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Collaborative Online Education: A Case Study of an Ed.D. Program

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ABSTRACT

This dissertation discusses collaborative teaching and learning models of online courses. Four research questions guide the study: How do instructors design online courses to facilitate instruction using collaborative teaching and learning models? When instructors co-teach online, how do they utilize collaborative teaching and learning models? How do students build online learning communities from collaborative teaching and learning models? and How do instructors and students evaluate online collaborative teaching and learning models? We conducted a case study of an Ed.D. cohort of Chinese students in the College of Education of the University of Missouri-St. Louis (UMSL). We employed a qualitative approach to this study, using a sample of seven students and four instructors who participated in online courses that used collaborative approaches to learning and teaching. We collected data from three primary sources: interviews, questionnaires, and relevant documents. The data analysis and discussion focus on the perspectives of instructors and students on collaborative learning and teaching in online contexts and offer insights into improving the design and implementation of collaborative online education. Our findings revealed that collaborative approaches in online settings are relatively complex and can effectively support instructors and students in achieving teaching and learning goals. The findings provide support for the following arguments, that professional development for instructors, effective communication, varied strategies to increase classroom interaction, and clear roles and expectations are all factors that influence successful approaches to online teaching and learning. Finally, this study may be a valuable resource for instructors who intend to implement successful collaborative education in an online setting.

Keywords: Co-teaching, Collaborative Learning, Online Curriculum

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TABLE OF CONTENTS

ABSTRACT.....	II
ACKNOWLEDGMENTS.....	III
TABLE OF CONTENTS.....	VIII
LIST OF TABLES.....	XI
LIST OF FIGURE.....	XII
CHAPTER 1: INTRODUCTION.....	1
The Motivation for Developing This Study.....	1
Problem Statement.....	3
Co-Teaching.....	5
Collaborative Learning.....	6
The Definition of Online Courses Mentioned in This Research.....	8
The Differences between Collaborative Learning and Cooperative Learning.....	9
The Context of This Study: UMSL’s Ed.D. Program.....	11
Research Questions.....	13
CHAPTER 2: LITERATURE REVIEW.....	14
Literature Collection.....	14
Curriculum Design.....	14
Co-Teaching.....	17
Collaborative Learning.....	23
Online Learning Assessment.....	26
Concept Model.....	32
Constructivism Learning Theory.....	32
Co-Teaching Model.....	33
Online Collaborative Learning Theory.....	34
Theoretical Framework.....	36
Course Design in Higher Education and at UMSL.....	36
Flipped Classroom Theory.....	38

University of Missouri Intercampus Faculty Council: Evaluating
Classroom-Based, Online, Blended and Laboratory Teaching Interactions42

CHAPTER 3: METHODOLOGY.....	45
Aim of the Study.....	45
Nature of Research.....	45
Sample.....	47
Data Collection	49
Data Collection Procedures	49
Data Collection Tools.....	50
Data Analysis.....	55
Ethical Considerations.....	57
Minimal Risk.....	57
Privacy Policy.....	58
Validity.....	58
Potential Research Bias.....	59
Researchers' Roles.....	60
Chapter Summary.....	62
CHAPTER 4: DATA ANALYSIS.....	63
Introduction.....	63
Summary of the Data Analysis Process.....	64
Findings Concerning Online Curriculum Design.....	65
Knowledge Sources of Online Curriculum Design.....	66
Objectives and Benefits of Online Curriculum Design.....	68
Findings Concerning Co-Teaching.....	72
Classroom Interaction Strategies.....	73
Role and Collaborative Relationship in Online Co-Teaching.....	81
Findings Concerning Online Collaborative Learning.....	86
Influences, Contradictions, and Obstacles to Collaborative Learning.....	87
Goals and Objectives of Online Collaborative Learning.....	90
Findings Concerning Online Assessment.....	91
Instructors' Attitude towards Online Co-Teaching and Collaborative	

Learning.....	92
Students' Perspective Concerning Online Collaborative Learning and Co-Teaching.....	100
Chapter Summary.....	106
CHAPTER 5: DISCUSSION.....	107
Introduction.....	107
Findings.....	108
Further Considerations.....	116
Limitations of Study.....	119
Implications for Theory, Research and Practice.....	122
Recommendations for Further Research.....	123
Conclusion.....	126
REFERENCES.....	127
APPENDIX A: Instructors Semi-Structured Interview.....	144
APPENDIX B: Student Questionnaire.....	148
APPENDIX C: EMAIL INVITING INSTRUCTORS.....	153
APPENDIX D: EMAIL INVITING STUDENTS.....	155
APPENDIX E: Informed Consent for Participation in Research Activities.....	157

LIST OF TABLES

TABLE 1 Characteristics of Collaborative Learning.....25
TABLE 2 Participants for the Qualitative Interviews.....48
TABLE 3 Participants for the Qualitative Questionnaires.....48

LIST OF FIGURE

FIGURE 1 Online Collaborative Learning Process.....	35
FIGURE 2 Collaborative Teaching and Learning.....	65
FIGURE 3 Findings Concerning Online Curriculum Design.....	66
FIGURE 4 Findings Concerning Co-Teaching.....	73
FIGURE 5 Findings Concerning Online Collaborative Learning.....	87
FIGURE 6 Findings Concerning Online Assessment.....	92

CHAPTER 1: INTRODUCTION

In 2020, due to the COVID-19 pandemic, online learning and teaching became an essential solution in the field of education, when face-to-face classes were not possible. Campuses worldwide faced sudden closures, and administrators, teachers, and students had to engage in remote learning. The need to transfer face-to-face courses to virtual classrooms revealed the benefits and challenges of online education. As researchers, we thus seek to understand collaborative approaches to online education. We believe that the comprehension of the processes involved in learning and teaching collaboratively may be an essential way of planning future online education. As international doctoral students from Mainland China, we chose to base our research on a case study of our online doctoral program at the University of Missouri-St. Louis (UMSL), a Midwestern university in the United States. Our research focuses specifically on collaborative learning and teaching according to the perspectives of teachers and learners.

In this introductory chapter of our dissertation, we explain the significance of our research based on theoretical and practical reasons that motivated our research questions. First, we describe how we conceptualize collaborative teaching (co-teaching) and collaborative learning. Next, challenges of online teaching and learning are discussed, followed by reasons why we chose this research topic. Finally, we present the research questions.

The Motivation for Developing This Study

As students in an Ed.D. program, we began the program after a year of coursework at Shenyang Normal University in China. We transferred to the U.S. in August 2019 to complete the final two and a half years of the program at UMSL. After our initial class experiences, we were deeply impressed with the collaborative

teaching and learning methods used in the U.S. classroom. In China, in contrast, almost all classes are teacher centered. This completely new way of teaching in a new culture had a profound impact on us. We were impressed by our online course held weekly in which we interacted with U.S. students and other international students. From a perspective of Chinese culture, we shared our views on topics related to social justice and consequently gained insight into the perspectives of other cultures and issues affecting the U.S. educational system, which we were not aware of. The exchange was a rewarding learning experience.

Then, in mid-March 2020, all the courses at UMSL were changed to online formats due to the spread of COVID-19. The new demands for instructors and learners, both at global and local levels, reinforced our interest in understanding online education. Our group sought to study the collaborative online teaching and learning courses comprising the Ed.D. program at our university. Collaborative approaches to teaching and learning in online courses were determined to be an important topic, since co-teaching and collaborative learning in the U.S. and Chinese education offered us a new and exciting learning experience.

Based on our personal and professional needs and interests in collaborative online education, a case study was ideal for this research. Case study research, according to Farquhar (2012), is an appropriate method used to investigate events that occur in a contemporary, real-life context. It examines single or multiple units of study, using research methods for data collection, such as interviews or surveys.

Case studies consider the specificity of one case, and along with other case studies, can support the comprehensive understanding of a research problem (Creswell, 2012). Understanding successful collaborative teaching and learning approaches used at UMSL is relevant for our future work in Chinese higher education

institutions. Indeed, insights into the experience of a U.S. university is an important starting point for innovative practices in the development and design of online courses in China.

In conclusion, our prior experience as students in China and our current experience as students in the U.S. have allowed us to reflect on how the challenges of a pandemic have highlighted the importance of online education, and how the academic cultures in both countries can be complementary. Fall 2020 led our attention to how important it is to prepare learners and educators to engage in innovative and effective ways to approach online teaching and learning. We believe that the key to a successful experience is in collaboration among teachers and students, as is discussed in the next section.

Problem Statement

The main purpose of this study is to understand collaboration in online education. We aim to understand co-teaching and collaborative learning from the perspectives of instructors and students. In addition, course artifacts support our understanding of those perspectives.

Collaboration is the process of two or more people or organizations working together to complete a task or achieve a goal. The collaboration in the class discussed in this research includes co-teaching and collaborative learning.

Co-teaching is a widely used teaching model. Two or more teachers work with each other to collaborate, coordinate, and create course materials. They design curriculum plans and the syllabus, participate in the teaching process, carry out teaching evaluations, and finally achieve teaching objectives together.

Nevertheless, the integration of online teaching and co-teaching creates additional challenges for teachers. Collaboration is often challenging both in face-to-

face and online interaction (Zhao et al., 2020). Furthermore, online experiences require specific forms of collaboration for teachers. If teachers lack effective ways to manage their collaborative efforts, co-teaching cannot achieve the intended results. At the same time, educators have different perspectives on the online teaching model. Instructors may be unprepared to carry out the requirements of online education (Johnson, 2017). Online teaching may also face the problem of a lack of variety and quantity of course offerings (Burns & Mintzberg, 2019).

Compared with traditional in-person classroom formats, teaching remotely proves more difficult for teachers to quickly gauge effective feedback of students in the teaching process and adjust instruction as needed in a timely manner (Scribner-MacLean, 2011). Online co-teaching often fails to effectively help students maintain their focus on learning (Zhang, 2016). Students in a remote course also may be distracted. Therefore, the achievement of teaching objectives and teaching tasks, the interaction between teachers and students in online teaching, and the collaboration among teachers are worthy of attention and in-depth research.

In this dissertation, we understand collaborative learning as all relevant behaviors in which learners participate in groups to achieve a common learning object and maximize individual and group acquisition results under a specific incentive mechanism. Collaborative learning includes peer-assisted learning and joint inquiry learning.

In higher education in the U.S., many courses require students to collaborate on assignments and engage in group learning projects. There are often more group projects and other group learning scenarios than in primary and secondary schools. College students, whose schedules vary and who have less class with classmates than in a K-12 setting, may need direction if they are not used to collaborative work. If

students lack collaboration skills, or if teachers do not possess strong organizational course management skills to guide group projects, some classmates are likely to forgo their individual responsibilities or contributions and allow others to do the work for them. This situation prevents students from learning how to collaborate effectively in a group setting.

When classes meet remotely via the Internet, teachers and students are physically separated, and collaborative learning becomes even more challenging. Under the COVID-19 pandemic situation, when removed from the traditional classroom learning atmosphere, students were closer to the state of "individual learning" when they completed online learning at home (Tellakat, Boyd & Pennebaker, 2019). It is difficult for most students to complete self-planning, self-monitoring, self-evaluation, and self-summation, because most students have not developed independent, focused, and continuous self-learning habits in their past studies (Cloonan, 2019). However, because collaborative learning is more competitive than individual learning, collaborative learning can improve the learning effect of students.

Co-Teaching

Co-teaching is a widely used teaching model. According to Burns and Mintzberg (2019), co-teaching generally is comprised of a teaching team, a collaborative mechanism, joint design, and specific educational objectives, so some researchers call co-teaching joint teaching, team teaching, and duet teaching (Burns & Mintzberg, 2019). The teaching team is usually composed of two or more teachers who have the same or different professional backgrounds, fields, and subjects, and they teach in the same physical space, whether offline or online. Teachers of different fields discuss course content and design it together; they study various teaching plans according to their respective expertise. Centering on the teaching objectives, the team of instructors

coordinates and compliments one other to design the curriculum plan, write the syllabus, participate in the teaching process, and conduct teaching evaluations (Krometis et al., 2011). Co-teaching requires a set of implementation procedures, in which each participating teacher can monitor and observe students' performance and learning feedback at any time (Bouck, 2007). In this way, teachers who participate in co-teaching can identify problems, find solutions, implement them to ensure students' learning outcomes, and continue to develop the curriculum.

Teachers have used co-teaching approaches in K-12 and higher education for decades (Morelock et al., 2017). In K-12 education, to better integrate special education students into the general educational environment, teachers have widely adopted collaborative teaching models (Friend et al., 2010). Cook and Friend (1995) believe that students with individualized educational program needs can better transfer to the general education classroom through co-teaching.

Much of the research on co-teaching has focused on the K-12 setting, but it is not only limited to K-12 and special education. Compared to K-12 education, motivation and goals for co-teaching in higher education are different. There is often more attention to applying specific teaching methods, such as interdisciplinary teaching (Morelock et al., 2017). Even doctoral studies may utilize co-teaching, and this is what makes our research different from previous studies. As researchers, through our own online learning experience, we are familiar with the form of co-teaching used in our doctoral study in the U.S. Our research focuses on the collaboration mechanism, implementation process, and the effects of collaboration of the two-teacher model in higher education.

Collaborative Learning

Collaborative learning is a strategy for organizing students' learning in groups or

teams to achieve expected learning goals (Dillenbourg, 1999). Through group discussions and debates, students acquire knowledge. Thus, collaboration within teamwork is a part of the classroom learning goals. Working collaboratively in various activities, students interact with other group members, other groups, or with the whole class. They can share, explore, and discover new knowledge (Zhao & Li, 2000).

To achieve the goal of group learning among students, there is a variety of activities that students can fully engage in, such as through dialogue in pairs, multi-person discussions, group debates, and other ways to obtain the best way to achieve the learning goals. Zhao and Li (2000) found that collaborative activities in student learning support the development of thinking, enhance communication among students, and accommodate for differences among classmates. Moreover, according to Zhao and Li (2000), collaborative learning plays a positive role in improving students' academic performance and scaffolding critical and innovative thinking. Laal and Ghodsi (2012) emphasize important and positive impacts of collaboration for learning new content, improving communication skills, and managing the relationship between self-esteem and mutual respect between individuals.

Collaboration is a practical approach both in offline and online learning modes, and both modes may rely on collaborative learning as a learning model, adopting a collaborative approach to promote understanding (Zhao & Li, 2000). The implementation of collaborative approaches to learning and teaching usually consists of four essential elements, namely, collaborative groups, members, instructors, and collaborative learning environments (Zhao & Li, 2000).

Collaborative groups are an essential part of the collaborative learning model. The ways groups organize their work directly affects the effectiveness of

collaborative learning. Group members refer to learners assigned to collaborative groups according to specific strategies. Bruffee (1999) ponders that the ideal number of people in the collaborative group is two to four people under normal circumstances. Various factors determine the allocation of members to a group, such as learners' academic performance, knowledge structure, cognitive ability, and cognitive style (Zhao & Li, 2000). For example, successful students can work with students who need more scaffolding; students with different learning styles share their cognitive styles with other students. Zhao and Li (2000, p. 11) discuss how choosing group members with different strengths and limitations can promote the mutual reinforcement of students' cognitive styles.

Instructors have a significant role in collaborative learning approaches. Instructors can effectively manage group organization, establish norms and rules for collaboration, support students' learning, and assess the effects of collaborative learning. Collaborative learning places higher demands on instructors. Based upon the work of Barkley, Cross and Major (2014), instructors need to develop a teaching philosophy and concepts that emphasize learning within collaboration. Combined, the concepts of learning and collaboration lead students toward successful learning experiences. Moreover, a collaborative learning environment encompasses the organizational environment, spatial context, technology support, institutional setting, and other factors of where the collaboration occurs.

The Definition of Online Courses Mentioned in This Research

In this research, online courses refer to the sum of the teaching content and the implementation of teaching activities expressed through the Internet. They are the new forms of expression according to the system in this information age (Gao & Pei, 2013). Therefore, online courses include teaching content and a teaching support

environment organized according to specific teaching objectives and teaching strategies. Furthermore, the online teaching support environment refers explicitly to software tools, teaching resources, and teaching activities implemented in the online platform to support network teaching (Vai & Sosulski, 2015).

Defined in terms of learning tools, online courses are Web-based courses that are offered through software tools on the Internet. Defined in terms of guiding ideology and theoretical basis, online courses are classes that embody modern educational ideas and current teaching and learning theories. Defined from the characteristics of the constructivist learning environment, the online courses are based on collaborative learning. Finally, defined from the learning process features, the online course mentioned in our study is a system in which the learning process has the main characteristics of interactivity, sharing, openness, collaboration, and autonomy (Keegan, 2005).

The Differences between Collaborative Learning and Cooperative Learning

The study of collaborative learning and teaching demands understanding the conceptual and practical differences between cooperation and collaboration. For example, group composition, group goals, problem-solving, and evaluation are seen from different perspectives depending on collaboration or cooperation. Jacobs (2015) discusses some differences between both approaches, although he recognizes that the terms can often be used interchangeably to convey the same meaning.

Concerning group composition, collaborative learning groups members are typically students with similar levels in the same class. The members of cooperative learning, however, are students of different fields and levels. Depending on the goals for group work, collaborative learning group members make personal efforts to work on a problem while collectively working towards achieving the same purpose.

Students are accountable for each other and, with appropriate guidance, will learn together. Students learn to understand better and anticipate differences, recognize each other's values, and use them to their advantage (Dillenbourg, 1999). In cooperative learning, the different expertise of group members leads to interdependence, as the roles and responsibilities of each member are clearly defined but are open for negotiation, in a process that requires a strong sense of accountability (Johnson & Johnson, 2011, p. 14).

Tasks and problem-solving processes are different in collaboration and cooperation. In a typical collaborative learning process, students decide each other's schemes and continuously support each other in the process. Instructors monitor the group and provide support when required, and students assess their individual and group performance. Success depends on different strengths (Bruffee, 1995).

In contrast to collaborative learning, a cooperative learning structure takes the following form: activities are structured with each student assigned a specific role; teachers observe, listen and intervene where necessary; students submit work at the end of the lesson for evaluation/ assessment; the success of the group depends upon the efforts of everyone involved (Slavin, 2011).

The role of assessment in collaborative learning is to encourage students to participate in teamwork and help them better understand and embrace the collaborative, not competitive nature of a collaborative learning process (Dillenbourg, 1999). The assessment aims at strengthening student commitment to learning. It should be brief, clear, and timely to help students improve their skills and knowledge (Vaughan & Garrison, 2013).

Cooperative learning evaluation includes two levels: cooperative team and individual members. In cooperative learning, the basic unit of teaching and learning is

the cooperative group. However, the changes that occur on a single learner cannot fully characterize the output of the entire collaborative learning system. Therefore, it is also necessary to comprehensively measure the changes in the cooperative group and individuals. Thus, cooperative learning evaluation is a diversified evaluation, which is reflected explicitly in the evaluation method.

The Context of This Study: UMSL's Ed.D. Program

This research was conducted at the University of Missouri-St. Louis (UMSL), a member of a university system in the state of Missouri that comprises four campuses. A public research university, UMSL is a land-grant, research institution that summarizes its mission in its slogan "We transform lives", and it is one of the most culturally and ethnically diverse institutions in Missouri (College of Education [COE], n.d.). UMSL offers bachelor's, master's, and doctoral programs through the College of Arts and Sciences, the College of Business Administration, the College of Education, the College of Nursing, the School of Social Work, and the College of Optometry. (University of Missouri-St. Louis [UMSL], n.d.)

The College of Education (COE), which houses the Ed.D. cohort of this research study, offers various programs, and states its mission as promoting original student-centered programs, creative solutions for different settings, and nurturing the education of leaders, practitioners, and researchers. The COE offers a wide range of doctoral degrees, and two education specialist degrees (COE, n.d.). The Ed.D. Program offered by the College of Education at UMSL is guided by the Carnegie Project on the Education Doctorate (CPED) consortium. The CPED consortium members prepare educators for the application of appropriate practices, the generation of new knowledge, and for the stewardship of the profession (Carnegie Project on the Education Doctorate [CPED], n.d.).

The CPED provides a framework that consists of the principles and concepts that guide the design of Ed.D. programs. The Design-Concepts upon which Ed.D. programs are built (CPED, n.d.) include scholarly practitioner, signature pedagogy, inquiry as practice, laboratories of practice, dissertation in practice, problem of practice, and mentoring and advising.

UMSL's Ed.D. program is a doctor's degree program for practitioners in the field of education. Participants enter the field of study as a learning community. In the school's curriculum design, the entire program cycle is expected to be three to three and a half years in length (COE, n.d.). The purpose of the Ed.D. program is to prepare students to use practical wisdom, professional skills, and knowledge of educational literature to solve problems in their field of education (COE, n.d.). Through the practice research model, students collect, organize, judge, summarize and analyze situations, literature, and data, and use the data to guide decisions and lay the foundation for future work related to education.

Students are admitted to a degree program and enter a practical learning community formed around a theme (COE, n.d.). Under the guidance of a teaching team, they focus on a field or theme of educational practice. As a result, students can gain valuable results and make a positive impact through their studies. In addition, students gradually acquire higher collaboration and communication skills through cooperation and partnership with different communities and develop a professional knowledge base that integrates practical knowledge and scientific knowledge.

In addition to the practical learning communities, the coursework will also include experimental application and relevant research papers as final activities. The Ed.D. program at UMSL brings doctoral research from the university campus to an environment where theory, inquiry, and practice can intersect, and the implementation

of practice can be measured. The program aims to connect theory with systematic research; improve students' ability to generate, transform and use professional knowledge and practice; understand the value and function of establishing a practice community; and provide fair, moral, and social justice solutions to complex problems in practice (COE, n.d.).

The Ed.D. program collaborates with UMSL in the U.S. and SNU in China, closely following the pulse of Sino-U.S. education reform and development. Both universities implement a system of reciprocal teaching and guidance by teachers to maximize the quality of classroom teaching. The program adopts professional learning through collaborative learning and group inquiry; actively cultivates the professional quality of collaborative inquiry and student development: increases student potential in their career and improves their practical professional ability. Students work on projects through teamwork and collaboration.

Research Questions

Our research addresses the following questions:

1. How do instructors design online courses with the aim of facilitating instruction using the collaborative teaching and learning model?
2. When instructors are co-teaching online, how do they use the collaborative teaching and learning model?
3. How do students build online learning communities when learning experiences emanate from the collaborative teaching and learning model?
4. How do instructors and students evaluate the online collaborative teaching and learning model?

CHAPTER 2: LITERATURE REVIEW

This research focuses on collaborative teaching and learning in online contexts, mostly focusing on a) course design, b) teaching, c) learning, and d) assessment. In order to discuss curriculum design, teaching, learning, and assessment in online contexts, we start this chapter by presenting how different authors explore these components of online teaching and learning. We address key concepts and issues concerning online education, such as the concepts of cooperation and collaboration in relation to learning and teaching; learning theories that support online education assessment strategies, and present some approaches to online teaching and learning, such as flipped learning. Finally, we discuss the specific case of online learning within our research context, UMSL.

Literature Collection

Curriculum Design

The design of online co-teaching activities is the planning made by teachers for online teaching before class, which includes the planning of online teaching and learning for the whole course, the planning of the whole unit teaching process in each class, and the planning of how to lead students to engage in the learning process. To improve the average level of teachers, the teacher candidates establish a sense of agency and in the participating community from a passive receiver to an active thinker, and then improve their practice. From the perspective of social culture, we have found that co-teaching is consistent with situational learning theory and the concept of knowledge construction (Crow & Smith, 2005). For example, the advantages of the UMSL system can be concluded into developing high-quality curriculum resources with independent intellectual property rights and applying an efficient teaching system to enhance the online learning experience. Establishing a

suitable market development mechanism and continuously strengthening strategic collaboration with schools are the two most essential links in the entire process of online co-teaching design.

To achieve the purpose of the co-teaching of the course, online teachers should follow the procedures of the whole class, formulate a complete design according to students' learning progress, and list the leading contents of co-teaching in detail. Every course is distributed among the co-teaching units cut out of each week's class. To achieve its unit co-teaching objectives, the co-teaching procedure of each section must also have its flow designing of various activities. Salon and Giles (1997) propose the theory of five online co-teaching stages for all the co-teaching processes. For individual co-teaching, we suggest adopting a three-stage approach of unit co-teaching. The conversion and selection of each co-teaching activity in the team can refer to Salon's co-teaching event theory and the stepwise interpretation theory of Giles.

Five Stages of Online Course Co-Teaching Design. Swan, Shen, and Hiltz (2006) divided the online collaborative teaching process for an entire course into five stages: the beginning phase, online networking, information exchange, the pursuit of knowledge, and leadership. First, in promoting and recommending beginners in the beginning phase, online teachers ensure that students feel welcome and motivated enough to know where to turn if they need help using the system. Second, during the phase of online networking, students should feel comfortable in the online co-teaching environment and communicate with other members. Third, the information exchange process is the formal beginning of the interactive flow of information in online co-teaching. Fourth, teachers should play the role of the leader and supporter of the pursuit of knowledge so that each student can find, process, and provide information.

In this phase, teachers and students work together to create new meanings of information. In contrast, teachers gradually reduce their role of leadership and instead provide assistance as needed and maintain the smooth progress of online co-teaching activities. Finally, teachers should further withdraw from the leadership role and encourage students to become independent and self-taught.

Three-stage Theory of Unit Co-Teaching Design. Online co-teaching of content knowledge can also be designed according to the three-stage theory. They are exercise, development, and interpretation, which is consistent with the general collaborative design planning theory that divides the co-teaching process of a class into preparation activities, development activities, and comprehensive activities in that order. When designing any lesson of online co-teaching, teachers should first create several minutes of exercises (Von Schmieden, 2019). These activities should indicate the goals of the instructors and guide the students into the planned activities of the course. Once the students are focused on the lesson, the teacher can move on to the second process and have new procedures according to their style of online co-teaching (Luo, 2019).

This development will take up most of the time of the online co-teaching activities. It may require extensive time and effort to develop activities that help students learn the material. Then, there must be a comprehensive activity before the end of the class to consolidate the activities and ensure the learning objectives have been met (Gao, 2013). Teachers or classmates will review the learning achievements of various activities in this class, or a quick and short assessment may be conducted. The teacher can also explain the topic of the next class and the homework that students should do after class in this stage. Activities should be included in the process of a unit of co-teaching "or in what order these activities are carried out".

Here, we refer to the "nine major teaching events theory" proposed by Bishouty (2019, p. 165) and the "step-by-step interpretive theory" concluded by Luo, (2019, p. 202), which is a theory of stretching back and forth from the initial, essential learning goals to the actual course content. The teaching event theory of Bishouty (2019) explains that teachers should provide timely teaching activities, according to the progress of students' learning status. This theory can be used in the design of independent learning materials and in that of instructional activities. Online teachers create teaching activities, expand the outline structure and subject details of the whole teaching materials, and assist students in establishing a comprehensive learning experience.

Co-Teaching

Since 1906, the United States has conducted extensive research on the development of co-teaching from the federal government to the state government, from various school districts to specific school units (Liao, 2008). In 1906, the University of Cincinnati (Ohio) began to implement collaborative education. At that time, the school collaborated with enterprises to implement an alternative engineering training method for engineering students. The American Cooperative Education Committee believes that collaborative education is a structural education strategy that combines classroom learning with learning through productive work experience in related fields (Xu, 2003). The collaboration between schools and enterprises has become the leading model for co-teaching in the United States.

With a focus on co-teaching in U.S. colleges and universities, Liao (2008) analyzes the goals of collaborative education and practical application in terms of instruction, education management, the instructor, the actual plan of implementation of activities, and the successful practice of collaborative education. Liao's research

suggests that the co-teaching model is of great significance and value in cultivating students.

Ways of Co-Teaching. There are many ways of co-teaching. Friend and Cook (1996) proposed six co-teaching models for how two teachers might collaborate in the classroom. They are referred to as “One Teach, One Observe”, “One Teach, One Assist”, “The Parallel would”, “The Station would”, “Alternative Teaching”, and “Team Teaching”. Other educators have studied how two teachers may equally instruct in the same physical space and work together on all aspects of the curriculum, including curriculum design, improvement, and evaluation (Bowen et al., 2005; Lusk et al., 2016). Co-teaching is a breakthrough in educational approach, which brings new challenges to higher education classrooms. In recent years, educators have begun to pay more attention to this field and conduct research on co-teaching in higher education settings.

Chanmugam and Gerlach (2013) put forward seven suggestions for the successful implementation of co-teaching: discussion and resolution of specific issues, assessing one’s comfort, continuous debriefing during the semester, communicating explicitly with students, garnering full support from the institution, building awareness of additional time, and being cautious about imposing co-teaching unnecessarily.

Crow and Smith (2005) believe that co-teaching in higher education provides a powerful tool for reflective dialogue. Morelock et al. (2017) evaluate multiple cases and develop a single comprehensive model of three co-teaching factors: power and authority, dynamics of co-teaching, and co-teachers’ perceptions of power and authority.

Patel and Herick (2010) believe that although the university environment is not always suitable for co-teaching, those who want to be effective educators should seek ways to cooperate and implement co-teaching strategies within their respective departments' existing frameworks.

As co-teaching becomes more widely adopted in higher education, the teaching format is becoming more and more established. Co-teaching is considered a necessary and effective tool to enable teachers to cope with the increasing diversity in the classroom (Rytivaara et al., 2019). Co-teaching has many advantages, as it can integrate teachers' resources and provide teachers with new teaching methods, meaning classroom activities and assignments. Co-teaching also breaks the stable routine of individual teaching in the form of team teaching (Ward & Darling, 1996).

At the same time, in co-teaching, surveys on student satisfaction are critical, as they provide feedback on the effect of the instructors' co-teaching. Although students receive more academic help from having two teachers, not all of them understand why there are two teachers in the same classroom (Hang & Rabren, 2009). In another comprehensive study, students indicated they like co-teaching since they can access more assistance and attention from classes with two instructors (Gerber & Popp, 1999).

Online Teaching. U.S. higher education took the lead in adopting online teaching, and gradually led the development of global online teaching. Looking back over the past 20 years, U.S. online education has made great progress (Allen & Seaman, 2013). From 2002 to 2010, online course enrollment increased from 9.6% to 32% of the total enrollment, and more than half of schools offered online courses (Allen & Seaman, 2013). Liang and Xia (2016) proposed that the United States Online Education Alliance, in conjunction with college boards and other institutions

in the United States, conduct a decade-long large-scale online survey on the overall state of online education development in colleges and universities starting in 2002. The surveys collected data from educational administration offices or vice-presidents in charge of teaching at colleges and universities in the U.S. Data showed that online teaching is quite popular in U.S. colleges and universities and have gradually entered mainstream higher education (Liang & Xia, 2016).

Online graduate degree programs in the United States are also becoming a more common phenomenon (Herman, 2012). Research shows that 80% or more of the nine U.S. conservatories surveyed have implemented online graduate degree programs in the direction of Music Education (Groulx & Hernly, 2010). With the wide application of online teaching in higher education, more and more people have begun to pay close attention to the quality of online teaching. Many institutions have incorporated online education into their strategic plans, which means that the need for high quality online teaching is being recognized (Zhang, 2016).

The development of technology is important to implement effective online teaching, and communication technology and artificial intelligence help improve the quality and consistency of teaching. Nevertheless, educators are the core factor of teaching quality. Teachers need to carefully examine themselves, exert their creativity, and demonstrate their influence and appeal in the online classroom (Kanuka et al., 2007). Teachers need to intentionally learn more about how to maintain full participation and enthusiasm from students while teaching course content in the online classroom. The challenges of instructors to create a safe and non-judgmental teaching environment, maintain a personal yet professional demeanor, and encourage students to express their views have become the subject of further research by online teaching researchers. Creating an attractive online course requires educators to

develop strategies to increase student participation and build community awareness (Sharoff, 2019). There have been many studies exploring multiple aspects of online teaching, such as the effectiveness of teachers on online courses (Cherry & Flora, 2017), the online caring behavior of teachers (Kaufman & Mann, 2014), and the empathy of teaching practice (Leach et al., 2016).

During the period of COVID-19, online teaching once again took a new step. This has been the largest online education experiment in modern history. Even in these unusual times, online teaching makes teaching no longer limited by environment and space (Jiao et al., 2020), and demonstrates the importance and significance of online teaching. Distance education is an emerging trend, as it enables a group of learners to form a social and learning interaction (Gregory & Bannister, 2017). From the perspective of online teaching, the spread of COVID-19 has driven the rapid development of global online teaching. The questions of how to carry out online teaching and which online teaching tools are more professional and personalized have become a popular area of focus for current educators. In short, online teaching provides great convenience for education, reduces transportation costs, shortens the distance between people, and prevents learning from being limited by geography and emergencies. Another example of this development is that international academic conferences also take place in an online format.

Although these online courses provide great convenience, the difficulty of interpersonal communication and the limited choice of courses are still not to be ignored. For example, the development of educational technology provides a platform for online learning of college music courses, but this does not mean that all teaching staff are ready for the instructional reforms required for online teaching (Johnson, 2017). For instance, practice-based music courses are still more suitable for traditional

face-to-face teaching, while only theory-based courses seem to be easier to be implemented online.

Online Co-Teaching. Co-teaching and online teaching have been researched and promoted within the scope of U.S. higher education (Crow & Smith, 2005). Co-teaching has positive significance, and online teaching also enriches teaching methods. Online collaboration is classroom collaborative teaching with IT technology as the medium. When educators participating in collaborative teaching cannot appear in the classroom at the same time due to time and geographical constraints, online courses present the only solution. In terms of group behavior, due to the higher familiarity of team members, it has a more positive impact on team communication (Janssen et al., 2009; Stark & Bierly, 2009). For most courses, online co-teaching can provide the same opportunities for collaboration available in a traditional teaching environment (Chou & Chen, 2008; Graham & Misanchuk, 2004).

With the increasing popularity of online education, the number of students participating in this format is also increasing. In turn, teaching modes and higher education system have changed to transform the virtual space provided by the Internet into a social learning space (Harasim, 2017; McKiernan & Wilson, 2014). Online co-teaching extends traditional and general higher education institutional learning and teaching modes and is considered a promising differentiated choice (Kim & Bonk, 2006; Sursock, 2015). Online co-teaching is at its prime for innovation (Martin, 2014).

The Ed.D. program in the College of Education at UMSL, the case that is the focus of this study, combines in person and online learning. To achieve the teaching objectives of the Ed.D. program, under the guidance of a team of instructors, students are "admitted to a Learning Community" with a focus on an educational practice area or theme, such as "Advanced Scholarship and Practice in Educational Leadership (K-

12)", or "STEM THEMES Education Scholars" (COE, n.d.). Ed.D. programs of practice allow students to achieve higher learning outcomes and have a positive impact on others (Astin, 1984). In addition to traditional offline learning, online courses are offered every semester in the program, some of which are conducted in the form of collaborative online teaching. Meanwhile, by combining collaborative learning and group inquiry, the professional quality of collaborative inquiry and skill development of students can both be cultivated. To better understand online collaborative teaching, we need to further observe and learn from teachers' online collaborative teaching experience, such as the way teachers cooperate, the maintenance of classroom order, and the interaction between teachers and students.

Collaborative Learning

This section discusses three significant aspects of collaborative learning: the definition of collaborative learning, the theoretical framework of collaborative learning that supports the planning and implementation of collaborative learning, and characteristics of collaboration in educational environments (See Table 1). Exploring these aspects of collaborative learning enables us to have a clearer understanding of collaborative learning. Through this lens, we can clearly view what online collaborative learning is in the Ed.D. program in our study, thereby clarifying the purpose of our research.

With the increasing influence of social constructivist theory (Vygotsky, 2012) on educational research and the rapid development of information and communication technology, education has changed from exclusively face-to-face settings to a learning model of online courses or a combination of face-to-face and online courses. "Educational research and practice also changed from teaching as the center to learning as the center" (Liu & Chen, 2013, p. 46). Collaborative learning emphasizes

the focus on learners, pays attention to the characteristics of learners, and maximizes the collective and individual learning results through group cooperation, highlighting its "negotiation," "inquiry," "collective," and other characteristics. Therefore, it has received much attention and respect from researchers and front-line teachers.

Furthermore, the information and communication technology marked by the network has expanded the form of collaborative learning activities and changed the course of its operations, resulting in the research field of "online collaborative learning" (Yu & Huang, 2009, p. 54).

This lens of the theoretical framework of social constructivist theory gives us a deeper understanding of the theoretical construction principles of collaborative learning. In addition, we can gain deeper insight into the reasons behind the phenomenon in collaborative learning research.

The last few years have seen massive changes in how undergraduate and postgraduate courses are delivered. It is now expected that much, or perhaps all, of the course content will eventually be made available online (McInnerney & Roberts, 2009). With the paradigm shift from teaching to learning, online educators have advocated that collaborative learning is "one of the most promising pedagogical approaches for distance learning" (Bernard, Rubalcava & St-Pierre, 2000, p. 260) since collaboration among learners encourages active, constructive, reflective, and transformative learning. Zhan (2012) proposed that collaborative learning could play a positive role in developing critical thinking, reflection, and transformative learning in the virtual learning environment. Because of these advantages, collaborative learning "is now an accepted, and often the preferred, instructional procedure at all levels of education" (Johnson et al., 2007, p.15).

Collaboration has often been a significant part of education, including both K-12 and higher education. The theory of constructivism, first attributed to Piaget (1969), emphasizes the process of active development in education. The theory claims that individuals learn through interaction with their world and develop knowledge through social interaction rather than individual exploration. Jonassen et al. (1995) note that the collaboration in a constructivist classroom results in personal meaning-making on the part of the individual student and creates a container wherein social construction of knowledge and meaning can occur. Brookfield (1995) contends that collaborative processes promote initiative, creativity, critical thinking skills, and dialogue on the part of the learners. Collaboration, then, accomplishes several outcomes, as highlighted in Table 1.

Table 1 Characteristics of Collaborative Learning

Characteristics	Description
Assists with more profound levels of knowledge generation.	When working in small groups, teams, or even on the discussion board of an online course, the ability to create awareness and sense is enhanced.
Promotes initiative, creativity, and critical thinking.	The ability to collaborate enables the development of thinking critically, a skill that is more difficult to master individually.
It allows students to create a shared goal for learning and forms the foundation of a learning community.	Beginning an online course with a discussion of learning objectives and working toward a common goal not only creates the foundation of that learning community but is also the first step toward collaboration.
Addresses all learning styles.	In using collaborative approaches to learning, the instructor can be assured that the various learning

preferences in the group will be addressed and that the less preferred styles may be further developed.

Addresses issues of culture. Through collaboration, a more culturally sensitive online classroom can be created.

Although the characteristics listed in the table apply to online learning, collaboration serves the same functions in face-to-face or blended (also known as hybrid) classes. In addition, collaboration assists the instructor and all students in successfully achieving learning objectives more efficiently. As Palloff and Pratt (2010) discuss, although collaboration takes more time, the outcomes may be deeper, more efficient, and a more complete learning process. Understanding the characteristics of collaborative learning can better enable us to fully understand how our research participants experience collaboration.

Online Learning Assessment

The scholars below have conducted studies on the assessment of online teaching and learning. In this chapter, we discuss assessment in online education considering six aspects: the importance of assessment; the function of online assessment; the approach of online assessment; the methods of improving online assessment; the factors which influence online assessment; and the satisfaction of online assessment.

The Importance of Assessment. Scholars such as Rust and Price (2005) believe that assessment is the heart of the student teaching and learning experience and is probably the single most significant influence on how students approach their learning. Assessment can also be highly emotional; students describe it as a process that evokes fear, anxiety, and stress (Vaughan & Garrison, 2013). The assessment of courses is critical because it indicates the quality of learning, and it also has a substantial impact

on learning (Arend, 2007). When courses transfer into an online format, assessment is the engine that drives students' engagement with course activities. Assessment is particularly important in encouraging and shaping collaborative activity online (Swan et al., 2006).

Webb (2015) believes the most important aspect of assessment for learning is the interactive features that allow the learner to turn up or down the intensity, amount, and sharpness of the information needed for self-absorption and adoption of the feedback. Most notably in the assessment of learning are features that compare the learner with external standards of performance, and features that allow multiple performances and a wide array of affordances for authentic action, communication, and the production of artifacts (Webb, 2015).

The Function of Online Assessment. After understanding the importance of assessment, we focus on the function of evaluation in the teaching and learning process. Achtemeier et al. (2003) point out that effective assessment ensures effective online teaching and learning. Ascough (2011) asserts assessment can help overall course design. Wall et al. (2014) provide an alternative view of evaluation as an ethical value concerned with a social practice that creates space for dialogue about how higher education contributes to learning toward the public good.

The Approach of Online Assessment. Scholars have been researching assessment methods of online teaching and learning for some time now. Arend (2007) thinks the way of teaching should be different in the online environment. Arend (2007) emphasized the importance of using multiple and alternative assessment methods to follow effective teaching and learning practices. At the same time, online instructors need to ensure that assessments are used strategically, and that feedback is productive and able to be acted upon by students. In this aspect, Martin et al. (2019) has the same

opinion as Arend (2007); however, they have developed and refined this point of view. They recommend using traditional and authentic assessments and rubrics to assess students, course templates, quality assurance processes and surveys, learning analytics, and peer reviews for assessment and evaluation.

Concerning authentic assessment, Eddy (2013) feels this kind of assessment is best oriented towards evaluating student learning as they perform real-world tasks. Eddy also concludes with four steps for the authentic assessment. First, assessment is a process, not a static one-time event. Second, it involves assessing experiential learning. Third, multiple participants assess a student's work, either by themselves or by a public audience. Finally, it needs to provide learners with more options.

Aligned with competencies and learning activities, Guerrero-Roldán and Noguera (2018) proposed a model for e-assessment designing. They evaluated the students who study in a student-centered, competency-based online learning environment. Using technologies beyond the traditional way of assessment, they proposed a classification of e-assessment activities organized by competence. They introduced in detail how to construct competitive activities, enumerate the characteristics of e-assessment, and provide examples of e-assessment. Corresponding to the examples they mentioned, when describing the assessment methods, we can find in our case study whether our instructors use these e-assessment methods in the online teaching process.

As for assessment in the U.S. colleges and universities, Webber (2012) proposed using learner-centered assessment, which considers assessment as more than measuring student comprehension of factual knowledge. Learner-centered assessment of knowledge gained through activities includes progressive feedback, peer evaluation, collaborative assignments, and other tasks that foster knowledge construction. In his

perspective, higher education has already shifted from an instruction paradigm to a learning paradigm, and learner-centered assessment is the central element of the learning paradigm. He asserts this assessment method is the best practice in higher education pedagogy.

Some researchers recommend implementing group work in assessment. Webb (1994) stated it is necessary to think carefully about the purpose of an assessment and the effects of collaboration on the interpretation of scores from assessments. He also stressed that group work assessment should coincide with the purpose of the assessment. In this way, we can link assessment more closely to the growing emphasis on small group collaboration.

Conrad and Openo (2018) focused on specific aspects of online assessment, including the alternate forms arising from massive open online courses (MOOC), open educational resources (OER), open learning, blended learning, flexible learning, open learning, self-assessment, and social media's impact on assessment practice. A detailed description of their work and its impact on our research will be discussed later in this chapter.

With respect to teaching evaluation methods, some scholars have made new attempts to find factors that can affect evaluation results. Junco (2011) showed that we can use Twitter as an educational tool to help students engage more and to mobilize faculty into a more active and participatory role. Another helpful device is digital badges, which are electronic symbols used to document achievement or skills mastered including completion of a course, participation in professional development, or completion of training (Parker, 2015). Sullivan (2013) as well as Casilli and Hickey (2016) state that the availability of digital badges transform academic learning and educational assessment.

The discussion on assessment methodology in our study is essential. Our research data reveals ways in which the participating instructors evaluate student learning. Instructors may use one of the approaches identified by previous research, or a combination of approaches. We discuss what methodologies instructors use and our research participants' perspectives in Chapter 4.

Methods for Improving Online Assessment. It is important to examine the research that scholars have done to improve and enhance the evaluation methods of online courses. To ensure effective teaching and learning online, Achtemeier et al. (2003) investigated the methods to improve online assessment. They conducted experimental research to inform the revision of the University System of Georgia e-Core course evaluation instrument, providing a rubric for assessing and informing other instruments used to evaluate online course instruction. The direct result of this study was a redesign of an assessment instrument for the online undergraduate general education courses.

In our research, we discuss how instructors have developed and improved their assessment methods to increase their students' learning efficiency and achieve their teaching satisfaction. We based our discussion on the research conducted by Achtemeier et al. (2003) to see if the instructors in our study adopt the methods the authors recommended, what other methods are utilized, and whether the instructors have observed effects in doing so.

Factors Influencing Online Assessment. Various factors affect how instructors make decisions concerning assessment in their online courses. Swan et al. (2006) investigated assessment and collaboration in online learning. They identify three activities influencing assessment and collaboration: collaborative discussions, small group work, and collaborative exams. In our data, these activities proved instrumental

in understanding the research participants' perspectives on assessment and collaboration.

Soffer et al. (2017) discuss how the abrupt increase of online courses in higher education has fostered more interest in assessment within online contexts, as assessment is a crucial element for effective learning. The authors discuss how integrating assignments into online courses serves as a means for increasing student involvement and engagement in a course. Bailey, Hendricks and Applewhite (2015) consider that all strategies used in online environments should be seen as assessment strategies. The authors researched the level of student satisfaction with assessment in online courses based on levels of enjoyment, engagement, and student opinions of the meaningfulness of the assignments. They concluded that students prefer assignments that are less traditional and that incorporate various technological tools.

The evaluation of online courses in our study focuses on discussing whether teachers are pleased with collaborative approaches used in online teaching, and whether students are satisfied with learning in online courses through collaborative learning. The relationship between student perception of instructors' support, course satisfaction, and learning outcomes (Lee et al, 2011) is important to our study. By using interviews and questionnaires designed to elicit information related to factors influencing online assessment (Lee et al, 2011; Soffer et al. 2017; Swan et al. 2006;) we aim to understand the importance and challenges of online assessment according to educators and students.

The Six Aspects of Evaluation. Although our research focuses on student and teacher satisfaction with co-teaching and collaborative learning, we need to address the importance, function, strategies, and methods of assessment in online education.

Concept Model

Constructivism Learning Theory

Constructivist learning theory is a student-centered teaching concept. Piaget (1970) argues that the physical or causal structure of the object cannot derive the cognitive structure of the subject. Only living organisms can have cognitive structure. Cognitive structure is a series of continuous reflective abstractions and continuous updates of a series of self-regulating constructs. Vygotsky's Zone of Proximal Development (ZPD) theory holds that students can construct their own understanding in their minds through learning and development in social and cooperative activities. In this process, the role of teachers is a facilitator and helper. Teachers can guide, motivate and help students develop in an all-around way. Online co-teaching is also a student-centered approach. Therefore, our focus will also be realizing the student-centered teaching concept.

Constructivist learning theory advocates that learner should choose and construct their own learning experience actively. It holds that learning is to generate meaning and construct understanding based on existing knowledge and experience through sociocultural interaction. Constructivist learning theory consists of individual constructivism and social constructivism. Individual constructivism views that learners form, enrich, and adjust their cognitive structure through the interaction of new and old knowledge and experience. Learning is a two-way process. On the one hand, new knowledge has been incorporated into the existing cognitive structure and gained new significance. On the other hand, the original knowledge experience has been adjusted or reorganized due to the incorporation of new knowledge. To receive information, people must have a cognitive structure that enables them to assimilate this information, which is why teaching higher mathematics to a five-year-old child is

impossible. The learner does not yet have cognitive structures that facilitate understanding (Piaget, 1964).

According to the theory of ZPD, children's level of ability to solve problems independently determines their actual level of development. In contrast, their ability to solve problems with the guidance of an adult or in cooperation with peers determines children's potential level of development. Its most direct inspiration to the teaching concept is to pay attention to the interaction and collaboration between people in classroom teaching, the significant influence of the learning situation on learning, and endow teachers and students in interactive learning with new roles completely different from traditional teaching. Students need to determine learning objectives, design learning tasks, work together to complete learning tasks and evaluate their performance and plan the next step of learning. Teachers as facilitators help students complete the whole learning process. Learning is not only a student's active processing of learning content, but also encompasses cooperation between students to achieve learning goals. Oliver (2000) argues that constructivist learning theory usually encourages students to use active techniques to create more knowledge than to reflect on and talk about what they are doing and how their understanding is changing.

Co-Teaching Model

Co-teaching is an approach that pairs teachers in the same classroom and shares responsibility for planning, guiding, and evaluating students. In a co-teaching environment, teachers are considered equally accountable to their students (Morelock et al., 2017). Friend and Cook (1996) argue that co-teaching is a special offering based on collaboration which aims to meet student's educational needs and diverse learning options. They proposed six co-teaching models (Connecticut's State

Education Resource Center, n.d.): One Teach, One Observe; One Teach, One Assist; Alternative Teaching; Parallel Teaching; Station Teaching; Team Teaching.

Co-teaching determines courses according to the instructors' teaching styles and students' characteristics and needs, but it does not use the same teaching model for every course. Cook and Friend (1995) believe that co-teaching can create personalized options for students and improve “program intensity and continuity” (p. 4) and enable students to participate in more systematic ways. Students can enjoy the fun brought to them by the flexible and changeable co-teaching mode of teachers and make their own learning and the instruction become more seamless.

Chanmugam and Gerlach (2013) suggest that the successful implementation of co-teaching requires extensive discussion among collaborative instructors, “ongoing debriefing and shared reflection were essential” (p.115), and instructors should explicitly discuss with students about co-teaching mode “at the beginning of the semester” (p. 115). In our research, we focus on the co-teaching model used in the online co-teaching of Ed.D. program at UMSL. We have analyzed how teachers conduct online teaching activities, which includes interaction methods, the roles in the classroom, teaching forms, and teaching evaluations. At the same time, to better understand online co-teaching, we have conducted interviews with teachers to understand the basic information of the curriculum, the connection of curriculum modules, the expansion of curriculum content, and other relevant teaching elements.

Online Collaborative Learning Theory

Online collaborative learning theory can enhance understanding the model of online collaborative learning before conducting specific research. Online collaborative learning theory also encourages us to think of questions and present the status of the Ed.D. program online collaborative learning more objectively and

comprehensively.

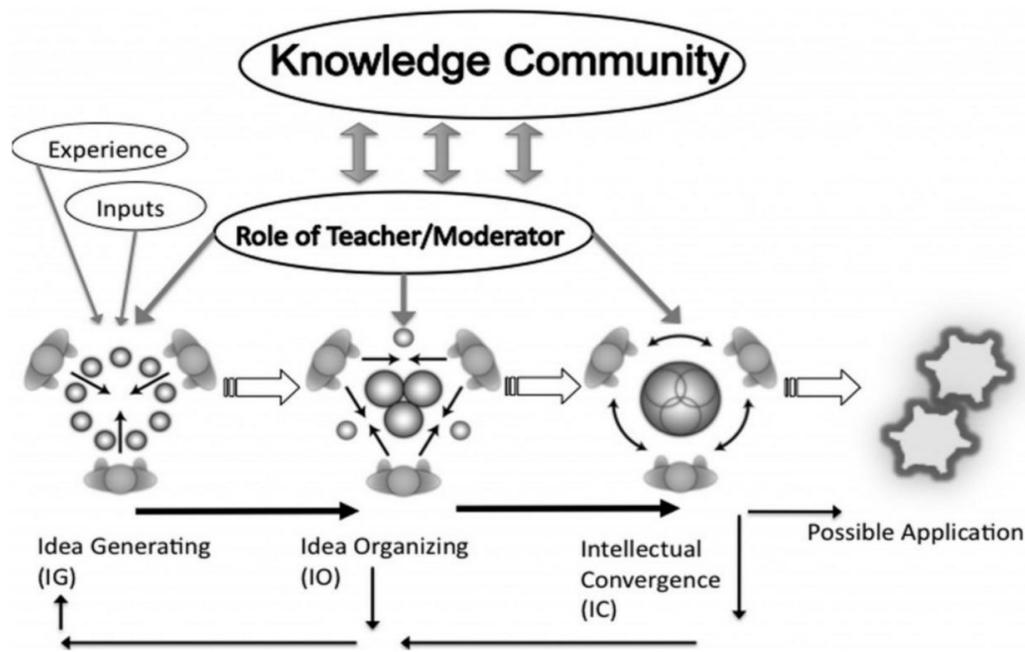
The online collaborative learning theoretical basis used in this study is derived from the work of Harasim (1986). She developed a collaborative learning theory, pedagogy, and research methodology of online discourse analysis drawing upon her rich experience of teaching and learning online. In 2017, she deepened her online collaborative learning theory and developed online collaborative learning pedagogies in practice and online course.

Online collaborative learning theory is a form of constructivist teaching focused upon instructor-led group learning online. In online collaborative learning, students are encouraged to solve problems through collaborative discourse instead of memorizing correct answers in online collaborative learning. Thus, the teacher is the key role of the intermediary. Harasim (2017) developed the online collaborative learning theory from computer-mediated communication or networked learning.

Harasim (2017) believes the instructor is critical to knowledge construction, not only through facilitating the process and providing resources to the group but also through ensuring the concepts that need learning are learned. In addition, she states that the teacher represents the knowledge community or subject domain under study, as shown in Figure 1.

Figure 1

Online Collaborative Learning Process



Note. This figure represents the pedagogy of collaborative group work from idea generating to idea organizing to and intellectual convergence. From "Learning Theory and Online Technologies", by Linda Harasim, 2017, Routledge. Copyright 2017 by Taylor and Francis.

Theoretical Framework

Course Design in Higher Education and at UMSL

Course design in higher education should be based on the intersection of course goals, learning outcomes, and course content and assignments. Moreover, instructors need to articulate and align course goals, learning outcomes, evaluation, and assessment tools. The process of designing courses also requires discipline-specific choices related to pedagogy, content, and modes of instruction. In the case of online courses, instructors also need to consider the available technologies and make decisions regarding course lessons and their levels of content.

Concerning pedagogical decisions, scheduling time outside of class to meet with students and address their needs is an example of how course design can impact on students' academic success in the most varied ways. For example, students who experience academic difficulty on the first graded assignment should be encouraged

to meet with instructors to learn study strategies, discuss the course content, understand course expectations, or prepare for a test.

Another important aspect of course design is related to lesson planning. It is vitally important for instructors to consider ways to create a classroom environment that allows for the respectful exchange of ideas. Students need to be sensitive to various views and beliefs expressed during discussions, whether they are held in person or online. Since successful learning experiences depend on student engagement (Fink, 2013), every lesson should focus on how instructional approaches may lead to meaningful participation of students.

Daily preparation is essential to ongoing and sustained learning in teaching design. Lack of preparation for class negatively affects our understanding and the teaching of our teammates. Classroom exchanges should be built on a respectful and equal basis. One's words and use of language should be tempered and within acceptable bounds of civility and decency. Since every student is entitled to full participation in class without interruption, all students are expected to come to class prepared and on time and remain for the whole class period. No other disruption to the learning process should be permitted (Harasim, 2017).

Teaching design should let students know and do what the course requires at the end of the semester. These objectives guide students to see the relevance of the assignments and requirements listed under the Evaluation Criteria and Grading (Ginda et al., 2019). It should be focused on course-end outcomes – the big picture view – thinking about what students will know/be able to do five years after completing the course. These should also easily lead to assessment. They guide students to see the relevance of assignments. Outcomes must be consistent across all course sections,

regardless of delivery mode. Thus, the consequences could be accessed by the teachers.

Many approaches and methods of curriculum development and course design in online education align with the basic principles of course design listed above. In our study, we also consider it important to address theories and concepts relevant for understanding and discussing online teaching and learning within the context of this research.

Flipped Classroom Theory

The flipped classroom teaching approach is a typical online co-teaching mode. First, students acquire knowledge by watching videos and course presentation materials, communication, and other online methods (Perera et al., 2020). Instructors no longer must use class time to teach these contents. Secondly, students take advantage of valuable classroom learning time to actively solve their own learning difficulties and problems to gain a deeper understanding of what they have learned. Instructors communicate with each student, conduct a type of coaching instruction, answer questions, and promote their students to complete the learning activities. Flipped classrooms enable instructors and students to form one aspect of the co-teaching method.

The previous classroom learning we participated in at UMSL adopted the flipped classroom model. To better understand this typical online collaborative teaching mode, instructors introduced details about flipped classroom teaching, including the role transition between instructors and students, flipped classroom teaching design module, instructors' ability requirements, students' autonomous learning ability requirements, and the applicability of flipped classroom mode to the curriculum.

Lage et al. (2000) introduced their flipped teaching model and their achievements in teaching Introduction to Economics at the University of Miami. They had students watch lectures in a computer lab or at home and do homework in class or in small groups. This teaching method was a subversive change to the traditional way of education. Students' learning changed from passive listening to lectures to active learning and thinking, and then they asked questions to instructors. The status of instructors has changed, and the teaching content of instructors has changed from introducing new knowledge to giving targeted explanations on the difficulties and contents that students do not understand in their self-study.

Flipped classrooms enable instructors and students to form a closer co-teaching method. Instructors no longer must use class time to teach this content. Students can use the valuable class learning time to focus on solving difficulties in learning the content to gain a deeper understanding of the knowledge learned. Instructors communicate with each student, coach them, answer their questions, and encourage them to complete active learning.

Bishop et al. (2013) assign asynchronous video lectures and practical problems as homework and carry out active problem-solving activities based on groups during class time. Compared with video lectures, students prefer face-to-face teaching but also favor interactive classroom activities. Anecdotal evidence shows that compared with the traditional classroom, student learning in flipped classrooms was enhanced.

However, some educators also worry that flipped classrooms will reduce the demand for teachers and their importance in teaching. The application of flipped classrooms pays more attention to the teacher's guidance and answering questions to students in the classroom. Therefore, a key point of flipped teaching is to make rational use of in-person teaching time (Bergman & Sams, 2014).

The generation of the flipped classroom teaching process should be based on modern information technology and promote the overall integration of teaching elements. Flipped classrooms strengthen the interaction and communication between instructors and students by constructing an intelligent learning environment, designing an open teaching content system, and adopting flexible teaching methods. Instructors and students often perceive flipped classrooms as more creative and fun. Using class time for problem-solving activities and discussions based on extracurricular materials is beneficial and helps students apply their knowledge under the supervision of instructors. Instructors can cover more information in the classroom, and students can review teaching materials as often as necessary. Instead of relying on in-class notes, students can review video clips as often as they need to enhance their learning. Many instructors and students believe that flipped classrooms lead to more active learning and overall better student performance (Kim et al., 2014). When collaboration occurs in the planning and delivery of courses across multiple departments, students benefit from the different strengths of the faculty. Flipped classrooms also promote consistency between sections of the curriculum, so instructors do not have to look at the same information repeatedly. In addition, instructors develop resources for flipped classrooms once, but are able to use them every semester (Hall & DuFrene, 2016).

Assessment Strategies

If we wish to discover the major truth about an educational system, we just need to examine assessment procedures (Rowntree, 1977). Our understanding of Rowntree's opinion is that for both instructors and learners, the assessment would top the list of teaching and learning processes, as well as the educational system. In the cycle of learning, assessment has long been embraced as the center of learning theories. However, with the development and growth of distance education, especially

e-learning or online learning, assessment faces new challenges: When the learning activity happens at a distance, what sorts of assessment can be suitable? Can we use traditional approaches to continue our online assessment?

Conrad and Openo (2018) researched assessment approaches in online courses in higher education. The authors found that for higher education, the theory, research, and practical advice are all based on the constructivist theory. In the social sciences and humanities, constructivist teaching and learning and pedagogy have a dominant role in education. The authors focused on specific opportunities and challenges associated with online learning and explored a way learning that can be assessed on the group and individual levels, as even this kind of evaluation is constructed in the contexts and minds of each learner.

Conrad and Openo (2018) begin with an overview of the history, definitions, and theory of assessment and then post the issues about online and offline evaluation. Then they examine the evaluation of online learning from basic pedagogical principles and explore issues such as teaching and epistemology, guiding philosophy, nature of online learning, to establish a framework for assessment discussions. Conrad and Openo (2018) suppose that assessment needs to answer the questions of what, why, when, and how. At the same time, authenticity and engagement issues also need to be considered. In the last section, the authors narrow their concern to address specific aspects of evaluation, which include the massive open online courses (MOOCs), open learning, open educational resources (OER), self-assessment, peer-assessment, blended learning, flexible learning, flipped classroom, wikis, badges and the impact of social media on assessment practice.

The work of Conrad and Openo (2018) discussed assessment in online education. They discussed how to assess online learning in an authentic and meaningful way

based on constructivist philosophy. They believe that the evaluation should connect with the potential of learning instead of the stringency of judgment. Their study is concerned with the depth and breadth of evaluation strategies, approaches, and techniques. Conrad and Openo (2018) also discussed how to separate the learning outcomes from the course design and how to tease out constructivism from group work. Educators can gain many opportunities for immediate application to the online learning environment by learning strategies for appropriate creative and authentic assessment (Gikandi et al., 2011).

Conrad and Openo's (2018) work is relevant to our research. First, our research on the evaluation of online courses focuses on higher education. Secondly, our research is not aimed at how to design the evaluation process. Our research is more inclined to evaluate students' online collaborative learning through certain methods and means, whether students are satisfied with such evaluation results, whether students are satisfied with the co-teaching, how satisfied teachers are with students' collaborative learning effect, and teachers' experience of co-teaching. Thus, their work offers insight into our research.

University of Missouri Intercampus Faculty Council: Evaluating Classroom-Based, Online, Blended and Laboratory Teaching Interactions

Our research is a case study, and the research context is UMSL's Ed.D. program in the College of Education. Therefore, when we refer to the assessment processes above, is it necessary to introduce UMSL's guidelines and policies on course assessment. In this section of this chapter, we discuss UMSL's Ed.D. program approach to assessment.

On June, 2019, after several discussions, the University of Missouri Intercampus Faculty Council (IFC) (2019) created and issued a task force to examine strategies to

evaluate teaching effectiveness with the primary goal of improving teaching effectiveness and student learning, which is called the IFC Statement on Evaluation Classroom-Based, Online, Blended and Laboratory Teaching Interactions.

The IFC statement includes four sections: critical issues in evaluating teaching: what the literature tells us; improving student ratings of teaching; multiple measures approach; and recommendations: enhanced strategies for evaluating teaching. Our research on evaluation focuses on the satisfaction aspect of co-teaching and collaborative learning. Therefore, the last two points in the IFC statement are relevant to our study, and we would like to introduce these parts in detail.

In the multiple measures approach section, national standards for measuring teaching effectiveness recommend using data from various sources. The best approach is to create a triangulation strategy, using three or more sources of evidence. This allows the strengths and weaknesses of each source to balance each other out (Applying et al., 2001). UMSL encourages faculty to implement strategies to gain feedback from students, peers, and self-evaluation to create a comprehensive evaluation. Next, in this part of the statement, the emphasis is on peer review. Two activities compose the peer review process: peer observation of in-class teaching performance and peer review of the written documents used in a course. When it is possible, both forms should be included in a comprehensive system.

The recommendation section lists a menu of different strategies that the instructors can employ. These strategies include course development or improvement, self-reflection and self-improvement; peer review of teaching materials; Student Classroom Assessment Techniques (CATs); peer observation of teaching; student interviews, 360-degree assessment, and the teaching dossier. These strategies are described in more detail in the report so that instructors can better understand them.

The IFC statement is of great value to our research. Our case study is based on an online course for Ed.D. students at UMSL. This statement provides many suggestions for strategies to evaluate and improve teaching quality. Whether instructors have applied these strategies and whether the system has effectively improved teaching quality and students' satisfaction will be discussed in the next chapters of this dissertation.

CHAPTER 3: METHODOLOGY

Aim of the Study

The study explores online teaching in the U.S. context and broadens online teaching literature from a geographical, cultural background. This study has the potential to offer possible insight into or solutions to problems such as distance education and its challenges of time and space. Especially during the COVID-19 pandemic, education facilities worldwide experienced hardship in time, staffing, and resources, and many universities have turned to online education. This study could potentially benefit administrators, instructors, and students in these complicated circumstances.

Nature of Research

Our research is a case study on a specific group of instructors and learners in an Ed.D. program at UMSL. A case study is a research method involving an up-close, in-depth, and detailed examination of a particular case. Case studies may apply qualitative and quantitative research methods and involve single or multiple issues (Creswell, 2012). Our research is a single case study as it focuses on one specific case. This type of research matches our research goals well because it offers rich opportunities for understanding the experiences, meanings, and perspectives of the research participants, instructors, and students of an Ed.D. program. As researchers, we aim to gather a systematic collection of qualitative data, a set of written and verbal texts to organize, describe, and interpret.

Furthermore, the case study method was chosen because of the researchers' in-depth local knowledge. The researchers in this type of methodology are able to "soak and poke," as Richard Fenno (1986) put it, and thereby have emic insight and are able to offer explanations based on their rich knowledge of the setting and circumstances.

As researchers, we studied in this Ed.D. program for three years, and we are familiar with its collaborative teaching and learning environment. As qualitative case studies provide opportunities for understanding individuals' unique real-life experiences, we felt that this approach would best support our study. Answers to our research questions require the versatility of a case study and the particularistic and contextual nature offered by this method of research. Hence, we selected the case study method.

Qualitative research involves collecting and analyzing non-numerical data (e.g., text, video, or audio) to understand concepts, opinions, or experiences. Qualitative research is commonly used in the fields of anthropology, sociology, education, health sciences, and history in the humanities and social sciences. It utilizes a variety of research approaches, such as case study, grounded theory, ethnography, phenomenology, and narrative techniques. Our research is in the field of education, and as stated above, we have conducted an in-depth study on the content of co-teaching and collaborative learning. We aim to focus on the depth of the problem, not the breadth.

We thus chose a case study research approach to investigate the complexity of a case that was familiar to us. Our experience as Ed.D. students at UMSL represented the opportunity of learning and experiencing new ways of teaching and learning. Choosing a cohort of an Ed.D. program meant the possibility of finding answers to questions that were meaningful to all of us, as we anticipated that our findings would be useful for our professional practice. The attributes of case study methods are adequate for understanding and problematizing participants' perspectives in their real-life settings (Creswell, 2012). Cases are situated in time and space, and contexts are fundamental to understanding the case (Harrison et al., 2017).

Unique features to our study include that the student participants are Chinese

students in the U.S., where English was the medium of instruction, and the instructors created learning opportunities that considered the cultural and linguistic background of the students. The complexity of this context added to the choice for the methodology to be a case study to best gain a thorough comprehension of perspectives, processes, practices and relationships (Harrison et al., 2017) occurring in the context of our Ed.D. cohort.

Sample

We use a convenience sample (Creswell, 2000) of instructors and students as participants who participated in the Ed.D. program that is jointly-sponsored by UMSL in the U.S. and SNU in China. This program is to help students develop abilities to solve problems in the field of education by using professional skills and literature. All the instructors are academic experts from UMSL.

We applied a custom design approach (Dillman et al., 2014) to recruit participants for the study. Our research is online co-teaching, and the student participants had to be in a Chinese cohort in three online courses from the Fall 2019 semester to the Spring 2021 semester. The inclusion criteria for teacher participants are the instructors who collaboratively participated in the comprehensive three online courses. In this way, we can ensure that all instructors involved in the three online co-teaching curriculum design and teaching are experienced in online co-teaching.

Initially, all ten students and six instructors were from the Ed.D., which included one teaching assistant. They were invited through purposeful sampling (Creswell, 2012; Merriam, 2009). After several rounds of communication, we finally received replies from three instructors, one teaching assistant, and seven students agreeing to participate in the study. Thus, the sample for the final study consisted of four instructors and seven students who had participated in all three online courses in the

Ed.D. program. Tables 2 and 3 summarize the demographic data related to our research participants. Table 2 below provides information on the participants' names, gender and years of teaching experience.

Table 2 Participants for the Qualitative Interviews

Participants	Name (pseudonym)	Gender	Online Teaching Experience
Instructor 1	Tom	M	1.5 years
Instructor 2	Lucy	F	1.5 years
Instructor 3	Ann	F	Over 6 years
Instructor 4	Mike	M	Over 26 years

Table 3 presents information related to student participants (name, gender, and age):

Table 3 Participants for the Qualitative Questionnaires

Participants	Name (pseudonym)	Gender	Age
Student 1	Lily	F	Over 35
Student 2	Angel	F	26-30
Student 3	Alice	F	26-30

Student 4	Emma	F	26-30
Student 5	Jerry	M	Over 35
Student 6	Jack	M	26-30
Student 7	Rose	F	Over 35

Data Collection

Data Collection Procedures

The data collection of this study is divided into two parts. The first part of the data collection discusses the data collected from the four instructors who agreed to participate in the study, specifically from the interview data collected via Zoom. We sent invitations for interviews via email to six faculty who have participated in online co-teaching in this Ed.D. program during the past three years. In the email, we stated that the interview was completely voluntary. Finally, we received replies from four teachers who agreed to participate in the interview and interviewed them one by one (see Appendix C Email Inviting Instructors). We scheduled the interviews at the instructors' convenience. The interview time for each teacher was about one hour. We recorded the four interviews on Zoom. We choose video interviews instead of telephone or other types of interviews because we have adopted a team interview method, where four interviewers (researchers) were present. The video method can help us better interact with the interviewees during the interview. After all the interviews were over, we used software to convert the interview video into text.

Data collection from students consisted of an online questionnaire (see Appendix D Email Inviting Students). In the initial stage, we also sent invitations to students to

participate in research by email. In total, we sent out invitations for investigation and study to ten students in this Ed.D. program in addition to our four researchers. Finally, we received questionnaires completed by seven students. Therefore, the number of valid questionnaires for this study is seven.

Data Collection Tools

Data collection tools in the research included semi-structured interviews, questionnaires, and artifacts related to the online courses we focused on. The syllabi of the three courses were the most important artifacts used in our analysis. As students enrolled in the Ed.D. cohort of this research, we were enrolled in the same online courses that the research participants attended. This way, we had access to the course artifacts and our notes, which we used in the process of analyzing our data. They proved important for us to recall events, practices, and other aspects of the participants' experiences that could support our understanding of the research data.

The interviews were used with instructors, while the questionnaires were used to gather data from the students. We used the course syllabi as artifacts that helped us to understand what information was available to students concerning course goals, teaching strategies, assessment and other information shared by the instructors. Combined, interviews, questionnaires, syllabi and student class notes allowed us to answer our four research questions.

Semi-Structured Interviews. The purpose of using a semi-structured interview in our research was to better understand instructors' perspectives on their participation in co-teaching. Semi-structured interviews are commonly used in qualitative research. Semi-structured interviews can provide participants with the opportunity to elaborate the main points of each question and fully express their views. Different from self-completed questionnaires, interviews allow researchers to ask to follow up questions,

and respondents have the opportunity to elaborate on their responses (Bloch et al., 2011). We used semi-structured interviews (see Appendix A) with the instructors with the major goal of answering the questions:

- “How do instructors design online courses with the aim of facilitating instruction using the collaborative teaching and learning model?”
- “When instructors are co-teaching online, how do they use the collaborative teaching and learning model?” and
- “How do instructors and students evaluate the online collaborative teaching and learning model?”

DeMarrais (2004) defined an interview as "a process in which researchers and participants engaged in a conversation focused on questions related to a research study" (p.55). The advantages of interviews lie in the clear communication objectives between researchers and participants and the focus on the topic of qualitative research. Through interviews, researchers can obtain participants' observations and answers to research questions and personal opinions (Yin, 2017).

As researchers and members of the online courses focused on this study, we had an emic perspective of how online co-teaching occurred in the Ed.D. cohort we studied. According to Merriam (2009), purposeful sampling should include knowledgeable participants, therefore, in this research, both interviewers and interviewees were familiar with co-teaching in the context of this research. Each interview for each instructor included questions related to online course design, online co-teaching, and assessment.

The interviews were recorded with the authorization of the participants from Zoom platform. Each interview lasted about an hour, and three researchers interviewed the participants while one researcher took notes. After each interview was

over, we transcribed the data and recorded our personal feelings during the interview in our class notes.

Questionnaires. We used the same questionnaire for all student participants so that we could make a comparative analysis of different perspectives on the same topic. We used the questionnaire mainly to answer the research questions of:

- “How do students build online learning communities when learning experiences emanate from the collaborative teaching and learning model?” and
- “How do instructors and students evaluate the online collaborative teaching and learning model?”

According to Bloch et al. (2011), self-completion questionnaires are more suited to issues where only a few questions that are relatively clear and simple are needed, and the choice of answers can be limited to specific options. Questionnaires can include both open and closed questions. Closed questions allow researchers to design questions and give several answers to each question, and the respondents can only choose their answers among these choices. Open questions allow respondents to use their own words in their responses. The questionnaire designed for this research (see Appendix B) included both kinds of questions. Closed questions included an agreement scale (Likert scale) to measure participants' agreement on various statements related to their experiences. Fourteen open-ended questions were designed to focus on the student's understanding of assessment within online contexts.

The questions were designed considering Rowley's (2014) affirmation that researchers should design questionnaires around the research questions and make the questionnaire closely related to the research theme. We developed questions that could allow students to give accurate answers to the questions. Students answered the open questions in English, being that their first language is Chinese. To eliminate

potential bias, we avoided inducement and suggestiveness (Rowley, 2014), so that participants could complete the questionnaire as independently and objectively as possible.

We organized the questionnaire in two different parts, focusing on two primary aspects: collaborative learning and online assessment.

The first part was about collaborative learning, with a total of 26 questions, including 21 multiple-choice questions and six open questions. The multiple-choice questions included 15 levels of measurement questions (Likert scale).

The second part of the questionnaire focused on understanding the students' perspectives on assessment. There were 16 questions in total, including two multiple choice questions and 14 open questions.

Finally, after developing the questionnaire, we created a digital version using a free online software (Google Forms), which generated a shareable link that was sent via email to the student participants. The email explained that students would have 30 days to complete the questionnaire.

Document Analysis. Document analysis is a qualitative research method, which is often used in social research. When using this research method, researchers explain the documents and give opinions and significance around the evaluation theme (Bowen, 2009). Common types of documents include personal documents, public records, and physical evidence (O 'Leary, 2014). Researchers can triangulate findings by using different documents and data sources, so document analysis is often an important part of triangulation and crystallization (Ellingson, 2009).

According to Ellingson (2009), in positivist and post-positivist traditions, triangulation involves an attempt to get closer to the truth by bringing together multiple forms of data and analysis. While triangulation seeks a more definitive truth,

crystallization problematizes the multiple truths it presents. We intended to problematize our analysis based on various tools and artifacts and using multiple perspectives. Our initial goal was to use a crystal instead of a triangle as a metaphor for research analysis. However, we considered that the time and scope of this research would favor the use of a more traditional data analysis and employ the triangulation approach, while understanding all research is inherently partial, situated, and unpredictable (Ellingson, 2009).

One advantage of performing document analysis is that documents are stable and do not change, which is convenient for researchers. Based on the availability of documents, researchers can create a reasonable research plan, clarify the questions to be asked and the phenomena to be observed in the research, and use document analysis to ensure that their own research is critical and comprehensive (Bowen, 2009).

To support our analysis of various sources of data, we accessed documents from the online courses taken by our participants. The most relevant documents were three course syllabi, of which the content proved important for our analysis. At UMSL, the Association of College and University Educators provides teachers with learning evidence-based teaching strategies by organizing teacher participants to share successful strategies in curricula and provides instructors with templates for course syllabi. At UMSL, the syllabus is “an agreement between teachers and students” (UMSL, n.d.). The syllabus “conveys instructors' expectations and course requirements to students,” and “clearly outlines students' responsibilities during the semester” (UMSL, n.d.). These syllabi included detailed information about the instructors and their teaching philosophy; course description and goals; assessment strategies, grading criteria and rubrics, teaching methods, and assessment standards.

We used information from the syllabi to support the process of coding the interview data, and to better understand concepts the instructors were referring to in their interviews.

Data Analysis

After collecting the data, we started the data analysis process. Firstly, we organized the data into three major groups: the transcripts of the interviews, the answers to the questionnaires, and the course documents (syllabi, student notes, and assignments). We stored our data on digital folders on a free storage software (Google Drive).

The information in the interviews required us to use transcription software. The transcription software is a Chinese software called IFLYTEK. Before we conducted data analysis, we needed to convert the video content into text content. Here, we used Chinese transcription software.

The use of Google Drive, and the applications Google Forms, Google Docs and Google spreadsheets, helped us to collaborate online in the process of data analysis. By using Google Drive, we could work collaboratively, which means that using Google Docs, we could see each other's work, make comments, evaluate each other's contributions to the research, and help and inspire each other. Online collaboration during data analysis supported all group members to be accountable for this dissertation.

As for the coding of our data, we applied both descriptive and value coding (Saldaña, 2016). In the first round of coding, we were guided by our four research questions. Our coding process was thus organized around the four major topics we were exploring through our analysis: curriculum design, co-teaching, collaborative learning, and assessment. Then, we launched the first round of coding for the

interviews, questionnaires, and documents. For the first round of coding, we highlighted the sentences which provided insight into the research questions (Yin, 2018). In this process, four different colors were used to represent the four research questions: curriculum design was highlighted in brown, co-teaching in yellow, collaborative learning in blue, and assessment in green. The colors made it easier to differentiate the codes. Various colors were also used to identify the collaborators in the coding process.

After the first-round of coding, we concluded the initial codes. Then we created four codebooks. In each codebook, we classified the initial codes, gave the definition of each code, and put the examples that appear in the documents after each code. As for this part of the content, we used an Excel table to organize the data.

At last, we combined similar initial codes to develop themes for each part. For the curriculum design part, two themes appeared:

- a) knowledge sources of online curriculum design, and
- b) objectives and benefits of online curriculum design.

For the co-teaching part, two themes summarized the findings:

- a) classroom interaction strategies, and
- b) role and collaborative relationships in online co-teaching.

For the collaborative learning part, we determined two themes:

- a) influences, contradictions, and obstacles to collaborative learning, and
- b) goals and objectives of online collaborative learning.

For the assessment part, the two themes that emerged were:

- a) instructors' attitude towards online co-teaching and collaborative learning, and
- b) students' perspectives concerning online collaborative learning and co-teaching.

Ethical Considerations

Qualitative researchers need to address a series of ethical concerns when designing an adequate research method for their studies. In our research, the instruments used for data collection (interviews, questionnaires, documents) were designed to guarantee that the research would not be harmful to society or participants.

Minimal Risk

One of our concerns was to make sure that participants would not experience any risks by collaborating with our study. Thus, we designed a minimal risk study. Our research is a "no greater than minimal risk" study, which means that the probability and magnitude of harm or discomfort anticipated in the research are not greater than those ordinarily encountered in daily life or during the performance of routine physical and psychological examinations or tests and where confidentiality is adequately protected.

No potential risks were anticipated due to this research focus being an analysis of commonly used educational techniques, which currently take place in this university. Stakes were held to a minimum due to anonymous coding and keeping all data confidential with no identification of specific students. No undue stress or embarrassment was anticipated as a result of participation in the research. It was possible that some students may have felt uncomfortable discussing their feelings and opinions around the issues addressed in the questionnaires. However, the risks were unlikely since we had sensitively created research tools with questions that would not negatively impact the participants.

We minimized the stakes by making it clear in the consent form (APPENDIX E) that participation in the study was voluntary, and participants could decide to leave

the study at any time. We protected research files in password-protected folders and used pseudonyms to refer to the participants' data.

Privacy Policy

Another important ethical consideration concerned the protection of participants' privacy. Interviews took place online via Zoom, the teleconferencing software used by our university. Online interviews were necessary due to restrictions imposed by the COVID-19 pandemic. Users of the Zoom software are allowed to record the interviews, meetings, and we used this feature to record the interviews with the participants. Interviews were audio and video recorded using Zoom. The video recordings were stored electronically in password-protected folders as MOV. files (videos). All participants allowed us to record the interviews.

Data generated through the student questionnaire and the transcriptions, notes, and other written data were also protected by passwords. In addition, only the researchers had access to identification data. The data was held on a secure server. The list of IDs linked to the participants was kept in a protected digital file in our computers, separate from the data on the server. The online recording system (Zoom) did not save the IP addresses or other identifying information related to this research participants. Data was kept on a password-protected computer and will be deleted three years after the completion of the research. Individual information was protected in all data resulting from this study. No personal data was collected other than basic demographic descriptors.

Validity

Validity is a term that primarily originated in a positivist approach to research. (Elo et al., 2014). As the amount of qualitative research increases, social and behavioral scientists critique the validity of studies that use such methodology. Thus,

qualitative researchers utilize various strategies for validation to make their studies credible and rigorous (Creswell & Miller, 2000). Manion (2000) claims that triangulation increases credibility and validity of research findings. Triangulation enriched our study as this method offers different angles to explain and describe the whole phenomenon. We employed triangulation to guarantee the validity of this study, collecting data from different sources to answer our research questions. The descriptive and reflective nature of our writing also helped enhance the perceptions of accountability in our work (Ellingson, 2009). Furthermore, all investigations were carried out through joint efforts and mutual supervision of the team members. This helped to ensure the validity of our case study.

Despite concerns with triangulation, we understand, based on Gallagher (2008), the positivist nature of the triangulation of methods. It should not be seen as an approach to collect all the hidden data that could lead researchers to the truth. In our work, triangulation is mainly a way of asking different questions about a topic and carefully discussing issues related to the real world (Gallagher, 2008).

Potential Research Bias

As researchers, we were aware of potential research bias (Pannucci & Wilkins, 2010). Qualitative researchers are mindful of the impossibility of researching without subjectivity, as discussed by Creswell (2000), "The importance of checking how accurately participants' realities have been represented in the final account" (Creswell, 2000, p.125). Race, gender, identity, status, different cultures, and other factors quickly lead to potential bias in research. As researchers, we considered that potential biases might affect the accuracy of our research conclusions. We also realized that there is potential bias through reflection and thus formulated countermeasures to eliminate potential bias. This way, we kept in mind that our research participants

came from different countries, and English was not everyone's first language. In addition, participants represented other races and ethnicities. However, our data analysis did not require that we address intersectionality (Bailey et al., 2005) of participants' social identities. Therefore, we did not associate the participants' responses or perspectives to their social identities or specific backgrounds. The only social identities we considered necessary were those of instructors and students.

The nature of qualitative data makes it difficult for the researcher to separate themselves from the data (Creswell, 2012). However, as we explain below, there are ways to avoid bias with qualitative data analysis. We understand that objectivity should not be the goal of qualitative researchers. As Gallagher (2008) ponders, subjectivity and objectivity are mutually constituting; "Our encounters with the world (objectivity) expand our thoughts (subjectivity) which in turn permit us to extend our notice of the world, and so on, in an ever-widening spiral of experience" (Gallagher, 2008, p. 154). However, we decided to triangulate our analysis and address possible biases aiming at balancing objectivity and subjectivity.

When multiple people are encoding data, comparing the interpretations of different researchers can help a team analyze their data more accurately and deliberately. Our group constantly discussed individuals' perceptions of what the data revealed to us. As a group of four researchers, we reviewed each other's analysis, and negotiated our reflections and understanding of the data, identified new points of view, and collaborated in the process of organizing, analyzing, and interpreting, and making meaning from our data.

Researchers' Roles

This dissertation is the result of the collaborative work of each of its authors. After choosing our research topic, we decided on the norms that would guide our

work and the tasks each member would be responsible for. Our group agreed on the norms of collaboration at the beginning of our working as a research team. Together, we brainstormed standards to help us develop the most efficient strategies as well as a fair workload. As a result, the group created the following rules:

- a) Comply with the research schedule and deadlines.
- b) Collaborate to overcome difficulties together.
- c) Respect different points of view.
- d) Be accountable for the entire project.

Concerning the organization of our teamwork, each of us led different tasks in developing this research. The literature review, development of research tools, data analysis, and writing of specific text sections were responsibilities led by different team members. However, all the group members discussed each area of content, provided feedback, and contributed to each other's responsibilities.

Concerning the theoretical component of this dissertation, Jinge Xu was responsible for writing about online course design; Yang Zhang discussed co-teaching; Rongjing Cao focused on online collaborative learning, and Han Rong led the writing about online learning assessment. Han, Jinge, and Yang held the interviews with the instructors while Cao assisted them in that data collection. Han and Cao sent the questionnaires to the students, Jinge and Yang assisted them. In the data analysis, Han, Jinge, and Yang were accountable for the first round of coding instructors' interviews and creating codebooks. Han and Cao were responsible for the first round of coding students' questionnaires and creating codebooks. Every team member discussed the coding process, and the codes initially were developed by the team. We also collaborated in every step of writing this dissertation, working together to overcome challenges.

We are Chinese citizens and international students in the U.S. English is not our first language. English is, for each of us, a new language (ENL) and a foreign language. The academic cultures of China and the U.S. vary considerably, and academic literacies are different in both contexts. Our writing, analysis, and relationship with our research theme are strongly marked by our culture, language, and worldviews. As researchers within the U.S. culture, our roles included facing the challenges of navigating the different languages, classroom cultures, and the condition of being an international student during the COVID-19 pandemic.

As researchers, we continuously reflected on and examined our assumptions, knowledge, experience, expectations, and belief systems. Our role as researchers was to incorporate our reflections into our study and express our understanding of the impossibility of bias-free research. However, despite our acceptance of our potential subjectivity in our study, we applied rigorous methodological procedures, including triangulation, to maintain objectivity.

We understand that research methods are not value-free in their application. However, we agree that researchers should adopt a reflexive approach and be honest and open about how values influence their research (Greenbank, 2003).

We considered it essential to inform the participants of the rationale for the research and the importance of their perspectives in what counts as collaboration in online education. We also believe it was important to share our findings with our participants when the study was over and include their perspectives in our dissertation. Unfortunately, it was impossible to share the results with the participants as we had initially planned. However, we still plan to share our findings with them after we graduate and include their voices in future publications based on this study.

Chapter Summary

In this chapter, we discuss our motivations to develop a case study research design, the context, participants, data collection procedures, ethical considerations, strategies to increase the validity of the study, and ways to avoid bias within our research. We also reviewed our roles as researchers.

CHAPTER 4: DATA ANALYSIS

Introduction

Our study focuses on collaborative teaching and learning in the context of online courses. We predicted that the understanding of the collective experiences of doctoral students and instructors from UMSL would provide important insight into the design

and implementation of similar course methods in Chinese educational institutions. We used a qualitative approach to data collection and data analysis (Creswell, 2012). As explained in Chapter 3, participants of this study were instructors and students in an Ed.D. cohort at a graduate program of UMSL. We used open-ended semi-structured interviews to understand the instructors' perspectives on curriculum design, co-teaching, and online assessments. In addition, students responded to questionnaires designed to elicit their perceptions regarding collaborative learning and online assessments.

Summary of the Data Analysis Process

Data analysis in qualitative research requires a systematic approach to examine the data. The process of analyzing this research data included the following steps (Cresswell, 2012): a) organization and preparation of data; b) reading and becoming familiar with all the data; c) coding; d) identifying themes and descriptions; and e) interpreting the findings.

Through the process described above, for our first topic of online curriculum design, three sub-themes were developed through thematic analysis: knowledge sources of online curriculum design, objectives of online curriculum design, and benefits of online curriculum design. These subthemes are the principal organizational axes of the fourth chapter of our dissertation.

The second topic was online co-teaching. We developed two sub-themes through thematic analysis: classroom interaction strategies and the collaborative relationship between online co-teaching. Again, we designed these themes from the data and documents.

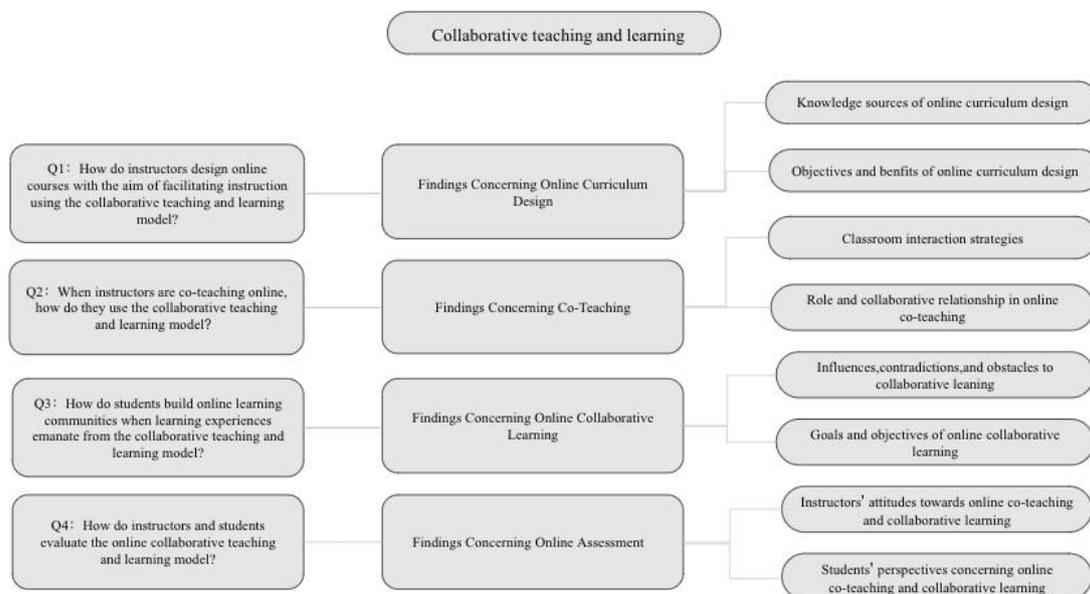
The third topic was online collaborative learning, and it was aligned with the third research question. Based on the student questionnaire and documents, we

generated three themes for online collaborative learning. The first theme is others' influence on online collaborative learning. The second theme is the goals and objectives of online collaborative learning. Finally, the third theme is the obstacles and contradictions of online collaborative learning.

The fourth topic that reflected the fourth research question was online assessment. Using instructor interviews and the data from the student questionnaire, four themes emerged through thematic analysis. The first two themes were generated from instructors' data: a) Instructors' attitudes towards online co-teaching, and b) Instructors' attitudes towards online collaborative learning. The following two themes were generated from students' data: a) Students' perspective concerning online collaborative learning, b) Students' perspective concerning online co-teaching. A summary of the findings related to the above themes is listed in Figure 2.

Figure 2

Collaborative Teaching and Learning



Findings Concerning Online Curriculum Design

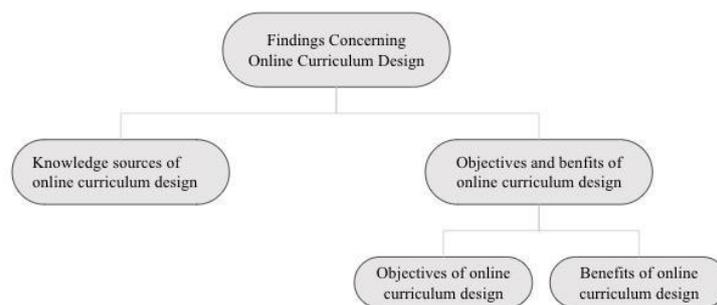
Based on the review of the literature and cross-analysis of data from instructors' interviews and course artifacts, we identified three major themes concerning research question one: How do instructors design online courses with the aim of facilitating instruction using the collaborative teaching and learning model? The themes are

- a) knowledge sources of online curriculum design, and
- b) objectives and benefits of online curriculum design.

We discuss these themes in the following sections of this chapter. A summary of the key features of the findings on online curriculum design is listed in Figure 3.

Figure 3

Findings Concerning Online Curriculum Design



Knowledge Sources of Online Curriculum Design

Instructors reported having different sources of knowledge about online curriculum design. Some participated in professional development initiatives that focused on online curriculum and course design. In addition, many universities provided free professional development and various resources related to online curriculum design due to the COVID-19 pandemic in 2020 and 2021. Dr. Tom said in the interview:

Yes, there is a teaching and learning center with professionals ready to provide support. However, in particular, I prefer to search online, like to look for articles

or blogs. So, I prefer to hear from the experience of other scholars and then ask if the institution should help me. But I know there is a center. So, this is an individual style. I prefer to be autonomous, looking for different ways of doing things.

Reading Dr. Tom's explanation on how he learns about the course and curriculum design in online contexts, it is possible to note that autonomous learning was very important in his process. While the school provided support for instructors concerning online course design, this instructor also had the freedom to find pedagogies based on his specific needs. The data has shown various resources and assistance provided to teachers who are unfamiliar with online curriculum design. The flexibility in finding resources for the online curriculum design was highlighted during the instructor interviews.

Another example of how instructors acquire knowledge related to online curriculum design can be found in Dr. Mike' interview:

You have to listen when people talk. Then you have to try and structure the communication in such a way that it's efficient and constructive. I've had some training, maybe not as much as, I'm sure. I have some change in this oh and, by the way, I also have learned a lot. Bye. Helping to supervise and advise Ed.D. students. And Ph.D. students, doctoral students like yourselves. I've learned a lot from their dissertation. I consider that a part of my education as a teacher. Learning from doctoral students like you.

We noticed, for example, through the analysis of the course syllabi, that the instructors used different applications such as FLIPiT, such as in Dr. Cindy's class, in the syllabus, it states:

As the semester unfolds, we will gradually introduce additional technology tools and procedures (e.g., Google drive, Google docs, Zoom Pro accounts, Zotero, etc.). These apps and software tools will help us compile relevant content and collaborate to produce various academic products.

These online tools above were a crucial part of her online curriculum design.

Objectives and Benefits of Online Curriculum Design

Objectives of Online Curriculum Design. We understand that defining the purposes of online curricula is a major step towards intentionally achieving the learning outcomes of an online course. When instructors know their goals, it is easier for them to select course materials, contents, teaching techniques, assessment tools, and other essential features of online courses. Similarly, online courses should consider the importance of student motivation and engagement in online learning (Chiu et al., 2021). As Francis and Wormington (2019) claim, motivation and meaningful reasons for engaging in online tasks are fundamental for online students and a predictor for academic success.

In most scenarios, student motivation and participation are the most important reference points in choosing teaching strategies (Harré & Van Langenhove, 1999). This is also to say that instructors must keep in mind what their students' interests are and always view learner development as the first goal of online curriculum design. The authors also believe that course design is guided by course objectives and student learning objectives. For example, Dr. Ann discussed course objectives towards student learning:

The learning goals are for students to be able to hear others, to hear, to be able to listen, and to understand other perspectives. So I think it is critical, not just reading the Information, but being able to in terms of reading the Information

also to be able to feel free to ask questions, to express their concerns is even lack of support for a particular topic that there is my goal is for there to be a sense of trust within the group. So the people will know that what they are saying is not going to be; it will not be canceled because they said it.

The excerpt above shows how Dr. Ann emphasizes the importance of creating opportunities for students to participate in her classroom and have their perspectives validated. Based on this quote from Dr. Ann's interview, we notice how she is concerned with learner-centeredness.

The importance of a learner-centered curriculum is discussed by scholars (Clark, 2005; Hannafin, 2009). These scholars see the importance of designing curricula that are student-centered in both online and offline courses. When designing online courses, instructors need to align the course learning outcomes to students' learning needs. Dr. Ann's approach reflects her concerns with integrating the course content, which focuses on social justice, to the other essential principles of curriculum design for online settings. The course documents we analyzed also reflect how Dr. Ann is worried about utilizing tools in teaching social justice in a university setting. For example, the course syllabus states that students must read two books related to social justice. On the learning platform (Canvas), Dr. Ann also asked students to answer questions related to social justice.

The students who took Dr. Ann's class also expressed their thoughts concerning a student-centered approach in online contexts. One example is this comment:

Well, when Dr. Tom asked me to share about social justice in the classroom, I utilized teaching materials from an electronic textbook and could not provide paper handouts to the students because it was an online class, and I felt nervous about it.

Concerning her experience with online teaching, Dr. Ann also pointed out in the interview that:

I'm not a fan of teaching without seeing students because you don't get that personal connection. You don't see them interact with other students or with yourself. You don't see it there. There are expressions. There are motions. There are just things that are missing without actually seeing a student for some kind of combination of hybrid of real-time and other activities. But it is the real-time that becomes difficult because, like I taught a 3-hour class yesterday face-to-face, I was able to put my students in groups and talk and do different things. But when you do that online, as we have done with the meeting rooms, the teacher can't be there. They can only pop in and out of a certain room. There has to be some interactive platform that could be their lives.

Based on the above quote from Dr. Ann's interview, she values establishing personal connections and having student-student and student-instructor interactions in her classes. She compares her online experience to her offline classroom experience and detects different levels of student engagement. Her concerns with student participation were stated on her syllabus:

This course requires students to assume responsibility for analyzing class readings and other course content, identifying implications for heritage leadership, and applying those insights to class discussions and assignments. This class will hold one synchronous class session, i.e., a seminar discussion, per week.

As we explored in our literature review, student engagement is fundamental to online education (Sannino, 2009). It is also evident that approaches vary according to the design of an online curriculum.

Benefits of Online Curriculum Design. One of the benefits of online curriculum design is that instructors can choose textbooks and teaching content flexibly. Dr. Tom presented these comments in an interview:

So, if I'm teaching a software engineering class, the catalog says that I have to teach software testing after teaching the server. So, there may be external forces that tell me the kinds of topics I have to cover. I almost always have freedom in deciding how to cover those and in what order and what textbook. If I'm doing it as a team teaching, I find that in team teaching, it takes longer to design, and so, I have to start very early. It also turns out better. That is, it's easier for me to do it on my own.

This comment shows that online curriculum design will vary in how an instructor designs a course curriculum. Teachers integrate flexibility in online classes. This has proven more acceptable by the teachers in our research. Dr. Ann discussed this in the interview:

So, depending on the course, you don't have a choice, but you get the book or materials they want you to use. And then I kind of just branch off that. For example, I had to teach the first part of our history last semester online. And I wanted to have a theme through the course of how this notion of freedom and republican ideals, how did that go through the first hundred fifty years of American history, and did the country practice freedom for all of its people? And so, they have how they were contradictory with their methods, especially Washington and Jefferson, who owned slaves. You said freedom for everybody, and that's a contradiction. And then they had to analyze photos, the things that I think are more important than just maps and pictures of White people in the book. I have them read letters and speech and speeches and things like that. So I kind of look at important figures but tear those figures down and see what they're made

up of and why they did the activities that they do from writing. I've had kids make me a board game before my content. I take basic hits and then throw in what the real meaning of it is. And that's why I grab certain content to see what happened and what textbook authors want you to read.

Ann has mainly included the content that she would like to teach and the content that she would like the students to focus on. This could have been possible because of the online curriculum process, which is one of the benefits of online curriculum design.

Our data analysis has shown that instructors design online courses intending to facilitate instruction using the collaborative teaching and learning model by using many knowledge sources and objectives of online curriculum design and taking advantage of the benefits of the online curriculum design. Thus, online curriculum design heavily influences the quality of online education, and instructors must use the tools of online curriculum design constructively.

Findings Concerning Co-Teaching

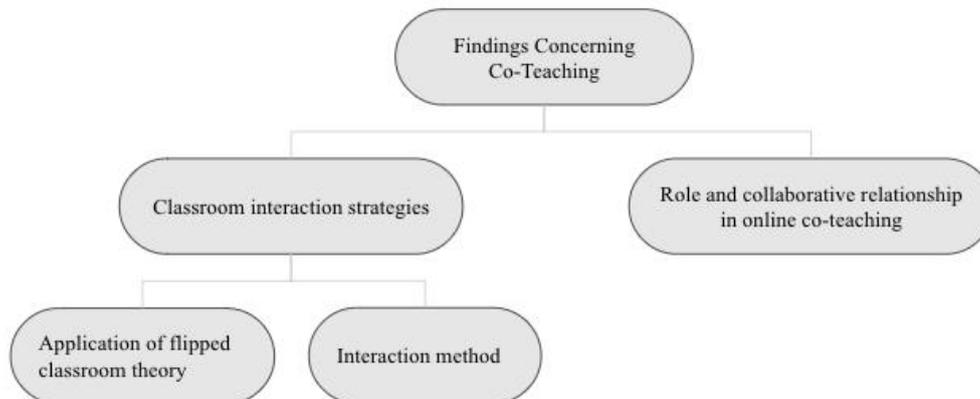
We conducted semi-structured interviews with four instructors who participated in online co-teaching through the Zoom platform, and collected and assembled the course documents. Analysis of the qualitative data revealed two themes in answer to the research question: "When instructors are co-teaching online, how do they use the collaborative teaching and learning model?" The themes are:

- a) classroom interaction strategies, and
- b) role and collaborative relationship in online co-teaching.

We discuss these themes in the following sections of this chapter. A summary of critical factors of online co-teaching is listed in Figure 4.

Figure 4

Findings Concerning Co-Teaching



Classroom Interaction Strategies

Classroom interaction strategy is a method for teachers to organize classroom activities (Tallent-Runnels et al., 2006). It includes how teachers organize teaching and methods adopted by teachers to promote classroom interaction between students and teachers. Due to various teaching methods, content, and purpose, in organizing classroom activities teachers adopt different interactive methods (Jones & Tanner, 2002). Teachers use classroom interaction strategies to promote students' learning ability (Suryati, 2015) and improve students' learning effect (Cahill et al., 2014) to achieve the curriculum objectives. Compared with traditional offline teaching and individual teaching, teachers need to develop unique online classroom interaction strategies so that all participating teachers and students can devote themselves to the teaching and learning process to achieve the course objectives (Tallent-Runnels et al., 2006). Teachers can also summarize successful classroom interaction strategies and form classroom practice models (Sulistiyani, 2020). The data under this theme reveal the classroom interaction strategies adopted by teachers participating in online co-teaching of Ed.D. program.

Application of Flipped Classroom Theory. Our research group was also interested in understanding how instructors used some of the strategies from flipped classroom approaches (Perera et al., 2020) to their teaching. Understanding how our research participants flipped their classrooms can provide insight into how instructors address the challenges and create solutions concerning creating the best learning opportunities for their students. In addition, understanding the instructor's strategies can support the work of other instructors who struggle with the novelty of online teaching.

The three syllabi and interviews that we analyzed provide evidence of how participants applied some principles of flipped classroom theory (Lage et al., 2000).

In Dr. Mike's syllabus, for example, within the classroom, students are more focused on proactive project-based learning, working together to gain a deeper understanding of local or global educational challenges and other educational realities. After class, students plan their own learning content, style, and way of presenting knowledge. Instructors adopt a collaborative approach to meet the needs of students and facilitate their personalized learning. In the interview, Dr. Tom stated, "I probably won't teach this in class, because students have already taught themselves by watching videos of the course before class."

According to the principles of the online co-teaching model (Crow & Smith, 2005), teachers no longer occupy class time to teach the knowledge in the textbook, and this method requires students to be more autonomous and independent learners. They also employ different academic skills. In order to be prepared for class, to cover the course content, and to address their own learning needs, students can watch videos, read the textbook, discuss topics with other students through the Internet, and refer to the materials they need at any time. Instructors alter curriculum to support different

learning strategies and attempt to scaffold their students' autonomy in learning; these are fundamental to flipping a classroom. For example, in Dr. Ann's syllabus, it reads, "Before class, the reading content needs to form thinking and summarize academic views. In class, use the way of speech to show the content of the lesson and discuss it". Dr. Lucy also makes a requirement through her syllabus, "Prepare to discuss self-directed learning experiences in class". Dr. Mike's syllabus also asks students to "Take online courses over the Internet".

The three previous quotes from the syllabi we analyzed inform students about the need to be prepared for class. However, we understand that it is very important that students be aware of what it means to be prepared and how to prepare for classes. Students may have different understandings of the role of the instructor as well as their own roles. Autonomy requires using a vast repertoire of learning strategies and academic skills (Suryati, 2015), and we consider that online teaching should be emphatic and explicit concerning what is expected from students, and how they can successfully fulfill those expectations.

If students are aware of what instructors expect from them, they can focus more on active learning strategies (Bishop et al., 2013), and instructors can utilize classroom time to individualize learning experiences. Flipping a classroom is a method of developing learners' autonomy, maximizing classroom time, and enhancing learner centeredness in online learning.

Interaction Method. Our analysis also focuses on how interaction takes place in collaborative online learning. Interaction plays an important role in collaborative teaching and learning. Instructors need to be aware of the importance and purpose of different classroom interaction patterns (Jones & Tanner, 2002). Awareness of different ways to create opportunities for learners to participate in collaborative

activities, or to interact with instructors and peers in the classroom, inform an instructor's decision on how to manage a course. Factors include how to present the course content, choose materials, and design tasks that will lead students into planning different interactive assignments and tasks in their course.

In the context of our research, instructors have great flexibility in the way they choose classroom interactions. In the interview, Dr. Tom stated:

I started thinking about classroom interaction when I designed this course. Before doing that, I need to determine the purpose of the class interaction. Students need to think actively. How can I engage them while still educating them? I tried to let them analyze photos, read letters, and make speeches. Sometimes, I change the topic of group discussion temporarily according to the students' listening status."

Dr. Ann found that some students were used to hiding in online collaborative courses. These students did not form good thinking habits or were not good at expressing their ideas freely in front of the public, resulting in only a fixed number of students responsible for speaking. In order to increase classroom interaction and help students deeply participate in teaching, Dr. Ann adopted classroom interaction strategies of constructing study groups and splitting the reading content. She shared her classroom interaction strategies in the interview:

I do not use discussion boards because I think it takes away from actual interaction with students. I also don't think much reading does any good. Students immerse themselves in it and have no time to digest and understand. I'd instead take a book, some reading material and spread it out over the semester so that students have enough time to interact with each other in class. Sometimes students like to hide on the internet, and they know some people will do all the presentations. The way to get them to interact is to break them up into small

groups, two or three at most, and then they have to talk. Occasionally, and this is after I've established a relationship with a student, I'll visit someone. I might say, Jane, I haven't been listening to you today. What's on your mind? However, I think the most effective way is to break them up into smaller groups and get them involved.

Dr. Lucy's also proposed building learning groups in her syllabus, to encourage students to actively participate in discussions. "Students need to participate in group discussions, issue reports in class, and use web conferencing tools. Running webcams in class is a 'friendly way' to attend class, and students need to participate in class discussions actively".

By building study groups of two or three students, students can't hide themselves during online lectures and promote interaction between teachers and students. In addition, splitting the large reading content can reduce the reading time of each study interval, reduce the difficulty and pressure of students' learning to a certain extent, increase the frequency and time of communication between students, and stimulate students' ability to think actively.

In Dr. Ann's syllabus, she requests "throughout the semester, you will be presenting your ideas to class members, both in small groups and to the entire class."

Dr. Mike also believes that by replacing big activities with small activities, every student can progress and get a good learning experience. His strategy is:

I think about activities that involve students. I try to provide them with textbooks and paper reading content and then test them to ensure that they are reading. I also provide many short videos to the students, which are five or six minutes long. I put some music in front and back to make it more interesting for the students and discuss it. I

try to design many group activities, not big events, and the students are in groups of two people.

Based on the quote from Dr. Mike, we also find that he insists dividing students into groups is conducive to promoting the interaction between students. Moreover, discussion after watching short videos can promote the interaction between students and teachers. Dr. Mike also made a more detailed description of group interaction: Divide students into groups that teachers can visit individually because you don't want groups to feel isolated. You want them to feel connected to the class and the teacher. But if you put three teachers and three students in a group, the students will shut up because they want to listen to the teacher. But if you have three or four students and a faculty member, sometimes they continue to talk and interact.

Dr. Mike's statement shows us that different ways to group students can affect the interaction between students and teachers in online collaborative courses. Furthermore, the effects of interaction vary with the proportion of teachers and students in the group.

As shown above, instructors have developed strategies to enhance classroom interaction. This is consistent with the literature review that creating an engaging online course requires educators to develop strategies to increase student participation and build a sense of community (Sharoff, 2019). The interviews clearly show the online classroom interaction strategies used by instructors, such as reading before class, watching videos, writing reports and holding group discussions.

Vygotsky's theory considers the social basis of human cognition. The notion of scaffolding is key to his learning model, as instructors, students, and others may support, or scaffold, an individual's learning to the next level. In the case of our study, for example, considering that English is not the native language of the Chinese

students participating in the Ed.D. program, Dr. Lucy chose the direct participation of students through oral presentations to promote interactions between native and non-native speakers of English. The interaction between domestic and international students scaffolded learning opportunities for both groups of students, and created learning opportunities related to content, language, and culture, among others. As Dr. Lucy described “I need to create opportunities for students to learn. I will make more use of student presentations and involve international students in the classroom.” This student-centered online classroom interaction strategy combined with the benefits of having international students in a classroom has not been sufficiently explored in previous research, and the fact that our research addressed this issue can be seen as an important contribution of our case study.

However, even when instructors co-teaching online have established an excellent collaborative relationship and designed and implemented flexible and effective classroom interaction strategies, they may still face some problems to be solved to achieve a successful online co-teaching (Jacobs, 2013). Analyzing the reasons why problems occur and taking preventive measures in advance can guarantee a better outcome of online co-teaching.

The COVID-19 pandemic has led to a shift to online courses. This change is challenging for teachers who have no previous experience in online co-teaching. However, as teachers gradually adapt to the online co-teaching mode, they can also obtain new teaching experience and master the new teaching model, a learning process to promote teachers to improve their teaching ability. Dr. Tom explained how he felt about changes after the pandemic, "The pandemic has had a considerable impact. Offline classes have been switched to online classes. As a result, we have been forced to change our teaching model".

Sometimes, students may not be able to turn on the camera in class for various reasons. The visual obstacle has become a trouble for teachers in online teaching. Dr. Lucy expressed her opinion:

I don't mind an online course if I can see the students' faces. However, teaching becomes harder when students don't turn on their cameras, show up or raise their hands to participate and pretend they are in class. That's why I have a friend who says, I don't believe in distance learning, and I believe in education. Or I don't believe in online education, but I believe in education.

Dr. Lucy clarified that successful teacher-student interaction was essential to ensuring the learning effect in online teaching mode. She suggested that if students turned on their camera, visual teaching would greatly improve the teaching effect, but the teacher might not force students to do so. Therefore, student participation is an uncontrollable factor in online co-teaching mode.

Online co-teaching is more dependent on information technology and equipment than traditional teaching models. Generally, such equipment and technical problems are more professional, and teachers may be troubled by this. As Dr. Ann described in the interview, "I loved the teaching process. The only problem I have met was a technical problem when the sound was cut off in the middle of the lesson".

The above excerpts show that in online co-teaching model, collaborative teachers have encountered problems. Some problems come from information technology, some from students' consciousness of classroom participation, and some from subjective consciousness.

In conclusion, classroom interaction is an essential link in online co-teaching mode, and the effectiveness of classroom interaction directly affects the smooth realization of teaching objectives. The study group approach is one of the most

common interactive strategies in the Ed.D. program. On the premise of realizing teaching objectives, the instructors who participated in the interview designed diversified forms of classroom interaction and employed targeted interactive strategies according to their students' characteristics, modes of online teaching, aspects of co-teaching, student pace of acquiring new knowledge, and other factors, in order to achieve the best teaching effect. However, participation in online co-teaching faces temporary challenges from IT technology, classroom organization, teacher experience, and other factors.

Role and Collaborative Relationship in Online Co-Teaching

Collaborative relationship refers to the role of instructors in online co-teaching and how instructors get along with each other (Hang & Rabren, 2009). Although there is limited evidence concerning students' attitudes towards collaborative and individual teaching, scholars believe that co-teaching is greatly beneficial to students (Dugan & Letterman, 2008). For instructors, if independent teaching is a solo, then co-teaching is a small chorus. Instructors who participate in co-teaching have different timbres and perform different parts in the process of collaboration. An excellent collaboration will make the chorus perform incisively and vividly. The instructors who participated in our research had much to say about the understanding of participant relationships in co-teaching. During the interview, Dr. Tom shared the thought:

I think the two things that you need between collaborative teachers are trust and respect, and you have to be able to trust and respect the knowledge and ability of other teachers to understand who they are and how they teach to make it work. So there should be adequate communication and planning between co-teachers. If the co-teachers do not like each other, please be aware that the students will see it,

and it will be very messy, and the rest of the study will not be easy. So trust and respectful communication. Otherwise, it will not work.

Dr. Mike's syllabus describes the relationship between collaborative instructors: "Teachers respect each other's teaching achievements, collaborate with each other and complete the teaching goal together." An essential element of co-teaching is trust and respect for each other's experience and methods. Dr. Lucy's syllabus states:

A fundamental principle for teaching and learning in this course is the open exchange of ideas in a climate of mutual respect in an academic environment where we can expand our horizons individually and collectively. We should be respectful of the experiences, approaches, and presence of our colleagues.

The statements show that trust, respect, and communication are essential elements in co-teaching, affecting the smooth progress of co-teaching. Collaborative instructors must establish a relationship of trust, respect each other's knowledge and abilities, understand each other's teaching habits, and even each other's schedules. Otherwise, the classroom will become a mess, and the teaching objectives will not be achieved.

Each teacher has his or her own philosophy of education or research. Instructors believe that co-teaching is typical work between participating instructors. Dr. Lucy believes that the teaching partners have an obligation to provide the necessary support to each other, including interrupting the other in class to make students understand what they are learning from different perspectives. Since the curriculum collaboration of the Ed.D. program is international, instructors need to look at problems from multiple perspectives and convey information to students, thus bringing more information to students and enabling them to learn more. Dr. Lucy shared her own

teaching story and expressed her understanding of the relationship between collaborative instructors:

I remember when I was working with colleagues in class, and I used to interrupt them. Because I want to add additional information, I believe that this spontaneity is essential because students will understand what they are learning from a different perspective. Also, because I'm international, I think I like to bring ideas from another environment. Everyone has their teaching philosophy or research philosophy, and my teaching philosophy is to open it up and embrace multiple perspectives. So, collaboration means it is very important to look at things from multiple perspectives, which I'm going to do.

In co-teaching, the relationship between instructors has two sides. Some work needs to be done together, and some work needs to be done separately. Therefore, collaborative instructors should be interdependent and independent. On the other hand, it is much easier for instructors to work together if collaboration is spontaneous.

When talking about this topic, Dr. Lucy stated:

Teachers have so many different things to do and teaching and designing lessons can become everyday activities. So, I think collaboration is necessary, and it is actively involved in every part of the process. Sometimes we can get together, plan together, and then you will come back with a mission. So, it requires both individuals and collaboration.

The collaborative climate and the compatibility of teaching styles between the collaborative instructors are important. Instructors believe that to achieve successful collaboration, the first step is to determine whether the instructors are compatible with each other. Dr. Ann describes her relationship with the collaborative teacher as follows:

I can't say that online courses are suitable for everyone because everyone has different styles and topics. However, for me, the most important thing is to create an atmosphere of collaboration. Even though it's online, students can still detect whether teachers are collaborating.

The statement shows that instructors need to find out what they are best at and how they feel most comfortable teaching. Dr. Ann also reminded the researchers that the collaborative relationship between instructors has a great impact on students. Although the course is online, students can still perceive whether the collaborative teacher is collaborating.

Collaborative instructors learn from each other and use their advantages to fully contribute their respective values to the teamwork. Dr. Mike compares the co-teaching relationship to the marriage relationship. In order to achieve exemplary teaching results, both parties involved in the collaboration need to work with each other and play off the other's strengths. He stated the relationship between collaborative instructors as follows:

I think everyone has their blind spots in teaching and has their strengths. In my collaboration, I will emphasize strengths, and avoid personal weaknesses. I think you should have confidence in your abilities, but you also have to be humble and realize that other people have their strengths. I think any two or even three people can make a good team. But it's not a match made in heaven. It's that people have to strive to be good partners. It's like marriage, no matter who you are. You decide to get married, start making yourself a good partner, and have a lot of work to do.

Dr. Mike also believes that: "One way to teach collaboratively is to teach as a team. There is a different approach to each teaching, which is to put together a team and have one person clearly lead and take the lead".

The statements indicate another point of view of the participants: in teamwork, instructors are not only colleagues, but also leaders and subordinates. Each course should have a teacher who is mainly responsible for it, namely the course leader. The leader should play a role in promoting the progress of the course in co-teaching.

The above excerpt shows that the four interviewed instructors and the teaching documents respectively elaborated the division of roles and collaborative relations among instructors participating in the collaboration from different perspectives. A successful co-teaching project needs to highlight the collaborators' teaching styles and professional advantages, followed by the degree of tolerance between instructors. It is also necessary to determine the master-subordinate relationship between the collaborators.

However, online co-teaching has a high requirement for the tacit understanding of instructors. If each partner feels comfortable, collaborative instructors need to spend ample time considering their contributions and compromising with each other. This kind of time and energy consumption will be a considerable investment for individual instructors. Dr. Mike also mentioned this topic in the interview:

It takes more time for collaborative teachers to compromise and collaborate, which is a big investment, right? It is a big investment of time. I think that's probably the biggest problem. An excellent team working together is like you are doing the waltz. We talked about it before. It takes a lot of time to get used to each other. It is expensive to do much co-teaching, and it's more efficient to have one teacher in charge of a class.

The statement shows that online co-teaching can produce good results for both universities and individual instructors, but it is expensive and sometimes not as efficient as one teacher teaching alone. Dr. Mike believes that this cost issue may be the biggest obstacle to the widespread implementation of online co-teaching in the future.

According to the literature review, students express their preference for co-teaching, for they could access more help and attention from two instructors (Gerber & Popp, 1999). However, our research shows that only strong collaboration of instructors can make an online collaborative classroom work smoothly. In the online teaching mode, collaborative instructors should find each other's best research directions on the premise of trust and respect, and there should be a clear division of teaching between instructors. Therefore, in the online co-teaching mode, instructors should understand each other, communicate, and tolerate each other. In addition, it is also essential to heed their professional advantages. However, cost and efficiency factors may make online co-teaching unable to be promoted smoothly and comprehensively.

Findings Concerning Online Collaborative Learning

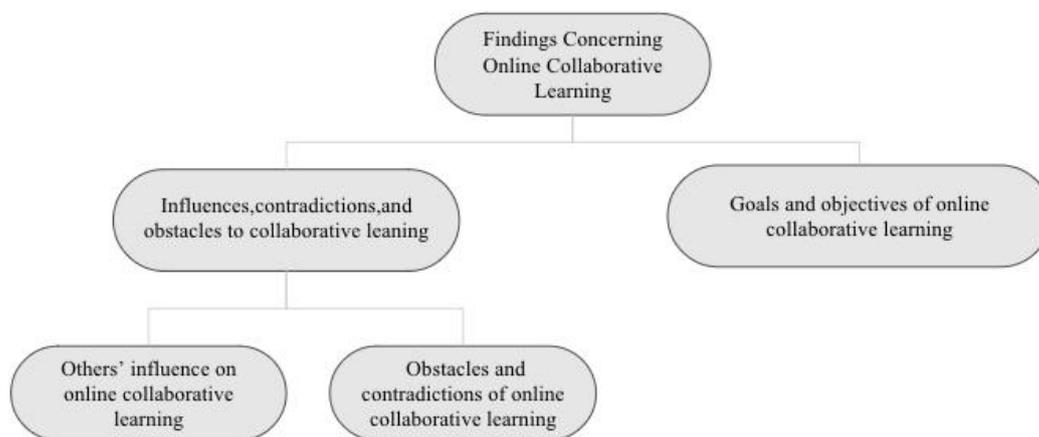
The data of our qualitative research method has shown that students have used multiple ways of collaborating with one another in their experience with online learning. As a result, we have identified these themes related to online collaborative learning:

- a) influence, contradictions, and obstacles to collaborative learning, and
- b) goals and objectives of online collaborative learning.

The themes that we identified reflect our critical reflection concerning the data retrieved from the students' answers to the questionnaires and course documents. A summary of how students build learning communities is listed in Figure 5.

Figure 5

Findings Concerning Online Collaborative Learning



Influences, Contradictions, and Obstacles to Collaborative Learning

Others' Influence on Online Collaborative Learning. The first theme of people's influence on online collaborative learning was generated by analyzing the student questionnaire (see APPENDIX B).

Multiple participants reported that based on their experience on online collaborative learning, the people they are working with influence their learning experience and outcomes. Most of the participants collaborated in classroom tasks with the same peers in their dissertation groups. However, mentors, instructors, graduate assistants, and students outside of the cohort also influenced how the students used collaboration in their learning experience. One relevant finding in analyzing students' answers to the questionnaire is related to English as a medium of instruction and communication in collaborative tasks. For example, Lily shared in her response:

The English language listening and speaking, in the beginning, is the best challenge for me. I kept practicing in my spare time and also attended many conferences to examine my skills. Yes. After meeting several times, I have changed a lot. Through communicating with others, expressing my feelings and ideas, they have changed. This is a story of a collaborative design that I think worked well with this summer course.

Lily's answer reveals that although she had to overcome some challenges related to her proficiency in English, she benefited from collaborating with her peers. She acted as an independent learner and used different strategies to improve her communication with students. For example, she attended conferences and practiced by herself, and the multiple experiences using English in her classes led her to conclude that collaboration was a successful experience.

In Dr. Mike's syllabus, it was stated that:

This course will foster depth of understanding, skill in asking questions and envisioning solutions, and creativity in making meaning and facilitating transformative experiences. We will seek to "open up rather than close history".

It has been made clear that communication and exchanging ideas have enhanced the online collaborative learning experience. Students have come up with ways to form effective collaboration, but they also need guidance and help in communication skills.

In one of the materials from instructors, it is required that:

As a professional, teaching practice is a significant, sometimes deeply personal aspect of our lives. To explore individual teaching practices in a group, mutual trust and respect are crucial. A fundamental principle for teaching and learning in this course is the open exchange of ideas in a climate of mutual respect in an

academic environment in which we can expand our horizons individually and collectively.

This shows teachers' expectations for students to work collaboratively and communicate because online corroborate learning could lead to academic success.

Obstacles and Contradictions of Online Collaborative Learning. We generated the theme of barriers to online collaborative learning based on the question-and-answer part of the questionnaire and documents. Many students report to have multiple obstacles in online collaborative learning and have developed numerous ways to facilitate online collaborative learning. Lucy said in the questionnaire: My biggest challenge was staying focused in class and not being distracted by my home environment. I tried to solve this by going into a quiet room and taking lots of notes. It's online, and it's hard. It's easier to think for each other face to face. Using zoom, everyone acts less humanely. It feels distant because when no one opens the camera, it doesn't feel very collaborative.

Students had to deal with different kinds of obstacles and challenges in online collaborative learning. However, to stay productive and motivated, students have shown to be very resilient and optimistic against these challenges, apart from challenges.

Contradiction against groupmates has flown to the surface too. There are many kinds of contradiction could have within a group that's working on a collaborative co-authored dissertation, why could disagree with the main topic of the dissertation, some have problems with each other's writing style, some has different work schedules, and some groups could have had different expectations on when to graduate. Jerry shared his experience in the questionnaire:

Biggest challenge is how to deal with the contradictory thoughts and ideas among

the group members. Usually, we discuss these thoughts on the table, share opinions, and then achieve agreements on the issues or problems. Emotional changes always get along with the status with collaborations with the group members. For instance, if each member is responsible, respectful and reliable, and does their parts of work, I would like to participate in collaborative learning all the time.

It is reported in the questionnaires that despite these contradictions in online collaborative learning, students are still willing to participate in online collaborative learning when group members are working responsibly, respectful and reliable.

Our data reflected that student built online learning communities when learning experiences emanate from the collaborative teaching and learning model by influencing each other in online collaborative learning, working against obstacles, and solving contradictions of online collaborative learning. Thus, building online learning communities is crucial for online education as a whole model with many interactive functions. Furthermore, these parts highly influence each other in many perspectives, such as learning outcomes and learning abilities.

Goals and Objectives of Online Collaborative Learning

We generated the theme of goals and objectives of online collaborative learning based on the course materials and questionnaires. Dr. Tom said in the interview:

Mostly the learning goals. And again, it's because of the subject matter, social justice. The learning goals are for students to be able to hear others, to hear, to be able to listen, and to understand other perspectives. I think it's critical, not just reading the Information, but being able to in terms of reading the Information to also be able to feel free to ask questions, to express their concerns is even lack of support for a particular topic that there's my goal is for there to be a sense of trust

within the group. The people will know that what they're saying is not going to be. It's not going to be canceled because they said it.

This has shown that the goals and objectives of online collaborative learning are changed and influenced by the purposes of the class. For example, this particular matter is social justice. Since this class is based on social justice, it also changes the main focus of the online collaborative learning between students and impacts online collaborative learning.

In one of the class documents, it states:

This course will foster depth of understanding, skill in asking questions and envisioning solutions, and creativity in making meaning and facilitating transformative experiences. We will seek to "open up rather than close history" (Caruthers, 2007). We will strengthen our knowledge of self through an examination of blind spots, bias, responsibility, and commitment. We will explore the intersectionality of justice, equity, voice, and agency for diverse audiences and communities. We will overlay ecological and human systems, revealing layers of historic trauma, oppression, colonization, degradation, restoration, and healing truth. We will examine underlying mechanisms, including the structural basis of racism, hegemony, and privilege. We will seek to define democracy, exploring the antecedents and contributions of knowledge systems, pluralism, and participatory culture to freedom.

These requirements undoubtedly change students' online collaborative learning because due to these requirements, students must engage well with one another and work closely together to achieve academic success.

Findings Concerning Online Assessment

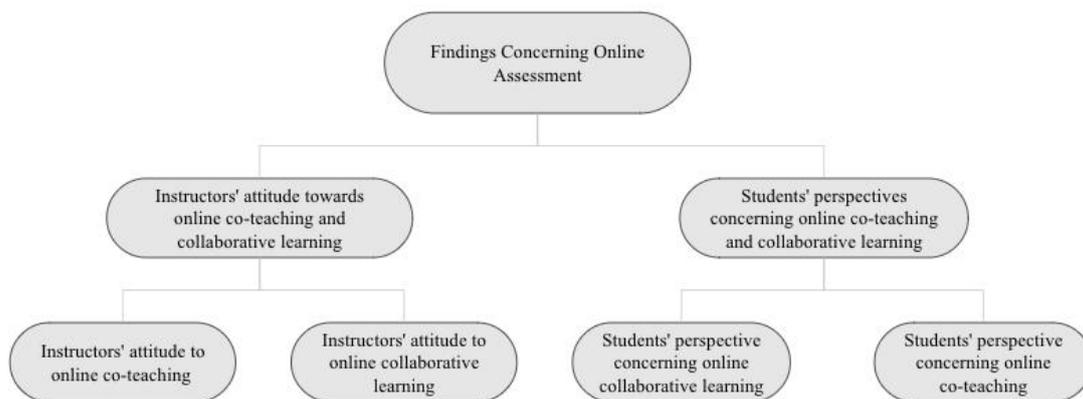
Two themes presented from the data of online assessment:

- a) instructors' attitudes towards online co-teaching and collaborative learning, and
- b) students' perspectives concerning online co-teaching and collaborative learning.

These two themes answer research Question 4: How do instructors and students evaluate the online collaborative teaching and learning model? A summary of the findings of how instructors and students evaluate online assessment is listed in Figure 6.

Figure 6

Findings Concerning Online Assessment



Instructors' Attitude towards Online Co-Teaching and Collaborative Learning

Instructors' Attitude towards Online Co-Teaching. Understanding instructor's attitudes concerning co-teaching is important because we can gain insight into the experience of instructors and provide feasible measures for better development of co-teaching.

Of the four participants, three of them claimed that having an excellent relationship with the co-teaching instructor is essential. One of the participants said

that inviting an expert to come in and deliver a presentation is valuable. Three instructors think if co-teaching is required, norms need to be defined in advance. Three instructors talked about their feelings concerning co-teaching. Two instructors offered their opinions on co-teaching methods in the future. Those are the instructors' perspectives concerning online collaboration.

A Good Relationship with the Partner is the Foundation for Co-Teaching.

When talking about the perspective of co-teaching, Dr. Lucy felt the co-teachers need to be compatible with each other. "If you get the right teacher together, you can just have a great experience. I mean the relationship with that instructor. Positive relationship with it." When Dr. Ann co-teaches with the people she does not care for, she stated, "I need to find a balance with the people I do not like." Otherwise, she continued "with people I got along with very well within the collaboration project, we could bring the craziest ideas." Dr. Mike compared the co-teacher as the partner in dance and compares the collaboration to a waltz:

It's a beautiful dance. The best collaborations are wonderful dances where you have to know your partner. Now I'm not a good dancer, but I know enough about dancing. I'm talking about waltz and dances where you have to work together. It's beautiful and it's particularly beautiful. If you can do it fast and you can, you can do innovation. You can react to each other. Because if you're not comfortable with each other, it can be very awkward. And the students will sense this discomfort. Whereas the dance is graceful if it becomes far more interesting than a solo dance.

Those three reflections show that instructors believe that good relationships play a vital role in developing online co-teaching. They are the prerequisite for all effective collaborative development and the basis of co-teaching.

Inviting Experts to Come in and Do the Presentation is a New Form of Co-Teaching. By inviting experts to deliver lectures for an online class, the guest lecturer involved in co-teaching is not a teacher who regularly attends the class. This can be seen as another way of co-teaching. According to her experience, Dr. Lucy mentioned what she did in the past:

What I've done in the past is to invite people to come in, who might have a specialty, to come in and do a presentation to teach a course. If the course is my course. I know that there are people who have expert skills, so I will invite those people to come for a class session. I think that's valuable.

Dr. Lucy is the only instructor who mentioned this kind of co-teaching. Maybe other instructors also use this activity while teaching online.

Defining Norms in Advance is Helpful for Co-Teaching. Three instructors believe that before starting co-teaching, it is necessary to formulate some essential rules for developing collaboration. This would be conducive to teaching work. Dr. Tom gave an example: " One teacher might give an overall directive and instruction and the other one can break it down for them in the simplest step. " Dr. Lucy believed that: "If you are obliged to collaborate, then it's important to define those norms. Remember those norms of expectations." When talking about co-teaching, Doctor Mike told us about the preparations he and his collaborators had made before the course started: " We talked about it before, it takes a lot of time to get comfortable with each other." In a word, through those statements, we found that before instructors start co-teaching, they think it is necessary to formulate collaborative rules and to understand and communicate with co-teachers.

The Feelings Concerning Co-Teaching are Complicated. When discussing the personal feelings of co-teaching experience with the Chinese cohort in this Ed.D.

program, instructors use different words. Dr. Lucy expressed it as, "That was one of the best experiences I've had." Dr. Ann explained: "I like to just say that for me, it's fascinating to imagine that it's like an international scholar, teaching Chinese students, in the United States." Dr. Mike reflected on co-teaching as "is interesting for me. It's more interesting for the students." In short, in the process of describing personal feelings, the instructors offered positive comments. These demonstrate that the instructors have a positive attitude towards the completed co-teaching courses.

Inspiration and Trends of Online Co-Teaching Methods. The instructors shared their opinions on the inspiration brought by this teaching method and some thoughts about the trends of co-teaching. Dr. Ann would like to continue to use a co-teaching method in her future work and give out her reasons.

I think I will continue teaching what I believe in classrooms that are like US, Chinese from China class, that we could have students from two different countries collaborating in the class. And why is that I think that the students we'll get tired of the structures, but they never get tired of their colleagues. So I think that interacting with other people from others and other contacts and other countries is more motivating.

Dr. Mike shared some of his concerns about the future of co-teaching:
My honest answer is that it's not going to happen as often as it has in the past because universities are trying to spend less and less money. It's costly to have a lot of collaborative teaching. It's more efficient and it's cheaper to have one person in charge of one course and the more students the better. So that's my realistic answer. I am afraid that you're going to see fewer and fewer courses taught with multiple factors.

Instructors' Attitude towards Online Collaborative Learning. When talking about online collaborative learning, instructors shared their point of view from three aspects, which are assessment methods, the qualities the students should process, and the some general perspectives.

Assessment Methods. All four interviewed instructors offered their opinion concerning assessment methods. Regarding how the assignments are completed, all of them mentioned group work. Among them, Dr. Ann believed, "Most of the time it's like a group. Great. Why? Because all the tasks that I see are designed for students to learn and not necessarily to prove anything." Dr. Tom proposed a more specific assignment ratio, which is "you're going to give 50% on your group work, and then 50% on your individual work."

Regarding the assignment ratio, Dr. Mike' assignment method is different. His method is described as "I make that group grade a serious part of their eventual semester grade about a third. But the other 2/3 is completely individual. So if students hate the grade they got with their group, they can still do pretty well if they are great on the other 2/3."

These instructors have their own experience in arranging students' homework, and the assignment ratio of the group learning part also differs. Regardless of the percentage of group work that the instructors arrange in students' assignments, generally speaking, in the evaluation process of group learning, the use of group work to complete the assignment is an evaluation method used by instructors. This is in agreement with the three factors mentioned by Swan et al. (2006) that influences evaluation and collaboration.

Since the course schedule is completed before the start of the course, the assignments that students need to complete each time have been clearly indicated in

the syllabus. However, in terms of homework, the instructors still said that they would make changes to the homework content during the semester. Dr. Tom said, "I kind of let current events and the world and my students help guide me and I do that through discussions and debates and their writings and see what I need to change into it and move from there." Dr. Mike changed the teaching content according to the situation of the students. Here he describes the pre-test method. The specific approach is as follows:

We certainly reacted to what we saw in those first drafts of the first chapter. The assessments were very much telling us what we needed to do with the rest of the semester. In software engineering, it's not. There's one thing I do at the beginning of a semester with a program, an individual programming assignment. And then as a programming assignment with pairs, and based on that, I may decide to give some tutorials in a program that I thought the students coming in should already know. But if they don't know it, then I have to. I have to change it so early in the semester.

In assessing student performance, instructors hold different views. Regarding group learning, whether the group members should be given the same grade or different grades, the instructors offered various answers. Dr. Lucy thinks the group members should be given different grades:

Each person, even if they're working in small groups, would get an individual grade. As they're working together, checking in things and any questions, who has a problem with one particular piece? It may be, let's say, let's say that all four of you are in a group, you've worked on different parts of the project. You'll get an individual grade, but the grade might be the same grade. It may be that each one of you guessed a great one. Not the group gets great.

As for Dr. Mike, he shared other opinions and he insisted on giving the group members the same grade:

I put people into groups one way or the other. Then I say to the group, everybody in this group is getting the same grade. You better work together, because your grade is going to depend on what everybody does, whether you like it or not. You better try to get along.

Through the above discussion, we found that the evaluation methods adopted by the instructors have their own merits, and everyone gave reasonable reasons for evaluation based on their own experience.

The Qualities Teachers Think Students Should Possess in Evaluating Students.

The instructors believed that compared with undergraduate students, graduate student requirements and evaluation standards should be higher. Therefore, when assessing graduate students, they think the characteristics that graduate students should possess are different. Dr. Ann shared her opinion about this topic:

In our syllabus, we include the assignment, bricks, um, and there, you'll find the specific criteria for affecting students' performance. Again, it will be different for underground and grand students. I think it's very important. It's very important because graduate students should be autonomous, responsible, and motivated. Because nobody is forced to go to graduate school, right? So you are, if a person chooses to go to grad school, even college, but graduate school, it's because you want to learn, you need to be open to learning.

Instructors' Perspective Concerning Online Assessment. Instructors shared some of their personal views on online assessment. Some points of view are similar, and some aspects are different. For example, Dr. Lucy and Dr. Mike believed that there is no universal standard at the stage of postgraduate education. Dr. Lucy said,

"There's not a specific standard. Dr. Mike expressed the same view, "There aren't any universal standards. I make them up. We don't have standardized tests." According to their points of view, we believe that the instructors themselves set the evaluation system for doctoral education.

In addition, regarding online assessment, instructors also shared some personal views and experiences that are different from other teachers. Dr. Tom supposed he would use various ways to assess the students. "With different learning styles, you have to have different learning access. You can't assess everybody the same way and have a variety of ways to assess them in group work and creative group work is one of those ways." Dr. Ann prefers to not judge the students by grades. "So for me, there is, if I couldn't, I would live in the world without grades. When my undergraduate students ask me about grades, I feel so disappointed because they should ask me questions about content. I wish you didn't have any grades anywhere in the world." Dr. Mike shared his story about how the assessment technique forces the students to study.

That's an assessment technique. That's mostly to enforce the idea that people took it. I don't check to see how they're doing and try to change my teaching. It's a book. You read the book, you don't read the book. It's kind of a discipline for the students to keep up with the reason. I think assessments can have different purposes. And the purpose of getting in the first version of chapter one is to find out how they're doing it. Change is teaching to make sure that they get better at what they're weak at. This other kind of assessment is really saying you better do this. This is a stick, right? Or a carrot. If you don't read the chapter, you're going to get beaten with this stick. You're going to get a bad grade.

Regarding the evaluation of online collaborative learning, every instructor has their own experience. Many of them have similar or identical views, and there are also unique experiences based on their own experiences.

Students' Perspective Concerning Online Collaborative Learning and Co-Teaching

Students' Perspective Concerning Online Collaborative Learning.

Concerning online collaborative learning, the students discussed three aspects, including the difficulty of group learning and methods to solve the challenges, factors to achieve a successful group learning, advantages and disadvantages for group learning, and whether they prefer group learning or independent learning.

The Difficulty of Group Learning and Methods to Solve the Challenges. The students admitted that they had encountered problems in the process of collaborative learning. In summary, there are three kinds of issues. In response to these three problems, the students also provided corresponding solutions to the issues.

The first problem is that in the process of group learning, students often have disputes because they have different ideas. Lily claimed, "Arguments and disputes exist in online collaborative learning. Disputes are always there because every person has their own thoughts, ideas, and opinions."

The second difficulty encountered by the students is related to a lack of efficiency in working together. This means compared with learning independently, they think group learning requires them more time because of having extra Zoom meetings with group members. In fact, some of the inefficiencies in the second problem are also caused by the first. Disputed issues need to be resolved in order to continue work, so there will be low efficiency. Angela explained another reason for the inefficiency of group learning: "Sometimes I feel that team members are off-topic. It's a waste of others' time."

The third problem is caused by low engagement of team members. This is described by Jack, "In every group there are probably people who do nothing and share credit." These group members delay the group work and find reasons and excuses not to participate in group discussions. When the deadline for the assignment is reached, other group members have to work together to complete the part that should belong to them in order to hand in the work on time.

In response to these three problems, the students gave suggestions for solutions. Regarding the first question, Lily shared:

To solve this problem, we need to respect each other, listen to each other, and find helpful and useful information to solve the problem, and achieve an agreement on the disputes. Disputes are always there because every person has their own thoughts, ideas, and opinions.

For the second problem, the group members talked about topics unrelated to learning during the meeting, which led to the low efficiency of group learning. Angela offered a solution. Her method is

Normally, I do respect others' time and try my best to make myself clear in a short time, and sometimes when I feel that team members are off-topic, I will remind them in a gentle way. But there is always someone who would consider my reminder as a disrespect, in that case, my strategy is to talk to that guy in private.

Regarding the solution to the third problem, Jack's point of view was to ignore the lazy group members and continue to complete the assignments assigned by the teacher: "The easiest solution is just doing the task and move on."

Factors to Achieve a Successful Group Learning. Only by deeply understanding factors influencing online teaching evaluation can instructors improve

online collaborative teaching methods, improve the efficiency of teaching, and produce good teaching effects. Based on three years of the group learning experience, students gave their views on the factors that contribute to successful collaborative learning. Among them, Lily thought a "respectful and reliable relationship" is an important factor. Angela supposed "proper method, comfortable environment, stable connection" are the three factors. Alice claimed that to "read and think deeply and individually at first" are necessary. Emma listed: "active attitude; energetic; take more responsibility; working hard; communicating skills." Jack said, "determination to finish a task alone" is a factor for his/her successful group learning. The answer given by Rose was "patience and open mind."

The above viewpoints are different, and we have not classified and summarized those points of view. Instead, we believe that combining these viewpoints constitutes all the factors that influence successful collaborative learning.

Before we discussed the factors that influence students to achieve a successful group learning, we analyzed instructors' views on co-teaching. In that section, the instructors have some of the same ideas about collaboration with the students, and they also mentioned good relationships. Therefore, we believe that the foundation for effective collaboration, whether it is co-teaching or collaborative learning, is a good relationship between and among members.

Advantages and Disadvantages of Group Learning. The students provided their views on the advantages and disadvantages of online group learning. In summary, the students listed three advantages and three disadvantages. The first advantage is that they believe that by learning in a collaborative way, they can be inspired by other team members, thereby gaining new inspiration and learning new knowledge. Lily stated, "This learning pattern gives me the chance of learning from other members."

Angela echoed the same idea, "The advantage of group learning is you can be inspired by others." Alice added, "The group work could engage me and get to know other views that inspire me sometimes."

The second advantage is that as a team, group learning can save time in some cases. Everyone can undertake learning tasks together, and they encounter the same difficulties together. Tom mentioned: "time-saving." Emma felt when doing group work, the group members "can face the problem together." While Jerry shared the same opinion, he answered, "Everyone works together, and we don't have to take everything on ourselves."

The third advantage is that through group learning, the ability and skills to communicate with others improve. Lily told us that group working could help her to "practice communication skills."

As for the disadvantages of group learning, one of the shortcomings of collaborative learning that students mentioned most are the relationship with the group members. Angela stated: "Sometimes it is hard to get along with everyone." Emma thought there are "a lot of disagreements" and Jack said there are "too many ideas." When they face people with different opinions, they may disagree and find it difficult to reach an agreement. This echoes the difficulties in group learning discussed earlier.

The second shortcoming of group learning that students talked about is the freedom in learning. Students think that group learning will limit their individual rhythm, or schedule, of learning. Some group members learn at a fast pace, and some group members like to delay completing assignments. In this way, co-learning with others leads to an restricted pace of learning. Lily thought group study means "less freedom." Sometimes the students need to work with different group members for

various assignments. Jerry told us, "Sometimes the pace may go a little too fast, or a little too slow for my level."

The last disadvantage mentioned is the lack of self-reflection with group learning. Regarding this disadvantage, only Lily talked about it.

Group Learning or Independent Learning? In the case of a choice between group learning or independent learning, the students made a total of three choices. Four of the seven students chose to study independently. In other words, compared with cooperative learning, 57% of students are more willing to study independently. Two of the seven students believe that both group learning and independent learning are needed. Lily said of completing assignments, "sometimes independently, sometimes in groups " is an excellent way to study. Only Rose believed that she could not choose whether she prefers group study or individual learning because it really "depends on the assignments."

Students' Perspective Concerning Online Co-Teaching. The students shared their opinion about co-teaching from their perspectives which include the benefit of attending a co-teaching class, advantages and disadvantages of co-teaching, improvements should be done in a co-teaching class, and their likeness of using co-teaching in their future career.

The Benefit of Attending a Co-Teaching Class. Students believe that in a classroom where two instructors are teaching together, they can bring their unique teaching styles and offer more perspectives to inspire students better and meet requirements of different students. As Lily said, "Students learn knowledge from two teachers at the same time." Angela stated a similar point: "Different teaching styles can fit different students' needs. Students could experience a different teaching style."

Advantages and Disadvantages of Co-Teaching. The students discussed two main advantages. They believe that one advantage for students is that they can learn more; that is, they can learn knowledge and opinions from two teachers at the same time. This point of view we have already discussed as a benefit of attending a class of co-teaching. For teachers, when co-teaching, one teacher's teaching content can be supplemented by another teacher. Second, co-teaching can save time. One teacher can take a break while another teacher is teaching. Rose said, "Teachers could take a break during the class." Lily talked about the issue of complementary teaching content, she said co-teaching could make the teachers "complementary to each other's teaching style and content."

When discussing the disadvantages of co-teaching, three of the seven students thought that co-teaching had no disadvantages. The remaining four students analyzed the possible disadvantages of co-teaching from a teaching perspective. Emma supposed that: "It's hard work to collaborate with another teacher and make an agreement on the goals." The students' worries about collaboration are reflected here. Jack made his point of view clear: "Co-teaching is harder when teachers do not share teaching philosophy and do not communicate after class. If teachers do not communicate after class, separate and fragmented instructions are made." Jack's point of view reflects his concerns about communication.

Improvement Needs to Be Done in Co-Teaching Classes. Regarding the areas that need improvement in a class that is co-taught, three of the seven students thought that there was nothing that needed improvement. Another student said that he had no idea. The remaining three students gave their opinions on areas that need improvement. Lily suggested that the co-teaching teachers need to "design the class for more beneficial and avoid redundant information." Alice considered teachers

should "accomplish the teaching goal perfectly." According to Emma's opinion, "Each instructors' job needs to be more specific." Those three students gave suggestions for improvement in co-teaching from the above three aspects.

Likelihood of Co-Teaching in the Future. The students who filled out the questionnaire will become teachers in the future. Therefore, after experiencing the teaching mode of co-teaching, we wanted to explore whether the students plan to engage in co-teaching in their future teaching work. Six of the seven students gave affirmative answers. Only one student says she probably would not co-teach in her future work because she thought, "It's really hard to make an agreement with her partner" when co-teaching. Rose supposed that she would "very likely" use the co-teaching method, while it still "depends on the school policy." Emma would like to utilize this teaching method and offered three reasons: "First, it's a good way to teach. Second, I think it is beneficial for students to learn. Third, it's a new method for us to apply in our educational background in the future." Jerry also gave an affirmative answer, while he also expresses certain concerns. "I think it would be nice to use co-teaching in the future. But, I don't think it is very popular or expected in China. These points of view are worthy of our in-depth consideration.

Chapter Summary

We started Chapter 4 by summarizing our research method, in order to contextualize how we identified the themes that guided our analysis and discussion. Then, we discussed our research findings. Our discussions covered the experience of instructors of co-teaching and curriculum design. In relation to co-teaching, we discussed classroom interaction strategies and the role and collaborative relationship in online co-teaching. Concerning curriculum design, we discussed the knowledge sources, the objectives, and the benefits of online curriculum design. We also

discussed instructors' attitude to online co-teaching to online collaborative learning. In relation to students' perspectives, we discussed how different people influence student motivation and attitudes toward co-teaching and online collaborative learning. We also focused our analysis on student recommendations for collaborative online learning. Finally, our findings included the participants' reflections on the goals, objectives, obstacles, and contradictions of online collaborative learning.

CHAPTER 5: DISCUSSION

Introduction

This chapter offers the discussion and interpretation of the research findings, the answers to our research questions, and how our findings relate to the theoretical framework. The chapter also addresses the limitations of the study, the implications of

the study for theory and practice related to collaboration in online education, as well as recommendations for future studies.

This research was a case study of an Ed.D. cohort that employed online collaborative teaching and learning practices as a teaching approach. We addressed the following four aspects related to online education: curriculum design, co-teaching, collaborative learning, and online assessment through the lens of the current theories that inform online teaching and learning, such as flipped classroom (Perera et al., 2020), constructivism, co-teaching model (Crow & Smith, 2005), collaborative online learning (Jones & Tanner, 2002), and assessment strategies (Crow & Smith, 2005), which gave us the grounds to answer our four research questions.

This research utilized a qualitative research design that examined multiple data sources, including questionnaires, interviews, and class documents (artifacts) from UMSL. Our findings show that collaborative online education strongly impacts the quality and the outcomes of students' academic success and motivation.

We generated our research questions from our understanding that collaboration and co-teaching are two widely used strategies and teaching models in university settings. We also discussed the use of co-teaching in online environments in this research. However, co-teaching in online environments when compared with traditional teaching methods may prove challenging; face-to-face classrooms deal with the challenge of providing students with timely feedback, an issue even more challenging in online classes (Burns, 2019). In addition, our research demonstrated that co-teaching in an online environment shows low efficiency in maintaining students' focus on classroom processes and teaching materials (Cloonan, 2019).

Findings

An initial objective of this project was to analyze four research questions that focused on curriculum design, co-teaching, collaborative learning, and assessment.

The research questions are:

- a) How do instructors design online courses with the aim of facilitating instruction using the collaborative teaching and learning model?
- b) When instructors are co-teaching online, how do they use the collaborative teaching and learning model?
- c) How do students build online learning communities when learning experiences emanate from the collaborative teaching and learning model?
- d) How do instructors and students evaluate the online collaborative teaching and learning model?

In the following paragraphs, we will discuss the findings of each research question:

Research Question 1: How do instructors design online courses with the aim of facilitating instruction using the collaborative teaching and learning model?

The first research question relates to curriculum design in online courses, understanding how instructors design online courses that encompass collaborative teaching and learning collaboration in online settings. In order to assess their curriculum design, our interviews with instructors focused on three major themes: their experience and scientific knowledge of online curriculum design, their objective when designing their online curriculum, and the benefits they identified in online curriculum design. The most important relevant finding in the analysis of this question is that the sources of knowledge about online curriculum design come from numerous sources, and the objectives of online curriculum design have a positive influence on online learning experiences. Concerning the sources of curriculum

design, we found that the institution provided various resources and assistance for instructors to learn how to develop curricula for online instruction. We also learned that instructors have autonomy in deciding how to design their courses. Regarding the definition of goals for online curriculum design, the interviews revealed that instructors made decisions based on a student-centered approach. This way of designing course objectives is more appropriate to the development of online courses. Finally, concerning the benefits of online curriculum design, our data revealed that instructors understood that collaboration in teaching and learning is a powerful approach to positively impact students' learning.

Research Question 2: When instructors are co-teaching online, how do they use the collaborative teaching and learning model?

The second question in this research aims at investigating how instructors who co-teach in online courses use the collaborative teaching and learning model. Regarding the process of co-teaching, we have identified that classroom interaction strategies and collaboration play a major role in online co-teaching. The analysis of this research question indicates that a) the effectiveness of classroom interaction directly affects the smooth realization of teaching objectives, and b) the teachers' roles and relationship with each other has an important impact on the course content and the quality of learning and perspectives gained by their students.

First of all, when implementing online co-teaching, teachers should choose appropriate classroom interaction strategies centering on teaching objects and encourage students to actively think about learning content to achieve the purpose of receiving education (Jones & Tanner, 2002). The courses of the Ed.D. program that were the context of our study generally adopted group learning and flipped classroom techniques to improve student engagement and participation in classes. Based on the

instructor's assessment of their learners' characteristics, such as language proficiency and learning styles, instructors encourage learners to publicly share their learning experiences to promote oral expression. According to the characteristics of students, instructors may be flexible as they assign classroom presentations, decide on ways to group students together, split reading content, provide short videos, and design other classroom interaction methods to create the most effective learning opportunities for their students.

Secondly, collaborative teachers need to have in-depth communication with each other and clearly define their roles in the course division to carry out online co-teaching. Collaborative teachers should trust and respect each other, include their individual strengths and provide each other with the necessary support. When implementing online co-teaching, instructors also need to actively address challenges, improve their ability to adapt to online and co-teaching methods and adjust the necessary IT equipment in advance to avoid sudden technical problems in class.

Research Question 3: How do students build online learning communities when learning experiences emanate from the collaborative teaching and learning model?

Research Question 3 seeks to understand collaborative learning from the perspectives of students. Comprehending how students build collaborative communities in online courses is important to inform the design and management of collaborative tasks. As we have discussed in previous chapters of this dissertation, collaboration has multiple faces in online classes. Discussions, clarification and evaluation others' ideas and perspectives, brainstorming, and peer-reviews are examples of collaborative learning opportunities. Groups need to have clear goals and norms and be able to build trust and employ diverse communication strategies to reduce anxiety and scaffold learning of group members. Our analysis of students'

responses to the student questionnaires revealed two main themes: influences, contradictions, and obstacles to collaborative learning; goals and objectives of online collaborative learning. We analyze these findings in this section of the dissertation.

In relation to others' influence, the instructors hope that students can learn in a group, which the teachers believe will benefit their future work. The students summarized some effective methods of collaborative learning, but they still need the organization and guidance of the instructors. These influences from people are a pivotal factor of online collaborative learning.

Concerning the goals and objectives of online collaborative learning, students will make some adjustments to their learning objectives and content according to the situation. As these adjustments occur, the group learning of students will be affected. Because after all, the learning tasks of students change with the changing of goals and objectives of online collaborative learning.

In relation to the obstacles and contradictions of online collaborative learning, the students' answers to the questionnaire showed that they identified many obstacles to online collaborative learning, including problems such as poor communication and disagreement among team members. Students also mentioned challenges in their experiences. For example, Lucy said in the questionnaire:

My biggest contradiction was staying focused in class and not being distracted by my home environment. I tried to solve this by going into a quiet room and taking lots of notes, but then I'm less engaged in talking with my classmates.

However, despite these drawbacks in online collaborative learning, students are still willing to participate in online collaborative learning when the team members are responsible, respectful, and reliable.

In summary, our findings regarding the students' perspectives on collaborative learning revealed that different variables influenced how the learners experienced collaboration. Instructors influence the settings and context of online collaborative learning, while classmates affect the experience of online collaborative learning. We also found out that, regarding goals and objectives of online collaborative learning, students adjusted their methods and strategies to engage in courses. Finally, regarding the obstacles and contradictions of online collaborative learning, the questionnaires provided evidence that students have found ways to solve the obstacles of online collaborative learning.

Research Question 4: How do instructors and students evaluate the online collaborative teaching and learning model?

Research Question 4 aims to understand how assessment in online learning was perceived by students and instructors. Regarding online assessment, we have identified two themes: instructors' attitudes towards online co-teaching and collaborative learning; students' perspectives concerning online co-teaching and collaborative learning.

When discussing co-teaching, most instructors emphasized the importance of a good relationship with their collaborators, and believe that this is the prerequisite guarantee for all collaboration. The instructors' feelings about co-teaching are complicated, but in summary, their feelings are all generally positive. At the same time, instructors may also believe that inviting other instructors to deliver presentations in the classroom can be regarded as another form of co-teaching. Regarding the prospect of co-teaching, some instructors expressed concern that due to the impact of funding, the use of co-teaching may be reduced in the future.

When discussing online course evaluation, teachers first discussed a lot of methods for evaluating students, such as an assessment test at the beginning of the semester and the combination of collaborative work and independent work. Instructors arrange ways to evaluate students based on the needs of the curriculum and their own experience. At the same time, instructors also have expectations for the subjective initiative of group learning students. For example, some instructors believe that Ed.D. students should be innovative, responsible, and curious. Instructors shared their different experiences of online assessment. Based on different subject characteristics and one's teaching experience, specific assessment methods and strategies vary.

Concerning students' experience with group learning, the first topic mentioned was the difficulties encountered in social aspects of collaboration. Students sometimes had conflicts and tensions with group members, which negatively affected their experience. Nevertheless, conflicts based on different opinions or personalities may be beneficial to students learning if carefully managed. We feel that disagreements may lead to new realizations and perspectives or gaining different insights into a problem.

However, as the students in the cohort were all Chinese, it is important to highlight the influence of the Chinese value that harmony must be maintained above all else in relationships. Thus, the presence of conflict may be more disruptive than engaging. When instructors design collaborative tasks for international students, they should be aware of cultural differences related to communication styles. In the case of Chinese students, harmony is the foundation of successful communication. This way, we consider that preparing students to see conflicts from different perspectives is extremely important.

To overcome the challenges of collaboration, students mentioned to believe that communication is the key to solving these problems. If the communication fails, students should concentrate on their tasks and be psychologically prepared to complete all the work independently. Students also shared some of the factors they see as positively affecting group learning such as a being actively engaged, proper methods, communication skills, a comfortable environment, among others.

Concerning the students' perspectives on the advantages and disadvantages of group learning, the data showed that students viewed saving time, being inspired by other students, and improving their communication skills in English and Chinese as advantages of collaboration. Based on the students' perspectives, the disadvantages included wasting time, the possible conflicts arising from collaboration, the loss of personal autonomy, and less ability for self-reflection.

The questionnaire aimed to understand the students' willingness to continue engaging in collaborative work with other students. Based on the responses to the question: "Do you prefer to complete your assignments: independently or in groups?", we learned that 57% of students prefer to study independently.

Finally, as researchers, we were interested in learning more about student perspectives on co-teaching. Our data showed students believe that participating in a class that uses co-teaching methods is beneficial to their learning. They think that through observing the collaboration among instructors, they can learn through various teaching methods of two instructors and be inspired by those two teachers' experiences and ideas.

Students also shared their perspectives on the advantages and disadvantages of the co-teaching model. Regarding the advantages, the students put forward the three advantages of the instructors being able to use class time more efficiently,

complementing knowledge between teachers, and students benefiting from two teachers simultaneously. Regarding the disadvantages of co-teaching, students believe that if teachers cannot collaborate and communicate well, the quality of co-teaching cannot be guaranteed. Therefore, students shared perspectives on how co-teaching can be enhanced. Generally speaking, their answers showed that some improvements can be made in curriculum design, completion of classroom goals, and the division of labor between the two teachers.

Finally, six-sevenths of the students said they would like to choose the co-teaching method for their future teaching work. However, some of them still expressed concern about this, believing that right now in China, it will not be a viable teaching method, or will not be allowed by school policies.

Further Considerations

After answering our four questions, we started reflecting on some implications of our research for the implementation of online education in diverse contexts. We share some of our thoughts in this section of our dissertation. These reflections are based on our research findings, our readings, our experiences, and our interest in creating opportunities for Chinese students to benefit from collaboration in online education.

Our study also has some theoretical implications that may contribute to improving and expanding research on collaboration in online education. Recently, we have observed a greater need for online education because of the pandemic. As many schools have temporarily stopped offline face-to-face classes and turned to online education, our research may help to enlighten the path of conducting online education in a timely fashion and with satisfying results. Our research generated theoretical and empirical knowledge that may support future research and practice even when the

world is not facing a moment similar to the moment we experienced while we carried out this study.

Based on our research findings, some implications for practice that originated from our study are as follows: one important implication is related to the administrative level of schools where online education is implemented. We believe it would be important for leaders to accept and value the changes in the methods and concepts of online education. Second, they would benefit from acknowledging the power of teachers and invest in teacher education and high-quality teachers as the basis for improving online education. Furthermore, administrators and educators should be active participants in the construction of a teaching management platform and develop high-quality online teaching courses.

Moreover, administrators need to work with teachers to strengthen the corresponding system, structure, and support. If implementation of a system is too slow, it is not conducive to student learning. Teachers with digital literacies who work from home need to have high-performance computers and the best electronic devices that support online teaching. Finally, we think it would be beneficial to implement reward systems to stimulate teachers to deliver online teaching effectively.

Considering the roles of instructors in online education, it is important that teachers' roles and philosophies embrace innovative principles of online education. Secondly, teachers need to learn the idea and technology of online teaching. In the teaching process, they need to adhere to the teacher's code of conduct and improve the completion rate of the course. Teachers should promote students' positive attitudes about learning. Online learning students who are not active in learning may chat privately. At the same time, the use of electronic devices in use needs to be guided and combined with the supervision and management of the group and the parents.

Based on respecting students' personalities, the management process should encourage students to learn independently and guide students to develop active strategies.

Instructors also need to consider feedback and teaching evaluations. Opinions put forward by students, parents, teachers, and management may provide information that teachers should consider, absorb, and accept to improve their quality of teaching. Also, instructors need to recognize outstanding students. The class environment can be improved by the spirit and leadership of exceptional students who lead ordinary students to learn actively. Furthermore, teachers must cooperate with students and parents and work together to achieve the ideal teaching objectives.

We also believe that instructional design should ensure online and offline integration. Therefore, we should design the curriculum as a whole, based on creative ways of integrating online and offline, synchronous and asynchronous modes. The curriculum should start from the concept of online and offline integration to achieve deep integration of hybridity. A significant challenge of using online audiovisual platforms for teaching and learning could be the school management regulations, or contexts where most teachers and students are not allowed to use innovative mobile products during class time. Another challenge is related to access to different technologies and to a decent Internet provider.

To overcome possible challenges and find solutions for potential problems, teachers should be granted autonomy and imprint their subjectivity in their teaching. Moreover, online learners should always be in the center of the process of designing online or offline experiences. Autonomous instructors can better support and guide their students and use online teaching as an extension and supplement of offline teaching. In addition, instructors should pay attention to the connection between class

hours in the online and offline sections. For example, instruction could require completing offline homework for preparation of an online classroom of each class hour, as suggested in flipped learning models.

We also consider it necessary to guarantee a balanced combination of the intensity of online teaching and offline teaching. Combining online and offline teaching should not create an excessive burden on instructors or students; indeed, it should strengthen the overall arrangement of physical classrooms and platform classrooms, and ensure the integration of hybrid teaching.

Considering learner centeredness, we understand that instructional design should ensure the individualization of student learning. When using online audiovisual platforms to teach, teachers should fully respect the subjectivity of students' learning and set a good course design to make the online audiovisual platform the growth space for students to demonstrate their comprehension to the maximum extent.

In many cases, instructors use teaching activities that do not differentiate instruction, as in the case of program-fixed reading exercises, restricted homework requirements, or challenging reading tasks. Unfortunately, instructional design that does not consider different learner's needs or learning styles can neither stimulate students' enthusiasm for learning nor take advantage of the tooling advantages of online audiovisual platforms. However, in this era of rapid development of digital resources, students are more digitally literate. They seek to explore technology, delve into the "hidden" functions of the platform, and discover the "treasure" software to satisfy their learning needs, all of which provides motivation for learning.

Limitations of Study

As researchers, we did not aim that our study would represent the whole phenomenon of collaboration in online education or generalize every context. We developed a case study knowing that our data and the discussion of our findings would be a "piece of a puzzle", and along with other research, our study can contribute to better understanding and planning online education. We also understand that some characteristics of our research design have impacted the results of our study. This is why we consider it important to share our reflections concerning the limitations of this study.

Our reflections are intrinsically related to our process of becoming doctors in education. In this process, we discovered new knowledge, confronted our beliefs and assumptions, and explored new ways of doing research. We do not view limitations as weaknesses. The limitations we present here are the recognition of the existence of limitations on our study, the understanding of the causes and consequences of these limitations and looking forward to future research.

The first limitation in our study is related to approaches we used to gather data from the two groups of participants. We researched the perspectives of instructors via interviews and students via questionnaires. After completing this study, we believe that the students could have been interviewed too. In the process of data collection, we decided not to interview the students for two main reasons. First, English is not the students' first language, and we did not want language to be a barrier to our communication with them. Any use of Chinese in questionnaire responses was discarded, as all participants were immersed in a doctoral program where English was the medium of instruction. The second reason for exclusively using questionnaires with students was related to the social relations between the researchers and students. As we were members of the same cohort, we predicted that it could have been

uncomfortable being interviewed by peers. After the study was completed, though, we considered that research carried out in a similar context, a context with non-English speakers could be used for data collection. Future research with international students may benefit from creating opportunities for participants to use their first language or the language they feel most comfortable with.

Considering research tools used with instructors, we believe that some questions in the semi-structured interview could have been answered in a questionnaire. Therefore, we think that future researchers inspired by our study could also develop questionnaires to use with instructors. This way, questionnaires and interviews would be complementary research tools.

A second limitation we reflected upon is related to the time and the process of doing this research. First, it is very important to remind our readers that we carried out this study amidst the global trauma of the COVID-19 pandemic. As Jorge (2020) ponders, the pandemic is a global crisis that has opened the wounds of humanity, and exposed persistent inequalities based on race, gender, and social class. Jorge (2020) affirms that global populations are facing fear, anxiety, and grief, and we believe that as Chinese students in the U.S., we were all impacted by the pandemic times. For us, completing this study in a drastically affected terrain for the practice of research is not only the accomplishment of a doctoral degree, but it is an act of resistance and resilience (Slapac, et al., 2021) as must be the case of all international and domestic students completing their work during a pandemic.

The research process could have been longer. The research was conducted over two years, from the moment we decided on a research problem to the completion of this dissertation. We had limited time to write our research proposal, carry out a pilot study, and engage with the participants in our study. Therefore, we understand that

this study reflects the challenges of writing a dissertation in a new language, developing research during a pandemic, and building knowledge on a topic that we embraced for the first time. In papers that we intend to publish based on our data and on our research findings, we will address the necessary refinement and explore the possibilities of a multi-level analysis. This research could have included, for example, more details on the operational level of online education. We could have, for example, taken a closer look at the history of online education at UMSL, and the relation of our Ed.D. program with Carnegie Project on the Education Doctorate.

Another limitation we identified in our study is related to its demographics and context. Although we consider that the demographics of this study were enough to answer our research questions, we believe that the field of online education could benefit from studies including more participants and institutions. In addition, a broader sample would support the depth and quality of this study.

Regarding the context of this study, we understand that not only higher education needs to gain a deeper understanding of collaborative online teaching and learning, but elementary education also needs to be researched. In that case, we suggest that not only students and teachers participate in the study. Parents and principals, for example, should also be part of research.

In the context of the pandemic, as Chinese researchers, we need to discuss how this research impacts online education in general and online education within the Chinese context. This way, if we carried out a similar study in China, it would have been essential to have questionnaires and interviews with students' parents; in China, parents are actively involved in the education of their children, even during higher education.

Implications for Theory, Research and Practice

In the section entitled Further Considerations of this chapter, we shared some of our reflections on how this study has possible impacts on theory and practice related to online instruction and collaboration. Our four research questions guided us to better understand the perspectives of instructors concerning how they design and deliver online courses in collaboration with other instructors, how co-teaching is implemented and perceived by instructors, how students build online learning communities, and finally, how instructors and students evaluate their experiences with collaborative online teaching and learning. Our analysis and discussion of this study's data led us to develop theoretical and empirical knowledge that, we hope, will contribute to implementation of collaborative practices in China, our country of origin. However, this does not mean that we will not benefit from learning about the experiences of instructors and learners at UMSL. We see that the main theoretical contribution of our study is the knowledge about instructor and student perspectives of online education regarding co-teaching and collaborative learning. Considering the praxis of teaching and learning collaboratively in online settings, we see that the major contributions of our study relate to possible changes in the implementation of online courses according to the points of view of students and instructors. Combined, theoretical and practical implications of this study may result in more informed praxis within multilingual and international classrooms.

Recommendations for Further Research

After reflecting on the limitations of this study and considering potential theoretical and practical implications of our study, it is important to consider what studies could be carried out by other researchers that would complement or expand ours. When we discussed the limitations of this research, we shared some reflections on what we thought could have been done differently. All those reflections implicitly

suggest further and future research. However, in this section of our dissertation, we would like to share some studies that we see as important to further understand collaborative online teaching and learning. We believe that, although our research has some limitations, the online co-teaching model still has excellent research space and research value in future research.

Firstly, different qualitative research methods can be used for further research, such as narrative analysis and grounded theory. By understanding the gender, race, nationality, life events, and experience of the participants, as well as the importance and influence of other people in the participants' lives, we can further analyze the evolution of teachers from offline to online, from individual teaching to co-teaching, the gradual adjustment of teaching strategies, and the actual teaching results.

Other research could include international students or participants from different countries. This way, the research could reveal the views of international students and their evaluation of online co-teaching, considering the different social, economic and cultural backgrounds in the analysis.

Ethnographic, long-term classroom-based research would also be an excellent approach to provide richer data based on the observation of the performance of teachers and students in their learning contexts. Other research could also include participants' voices in the analysis. For example, researchers could invite participants to reflect on, analyze, and explain their video records. This could also promote the participants' awareness of their roles and performance. Instructors, for example, could analyze their teaching performance through the perspectives of students, as well as reflect on how to improve and enhance their teaching. In this case, we would also suggest research that would also focus on teacher education and reflective practice.

In addition to qualitative research methods, future research could also increase the number of participants and use quantitative analysis methods to make multi-angle evaluation and analysis of online co-teaching and learning. For example, research could cover a larger university system or an entire school district.

The present study only analyzes the collaboration in teaching and learning in the context of a university in the U.S. In further research, researchers could carry out a comparative and contrastive analysis across universities in China or other countries and enlarge the research to a broader vision of online education. For example, by comparing the experiences of universities in the two or more countries, researchers could explore similarities and differences and then explore the educational and cultural factors affecting the educational experience of different countries and expand the research scope to a broader vision of online education. Through comparative research, researchers could examine, analyze, and reflect on online co-teaching to further improve it (Zhang, 2007). Based on their reality, if participants properly absorb other countries' advanced and complimentary experiences and achievements, it is undoubtedly a feasible way to speed up the reform and development of online collaborative education.

In summary, there are unlimited possibilities for better understanding collaboration in online teaching and learning. Our recommendations and ideas represent possibilities based on the case we studied. However, we believe that research funding agencies should invest in research concerning online teaching and learning. The lessons learned by instructors from all over the world need to be further explored and recorded in our studies. Education has gone through a disruptive moment that may promote amazing and necessary changes in online education. Collaboration is also an important concept for future pedagogies and ways of living in

the world. We will be supportive of any research that explores the theme of collaboration in relation to individualistic or collectivist classroom cultures.

Conclusion

Online co-teaching can provide the exact links available in a traditional teaching environment (Chou & Chen, 2008; Graham & Misanchuk, 2004). However, the teaching mode and higher education system have changed to transform the virtual space provided by the internet into a social learning space (Harasim, 2000; Liang & Chen, 2012; McKiernan & Wilson, 2014). This case study finds that online collaborative education is a relatively complex education model that includes curriculum design, the definition of co-teaching norms, the definition of roles and relationships among teachers, unified evaluation standards, and the construction of learning groups. The practice includes curriculum design, the definition of co-teaching norms, the definition of roles and relationships among teachers, unified evaluation standards, and the construction of learning groups. In the teaching process, teachers should design classroom interaction strategies to mobilize students to participate in the class fully, and students should work together to eliminate differences and complete learning tasks. The application of this case study can provide some reference for teachers and students participating in online co-teaching mode. At the same time, the results of this study also enrich the knowledge related to online collaborative education.

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APPENDIX A: Instructors Semi-Structured Interview

Read Explanatory Statement to Participants

We are very glad that you agreed to participate in this interview. This interview includes three parts which are the online curriculum design, the online co-teaching and the online assessment. The whole interview will last approximately one hour.

Part I: Interview Questions about Online Curriculum/Course Design

1. What do you think should be included in online course design?
2. Have you attended any training in online course design?
3. How did you learn about online course design?
4. If you need more information about course design, where do you look for it? Does your university offer you any support concerning online course design?
5. What do you focus on when designing online courses?
6. How do you decide what content to include in your online course?
7. How do you decide the course goals? What is important for you in defining learning goals for your courses?
8. What aspects do you consider when assessing a students' learning?
9. What teaching strategies do you choose when designing online courses? How do you decide which strategies are better for the content you are teaching?
10. How important is it for faculty to know about instructional design? Why? What should be emphasized in faculty development programs? What are the biggest challenges? What are the most common difficulties?

Part II: Interview Questions about Online Co-Teaching

1. Please describe the experience with teaching an online course in collaboration with other instructors. Have you had any experience doing that before teaching this Ed.D.

cohort? Do you collaborate with more than one instructor (for example a T.A or a professional instructional designer?)

2. What kind of courses do you think are suitable for online co-teaching?
3. What are the characteristics of online co-teaching? How do you describe the experience of online co-teaching?
4. What are the requirements for two teachers in online co-teaching? (For example, how do you define your role with your partner teacher?)
5. In online co-teaching, what are the key points and difficulties in teaching?
6. Have you encountered any unexpected problems in teaching?
7. Is the course carried out according to the schedule you designed in advance? If not, please analyze the reason. If so, please share your experience.
8. Please talk about how you conduct the interaction between collaborative teachers, between teachers and students, and students in online co-teaching, how to mobilize the classroom atmosphere?
9. Some researchers say that online teaching is easy to make classroom discipline out of control, or it cannot guarantee that every student can be in a positive learning environment and have a focused learning state. What do you think of this problem?
10. Through your observation in the teaching process, do you think the students have adapted to the online co-teaching mode? What are you going to do to help students achieve better learning results?
11. What do you think is the key to the success of online co-teaching? What do you think are the advantages of online co-teaching (compared to the traditional offline teaching method)?
12. What is the biggest challenge for online co-teaching?
13. What are your new inspirations and strategies for online co-teaching in the future?

What do you think are the future trends of online co-teaching?

Part III: Questions for Instructors about Assessment

1. Concerning online course assignments, do your students complete homework or other assignments collaboratively? Why and how?
2. Do you evaluate students in stages? If so, what periodical evaluation methods and approaches have you adopted in this specific Ed.D. cohort? What about other cohorts with domestic students only?
3. How do assignments relate to each other? Do you change assignments based on students' results after identifying specific needs? Could you give us an example of a situation that required changes?
4. Do you evaluate and grade students' performance during group learning in online class?
5. When you give the students homework, do you ask them to work in groups? How do you make decisions on assessing individuals or groups? Would you like to change that?
6. What are your standards for evaluating students' online course performance and group work?
7. What software and hardware tools are needed to evaluate students' online learning performance and group work? Why?
8. Are you satisfied with the results of students' online study in the form of group discussion and collaborative work? How do you think you could improve your practice?
9. Do you think the performance of the students in online courses are more difficult to evaluate than offline courses? If so, what are the difficulties? How did you solve these difficulties? If not, why?

10. Are you satisfied with the outcomes of co-teaching? Why or why not?
11. What do you think are the advantages and disadvantages of co-teaching compared with independent teaching?
12. Have you encountered any difficulties in your online co-teaching? If so, how did you resolve these difficulties?
13. Are you willing to continue to use co-teaching methods in future online courses?
Does the fact of having international students change the way you think about this?

APPENDIX B: Student Questionnaire

The Explanatory Statement to Participants

We are very glad that you agreed to participate in this questionnaire. This questionnaire includes two parts which are the online collaborative learning and the online assessment. This would take you approximately 45 minutes.

Part I: Questionnaire Questions about Online Collaborative Learning

Instructions: Collaborative learning is a strategy to organize students to learn in the form of groups or teams (Dillenbourg, 1999). For example, through a series of collaborative activities such as group discussion, inter-group communication, teacher mutual assistance, group self-evaluation, and inter-group mutual evaluation, the tasks are finally completed.

Read the following questions carefully and choose the corresponding answer.

1. Age

A.Under 20 B.20-25 C.26-30 D.31-35 E.Over 35

2. Gender

A.Male B.Female C.Other

3. Computer skills

A. Use computer proficiently B.Average computer skills C.Not good at using computers

4. Have you ever participated in an online group activity/ assignment?

A.Yes B.No

5. If yes, when do you USually participate in group activities/ assignments?

A.In class B.Out of class C.Both

6. What has been the typical size of your group?

A.1-3 B.4-5 C.6 or more

From this question is the Likert Scale part of this questionnaire, please check the answer accordingly.

7. I felt comfortable collaborating with other students in my cohort.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

8. I felt isolated and unable to fully participate as a member of groups.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

9. I willingly participate in collaborative learning activities.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

10. I have to participate in collaborative learning activities.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

11. I am satisfied with my role in group collaborative learning.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

12. Collaborative learning has helped me achieve a good academic performance.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

13. I learned more about interacting with my group members than working alone.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

14. Group work has allowed me to increase my knowledge through other peers' input.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

15. In online collaborative learning, I need to think independently.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

16. The content of online collaborative learning can be used in my future work.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

17. In online collaborative learning, I dare to express my views.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

18. When listening to other people's opinions, I have new gains.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

19. I have experience helping others to conduct online collaborative learning.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

20. In online collaborative learning, I have disputes with other group members.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

21. In online group collaborative learning, I cannot get help from others when I encounter a problem.

A. Strongly agree B. Agree C. Neutral D. Disagree E. Strongly Disagree

From this question is the open questions of this questionnaire, please use no less than 50 words to do the explanation.

22. Did you participate in the online collaborative learning process? How did you join?

23. What is your favorite online collaborative learning experience? why?

24. Describe your biggest challenge in online collaborative learning. How do you solve these problems?

25. Do you have experience in online collaborative teaching? If you have, do you find it helpful to your online collaborative learning? What is your online collaborative teaching's contribution to online collaborative learning?

26. What emotional experiences have you experienced in the process of participating in online collaborative learning? How have these emotional experiences changed?

Part II: Questionnaire Questions about Assessment

Please, answer the following questions. For each of the questions please use 50-70 words to do the explanation.

1. Before you joined the Ed.D. program, have you ever had the experience of collaborative online learning? If you choose Yes, please answer Q2; If you choose No, please answer Q3.

A.Yes B.No

2. What do you remember from the experience of online collaborative learning?

What's your opinion about this teaching method and could you please tell us your feelings? (think about methods, your feelings....)

3. If you have never had the experience of collaborative online learning, why do you think your instructors did not use this teaching method?

4. Have you encountered any difficulties in doing online group learning? If you choose Yes, please answer Q5; If you choose No, please answer Q6.

A.Yes B.No

5. Could you please give examples of the difficulties you have met? How did you solve these difficulties? Who helped you overcome the difficulties you found? What difficulties were never solved? Why?

6. What factors do you think have contributed to a successful experience?

7. How much do you like online group learning? Please state your reasons.

8. Do you think the grade you got is a true reflection of your learning or commitment to the group? You can choose from those three options: lower than my expectation; true reflection; and lower than my expectation. Please choose one and then give out your reason.

9. Do you prefer to complete your assignments: independently or in groups? Why is that?

10. Compared to independent/individual learning, in your opinion, what are the advantages and disadvantages of group learning?

11. Some classes were simultaneously taught by more than one instructor (co-teaching). What are your thoughts concerning co-teaching? Why? Do you remember a specific situation that illustrates your perspective?

12. What are the advantages and disadvantages of co-teaching compared with independent teaching? (Co-teaching refers to the educational method that involves two teachers working together to do the instruction and make assessments on a group of students.)
13. What do you like about co-teaching approaches to online learning? What aspects of co teaching an online class that you do not like? Why?
14. What were the most important benefits of attending a class where instructors were co teaching?
15. What improvements can be done in a co-teaching class?
16. How likely are you to use co-teaching in the future (in your own classes)? Explain your answer.

APPENDIX C: EMAIL INVITING INSTRUCTORS

Subject: Would you like to participate in a study about collaborative learning and teaching?

Dear Dr. _____,

We hope this email finds you well.

We are Han Rong, Rongjing Cao, Jing Xu, Yang Zhang, and we are Ed.D. students from the school of education at the University of Missouri, St. Louis. We are writing to you today to invite you to participate in an online co-teaching research project. The project plans to better understand collaborative teaching and learning within the context of an Ed.D. program in the USA. The data generated by the project will be used for the doctoral dissertation of researchers.

Participation in the project requires:

1. A time commitment of approximately 1 hour for an interview with the dissertation team. The interview will be conducted in the form of a Zoom Meeting at your convenience.
2. If you use online co-teaching method to teach Ed.D. students in the current semester, we will observe your online teaching through Zoom Meeting.
3. A possibility of follow-up for any clarification which would not be expected to exceed 30 minutes.

If you are interested in participating in this project that will also result in a study or if you would like more information about it, please send us an email.

The Emails of our group members and are listed below:

Han Rong: hrdk5@umsystem.edu

Jinge Xu: jx6c2@umsystem.edu

Rongjing Cao: rcdh9@umsystem.edu

Yang Zhang: yznwx@umsystem.edu

Best Regards,

Investigator team member: Han Rong, Rongjing Cao, Jinge Xu, Yang Zhang

APPENDIX D: EMAIL INVITING STUDENTS

Subject: Would you like to participate in a case study of an Ed.D. program collaborative online education?

Dear _____,

We hope this email finds you well.

We are Han Rong, Rongjing Cao, Jing Xu, Yang Zhang, and we are Ed.D. students from the school of education at the University of Missouri, St. Louis. We are writing today to invite you to participate in an Ed.D. program collaborative online education program that will also generate data for a study. The project plans to better understand collaborative teaching and learning within the context of an Ed.D. program in the USA. The data generated by the project will be used for the doctoral dissertation of researchers.

Participating in this program will entail answering two survey questionnaires, participating in one interview. The content of the interview is about online collaborative learning and online course assessment. These two questionnaires and one interview will take approximately 90 minutes to complete. No names are required for the interviews and your answers will remain anonymous.

If you are interested in participating in this project that will also result in a study or if you would like more information about it, please send us an email.

The Emails of our group members and are listed below:

Han Rong: hrdk5@umsystem.edu

Jinge Xu: jx6c2@umsystem.edu

Rongjing Cao: rcdh9@umsystem.edu

Yang Zhang: yznwx@umsystem.edu

Best Regards,

Investigator team member: Han Rong, Rongjing Cao, Jinge Xu, Yang Zhang

APPENDIX E: Informed Consent for Participation in Research Activities

Collaborative Online Education: A Case Study of an Ed.D. Program

Participant _____ HSC Approval Number _____

Principal Investigator: Han Rong, Jinge Xu, Rongjing Cao, Yang Zhang

PI's Phone Numbers:

Han Rong 314-398-8839

Jinge Xu 314-243-6562

Rongjing Cao 314-665-9576

Yang Zhang 314-224-0074

Summary of the Study

This is a brief description of the project

1. You are invited to participate in a research study conducted by Han Rong, Jinge Xu, Rongjing Cao, Yang Zhang, and Miriam Jorge. This qualitative case study focuses on students' and instructors' perspectives on collaborative learning and teaching in online classes. The context of the study is an Ed.D. cohort which was developed as a partnership between the U.S and a Chinese university. All students in the cohort are international Chinese students taking classes in the United States. The student participants (n=14) are enrolled in the same courses, and the focus of this study are the online courses taken by students. All the students are Chinese and are fluent in both Chinese and English. The faculty participants (n=5) are the instructors who taught online courses in collaboration with other faculty. There are no exclusion criteria for student participants, and faculty who did not teach online courses in collaboration with other faculty will be excluded from the study. All data will be

collected in the United States, and the Chinese university (SNU) does not play any role in this research. The theoretical framework that guides the study includes studies on co-teaching and collaborative learning in relation to curriculum design, evaluation, learning, and teaching processes, among others. Data will be collected through qualitative research tools such as questionnaires and interviews. Student participants will complete two different questionnaires. Faculty participants will participate in one online interview. Course documents will also be used (syllabus, student notes, and others). Data analysis and discussion will problematize different dimensions of online collaborative teaching and learning based on students' and instructors' perspectives. The results are expected to contribute to the design of collaborative online learning and teaching experiences that include perspectives of students and instructors of an international collaboration.

2. a) Your participation will involve

- You are asked to complete one questionnaire. This questionnaire would include two parts, one is about online collaborative learning, the other one is about online course assessment.
- All information obtained in this study is strictly confidential unless disclosure is required by law. All electronic or digital information will be stored in a password-protected computer. Your name will be replaced by pseudonyms when data are disseminated.
- Approximately 19 participants may be involved in this research at the University of Missouri-St. Louis. Those 19 participants include 5 instructors and 14 students.

b) If you are an instructor, your participation time is one hour, if you are a student, your participation will be 45 minutes.

3. There are certain risks or discomforts associated with this research. This is a "no greater than minimal risk" study, which means that the probability and magnitude of harm or discomfort anticipated in the research are not greater than those ordinarily encountered in daily life or during the performance of routine physical and psychological examinations or tests and where confidentiality is adequately protected. No potential risks are anticipated due to this research focus being an analysis of commonly used educational techniques which currently take place in this university. Risks are held to a minimum due to anonymous coding and keeping all data confidential with no identification of specific students. No undue stress or embarrassment is anticipated as a result of participation in the research. The risks are unlikely since we have designed questions in a sensitive way, and we don't anticipate that these questions would have a major impact on the participants. We will minimize the risks by making it clear in the consent form that the study is voluntary, and participants can stop at any time. We will protect research files in password-protected folders and use pseudonyms to refer to participants' data.
4. There are no direct benefits to participants in this study. However, participation in this study may help you in becoming a reflective student. Your participation may also help educators to create classroom environments that best support your education.
5. You will not receive the results of the tests and assessments you will undergo as part of this research study.
6. Your participation is voluntary and you may choose not to participate in this research study or withdraw your consent at any time. You will NOT be penalized in any way should you choose not to participate or withdraw.
7. We will do everything we can to protect your privacy. As part of this effort, your identity will not be revealed in any publication that may result from this study. In rare

instances, a researcher's study must undergo an audit or program evaluation by an oversight agency (such as the Office for Human Research Protection) that would lead to the disclosure of your data as well as any other information collected by the researcher.

8. If you have any questions or concerns regarding this study, or if any problems arise, you may call the Investigator, Han Rong 314-398-8839, Jinge Xu 314-243-6562, Rongjing Cao 314-665-9576, Yang Zhang 314-224-0074, or the Faculty Advisor, Miriam Jorge 314-359-2644. You may also ask questions or state concerns regarding your rights as a research participant to the Office of Research, at 516-5897.