independent variable was the online mind-mapping strategy intervention. The dependent variables were students’ idea elaboration and idea organization through their
mind-mapping assignments, argumentative essays, and survey results. One of two writing classes at a private university located in Southern Vietnam was assigned to the online mind-mapping intervention group with Mindomo. Before the study began, the participants in the treatment group received an hour of online mind-mapping training with two quizzes before and after the training session to measure their prior knowledge and understanding of the online mind-mapping application. Students from the treatment group also were asked to work in pairs and develop a mind map with Mindomo based on the provided information in 15 minutes. In the following 4 weeks, the students in the treatment group worked on their second writing projects, using Mindomo mind mapping to brainstorm and organize their ideas within pairs. Students in the control group also worked in pairs, but they had no intervention instruction. Finally, both classes had an online survey to evaluate their perceptions of course instruction. Additionally, five participants in the treatment group were selected randomly to engage in an online interview via Zoom in week 9.
CHAPTER IV

RESULTS

The purpose of this mixed-method study was to examine the effectiveness of online mind-mapping intervention on English as a Foreign Language students’ academic performance in one ERW421 class and the perceptions of usefulness, interest, and effectiveness in both ERW421 classes. The research was conducted in two phases: collecting student learning outcomes and online interviews.

In the first phase, data collection for both the control and treatment ERW421 classes included a presurvey, a questionnaire and a posttest from the mind-mapping training session, class assignments, a coursework inventory, and the final writing exam grades from their previous ERW411 class. At the beginning of the study, students from both classes took a presurvey regarding their experience in brainstorming and organizing ideas before their actual writing. For the control group, the students’ coursework inventory and assignment grades in the ERW421 class, as well as the final writing grades from their ERW411 class, were collected. For the treatment group, mind mapping was part of instruction in the course, so students took an online training session of mind mapping during week 5 of their ERW421 class. A questionnaire and a posttest were applied to examine students’ understanding before and after the training. The questionnaire was conducted at the beginning of the training to measure the students’ prior knowledge of mind mapping, and the posttest was conducted at the end of training to examine their understanding of mind mapping. The mind-mapping assignments, final writing exam grades from the ERW411 class, and the mind-mapping coursework inventory also were collected from the treatment group.
The final writing exam grades from the ERW411 class indicated a slight difference (0.48) between the control and treatment groups (Table 3). The exam grade mean of the control group was 5.20, and the mean of the treatment group was 5.68, indicating that the final grades for both groups are satisfactory based on the rubric. There is no statistically significant difference between the two groups in terms of their previous course. Cohen’s $d$ value of final writing exam grades resulted in a very small size of 0.24.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control ($n=12$)</th>
<th>Treatment ($n=30$)</th>
<th>$t$</th>
<th>$df$</th>
<th>Cohen’s $d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam Grades</td>
<td>M=5.20, SD=0.96</td>
<td>M=5.68, SD=1.19</td>
<td>1.20</td>
<td>40</td>
<td>0.24</td>
</tr>
</tbody>
</table>

The mind-mapping assignments in Mindomo were graded and returned to students from the treatment group with feedback from the instructor. The mind-mapping rubric, developed by Ohassta (2004), included five criteria: depth of coverage, central image, ideas with key images, colors, codes, and links for illustrating connections between ideas, and ideas radiating out from central image (from the most to least complex). Grades from the mind-mapping assignments were not counted toward the course grade. This Mindomo mind-mapping assignment aimed to help students brainstorm and organize ideas for their argumentative essay project 2. Based on the scoring rubric for assessment of the argumentative essay from Gordon and Iber (2014), the writing rubric for the students’ project 2 consisted of six parameters: (a) introduction (background and history, define the problem, and thesis statement), (b) organization, analysis, and refutation, (c) evidence and support, (d) coherence and cohesion, (e) conclusion, and (f) grammar, mechanics, and citation (sentence structure, punctuation, and contradiction).
The second phase was online interviews via Zoom. The interview results were used as qualitative data and supporting quantitative data. This chapter presents the results of this study that include descriptive results, quantitative results, qualitative results, and a summary of findings in response to the research questions mentioned below.

**Research Question 1**

*To what extent is there a statistically significant relationship between the students’ understanding of online mind mapping and their brainstorming and organization for the treatment group?*

The first research question was designed to examine whether there was a relationship between students’ understanding of online mind mapping and their brainstorming and organization for the treatment group through the application of the Pearson product-moment correlation coefficient. Students took a posttest after the training session to show their understanding of using online mind mapping. The posttest consisted of five questions in total: three multiple-choice and two short-answer questions, focusing on examining theoretical knowledge (questions 1 to 3) and practical knowledge (questions 4 to 5). From weeks 5 to 6, students in the treatment group also worked in pairs to brainstorm and organize ideas for their argumentative essays by using Mindomo online mind mapping. Their pair mind maps were collected and analyzed based on a mind-mapping rubric adapted from Ohassta’s (2004) rubric. The mind-mapping rubric included five criteria: depth of coverage, central image, ideas with key images, colors, codes, or links for illustrating connections between ideas, and ideas radiating out from central image. A full history of changes in Mindomo also helped the instructor see her students’ contributions to their mind maps over time. The students’ mind maps, however, were not counted for their coursework grade.
The correlation coefficient between students’ understanding of online mind mapping and their brainstorming and organization indicates a moderate positive correlation (Table 4). This result shows that a linear relationship exists between student understanding of online mind mapping and their idea brainstorming and organization, contributing to 45% of the variation.

Table 4
Descriptive Statistics and Correlation Coefficient for Mind-Mapping Total Score and Students’ Idea Brainstorming and Organization

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>M.M. Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.M. Total Score</td>
<td>30</td>
<td>4.80</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Idea Brainstorming and Organization</td>
<td>30</td>
<td>5.03</td>
<td>0.89</td>
<td>0.67*</td>
</tr>
</tbody>
</table>

* Correlation coefficient is statistically significant at the .05 level (2-tailed).

Research Question 2

*To what extent is there a difference between students’ idea elaboration with and without using online mind mapping in their argumentative papers?*

The second research question was developed to investigate whether there was a difference in students’ idea elaboration on their argumentative papers between the control and treatment groups. Students from both groups worked in pairs to write argumentative papers on topics of their choice. Regarding idea elaboration, their argumentative essays were expected to provide ample, relevant, and compelling evidence to support each point of view as well as writing a strong thesis statement. Supporting evidence should be drawn from a variety of credible sources and integrated into the argument. The rubric for assessing the students’ idea elaboration was categorized into five levels: 9-10 (excellent), 7-8 (good), 5-6 (satisfactory), 3-4 (needs improvement), and 1-2 (failing).

The independent-samples $t$ test was conducted to examine whether there was a difference between the control and treatment groups regarding students’ idea elaboration. Descriptive
statistics including sample size, mean, and standard deviation are in Table 5. There is a slight difference (0.72) between the means of both groups. The idea elaboration mean of the control group was 5.91, and the mean of the treatment group was 6.63, indicating that the idea elaboration for both groups are satisfactory based on the rubric. The mean of students from the treatment group were slightly higher than those from the control group, whereas there was no difference in the standard deviation between both groups. Cohen’s $d$ value of 0.60 is a medium size and there was no statistical significance, which may be due to a small sample size and lack of power.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control ($n=12$)</th>
<th>Treatment ($n=30$)</th>
<th>$t$</th>
<th>df</th>
<th>Cohen’s $d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idea elaboration</td>
<td>5.91</td>
<td>6.63</td>
<td>1.75</td>
<td>40</td>
<td>0.60</td>
</tr>
<tr>
<td>$SD$</td>
<td>1.20</td>
<td>1.19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Research Question 3**

To what extent is there a difference between students’ organization of ideas with and without using online mind mapping in their argumentative papers?

The third research question was designed to examine whether there was a difference in the students’ organization of their ideas on their argumentative papers between the control and treatment groups. Argumentative papers from 12 students in the control group and 30 students in the treatment group were collected and graded to address the third research question. Regarding idea organization, students’ argumentative essays were examined based on two criteria: (a) analysis and refutation and (b) clarity and coherence. The organization grade was calculated using the mean of the students’ grades for analysis and refutation and clarity and coherence. The
same rubric scale was applied to examine students’ idea organization on their argumentative essays: 9-10 (excellent), 7-8 (good), 5-6 (satisfactory), 3-4 (needs improvement), and 1-2 (failing).

For analysis and refutation, students were expected to produce exceptionally well-organized body paragraphs with a clear and logical structure and insightful analysis and evaluation of sources. The refutation should address effectively counterarguments with thoroughness and precision by using compelling and reasoning evidence to refute arguments. Students also were expected to express a nuanced understanding of opposing perspectives. In terms of clarity and coherence, student essays had to use precise language, varied sentence structure, and sophisticated vocabulary that enhanced understanding and engagement. Finally, essays should be compelling and free from grammar errors.

Three independent-samples t tests were conducted to examine whether there was a difference between the control and treatment groups regarding students’ idea organization on their argumentative essays. Descriptive statistics including sample sizes, means, and standard deviations are provided in Table 6. There is a slight difference (0.25) between the means of organization between both groups. The organization mean of the control group was 6.06, and the mean of the treatment group was 6.31, indicating that the idea organization for both groups are satisfactory based on the rubric. In particular, the clarity and coherence had little or no difference, whereas the means of analysis and refutation had little difference between both groups. The means of analysis and refutation, and clarity and coherence were in the range between 5 and 6, revealing that the students from both groups are at the satisfactory level. The analysis and refutation mean of the control group was 5.67, and the mean of the treatment group
was 6.06. The clarity and coherence mean of the control group was 6.46, and the mean of the treatment group was 6.57. Cohen’s \( d \) value of organization resulted in a very small size of 0.19

Table 6
Independent-Samples \( t \)-Test Result for Idea Organization Scores for Control and Treatment Groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control (( n=12 ))</th>
<th>Treatment (( n=30 ))</th>
<th>( t )</th>
<th>( df )</th>
<th>Cohen’s ( d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis &amp; Refutation</td>
<td>5.67 1.56</td>
<td>6.06 1.40</td>
<td>0.46</td>
<td>40</td>
<td>0.27</td>
</tr>
<tr>
<td>Clarity &amp; Coherence</td>
<td>6.46 1.16</td>
<td>6.57 1.26</td>
<td>0.79</td>
<td>40</td>
<td>0.09</td>
</tr>
<tr>
<td>Organization</td>
<td>6.06 1.30</td>
<td>6.31 1.29</td>
<td>0.58</td>
<td>40</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Research Question 4

What are the students’ perceptions of the coursework with and without collaborative online mind mapping?

The fourth research question was designed to investigate whether there was a difference in students’ perception of the coursework regarding their interest, success, and usefulness in learning between the control and treatment groups. Based on the MUSIC inventory of Jones (2017), a modified coursework inventory with 12 questions was developed to examine student thoughts. Participants were expected to rate themselves by using the 6-point Likert scale: 1 (strongly disagree), 2 (disagree), 3 (somewhat disagree), 4 (somewhat agree), 5 (agree), and 6 (strongly agree). An additional space was included at the end of the inventory for students to leave additional comments. Students from the treatment group also had to address question 13 about the degree of their willingness to use online mind mapping for future coursework. Fourteen students from the control group and 30 students from the treatment completed the coursework inventory.

Three independent-samples \( t \) tests were conducted to examine whether there was a difference between the control and the treatment groups regarding student perceptions of their
interest, success, and usefulness in the coursework. Descriptive statistics included sample sizes, means, and standard deviations are provided in Table 7.

Regarding the interest rating, there is little difference in means between the two groups. Students from the control group had higher interest in the coursework than those from the treatment group. The mean for both groups are between 4 and 5 (4.66 and 4.33), indicating that the students were somewhat interested in the instructional methods and coursework. Cohen’s $d$ value of -0.31 is a small effect size.

For the success rating, there is little or no difference between the means of the two groups. Students from both groups somewhat believed that they could succeed in the coursework. The means for both groups are very similar: the control group had an average rating score of 4.14 and the treatment group had an average rating of 4.15. There is no statistically significant difference in the students’ perception of their success between the two groups. Cohen’s $d$ value of .01 is close to zero.

For the usefulness rating, the means also showed difference between the two groups. The mean of the treatment group (4.68) is slightly higher than the control group (4.60). Cohen’s $d$ value of .09 is below a small effect size. There is no statistically significant difference in the usefulness rating between the two groups.

Table 7
Independent-Samples $t$-Test Result in Interest, Success, and Usefulness for Treatment and Control Groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control ($n=12$)</th>
<th>Treatment ($n=30$)</th>
<th>$t$</th>
<th>$df$</th>
<th>Cohen’s $d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest</td>
<td>M = 4.66, SD = 0.73</td>
<td>M = 4.43, SD = 0.74</td>
<td>0.35</td>
<td>40</td>
<td>-0.31</td>
</tr>
<tr>
<td>Success</td>
<td>M = 4.14, SD = 0.46</td>
<td>M = 4.15, SD = 0.91</td>
<td>0.97</td>
<td>40</td>
<td>0.01</td>
</tr>
<tr>
<td>Usefulness</td>
<td>M = 4.60, SD = 0.80</td>
<td>M = 4.68, SD = 0.70</td>
<td>0.79</td>
<td>42</td>
<td>0.09</td>
</tr>
</tbody>
</table>
Research Question 5

*What are treatment students’ perceptions of the effectiveness of collaborative online mind mapping in their writing process?*

To address question 5, a thematic analysis was applied to obtain student insights on using online mind-mapping for brainstorming and organizing ideas during the prewriting stage. Five participants from the treatment group who gave their consent participated in interviews. Of the interviewees, 60% are female and 40% are male with an age range between 18 to 22. Interviewees are juniors who took the ERW421 class this Spring 2024 semester. All interviewees have from one to 7 years of experience with using mind mapping in studies. Demographic information and mind mapping experience of the interviewees is detailed in the table below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Age range</th>
<th>MM experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thi</td>
<td>Female</td>
<td>21 - 22</td>
<td>5 years</td>
</tr>
<tr>
<td>Bao</td>
<td>Female</td>
<td>21 - 22</td>
<td>7 years</td>
</tr>
<tr>
<td>Thanh</td>
<td>Female</td>
<td>18 - 20</td>
<td>1 year</td>
</tr>
<tr>
<td>Dinh</td>
<td>Male</td>
<td>18 - 20</td>
<td>6 years</td>
</tr>
<tr>
<td>Hoang</td>
<td>Male</td>
<td>18 - 20</td>
<td>1 year</td>
</tr>
</tbody>
</table>

With two designed themes: benefits and difficulties, the researcher developed two central questions to address students’ perspectives. The content questions for the interview are as follows:

Do you think online mind mapping was useful in your collaborative prewriting? In what ways?

Did you experience any difficulties when using online mind mapping in your collaborative prewriting? If yes, please include specific examples.
Additionally, students were asked about their prior knowledge of using mind mapping as well as their suggestions on how to better use online mind mapping for their coursework.

Students also were asked if they were willing to use online mind mapping in their future studies.

The interviews were individually conducted and captioned via Zoom. Transcripts of the interviews are provided below:

<table>
<thead>
<tr>
<th>Interview questions</th>
<th>Code</th>
<th>Participants’ Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.1. Do you think online mind mapping was useful in your collaborative prewriting? In what ways?</td>
<td>Benefits</td>
<td>Thi: Yes. I can design and edit with my partner simultaneously. We also can comment and chat with each other.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bao: Yes, online mind mapping can be extremely useful in collaborative prewriting. Online mind mapping tools allow multiple users to work on the same mind map simultaneously from different locations. This facilitates collaborative brainstorming sessions where team members can contribute ideas in real-time. Since online mind mapping tools are typically cloud-based, I and my teammate can access and edit the mind map from any device with an internet connection. This ensures that everyone involved in the prewriting process can contribute regardless of their location or device. We met each other via GoogleMeet and assigned each part for each person to complete a mind map (twice a week for 3 weeks, 30 mins per meeting). After meeting, I also did myself on mind mapping and made comments on the mind map.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thanh: I suppose that making online mind mapping on Mindomo is useful for me in collaborative prewriting. To be more specific, I was given the assignments on making outlines for our writing projects (informative and argumentative essays). I made it with my partner, and we found that through making outlines on Mindomo, it’s easier for us to brainstorm and link our ideas together, as we could discuss and construct the outlines at the same time. Moreover,</td>
</tr>
</tbody>
</table>
when making mind mapping on Mindomo, we recognized that we could notice the balance of our outlines so that we could make our ideas become shorter (using keywords and shortening the sentence), which we hadn’t noticed when we constructed the mind mapping on google docs.

Dinh: Yes – drafted on the Google docs before – helped to understand better (structure, ideas and being clearer).

Hoang: I do not think it was very useful. The experience was that me and probably my teammate did not really feel the need to use mind mapping.

Q.2. Did you experience any difficulties when using online mind mapping in your collaborative prewriting? If yes, please include specific examples.

<table>
<thead>
<tr>
<th>Difficulties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thi: I struggled with perfectionism because online mind mapping offers many features and customization. I always want to make my mind map look aesthetic, catchy, and well-organized. Sometimes having many formats, templates, and functions… makes me feel overwhelmed and cluttered at the beginning. It also causes the paradox of choice. Having too many options makes me feel hard to choose.</td>
</tr>
<tr>
<td>Bao: At the beginning, I didn’t know the features of Mindomo and tried it myself. While online mind mapping can be highly beneficial for collaborative prewriting, there are also potential difficulties that I encountered. Online mind mapping tools may sometimes experience technical glitches or downtime, which can disrupt collaborative sessions. For example, if the tool crashes unexpectedly or if there are issues with internet connectivity, it can interrupt the flow of the prewriting process. Some people may struggle initially with learning how to use the online mind mapping tool effectively. This can slow down the collaborative prewriting process.</td>
</tr>
<tr>
<td>Thanh: Through my experience, it was quite difficult for me to make the mind mapping online (on Mindomo) because I didn’t get used to the tools and it took me such a long time to finish making a mind mapping for the first time.</td>
</tr>
</tbody>
</table>
Dinh: None – used Canva (a year ago) – get prepared for any subjects before the exams.

Hoang: With technicality I suppose I did not face much or any difficulties with that side. However, I think one difficulty I faced a lot is that I did not feel the need, the motive to use mind mapping. I only mainly used the mind mapping as it was required for my assignments, but I did not find it very beneficial for myself as I find myself brainstorming ideas the way I usually do which is to write everything out, then organize them and putting them on the mind mapping app.

In terms of learning benefits, four out of five participants found online mind mapping beneficial in brainstorming and organizing ideas for their collaborative prewriting. Both Thi and Bao agreed that Mindomo mind mapping allowed them and their partners to work more closely and effectively on their outlines regardless of location and time. They could chat or leave comments for each other to complete their outlines synchronously. The other participant, Thanh, thought that it was easier to organize her ideas on Mindomo because she just needed to take notes with key words or phrases. Compared with Google docs, Dinh preferred to use Mindomo mind mapping because it helped him better understand his partner’s ideas with a clear structure. In contrast, Hoang and his teammate did not think that mind mapping was useful in their collaborative writing process because they preferred writing their brainstorm and ideas on paper instead of using online mind mapping.

Regarding difficulties, Dinh did not encounter any issues when using Mindomo mind mapping because he was familiar with using mind mapping on Canva from the previous year. The other interviewees struggled to use a variety of features provided by Mindomo at the beginning. Because Thi and her partner wanted to create a catchier and more well-organized
mind map, they spent a lot of time choosing the best options to apply to their mind map. Bao was afraid that unexpected technical issues or low connectivity might affect her collaborative work while designing a mind map in Mindomo.

In summary, the interviewees revealed a range of benefits and difficulties when using online mind mapping for their collaborative prewriting. Regardless of the difficulties, all interviewees were willing to use online mind mapping in their future studies. Bao said that she wanted to use online mind mapping for illustrating key concepts, outlining lecture topics, and including resources for further research. Similarly, Dinh expressed a desire to use mind mapping for taking notes in sociology classes, whereas Thanh wanted to continue using online mind mapping for brainstorming in her IELTS classes. Interviewees also expressed the same desire to receive more training on using Mindomo mind mapping through instructional videos or supplemental so that they could use it more effectively in the future.

Summary

The purpose of this mixed-method study was to examine the effects of online mind mapping intervention on student learning outcomes and their perceptions in their ERW421 classes. This chapter contains the results of the five research questions.

The first question aimed to explore whether there was a statistically significant relationship between students’ understanding of online mind mapping and their brainstorming and organization for the treatment group through the application of the Pearson product-moment correlation coefficient. The correlation coefficient between student understanding of online mind mapping and their brainstorming and organization showed a moderate positive correlation (0.67), indicating a linear relationship between students’ understanding of online mind mapping and their idea brainstorming and organization, which contributed to 45% of the variation.
The second research question investigated whether there was a difference between the control and treatment groups regarding student idea elaboration through conducting an independent-samples \( t \) test. The mean of students from the treatment group was slightly higher than those from the control group, whereas there was no difference in the standard deviation between both groups. Cohen’s \( d \) value of .60 indicates a medium size.

Three independent-samples \( t \) tests were conducted to examine whether there was a difference between the control and treatment groups regarding student idea organization on their argumentative essays in the third research question. There was a slight difference (0.25) between the means of organization between both groups. Cohen’s \( d \) value of organization resulted in a very small size of 0.19.

The fourth research question aimed to discover whether there was a difference between the control and the treatment groups regarding student perceptions of their interest, success, and usefulness in the coursework by conducting three independent-samples \( t \) tests. Regarding the interest rating, there is little difference in means between the two groups, and Cohen’s \( d \) value of -0.31 is a small effect size. For the success rating, there is little or no difference between the means of the two groups. There is no statistically significant difference in students’ perception of their success between the two groups. Cohen’s \( d \) value of 0.01 is close to zero. For the usefulness rating, the means showed a slight difference between the two groups, with the mean of the treatment group slightly higher than the mean of the control group. Cohen’s \( d \) value of 0.09 reveals a very small effective size.

The fifth research question aimed to discover students’ perceptions on online mind mapping in their collaborative prewriting. Qualitative data were collected to answer the question. Two major themes were formed from the transcript: (a) benefits and (b) difficulties. The data
found that all interviewed students had prior knowledge of using mind mapping before taking the ERW421 class, whereas two have used mind mapping since secondary school. The data revealed that most students believed that online mind mapping was useful for brainstorming and organizing ideas in class, but one student preferred writing down ideas on paper. Three-fifths of the students experienced difficulties when using mind mapping at the beginning due to the variety of features offered in Mindomo. All students, however, shared that they were willing to utilize online mind mapping for future learning if they could gain more knowledge and have more practice with online mind mapping.
CHAPTER V
SUMMARY, LIMITATIONS, DISCUSSION, CONCLUSION, IMPLICATIONS, AND RECOMMENDATIONS

The study aimed to examine the effects of the online mind-mapping strategy on student learning outcomes and their perceptions during collaborative prewriting. This chapter presents a summary of the findings, an analysis of the study’s limitations, a discussion of the study’s results, implication for future research and educational practice, and recommendations for future research on the implementation of online mind mapping on student language acquisition, especially for student writing skills.

Summary of the Study

The purpose of this mixed-method study was to investigate how online mind mapping can help students collaboratively brainstorm and organize their ideas during the writing process. This study focused on the effects of the online mind-mapping intervention on student academic writing performance and perceptions in a Read-Think-Write 2 class at FPT University, a private university in Southern Vietnam. In the study, the independent variable was online mind mapping, and dependent variables were the student idea elaboration and organization. Data collection included a presurvey, a questionnaire and a posttest from the mind-mapping training session, class assignments, a coursework inventory, and the final writing exam grades from students’ previous ERW411 class.

At the beginning of the study, students from both classes were allowed to accept or decline to have their data included in the research by signing the provided consent form and taking a presurvey regarding their experience in brainstorming and organizing ideas before they wrote their essay for Project 2. For the treatment group, mind mapping was part of the instruction in the course, so students took a mind-mapping training session, a questionnaire to examine their
prior knowledge before the training, and a posttest after the training. Students from both groups completed a modified coursework inventory to share their experiences regarding their interest, success, and usefulness at the end of the course. Five students volunteered from the treatment group to have a Zoom interview and share their perceptions of the benefits and difficulties of using Mindomo online mind mapping for their collaborative prewriting.

The study addressed five research questions as follow:

1. To what extent was there a statistically significant relationship between the students’ understanding of online mind mapping and their brainstorming and organization for the treatment group?
2. To what extent was there a difference between students’ idea elaboration with and without using online mind mapping in their argumentative papers?
3. To what extent was there a difference between students’ organization of ideas with and without using online mind mapping in their argumentative papers?
4. What were the students’ perceptions of the coursework with and without collaborative online mind mapping?
5. What were treatment students’ perceptions of the effectiveness of collaborative online mind mapping in their writing process?

Summary of Findings

This section presents a summary of the study findings of five research questions as the basis of the study. The first four quantitative results are discussed first, followed by a presentation of the qualitative results.

The first question was designed to examine whether there was a statistically significant relationship between student understanding of online mind mapping and their brainstorming and
organization for the treatment group by applying the Pearson product-moment correlation coefficient. The correlation coefficient between student understanding of online mind mapping and their brainstorming and organization showed a moderate positive linear relationship.

The second research question examined whether there was a difference between the control and treatment groups regarding student idea elaboration by conducting the independent-samples $t$ test. There were slightly higher scores in the means of students in the treatment group than those from the control group, whereas there was no difference in the standard deviation between both groups. Cohen’s $d$ value of 0.60 shows a medium effect size.

Using three independent-samples $t$ tests, the third research question aimed to discover whether there was a difference between the control and treatment groups regarding student idea organization on their argumentative essays. There is a slight difference between the means of organization between both groups. Cohen’s $d$ value of organization resulted in a very small effect size of 0.19.

Three independent-samples $t$ tests were conducted to address the fourth research question about whether there was a difference between the control and the treatment groups regarding student perceptions of their interest, success, and usefulness in the coursework. Regarding the interest rating, there was little difference in the means of the interest rating between the two groups, and Cohen’s $d$ value of -0.31 is a small effect size in favor of the control group. For the success rating, there was no statistically significant difference in students’ perception of their success between the two groups, and Cohen’s $d$ value of 0.01 shows a near zero effect. Regarding the usefulness rating, the means showed a slight difference between the two groups. The mean of the treatment group is slightly higher than the control group. Cohen’s $d$ value of 0.09 is a very small effect size.
The fifth research question aimed to discover student perceptions of online mind mapping on their collaborative prewriting by analyzing the two major themes formed from the transcripts: benefits and difficulties. The qualitative data revealed that most students believed that online mind mapping was useful for brainstorming and organizing ideas in class. Sixty percent of the interviewees found difficulties in using mind mapping at the beginning because of various features in Mindomo. All students, however, expressed their willingness to continue using online mind mapping for future learning if they could receive more knowledge and more practice with online mind mapping.

**Limitations**

The researcher strived to minimize the range of limitations throughout the research process, but several limitations remain that the researcher could not control. In this section, five following limitations that had a major effect on the research findings are acknowledged and explained.

The first limitation was the scope of factors that might influence the students’ argumentative writing process. Focusing only on idea elaboration and organization during the collaborative prewriting stage in this study might not be sufficient to examine the difference in student academic writing skills and their final course grade. Students from both control and treatment groups received classroom instruction from the same instructor for their ERW421 class, and their final writing exam grades from their previous ERW411 course were similar between both groups. Even though students shared a similar academic background, other factors like cognitive development, personal experience, language proficiency, peer influence, technology literacy, and feedback also should be taken into consideration to support students in their writing growth.
The second limitation was the sample size. Although ERW421 is one of the required courses in the English program, students have a right to decide when they want to take that course, so the total number of students registered for this ERW421 course was 42 out of the 62 students in the English program who enrolled for the Spring 2024 semester. The small sample size limits the generalizability of the study result. Moreover, the different class times led to an unequal number of students between both classes. There were 30 students in the morning class (the treatment group) and only 12 students in the afternoon class (the control group). The test conducted in this study, therefore, was not robust with respect to having a similar sample size. The participants were from FPT University, a private university that has five campuses across Vietnam, but this study was only conducted at its Southern campus, so the results may be geographically limited to the student population in the South. Furthermore, the relatively small sample size restricts the researcher from investigating the difference among ethnic groups or genders.

The next limitation was the quantitative data collection method. There was an assumption that students in the control group used Google Docs in their brainstorming and organizing ideas, whereas students in the treatment group applied Mindomo mind mapping to work on their Project 2 from weeks 5 to 8. Because all students previously were introduced to using mind-mapping on an online graphic design tool called Canva in their first year, the researcher does not know whether students in the control group used paper mind mapping strategies or other free online mind-mapping software to collaborate with their peers during the study. If students from the control group also used mind mapping in their brainstorming and organizing ideas, it would be difficult to examine the effectiveness of online mind mapping and differences in learning outcomes between two groups.
Another potential limitation was associated with the instructor’s experience and implementation of online mind mapping during the study. Although the instructor was willing to spend her weekend time on exploring mind mapping and having a few Zoom meetings with the researcher to exchange the use of Mindomo mind mapping before the study started, the examination of the instructor’s understanding and application of Mindomo in this study was not addressed to ensure the quality of the mind-mapping training as well as appropriate instruction and feedback given to the treatment group students.

The fifth limitation identified was related to the typical characteristics of Vietnamese students in the relationship with their instructor. Sixty percent of the interviewed students found difficulties in using mind mapping at the beginning, but none of them was willing to contact their instructor or the researcher for help. They managed to solve the problem by themselves instead. Hesitation or shyness to raise questions and work closely with instructors could be a factor that prevented the students in this study from better understanding of online mind mapping as well as effectively using them in their collaborative prewriting process.

Discussion of Findings

The purpose of this study was to examine the effects of online mind mapping on EFL students’ learning outcomes and perceptions regarding idea elaboration and organization in ERW421 classes. The findings of each research question in connection with the findings of previous research in the context of online mind mapping on language acquisition, specializing in the writing skill are discussed in this section.

Finding 1

The first research question aimed to explore whether there was a statistically significant relationship between students’ understanding of online mind mapping and their brainstorming
and organization for the treatment group. There are few, if any, studies specifically addressing this question. Previous studies focused on the effects of mind mapping on enhancing students’ comprehension or cognition (Harahap et al., 2020; Hardiah, 2019). Therefore, this study’s finding can be considered as an initial analysis to better examine such a relationship. With the positive correlation of .67, the study revealed that students’ understanding of using online mind mapping is related moderately to their capabilities of brainstorming and organizing ideas in argumentative essays.

Finding 2

The second research question investigated whether there was a difference in student idea elaboration on their argumentative papers between the control and treatment groups. Findings from previous studies (Karim et al., 2023; Liu et al., 2023) showed that mind mapping potentially influenced students’ cognitive process.

Conducting a quasi-experiment to examine how computer-based mind mapping enhanced students’ reflective activities, Liu et al. (2023) found that students performed better on reflection, higher-order cognitive presence, and learning outcomes with the application of computer-based mind mapping. Moreover, mind mapping improved higher levels of cognition and positively moderated student reflections, cognitive presence, and learning outcomes. Using an online survey to collect data regarding perspectives toward the application of online mind mapping from 372 technical students at selected public higher institutions in Malaysia, findings from Karim et al. (2023) revealed that students agreed that online mind mapping helped them developed their design-thinking skills. For language learners, using mind maps is a visual way of organizing their random ideas into logical groupings to write a more coherent paper.
The current study’s results reinforce findings from previous studies (Karim et al., 2023; Liu et al., 2023). In this study, there was a slight difference between the means of both groups. Although the students’ idea elaboration from both groups were at the same satisfactory level, the mean of students from the treatment group of 6.63 were slightly higher than those from the control group of 5.91, indicating that students from the treatment group, on average, elaborated ideas in their argumentative essays better than students from the control group.

**Finding 3**

The third research question investigated whether there was a difference in students’ organization of their ideas on their argumentative papers between the control and treatment groups. The research question was designed in response to previous studies regarding student abilities in organizing ideas with the intervention of mind mapping (Fadhil, et al., 2020; Pratiwi et al., 2023).

Using a quasi-experimental design to collect data from 40 students from a suburban National Secondary School in Malaysia, Fadhil et al. (2020) conducted a study to examine the use of an i-THINK map (tree map) in the student’s organization of their ideas during the prewriting stage. Findings from pre- and posttests indicated statistically significant improvement in the participating students’ idea organization in their argumentative essays. Additionally, Pratiwi et al. (2023) studied the incorporation of mind-mapping techniques with the application Writeabout in online writing classes during the 2020-2021 academic year. Participants in the study were freshmen who enrolled in the Railway Mechanical Technology program in Indonesia. Data collected from the participants’ essays revealed a positive result on students’ writing. The students’ textual organization skills were improved from level 3 to level 7.
Having similar findings from previous studies (Fadhil et al., 2020; Pratiwi et al., 2023), this current study showed that there was a slight difference (0.25) in the means of organization between the control and the treatment with Mindomo online mind-mapping intervention. Although the idea organization for both groups are at the same satisfactory level based on the rubric, the organization mean of the control group was 6.06, and the mean of the treatment group was 6.31, indicating that online mind mapping might benefit participants during their idea organization.

**Finding 4**

The fourth research question was developed to investigate whether there was a difference in students’ rating of their interest, success, and usefulness in learning between the control and treatment group. Students’ perceptions of interest, success, and usefulness were measured by a MUSIC inventory of academic motivation developed by Jones (2009). The modified version of the MUSIC inventory used in this study included 12 of the original 24 items, which were categorized into three components: (a) interest, (b) success, and (c) usefulness. The research question was designed in response to previous studies regarding students’ perceptions of the mind-mapping intervention in language acquisition (Karim, 2018; Sairo et al., 2021). Prior studies suggested that the mind-mapping strategies benefit and motivate student learning.

Karim (2018) investigated the effects of mind mapping in an English writing course named “Integrated Language Skills III” at the MARA University of Technology in Malaysia. Twenty-five students participating in the study were instructed on how to use online mind-mapping techniques Bubbl.us before being asked to develop their own mind maps in the prewriting stage during the 12-week period. Participants also were expected to complete a 17-question survey. The findings indicated that 90% of the students agreed that online mind
mapping was beneficial to their writing acquisition. Moreover, 70% of the participants admitted that their novice writing skills had been enhanced, and more than 80% stated that their ideas have been improved in quality when using online mind mapping.

To examine the effects of digital mind mapping on writing skills over five sessions divided into two cycles, Sairo et al. (2021) conducted a study with the participation of 33 students. The researcher collected data through observation, interviews, and test sheets. Students in the study were expected to take a one-hour posttest in which they had to create a digital mind map within the first 20 minutes and write a paragraph based on a given topic in the next 40 minutes. The rubric for assessing the test was borrowed from Brown’s (2007) study, including five areas: content, organization, vocabulary, and mechanics. The quantitative findings revealed that participants’ motivation and their writing performance were improved by the app Digital Mind Mapping. Furthermore, students’ average test score increased from 24% on the pretest to 90% on the posttests I and II. The qualitative findings indicated that students expressed a positive attitude toward using the app Digital Mind Mapping in their prewriting stage, because it guided them in organizing ideas as well as developing their creativity and critical-thinking skills.

The findings of this study indicated little or no difference between the control and treatment group regarding student perceptions of their interest, success, and usefulness in the coursework. Regarding the interest rating, there is little difference in the means of the interest rating between the control and treatment group. Students from both groups agreed somewhat that the instructional methods and coursework were interesting. For the success rating, there is no statistically significant difference in the student perception of their success between the two groups. The means of both groups are very similar (4.14 and 4.15), indicating that students somewhat believed that they could succeed in the coursework. Regarding the usefulness rating,
the mean of the treatment group is slightly higher than the control group, but still between ratings of 4 and 5, so students from both groups also found the instructional methods and coursework somewhat useful.

Having similar findings of previous studies (Karim, 2018; Sairo et al., 2021), the current study revealed that students in the treatment group found the course instruction useful and the online mind mapping was beneficial to students’ brainstorming and organizing ideas. During the interview, Thanh stated that Mindomo helped her discuss and construct outlines easier with keywords and short sentences.

Finding 5

The fifth research question aimed to discover student perceptions of online mind mapping on their collaborative prewriting. The insightful reflections provided by students about the online mind-mapping intervention during their coursework supported the quantitative data.

With regard to the benefits of collaborative learning with mind maps, findings from Koznov and Pliskin (2008) showed five positive consequences of Comapping in participants’ learning process: (a) quickly measure the students’ understanding in different topics, (b) provide immediate collaboration between teacher and students by the Author or Commenter cycle review process, (c) promote the efficiency of paper writing through the tree-like structure, (d) enhance the collaboration among students by sharing their work and receiving peer feedback, and (e) create an online resource of students’ work.

Using a qualitative experimental design to examine how Electronic Mind Mapping (EMM) effected 29 freshmen student responses in the ITRDR1101 course at the Ibri College of Applied Sciences in Oman, Al-Badwoi (2015) found that most student participants from three groups (self-selected technique, pen-based mind mapping, and EMM) were able to organize
content correctly, but the EMM group spent the least amount of time. Additionally, students from the EMM group achieved the highest accuracy percentages, ranging from 90 to 100%.

From the textual analysis in this study, most interviewees agreed that online mind mapping benefited their collaborative prewriting. Thi shared that she and her partner could design and edit their outline on Mindomo asynchronously. Bao agreed that online mind mapping allows multiple users to work on the same mind map regardless of time and location. Two other interviewees expressed similar positive comments about Mindomo online mind mapping.

Even though there were positive comments about online mind mapping, previous studies and interviewees in this study also found some difficulties in the application of online mind mapping. Most students from Wazil’s research (2022) experienced difficulties in writing argumentative essays throughout the use of mind maps because of their low language and technology. Moreover, Gonzalez et al. (2020) found that some students had difficulty learning mind maps at the beginning of their learning process, leading to some frustrations in their future mind-mapping use. Three out of five interviewed students in this study also reported being confused when using Mindomo at the beginning. They all figured it out and managed to complete, however, the mind-mapping assignment by the deadline.

The results of the present study support former research by indicating that 60% of the interviewees found difficulties in using mind mapping at the beginning because of various features in Mindomo. Because Mindomo offers a variety of features to develop and customize mind maps, Thi and her partner felt overwhelmed with choosing the most appropriate options to design and format their product. Moreover, dealing with some technical and connectivity issues was a major concern for Bao and her partner when they worked on their mind map.
Although there are some difficulties, all interviewed students in this study expressed their willingness to continue using online mind mapping for future learning if they could receive more lessons and supplemental practice so that students could more effectively use online mind mapping in future classes. Bao would like to use online mind mapping for illustrating key concepts, outlining lecture topics, and including resources for further research, whereas Dinh wanted to apply mind mapping for taking notes in sociology classes. Thanh indicated that she would continue using online mind mapping for brainstorming in her IELTS classes.

Conclusions

The purpose of this study was to investigate the effectiveness of online mind mapping on helping students collaboratively brainstorm and organize their ideas during their writing process. This study focused on the effects of online mind mapping on the cognitive outcomes of students in a Read-Think-Write 2 class throughout a 4-week period. A mixed-method study was conducted to examine the relationship between the independent variable (online mind mapping) and the dependent variables (students’ brainstorming and idea organization) in two Read-Think-Write 2 classes. Data collection included a presurvey, a questionnaire and a posttest from the mind-mapping training session, class assignments, a coursework inventory, and the final writing exam grades from students’ previous ERW411 classes.

One of the study’s important findings is that online mind-mapping intervention may enhance student idea elaboration and organization in their argumentative essays. Although there were no statistical differences in the means between the two groups, students from the treatment group had slightly higher average scores in both idea elaboration and organization than students in the control group, respectively 0.72 and 0.25.
The second important finding of the study is that students in the treatment group acknowledged the usefulness of the coursework with the application of online mind mapping. Students in the treatment group had slightly higher scores, on average, than those from the control group. Students from the treatment group found the coursework with online mind mapping beneficial and relevant to their academic goals, so they expressed a desire to brainstorm and organize ideas with the aid of online mind mapping in future courses.

Another important finding of the study is that four out of five interviewed students shared positive attitudes toward the use of Mindomo online mind mapping during their prewriting. They also expressed a wish to learn more about this tool and to continue using it for future classes.

**Implications for Future Research**

As mentioned previously, one limitation in the current study is a range of factors that may influence students' argumentative writing process. Addressing other considerable variables such as learning style, personal experience in mind mapping, language proficiency, or technology literacy could provide a more insightful understanding of the factors affecting student writing ability and their academic performance.

Second, future research should aim for a larger and more diverse sample size. To enhance the generalizability of findings, future researchers should include students from different regions, ethnic groups, genders, and academic backgrounds to learn if there are any differences in these demographic factors before generalizing findings for a broader population of students. Moreover, maintaining an equal number of participants between the control and treatment groups will result in more robust data with respect to having a similar sample size.

Third, providing students with sufficient training and supplemental materials should be addressed in future research. Carrying out a training trial pilot before the study is a need so that
the quality of training will be examined and adjusted if needed. Using a message app like Slack also can help students receive prompt support either from other classmates or their teacher when they encounter any difficulties. The Slack app, moreover, allows students to share any additional document with their peers at any time.

Future research also should consider using more rigorous data-collection methods to enhance the reliability and validity of the data. Instructors should monitor their class activities closely to ensure that students in the control group are not using mind-mapping tools during the study. Additionally, using standardized assessments to measure student writing skills and evaluating student academic performance from their previous classes are also necessary for the study.

Finally, future researchers should consider longitudinal studies to examine the long-term effects of a variety of factors such as demographics and others on student writing ability and academic performance, which will allow researchers to track student progress over time and investigate how various factors effect their writing development rather than only focusing on the prewriting stage for a short period of time.

**Implications for Educational Practice**

In English language acquisition, writing is the most difficult skill that English learners have to master because it requires a lot of cognitive processes before transferring ideas and thoughts in the form of written language (Ali, 2018; Elahawwa, 2022). The integration of online mind mapping into the writing process in this study has some meaningful implications for stakeholders such as teachers, institutional managers, academic researchers, and students.

First, this study may help educational practitioners recognize the effects of online mind mapping on promoting student writing skills for a collaborative prewriting process. Online mind
mapping, namely Mindomo in this study, facilitated collaborative writing by allowing participating students to contribute ideas simultaneously, regardless of location, device, or time. Students can even chat or leave comments for each other while working on their mind maps. Findings from Roza et al. (2021) indicated that the integration of mind mapping and carousel feedback effectively enhanced individual and group brainstorming. The students’ writing skills, particularly on content, organization, and vocabulary were greatly improved in Roza et al. (2021). Besides the enhancement of group brainstorming sessions, online mind mapping also promotes a sense of shared ownership over the writing process. Because teachers can track student contributions through the full history of changes offered by the online app, each student is expected to contribute to complete the group’s work.

Second, this study may inspire educational practitioners with new insight into teaching students how to learn languages. Mind maps are a visual representation of ideas, so the application of online mind mapping in the writing process will help teachers differentiate their teaching styles to address different learning styles, especially visual learners. Mind mapping can help students develop more coherent and structured writing by making connections among concepts or ideas and identifying gaps in their thinking during the prewriting process.

Third, the proposed approach of integrating online mind mapping into the writing process encourages students to explore ideas freely without being constrained by the linear structure of traditional outlines and papers. With features like drag-and-drop, online mind mapping allows users to easily rearrange or reorganize ideas. Besides text, students can attach images, videos, or sources into their mind maps. Such flexibility can be helpful especially during the early stages of the writing process as well as leading to more creative and innovative writing for writing learners at different levels.
Afterword

This study contributes to the growth of research on technology-assisted language learning and provides valuable insights for educators seeking to enhance their teaching practice. The study findings revealed a noticeable effect of online mind mapping as a valuable technology tool for supporting language students in the prewriting stage, particularly in generating and organizing ideas collaboratively. Although the study did not find statistically significant differences between the treatment and control groups in idea elaboration and organization, the higher means in the treatment group indicate a potential benefit of online mind mapping in language learning. Additionally, participating students’ positive perceptions and attitudes toward online mind mapping further support its potential effectiveness in enhancing their academic performance during the writing process.

This study informs educators of an evidence-based framework for designing more learner-centered instructional techniques that incorporate online mind mapping tools into writing instruction to support students in brainstorming and idea organization. To enhance language teaching and learning, this study also highlights the importance of providing sufficient training and supplemental materials for students before the application of any support tool in class activities. Future research should expand this study by including a larger and more diverse sample of participants and exploring different instructional strategies for effectively integrating online mind mapping into the writing process.
REFERENCES


Suyanto, A. (2010). *The effectiveness of mind mapping to teach writing skills viewed from their IQ*.


http://dx.doi.org/10.1177/0265532209104670
APPENDIXES
Appendix A

A Script of the Consent Form
A Script of the Consent Form

Hello! My name is Yen Duong, a doctoral student at the University of San Francisco. I am conducting a research project, and I would like to invite you to participate in my study. You will receive a consent form. The consent form includes essential information about the rationale for conducting the study in week 5. In the consent form, you will be asked if you would like to participate in the study by allowing the researcher to obtain the data for the study after week 8. Your final writing exam grades from the ERW 411 class also will be provided as part of this data. Your identity will not be known to me. Your instructor will provide me with the data that have been associated with your student ID numbers. No names will be associated with your data, and I will not know who the data belongs to. If you consent to participate, type your name at the end of the form to indicate that you have read and understood the information on the consent form. You are entitled to and will receive a copy of this form a week after you sign. If you do not wish to participate, your information will not be included in the study. If you have any questions, please let me know. Thank you for your time and consideration.

Transcript for a mind-mapping coursework inventory and invitation for the interview [Only for those in the treatment group]

Now you are being asked to complete a questionnaire regarding the application of online mind mapping in the Read-Think-Write 2 class. Your responses are anonymous. If you are interested in volunteering for a 30-minute interview, you can indicate your willingness on the form attached to the questionnaire. For those who participate in the interview, there will be a $20 Tiki gift card provided for your participation.

Everyone who is a student in this class will be able to continue to use Mindomo mind-mapping software for free until July 2024.
Transcript for a coursework inventory [Only for those in the control group]

Now you are being asked to complete a questionnaire regarding the Read-Think-Write 2 class. Your responses are anonymous. When the research ends, everyone who is a student in this class will be able to access the recording of the mind-mapping training session and have free access to Mindomo mind-mapping software until July 2024.
Appendix B
Department Chair Informed Consent Form
Department Chair’s Consent for Research

My signature below indicates that I acknowledge and authorize Yen Duong to conduct a research project in Read-Thinking-Write 2 classes during the Spring semester of 2024. I am aware that the researcher will collect class assignment grades, test grades, survey results, and final writing exam grades from the ERW 411 class from students who consent to participate in the study during week 9. During week 8, the researcher will ask students from both classes to complete a pre-survey of mind mapping. During week 8, the students will be asked to complete a coursework inventory. The researcher will randomly ask students in the treatment group to participate in a 30-minute Zoom interview regarding their perceptions of using mind mapping. All the instructions and mind maps are part of the regular coursework in the treatment group, and the students from the control and treatment groups can withdraw a consent form if they do not want their data to be included in the study.

Thuyet Thi Minh Dang  Head of English Department, FPT University, HCM City Campus

Name                                           Title

12/30/2023

Signature                                           Date:
Appendix C
Course Instructor Informed Consent Form
Instructor's Consent for Research

My signature below indicates that I acknowledge and authorize Yen Duong to conduct a research project in my Read-Think-Write 2 class during the Spring semester of 2024. I am aware that the researcher will collect class assignment grades, test grades, survey results, and final writing exam grades from the ERW411 class from students who consent to participate in the study. At the end of week 4, students from two Read-Think-Write 2 classes will read and sign the consent form if they agree to have their data included in the research study. During week 5, the researcher will ask students from both classes to complete a presurvey of mind mapping. During week 8, the students will be asked to complete a coursework inventory. The researcher will randomly ask students in the treatment group to participate in a 30-minute Zoom interview regarding their perceptions of using mind mapping. All the instructions and mind maps are part of the regular coursework in the treatment group, and the students from both control and treatment groups can withdraw a consent form if they do not want their data to be included in the study.

Thuyet Thi Minh Dang

Name

ERW421 Instructor

Title

12/30/2023

Date

Signature
Appendix D

Consent Form for Students
Consent Form for the Treatment Group

Study Title:
The effects of Online Mind-Mapping on the Cognitive Outcomes of Students and Their Perceptions in the Collaborative Prewriting Stage

Student Researcher: Yen Duong

I am a doctoral student at the University of San Francisco (USF) in the School of Education. I am planning to conduct a research project, and I would like to invite you to take part in my study. This form has important information about the rationale for doing this study, what I will ask you to do if you decide to be in this study, and the way I would like to use information about you if you choose to be in the study. The information that you provide will be anonymous.

Why are you invited to this study?
The purpose of this research is to examine the effects of online mind mapping in helping students during the brainstorming and organization writing process as well as understanding students’ perceptions of online mind mapping during the brainstorming and organization process in the Read-Think-Write 2 university classes.

What will I do if I choose to be in this study?
At the beginning of your learning journey (week 5), you will take a short presurvey to share your thoughts regarding brainstorming and organizing ideas before you start writing. Then you will take a questionnaire consisting of six questions regarding your demographic information and prior knowledge of mind mapping before a one-hour training session of online mind mapping. At the end of the mind-mapping training session, you will take a posttest to examine your understanding of using online mind-mapping in real-world contexts. During week 8, you will complete a mind-mapping coursework inventory to share your thoughts regarding the course with the application of online mind mapping. If you agree to participate, you will be asked to type your name and sign this consent form to share your opinions about the course. If you agree to participate in the study, you will authorize your instructor to release the following records with the researcher:

• class assignment grades
- a presurvey
- a questionnaire and a posttest
- a coursework inventory
- the final exam grade from ERW411 from last semester

If you also consent to an interview, you will type your name and email address at the end of the coursework inventory. I will conduct a Zoom meeting to collect your opinions regarding your experience in this study. The interviews will be recorded for transcription and data analysis. Your personal information will be protected, and the recording will be deleted after the study ends.

**Study Time:**

A 10-minute presurvey will be conducted during week 5, and a 10-minute mind-mapping coursework inventory will be conducted during week 8. You also will participate in a one-hour mind-mapping training with a questionnaire before and a posttest after. During week 9, the researcher will be provided with the students’ test grades, class assignment grades, and online survey results from students who give permission to share their data.

**Study Location:**

All study procedures will take place at the Read-Think-Write 2 class at the Ho Chi Minh City campus of FPT University.

**What are the possible risks for me or others?**

Your participation in this study does not involve any physical or emotional risk to you, beyond that of everyday life.

**What are the possible benefits for me or others?**

Your participation in this study will provide you with a better understanding of mind mapping and its importance in academic writing performance. You will also receive a free subscription to Mindomo mind-mapping software until July 2024. Finally, those who volunteer for the interview will receive a $20 Tiki gift card.

**How will the researcher protect the information collected from you, and how will that information be shared?**
The information that can identify you will not be known to me, and the data you agree to provide will be given to me without your names or identification so it will be anonymous. Results of this study may be used in publications and presentations.

**Financial Information**

Participation in this study will involve no cost to you. You will not be paid for participating in this study. Volunteers for the interview will be provided with a $20 Tiki gift card.

**What are my rights as a research participant?**

Your participation in this study is voluntary. You do not have to answer any questions that you do not want to answer. If you decide to participate in this study, your participation will not affect your grade in the course.

**Who can I contact if I have questions or concerns about this research study?**

If you have questions, you are free to ask me now. If you have questions later, you may contact the researcher, Yen Duong, at +1 408-370-8731 or yduong@dons.usfca.edu. If you have any questions about your rights as a participant in this study, please contact the following office at the University of San Francisco:

Institutional Review Board for the Protection of Human Subjects (IRBPHS) University of San Francisco
2130 Fulton St.
San Francisco, CA 94115
Email: IRBPHS@usfca.edu

**Consent**

I have read this form, and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told who to contact. I agree to participate in the research study described above.

__________ I agree to participate in this study.

__________ I do not agree to participate in this study.
Consent Form for the Control Group

Study Title:
The effects of Online Mind-Mapping on the Cognitive Outcomes of Students and Their Perceptions in the Collaborative Prewriting Stage

Student Researcher: Yen Duong
I am a doctoral student at the University of San Francisco (USF) in the School of Education. I am planning to conduct a research project, and I would like to invite you to take part in my study. This form has important information about the rationale for doing this study, what I will ask you to do if you decide to be in this study, and the way I would like to use information about you if you choose to be in the study. The information that you provide will be anonymous.

Why are you invited to this study?
The purpose of this research is to examine the effects of online mind mapping in helping students during the brainstorming and organization writing process as well as understanding students’ perceptions of online mind mapping during the brainstorming and organization process in the Read-Think-Write 2 university classes.

What will I do if I choose to be in this study?
At the beginning of your learning journey (week 5), you will take a short presurvey to share your thoughts regarding brainstorming and organizing ideas before you start writing. During week 8, you will complete a coursework inventory to share your thoughts regarding the course. If you agree to participate, you will be asked to type your name and sign this consent form to share your opinions about the course. If you agree to participate in the study, you will authorize your instructor to release the following records with the researcher:

- class assignment grades
- a presurvey
- a coursework inventory
- the grade from ERW411 from last semester

Study Time:
A 10-minute presurvey will be conducted in week 5, and a 10-minute mind-mapping coursework inventory will be conducted in week 8. During week 9, the researcher will be
provided with the students’ class assignment grades and survey results from those who give permission to use their data.

**Study Location:**

All study procedures will take place at two Read-Think-Write 2 classes at the Ho Chi Minh City campus of FPT University.

**What are the possible risks for me or others?**

Your participation in this study does not involve any physical or emotional risk to you, beyond that of everyday life.

**What are the possible benefits for me or others?**

Your participation in this study will provide you with a better understanding of mind mapping and its importance in academic writing performance by accessing the recording of the mind-mapping training session when the research ends. You will also receive a free subscription to Mindomo mind-mapping software until July 2024.

**How will the researcher protect the information collected from you, and how will that information be shared?**

The information that can identify you will not be known to me, and the data you agree to provide will be given to me without your names or identification, so it will be anonymous. Results of this study may be used in publications and presentations.

**Financial Information**

Participation in this study will involve no cost to you. You will not be paid for participating in this study.

**What are my rights as a research participant?**

Your participation in this study is voluntary. You do not have to answer any questions that you do not want to answer. If you decide to participate in this study, your participation will not affect your grade in the course.

**Who can I contact if I have questions or concerns about this research study?**

If you have questions, you are free to ask me now. If you have questions later, you may contact the researcher, Yen Duong, at +1 408-370-8731 or vduong@dons.usfca.edu. If you have
any questions about your rights as a participant in this study, please contact the following office at the University of San Francisco:

   Institutional Review Board for the Protection of Human Subjects (IRBPHS) University of San Francisco
   2130 Fulton St.
   San Francisco, CA 94115
   Email: IRBPHS@usfca.edu

Consent

I have read this form, and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told who to contact. I agree to participate in the research study described above.

________ I agree to participate in this study.

________ I do not agree to participate in this study.

____________________________________________________________________________________

Participant’s Name

____________________________________________________________________________________

Participant’s Signature Date
Appendix E
Presurvey
Presurvey

You're invited to participate in this presurvey to collect your thoughts regarding brainstorming and organizing ideas before writing that you have applied. All response data are anonymous.

Your student ID number: _________________________

1. Do you brainstorm before writing?
   ○ Yes
   ○ No

2. How do you brainstorm?
   ○ Verbal brainstorming: gather in face-to-face groups to share ideas verbally
   ○ Within groups
   ○ Other. Please specify ________________

3. What difficulties have you encountered while brainstorming?
   ____________________________________________

4. Do you organize your ideas before writing?
   ○ Never
   ○ Sometimes
   ○ About half of the time
   ○ Most of the time
   ○ Always

5. In what ways do you organize your ideas before writing?
   ____________________________________________
Appendix F

Questionnaire – Mind mapping (before the training)
Questionnaire – Mind mapping (before the training)

Instructions
This questionnaire assesses your demographic information and prior knowledge of mind mapping. There are no right or wrong answers, so please answer the questions to the best of your ability. Your responses will be confidential.

Please note that a mind map is known as a visual thinking tool to structure information and generate ideas. It is also known as a “spider diagram” (Sourced from Mindomo’s website).

Demographic Background
1. How old are you? (What was your age on your last birthday?)
   - 18-20
   - 21-22
   - 23-25
   - 26 above

2. What is your current gender identity?
   - Female
   - Male
   - Nonbinary
   - Trans
   - Other

Prior Knowledge of Mind Mapping
1. How do you rate your current understanding of mind mapping?
   - Not at all (If the student chooses this option, s/he will quit the questionnaire right away)
   - Slightly well
   - Moderately well
   - Very well
   - Extremely well
2. When did you learn or know about mind mapping?

______________________________________________________________________________

3. How often do you use mind mapping in your studies?
   ○ Never
   ○ Sometimes
   ○ About half the time
   ○ Most of the time
   ○ Always

4. Please list some difficulties you have encountered while using mind mapping?

______________________________________________________________________________
Appendix G

Posttest – Mind mapping (after the training)
Posttest – Mind mapping (after the training)

Instructions:
This test assesses your understanding of mind mapping after taking the training session. Your answers will NOT be graded as part of your course, and your responses will be kept confidential, so please answer the following questions to the best of your ability.

1. Identify the following statements if they are TRUE (T) or FALSE (F) to define a mind map. Write an appropriate letter T or F next to each statement to express your thoughts. Select all that apply.
   □ A mind map is a diagram to visually organize concepts and ideas, promoting creativity and encouraging brainstorming.
   □ A mind map can also be called a network of connected and related concepts or ideas connected to any other developed through free-form, spontaneous thinking.
   □ A mind map takes a variety of forms ranging from hierarchical to non-hierarchical forms, even data-driven maps where the input determines the shape of the map.
   □ A mind map is often difficult for others to read as they represent only hierarchical relationships (in radial form) and are inconsistent in terms of the level of detail, often too complex and missing the “big picture”.

2. What is the first item entered into a mind map, using the Mindomo mind-mapping software?

______________________________________________________________________________

3. Choose ONE of the following that does NOT pertain to graphic organizers?
   ○ Visual organizational tool
   ○ Auditory organizational tool
   ○ Groups thoughts around a central idea or concept
   ○ Helps users organize and focus on their thoughts

4. You are entering “FPT University” as a theme for your mind map. How can you add your course, ERW421, as a topic?
   ○ Type in “ERW421” and hit the Tab key
   ○ Hit the Tab key and type in “ERW421”
○ Type in "ERW421" and hit the Enter key
○ Hit the Enter key and type in “ERW421”

5. If you want to customize the “ERW421” topic, what will you do?
○ Select the “ERW421” topic, right click, and choose Customize.
○ Select the “ERW421” topic, right click, and choose Format.
○ Select the “ERW421” topic and click on the white triangle.
○ Select the “ERW421” topic and click on the white circle.
Appendix H
Rubric for Argumentative Essays
## Rubric for Argumentative Essays

<table>
<thead>
<tr>
<th>Criteria</th>
<th>9-10</th>
<th>7-8</th>
<th>5-6</th>
<th>3-4</th>
<th>1-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction 10%</strong>&lt;br&gt;Background/history 2.5%&lt;br&gt;Define the problem 2.5%&lt;br&gt;Thesis statement 5%</td>
<td>Well-developed introductory paragraph contains detailed background, a clear context for the argument, and a compelling thesis statement.</td>
<td>The introductory paragraph provides adequate context for the argument and presents a clear thesis statement that captures the reader's attention and establishes the essay's direction.</td>
<td>The introduction introduces the topic but may lack some clarity or depth in setting context for the argument. The thesis statement is present but may be somewhat vague or lacking in specificity. The introduction attempts to engage the reader but may be somewhat uninspired.</td>
<td>The introduction provides limited context for the argument and may fail to clearly introduce the topic or thesis statement. The thesis statement may be unclear, and the introduction fails to effectively engage the reader's interest.</td>
<td>The introduction is entirely absent or incomprehensible, failing to provide any context for the argument or thesis statement. It does not engage the reader in any way.</td>
</tr>
<tr>
<td><strong>Body paragraphs 60%</strong>&lt;br&gt;Analysis &amp; Refutation</td>
<td>Body paragraphs are exceptionally well-organized, with a clear and logical structure, offering insightful analysis and evaluation of sources and arguments.</td>
<td>Body paragraphs are generally well-organized, with a logical structure that supports the argument, providing thoughtful analysis and evaluation of sources and arguments. The refutation</td>
<td>Body paragraphs are somewhat organized, but the structure may be somewhat disjointed or unclear at times, impacting the argument's coherence, analysis and evaluation of sources and arguments.</td>
<td>Body paragraphs lack clear organization, with a structure that confuses rather than supports the argument. The refutation inadequately addresses counterarguments, with limited effectiveness or clarity. The body paragraphs are extremely disorganized, with no discernible structure or coherence. Transitions between ideas are absent, and paragraph structure is nonexistent or entirely ineffective with analysis.</td>
<td></td>
</tr>
<tr>
<td>Body paragraphs 10%</td>
<td>The essay provides ample, relevant, and compelling evidence to support each point, drawing from a variety of credible sources. Evidence is effectively integrated into the argument.</td>
<td>The essay provides some evidence to support most points, drawing from credible sources. Evidence is generally well-integrated into the argument and effectively</td>
<td>The essay lacks sufficient evidence to support most points, relying heavily on unsupported claims or irrelevant sources. Evidence is poorly integrated into the argument, and many points lack</td>
<td>The essay provides little to no evidence to support points, relying entirely on unsupported claims or irrelevant sources. Evidence is absent or completely disconnected from the argument.</td>
<td>Evidence &amp; Support 10%</td>
</tr>
<tr>
<td>Argument and Supports the Thesis Statement Thoroughly</td>
<td>Supports the Thesis Statement</td>
<td>Lack Adequate Support</td>
<td>Credible Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-------------------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clarity &amp; Coherence 10%</strong></td>
<td>The essay demonstrates exceptional clarity and coherence, with precise language, varied sentence structure, and a sophisticated vocabulary that enhances understanding and engagement. The writing is compelling and free from errors.</td>
<td>The essay is generally clear and coherently effective, with clear language, varied sentence structure, and a vocabulary appropriate to the audience and purpose. The writing is engaging and mostly free from errors.</td>
<td>The essay lacks clarity and effective coherence, with language that is often unclear or awkward. Sentence structure may lack variety, and errors may occasionally detract from readability.</td>
<td>The essay is extremely unclear and poorly coherent, with language that is incomprehensible or entirely inappropriate for the audience and purpose. Sentence structure is repetitive or convoluted, and errors are frequent enough to hinder understanding.</td>
<td></td>
</tr>
<tr>
<td><strong>Conclusion 10%</strong></td>
<td>The conclusion effectively summarizes the main points of the essay and reinforces the significance of the argument. It restates the thesis statement with clarity and provides a compelling closing thought that</td>
<td>The conclusion attempts to summarize the main points of the essay but may be somewhat repetitive or lacking in clarity. It restates the thesis statement but may do so in a formulaic or uninspired manner. The conclusion provides limited or vague summary of the essay's main points and fails to effectively reinforce the argument's significance. It may fail to clearly restate the thesis statement or provide a meaningful closing.</td>
<td>The conclusion is entirely absent or incomprehensible, failing to summarize the essay's main points or reinforce the argument's significance. It provides no closure or resolution to the essay's discussion.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
leaves a lasting impression on the reader. The conclusion demonstrates insight and offers suggestions for further exploration or action.

leaves the reader with a sense of closure but may lack some depth or originality.

conclusion provides a closing thought but may feel somewhat abrupt or incomplete.

thought, leaving the reader with unanswered questions or confusion.

---

**Grammar/Mechanics/Citation 10%**

**Sentence structure, Punctuation, & Contraction**

The essay demonstrates impeccable grammar, spelling, punctuation, and sentence structure throughout. There are no errors, and the writing flows smoothly, enhancing the clarity and readability of the argument. The essay demonstrates impeccable citation and documentation practices, accurately citing all sources and adhering to the required citation style consistently.

The essay exhibits strong grammar, spelling, punctuation, and sentence structure with only minor errors that do not detract significantly from the overall clarity and readability of the argument. The essay exhibits strong citation and documentation practices, with minor errors in citation format or consistency. Most sources are properly cited, and the

The essay contains occasional errors in grammar, spelling, punctuation, or sentence structure that may momentarily disrupt the flow of the argument or cause confusion but do not severely impact overall understanding. The essay contains occasional errors in citation format or consistency, with some sources improperly cited or missing from

The essay contains frequent errors in grammar, spelling, punctuation, or sentence structure that hinder the clarity and readability of the argument, making it difficult for the reader to follow the discussion. The essay demonstrates limited adherence to citation and documentation practices, with frequent errors in citation format, consistency, or accuracy. Many sources may be improperly cited or

The essay is riddled with numerous and significant errors in grammar, spelling, punctuation, or sentence structure that severely impede understanding and distract from the argument. The essay exhibits significant deficiencies in citation and documentation practices, with numerous and serious errors in citation format, consistency, and accuracy. Many sources are improperly cited or
| throughout the essay. | bibliography/reference list is mostly complete and accurately formatted according to the required citation style. | the bibliography/reference list. While attempts at citation are made, there may be inconsistencies or inaccuracies in formatting. | missing from the bibliography/reference list, and citation formatting may deviate significantly from the required style. | entirely omitted from the bibliography/reference list, and citation formatting is entirely inconsistent with the required style. |
Appendix I
Rubric for Mind Maps
### Rubric for Mind Maps

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depth of coverage</strong></td>
<td>- Bare minimum of content covered.</td>
<td>- Show a basic level of coverage of key ideas only.</td>
<td>- Shows a solid grasp of most of the content.</td>
<td>- Shows a solid grasp of all the content covered.</td>
</tr>
<tr>
<td></td>
<td>- No extension of ideas evident.</td>
<td>- Attempts extension of a few ideas.</td>
<td>- Shows extensions of most key ideas.</td>
<td>- Extensions of the key ideas show a deep understanding of the content.</td>
</tr>
<tr>
<td><strong>Central Image</strong></td>
<td>Present but difficult to separate from other information.</td>
<td>Present but not clearly related to key idea.</td>
<td>Clear use of picture or image that relates to key idea.</td>
<td>Stands out meaningfully and grasp the key idea through metaphor or humor.</td>
</tr>
<tr>
<td><strong>Ideas have key images</strong></td>
<td>A little evidence of key images. Has only a few keywords.</td>
<td>Images and keywords are evident, but either too few or some are imprecise.</td>
<td>Images and key words clearly show an understanding of the content.</td>
<td>Images and key words clearly and dynamically show an understanding of the content. (One or more of: use of metaphor, humor, cut-outs from magazines, clipart, illustration.)</td>
</tr>
<tr>
<td><strong>Color or codes or links used to illustrate connections between ideas</strong></td>
<td>A little use of color, codes, or links to illustrate connections between ideas.</td>
<td>Obvious attempt is made to use color, codes, or links to enhance clarity and memory. Still some inconsistency of application.</td>
<td>Clearly uses color, codes, or link to clarify connections and to assist with memory for most aspects of Mind Map.</td>
<td>Effectively uses color, codes, or links to meaningfully clarify connections for all aspects of Mind Map.</td>
</tr>
<tr>
<td><strong>Ideas radiate out from central image and from most to least complex</strong></td>
<td>- Some ideas are connected to and radiate out from the central.</td>
<td>- All ideas radiate out from the central.</td>
<td>- Ideas clearly connect to central image and ideas.</td>
<td>- Ideas clearly connect to central image and ideas.</td>
</tr>
<tr>
<td></td>
<td>- Some confusion in moving from most to least complex.</td>
<td>- Still some confusion in moving from most to least complex.</td>
<td>- Generally moves from most to least complex.</td>
<td>- Consistently and accurately shift from most to least complex.</td>
</tr>
</tbody>
</table>
Appendix J
Modified Coursework Inventories
A Modified Mind-Mapping Coursework Inventory

Instructions

Please rate the items in this section using the scale below. There are no right or wrong answers, so please answer the questions honestly. Your answers are private and confidential. All questions refer to your Read-Think-Write 2 course with the application of online mind mapping, including assignments, activities, reading, etc.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Somewhat disagree</td>
<td>Somewhat agree</td>
<td>Agree</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>

_____ 1. The coursework with online mind mapping held my attention.

_____ 2. I did not find the coursework with online mind mapping beneficial for me.

_____ 3. The coursework with online mind mapping was not interesting to me.

_____ 4. The instructional methods with online mind mapping engaged me in the course.

_____ 5. I felt confident that I could succeed in brainstorming and organizing ideas in the coursework.

_____ 6. I felt that I could not be successful in meeting the academic challenges with online mind mapping in this course.

_____ 7. I had no interest in completing the class assignments with online mind mapping.

_____ 8. I felt that I could get a high grade in this course with the application of online mind mapping.

_____ 9. Throughout the course, I felt that I could be successful on the coursework with online mind mapping.

_____ 10. I found the coursework with online mind mapping to be relevant to my academic goals.

_____ 11. I will not be able to use the knowledge I learned from this course, namely brainstorming and organizing with online mind mapping, in future courses.

_____ 12. The knowledge I gained in this course is not important for my future.

_____ 13. I am willing to use mind mapping in my future studies.
If you are interested in participating in a 30-minute Zoom interview about your experience with the study, please provide your name and email address below. Volunteers will receive a $20 gift card for their time.

Name: ____________________________________________________________

Email: ____________________________________________________________
A Modified Coursework Inventory

Instructions
Please rate the items in this section using the scale below. There are no right or wrong answers, so please answer the questions honestly. Your answers are private and confidential. All questions refer to your Read-Think-Write 2 course, including assignments, activities, reading, etc.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Somewhat Disagree</td>
<td>Somewhat agree</td>
<td>Agree</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>

_____ 1. The coursework held my attention.
_____ 2. I did not find the coursework beneficial for me.
_____ 3. The coursework was not interesting to me.
_____ 4. The instructional methods engaged me in the course.
_____ 5. I felt confident that I could succeed in brainstorming and organizing ideas in the coursework.
_____ 6. I felt that I could not be successful in meeting the academic challenges in this course.
_____ 7. I had no interest in completing the class assignments.
_____ 8. I felt that I could get a high grade in this course.
_____ 9. Throughout the course, I felt that I could be successful on the coursework.
_____ 10. I found the coursework to be relevant to my academic goals.
_____ 11. I will not be able to use the knowledge I learned from this course in future courses.
_____ 12. The knowledge I gained in this course is not important for my future.

Any comments (optional): __________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Appendix K
Online Interview Questions
Participants’ Perceptions of Using Online Mind Mapping in the Prewriting Stage
Online Interview Questions
Participants’ Perceptions of Using Online Mind Mapping in the Prewriting Stage

Instructions

In this interview, there is no right or wrong answer, so please answer the following questions honestly. Your answers will be kept confidential.

Opening question

How is your day?

Content questions

1. Do you think online mind mapping was useful in your prewriting? In what ways?

2. Did you experience any difficulties when using online mind mapping in your prewriting? If yes, please include specific examples.

3. Would you use online mind mapping in your future courses? If yes, how do you think you will use it?

Closing instruction

Thank you for having a Zoom meeting with me today. Our conversation information will be confidential. If you have any questions or concerns, please feel free to reach out to me via my email address: yduong@dons.usfca.edu.
Appendix L
Training Presentation Slides
Prewriting

- Prewriting is the first phase of writing which is recognized as a source of composing. All the activities that intervene between the first decision to write and the beginning of a maintained first draft are related to the prewriting phase so named as pre drafting (cited in Hashempour et al., 2015, Huff & Kline, 1967, p.87)

- Prewriting is defined to be a very significant step in improving the writing performance, and it is emphasized the more time for the prewriting stage is devoted, the better the quality of the writing performance gets. Lilly (2003) calls prewriting the idea generation stage and highlights the importance of prewriting activities as they aid students to discuss a topic, develop ideas, and arrange the content and the outline to develop the quality of their writing.
Collaborative Prewriting

- Collaborative prewriting refers to the situation where student members generate their group ideas and arrange these ideas in a systematic organization through discussions.

- In an investigation of potential benefits of collaborative prewriting, Higgins, et al. (1992) found that group discussions enhance the quality of the students' future writing plans.

Mind Mapping

- A mind map is also known as a “spider diagram” and it is a visual thinking tool. It is used to structure information and generate ideas. (Sourced from Mindomo’s website)
Features of Mind Mapping

Getting started with Modomo mind mapping
An example of Mindomo mind map

Questions/Concerns
Appendix M
Mind-mapping Training Website
Welcome!
My name is Yen, and I'm pursuing a doctoral degree in Learning and Instruction at the University of San Francisco, California. This site is to introduce my research project of online mind mapping.

For more information, please contact me via email address (yduong@dons.usfca.edu)
Mind mapping

The purpose of the study

This study is to examine the effects of online mind mapping on the cognitive outcomes of students in Research Method classes at a private university in Southern Vietnam. This study will focus on how online mind mapping can help the student participants collaboratively work with their teammates to elaborate and organize their ideas in their research writing process.

Study time

The training session will take about 60 minutes to complete, and an interview will last for a maximum of 30 minutes per participant.
Appendix N

Timeline for the Treatment Group
### Timeline for the Treatment Group

<table>
<thead>
<tr>
<th>Week</th>
<th>Teacher</th>
<th>Students</th>
<th>Mind-mapping Research plan</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week 1</strong></td>
<td></td>
<td><strong>Project 1 – Informative Essay:</strong> Content, requirements, rubrics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Project 1 – Informative Essay:</strong> Group forming – pair work Task delegation Search topics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Week 2** |  | **Project 1 – Informative Essay:** Checking and approval of topics/specific aspects/claims that students select to write about |  | - The MM training content will be sent to the teacher in Week 2.  
- The teacher and researcher will work on the training content together in Weeks 2 & 3 if anything needs to be adjusted to meet the class expectations. |
|  |  | **Project 1** Topic submission Specific aspect submission Specific claim submission |  |  |
| **Week 3** | Receiving **Project 1** Peers’ Project 1 delegation |  | **Project 1** Topic submission Specific claim submission | The consent form file and the presurvey link will be sent to the teacher by email in Week 3. |
| **Week 4** | Feedback on **Project 1** |  | **Project 1** submission Peer-reviewing Project 1 – Pair work – At home | Links of the questionnaire and the posttest will be sent to the instructor before the training. (The researcher meets the students via Zoom) |
| **Week 5** | **Project 2 – Argumentative Essay:** content, requirements, rubrics | **Project 2 – Argumentative Essay:** Forming specific idea from **Project 1** – Pair work |  | - Students read and sign a consent form.  
- Students take an online presurvey about brainstorming & organizing ideas.  
- For students from the treatment group:  
  • They will complete a questionnai |
re to test their understanding of mind mapping right before the training.
- They will attend a mind-mapping training session within 1 hour.
- They will take a posttest to examine their understanding of MM and its application right after the training.

- Students in the treatment group start using MM to complete their pair work.

<table>
<thead>
<tr>
<th>Week 6</th>
<th>Project 2A – Checking and approval of claims that students select to write about</th>
<th>Project 2A – Specific claim submission – At home</th>
<th>- Students in the treatment group will use MM to complete their assigned pair work.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 7</td>
<td>Receiving <strong>Project 2A</strong> – Peers’ Project 2A delegation</td>
<td><strong>Project 2A</strong> submission Peer-reviewing <strong>Project 2A</strong>: Presentation – Pair work</td>
<td>- Students in the treatment group will use MM to complete their assigned pair work.</td>
</tr>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
<td>- Students from both groups will take the</td>
</tr>
<tr>
<td>Week 9</td>
<td><strong>Project 2B – Argumentative Essay Test</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Project 2B:</strong> Argumentative Essay Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Doing an Argumentative Essay Test – in</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>class – Individual work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feedback on argumentative essay test</th>
<th>Self-reflection on argumentative essay test – in class- individual work</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructor will share the students’ grades from Projects 1, test grades, survey results, and final writing exam grades from the ERW411 with the researcher</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 10</th>
<th>Feedback on Project 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feedback on peers’ Project 2A: Presentation – Pair work</td>
</tr>
</tbody>
</table>
Appendix O

An Example of a Mind Map Developed by ERW421 Students
An Example of a Mind Map Developed by ERW421 Students