UNDERGRADUATE STUDENTS' FRUSTRATIONS

IN COLLABORATIVE GROUP WORK

by

XIGUI YANG

(Under the Direction of Lloyd P. Rieber)

ABSTRACT

Collaborative learning is acknowledged as an important skill in both higher education and modern society. However, there are many challenges when designing and implementing collaborative learning and many studies report that college students are often frustrated when placed in such situations. Despite the fact that the literature has a wide range of recommended strategies to ameliorate students' negative experiences in group work, it is impossible to make every collaborative learning experience positive for all students. Therefore, it is important to understand college students' perspectives on the frustrations they experience in collaborative group work and provide opportunities for students to have open discussions about their frustrations. The intent of these discussions is to help students to reconcile these frustrations and help them establish positive internal norms and expectations for future collaborative learning activities. The goal of this research study is to reveal students' perspectives on various sources of frustrations in group learning and investigate how these frustrations might be addressed through scaffolded group discussions. Chapter two provides a historical review of collaborative learning and cooperative learning, including their definitions, characteristics, development, and research paradigms. Chapter three reports on the development of five learner personas created using Q

methodology. These personas are intended as a resource for faculty and instructional designers who wish to create positive collaborative learning experiences for students. Chapter four reports on a research study that examined the phenomenon of frustrations in collaboration under a framework of hermeneutic phenomenology.

INDEX WORDS: Collaborative learning; Frustrations in collaboration; Q methodology; Mixed methods; Learner persona; Hermeneutic phenomenology

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DEDICATION

To Ki and Su. I am deeply grateful for having you in my life.

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CHAPTER 1

INTRODUCTION

Collaborative Learning in an Uncertain World

Situated with the constructivist movement in education and instructional design, collaborative learning is regarded as "the golden key to the future" (Kirschner, 2002, p. 10). Collaborative learning has been a widespread pedagogical practice in various educational settings for decades (Dillenbourg et al., 2009). The ability to collaborate with diverse groups of people is still one of the most needed skills in the workplace (Dzombak, 2018). With the uncertainties of today's world and perhaps future society, collaborative learning and teamwork skills are even more important for innovation and knowledge creation than ever before (Vauras et al., 2019). Johnson and Johnson (2018) even predicted that collaborative learning "will remain a prominent instructional method in the foreseeable future" (p. ix). Thus, promoting college students' collaborative learning skills should be considered a top priority in the future of higher education (Dzombak, 2018).

Used as an umbrella term for various types of group-based learning, collaborative learning emphasizes "active engagement and interaction among group members to achieve a common goal" (Nokes-Malach et al, 2015, p.646). Collaborative learning can take many forms. It could be designed to solve well-structured or ill-structured problems, it could be a convergent or a divergent process, and it could also vary in different scales in terms of group size and time commitment (Kirschner et al., 2018). With the support of modern technology, collaborative

learning can occur anywhere and anytime among learners who are co-located or geologically distributed, either synchronously or asynchronously.

Collaborative learning is an important means of engaging students in authentic and meaningful tasks. However, designing and implementing collaborative learning environments is not easy to do (Reeves et al., 2004). As many scholars and researchers have indicated, not all collaborative learning results in learning, and simply putting a group of learners together does not guarantee collaboration (den Bossche et al., 2006; Kirschner et al., 2018). In reality, frustration, confusion, and conflict are very common in collaborative groups (Dzombak, 2018), and many college students develop adverse feelings towards group work (Capdeferro & Romero, 2012; Feichtner & Davis, 1984; Isaac, 2012; Salomon & Globerson, 1989; Sorensen, 1981; Tucker & Abbasi, 2016). Although many solutions were suggested by researchers, in practice, it is very difficult to ensure positive experiences for every student in every collaborative learning activity (Tucker & Abbasi, 2016). Therefore, it is critical to address these negative experiences and perceptions in order to enhance students' collaborative learning skills.

The COVID-19 pandemic disrupted normal campus-based instruction as universities worldwide took measures to ensure a safe and healthy environment on campus. With many uncertainties, it seems more important than ever for instructors to adapt in order to offer quality instruction in technology-rich environments and to design and facilitate collaborative learning activities. While collaborative learning can be adapted to increase student engagement and promote deep learning, college students are still facing potential frustrations in collaborative group work. It is important to provide them with opportunities to articulate their experiences and perspectives concerning collaboration, especially those negative aspects, before they start to work together.

The Utility of Q Methodology

The literature has documented various sources of frustrations when students are asked to work collaboratively, such as unequal contributions, personality conflicts, unfair assessment, dominating group members, language and cultural difference, and communication difficulties (Capdeferro & Romero, 2012; Feichtner & Davis, 1984; Isaac, 2012; Salomon & Globerson, 1989; Sorensen, 1981; Tucker & Abbasi, 2016). Yet it is unclear how students perceive different sources of frustrations in collaborative group work because most studies are not concerned with students' perspectives on this topic (Chiriac, 2014). Different viewpoints on these frustrations might influence students' pre-dispositions of collaborative learning. As every individual is unique, open discussion and clarification about these differences are necessary (Forrest & Miller, 2003) to help students have a better understanding of each other and be more cautious of potential issues during group work.

Q methodology is a systemic methodology designed to study human subjectivity (Brown, 1993). Therefore, Q can be a suitable approach for studying students' perspectives on frustrations during group work and facilitating an open discussion among students. Q is recognized as a mixed methods approach (Ramlo & Newman, 2011; Ramlo, 2016) because it draws upon the statistical method of factor analysis to reveal clusters of participants with different viewpoints combined with abductive reasoning typically found in qualitative research. Q uses a unique sorting activity to capture participants' subjective views on the topic at issue (Brown, 1993; Watts & Stenner, 2012). Through factor analysis of the Q sorts, various viewpoints shared by different groups of the participants are identified (Watts & Stenner, 2012). Interpretation of the resulting viewpoints focuses on identifying and understanding distinct viewpoints held by different groups of people. Qualitative methods such as interviews and focus

groups are usually used to assist the process of interpretation. It is also useful to ask participants to discuss their own interpretation of the Q sort results as part of a class discussion in order to help them understand their own perspectives and the viewpoints of their classmates.

Q methodology has long been used as a research tool, but its potential to be used as an instructional tool is rarely explored (Rieber, 2016; Walker et al., 2018). In this dissertation, Q was used for dual purposes. On the one hand, the framework of Q methodology is used to create a structured class activity, as a unique instructional tool, to help students understand their own perspective on frustrations in collaboration that is also shared by others and concurrently to become aware of other divergent views as represented by different groups of students. On the other hand, Q was also used as a research tool for the researcher and the instructor to better understand the students' collaboration dispositions.

Significance of the Study

Collaborative learning has been the subject of research in many disciplines such as educational psychology, instructional design and technology, learning sciences, and sociology (Nokes-Malach et al., 2019). However, most studies focused on the cognitive aspects of collaborative learning, while the affective and socioemotional aspects are less explored (Dillenbourg et al., 2009; Törmänen, 2021). Focusing on the students' frustrating experiences in group work, this dissertation brings more insight into how students' affective status influences their performance and behavior in collaborative groups. This dissertation used Q methodology as the primary research tool to collect data from students to gain a deeper understanding of the phenomenon of group work frustration. In addition, Q was also used as an instructional tool to make the research process a meaningful learning experience for the students. On the methodological level, this research responded to the call by leading Q scholars to introduce Q to

the broader research community interested in mixed methods (Ramlo & Newman, 2011; Ramlo, 2016). On a practical level, this study helps to inform the use of Q methodology as an instructional tool (Rieber et al., 2022). More importantly, this research contributed to the literature of collaborative learning by providing alternative means to deepen the understanding of the phenomenon of frustrations in collaboration.

Structure of the Dissertation

This dissertation is organized using the manuscript format, consisting of two articles that have been submitted for journal publication and a report of an original empirical research study. Chapter Two provides a historical review of collaborative learning and cooperative learning. Interestingly, the relationship between collaborative and cooperative learning is not clearly delineated in the literature. However, it should be noted that collaborative learning is used as an overarching term in the other chapters. Collaborative learning and cooperative learning are two separate methodologies developed independently by two groups of scholars around the same period of time in the 1960s and 1970s (Bruffee, 1999). Due to their different origins and intertwined paths of development, they share many similarities while having their own distinct features (Bruffee, 1999). This chapter first examines the definitions of the two terms and compares their characteristics. Then it discusses their historical development in the last fifty years. It further summarizes the four paradigms of research on collaborative and cooperative learning, namely, the “effect” paradigm, the “conditions” paradigm, the “interaction” paradigm (Dillenbourg et al., 1996), and the “design” paradigm.

Chapter Three investigates students’ perspectives on various sources of frustrations in group learning and reports the learner personas developed in this process. A learner persona, which is a constructed character that reflects the characteristics of the target audience, offers

potential to be a valuable tool for empathetic design (van Rooij, 2012). A Q sort activity was created to identify students' perspectives on group work frustration and help decide on the number of personas and their general characteristics. Interview data were used to generate composite stories for these persons to make them more engaging. In total, five learner personas with rich narratives were created: goal-oriented collaborator, fairness-oriented independent learner, learning-oriented collaborator, and adapted collaborator. These learner personas can be helpful for faculty and instructional designers to empathize with the leaners and create positive collaborative learning experiences.

Building upon the Q sort activity in Chapter Three, Chapter Four continues to address the issue of frustrations in collaborative learning groups. Chapter Four focuses more on the group discussion designed to follow the Q sort activity, providing students the opportunity to have an open conversation with each other before starting a major group project. Students' behaviors during the group project were also examined. Under a theoretical framework of hermeneutic phenomenology (Freeman & Vagle, 2013; Kafle, 2011; van Manen, 2017), Q methodology (Brown, 1993; Stephenson, 1953; Watts & Stenner, 2012), and collaboration scripts (Fischer et al., 2013), this study was designed as a two-phase mixed methods study. The first phase of the study took place before a group project and collected data using a refined Q sort activity (compared to Chapter Three) with a follow-up group discussion on the Q sort results. The second phase of the study, occurring after the group project, used surveys and interviews to analyze students' behavior during the group project. Results showed that the Q sort discussion could be a useful instructional tool to create meaning learning experiences for the students.

Subjectivity Statement

As a student, I have had both positive and negative experiences in collaborative group work. On the positive side, group projects have been the greatest opportunities for me to develop profound friendships with fellow students and to learn from each other. On the negative side, I once gradually discontinued my friendship with my roommates who I had known for five years, when I was too disappointed at their slacking behavior during a group assignment in a graduate level linguistics course.

As a teacher, I have created some very successful group work experiences for students, but have also given group assignments that were not designed or executed very well. My inability to design effective group assignments even made me doubt my capability to be a teacher. I accept that it is challenging to ensure each group work experience will be positive for all students (Tucker & Abbasi, 2016; Miller, 1994). Although collaborative group work may not be easy for either students or instructor, it can be a rewarding experience if appropriately designed and implemented. I have been learning English since I was in middle school and taught English to Chinese high school students for five years. One of the most important lessons I have learned from my earlier experiences as a foreign language learner and teacher is that it is almost impossible to learn a language well independently in a second language environment. Learning a foreign language is more effective done through collaboration and interaction with peers and other language users. This has made me a firm believer in collaborative learning, which might also be influenced by the fact that I come from a collectivist culture in China.

As a researcher, I recognize that my prior experiences of collaborative learning as a student and as a teacher will influence how I interpret my research participants' perspectives on collaborative learning. During the first pilot study of the Q sort on frustrations in group work, I

did the same Q sort as the students and included my own Q sort in the data analysis to see which factor I belonged to. Using myself as a vintage point helped me understand the similarities and different between me and others.

The research participants were students in an undergraduate-level course taught by a fellow doctoral student. I have taught this course before and thus have knowledge of the course content and general pedagogical approaches. My four years of college teaching experience has been a valuable asset to me in having deep conversations with the student participants. Since my goal is to create a space for "fusion of horizon," what I what to do is allow everyone, including myself, the opportunity to share their opinions and experiences without being judged. That is why I think Q sort is a useful tool for this purpose. It is important to note that when students are discussing the Q sort factors, they do so as part of a group of people who share similar experiences and are addressing the same questions.

Conclusion

Collaborative learning has been adopted in many educational settings and should continue to play an important part in the future of higher education. Therefore, it is crucial to deal with the challenges when designing and implementing collaborative to provide students with positive collaborative learning experiences. However, in the event that frustrations do occur in group work despite the best planning and intentions of the instructor, students should be given the opportunity to articulate and reflect upon their experiences in order to help resolve these negative perceptions and establish positive internal norms and expectations for group learning in the future. The goal of this dissertation is to reveal students' perspectives on group work frustrations and examine how these frustrations might be addressed through group discussions scaffolded by Q sort.

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CHAPTER 2

A HISTORICAL REVIEW OF COLLABORATIVE LEARNING AND COOPERATIVE LEARNING[1]

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Introduction

Collaborative learning is now used as an umbrella term for various instructional approaches to small group learning, including but not limited to cooperative learning, team-based learning, peer tutoring, study groups, project-based learning, problem-based learning, and learning communities (Koschmann, 1996; Smith & MacGregor, 1992; Udvari-Solner, 2012a). Notably, the relationship between collaborative learning and cooperative learning has been most confusing (Bruffee, 1999), "…more like an arbor of vines growing in parallel, crossing, or intertwining" (MacGregor, 1992, p. 37), given the fact that they were developed around the same period of time. Some scholars use the two terms synonymously, some consider cooperative learning a subcategory of collaborative learning, others treat them as two ends of a continuum, with cooperative learning being most structured and collaborative learning being least structured, and still, others draw a clear line between the two (Barkley et al., 2014). There is a theoretical rationale to discriminate the two terms, but in practice, it is difficult to separate them because collaboration and cooperation often co-exist in many group work processes (Jeong & Hmelo-Silver, 2016).

According to Bruffee (1999), collaborative and cooperative learning are complementary and supplementary, and their differences can be mainly attributed to their different origins:

> Collaborative and cooperative learning were developed originally for educating people of different ages, experience, and levels of mastery of the craft of interdependence. So teachers devising methods in each case tended to make different assumptions about the nature of knowledge and the authority of knowledge. (p. 87)

Therefore, the purpose of this paper is to provide a brief historical review of collaborative learning and cooperative learning to identify their origins, where they diverge from each other, and where they are aligned.

This paper is organized into five parts. The first part examines the definitions of the two terms and compares their characteristics. The next three parts outline the historical development of collaborative learning and cooperative learning in the past five decades, which can be roughly divided into three phases: early development between the 1960s and 1970s; maturation in the 1980s and 1990s; convergence in the mid-1990s; and the emergence of Computer-Supported Collaborative Learning (CSCL) in the late 1980s. A timeline of their history can be found in the Appendix. The fifth part summarizes the four paradigms of research on collaborative and cooperative learning, namely, the "effect" paradigm, the "conditions" paradigm, the "interaction" paradigm (Dillenbourg et al., 1996), and the "design" paradigm.

Definitions and Characteristics

It is challenging to define collaborative learning or collaboration, and there is no universal definition (Dillenbourg, 1999; Koschmann, 1996; Whipple, 1987). To Bruffee (1999), the most prominent collaborative theorist, collaborative learning "creates conditions in which students can negotiate the boundaries between the knowledge communities they belong to and the one that the professor belongs to" (p. 144). In this philosophical view, the notions of power and authority are challenged, with the assumption that knowledge is not transmitted from the professors to the students but socially constructed among people of a community (Bruffee, 1984, 1999). Thus education can be viewed as a conversation among people and a process of reacculturation (Bruffee, 1984, 1999). In light of Bruffee's conception, Panitz (1999) defined collaboration as "a philosophy of interaction and personal lifestyle where individuals are

responsible for their actions, including learning and respecting the abilities and contributions of their peers (p. 3). Likewise, Oxford (1997) also acknowledged the philosophical orientation of collaborative learning. With a focus on the learning processes, Roschelle and Teasley (1995) defined collaboration as “the mutual engagement of participants in a coordinated effort to solve the problem together” (p. 70). Due to its philosophical orientation, collaborative learning tends not to impose too much structure on learning activities (Bruffee, 1995, 1999), and the students “work together in small groups that are typically self-selected, self-managed, and loosely structured” (Davidson, 2021a, p. 12).

In contrast, the definitions of cooperative learning or cooperation are much less abstract. The most renowned cooperative theorists, Johnson and Johnson (1999), defined cooperative learning as “the instructional use of small groups so that students work together to maximize their own and each other’s learning” (p. 5). They emphasized interdependence in group work: students “can reach their learning goals if and only if the other students in the learning group also reach their goals” (Johnson & Johnson, 1999, p. 5). Cooperation can be defined as “a structure of interaction designed to facilitate the accomplishment of a specific end product or goal through people working together in groups” (Panitz, 1999, p. 3). Cooperation implies “the division of labour among participants, as an activity where each person is responsible for a portion of the problem solving” (Roschelle & Teasley, 1995, p. 70). Compared to collaborative learning, cooperative learning has a more practical orientation as “a set of instructional methods in which students work in small, mixed-ability learning groups” (Slavin, 1987, p. 3). Although with different goals and emphases, cooperative learning methods all tend to structure group interactions to ensure equal participation and individual accountability (Bruffee, 1995, 1999; Oxford, 1997; Sharan & Sharan, 2021). Most well-known small group learning techniques, such

as Jigsaw, Think-Pair-Share, Three-Step Interview, Teams-Games-Tournaments, and Group Investigation, were invented by cooperative learning researchers; conversely, very limited specific procures can be attributed to collaborative learning (Davidson, 2021a).

Therefore, the key difference between the two approaches lies in that: "in nurturing educational rewards to be gained from self-governed student peer relations, [collaboration learning] sacrifices guaranteed accountability… in guaranteeing accountability, [cooperative learning] risks maintaining authority relations of traditional education both within each small working group and in the class as a whole" (Bruffee, 1999, p. 92). Many scholars attempted to differentiate collaborative and cooperative learning (Bruffee, 1995; Davidson, 2021c; Davidson & Major, 2014; Dillenbourg, 1999; Jacobs, 2015; Oxford, 1997; Panitz, 1999; Smith & MacGregor, 1992; Veldman & Kostons, 2019) (see Table 2.1). It is critical to note that these differences are generalizations of the two approaches, especially at their earlier stages. Both approaches can take varied forms, and many of the distinctions seem to be blurred after years of development.

Table 2.1

Differences between Collaborative Learning and Cooperative Learning

Aspects	Collaborative Learning	Cooperative Learning
Origin	Group learning in British schools and universities (Abercrombie; Mason and colleagues)	American social psychological study on cooperation and competition (Lewin; Deutsch)
Education level	Started from higher education	Started from K-12, esp. primary schools
Premise	Learning is impeded by authority of knowledge.	Learning is impeded by competition and individualism.
Theoretical foundations	Social construction (Kuhn; Rorty) Constructivism (Piaget; Vygotsky) Critical pedagogy (Freire)	Social interdependence (Lewin; Deutsch) Cognitive development (Piaget; Vygotsky) Behaviorist learning (Skinner; Bandura)
Leading scholars	Humanist educators in literature and philosophy (Bruffee)	Social psychologists and STEM educators (Johnson & Johnson; Slavin)
Research methods	Qualitative	Quantitative

Research focus	Learning outcomes (achievement, social skills, etc.)	Learning processes (knowledge construction, argumentation, etc.)
Knowledge type	Nonfoundational knowledge (addressing questions with arguable or ambiguous answers)	Foundational knowledge (addressing questions with widely agreed-upon answers)
Task type	Open-ended tasks	Close-ended tasks (with correct answers)
Group processes	loosely structured	Highly structured
Division of Labor	No	Yes
Assessment	Group performance	Individual learning
Typical strategies / methods	Consensus groups (Bruffee) Peer tutoring (Bruffee) Collaborative writing (Bruffee) Reciprocal teaching (Palincsar & Brown) Learning communities (Smith & MacGregor) Team-based learning (Michaelson, Knight, & Fink)	Think-Pair-Share (Lyman) Jigsaw (Aronson) Group Investigation (Sharan & Sharan) Jigsaw II (Slavin) Student-Team-Achievement-Division (Slavin) Team-Games-Tournament (Slavin) Team-Accelerated Instruction (Slavin) Learning Together (Johnson & Johnson) Constructive Controversy (Johnson & Johnson) Three-Step Interview (Kagan) Inside Outside Circle (Kagan) Rally Robin (Kagan) Numbered Heads Together (Kagan) Co-op Co-op (Kagan)

To sum up, collaborative learning was founded by humanity educators in higher education, based on theories of constructivism (Piaget and Vygotsky) and critical pedagogy (Freire), with the goal of shifting the structure of authority in education. Collaborative learning research typically involves qualitative approaches, whereas the practice of collaborative learning is typically based on the design of open-ended tasks for students to work together to reach a consensus and typically does not intervene in group processes or teach team-building skills. In contrast, cooperative learning was established by social psychologists and STEM educators to improve K-12 education in a culture of competition and individualism, based on theories of social interdependence (Lewin and Deutsch), constructivism (Piaget and Vygotsky), and behaviorist learning theories (Skinner and Bandura). Cooperative learning researchers typically use quantitative approaches to test and validate their theories. The practice of cooperative

learning has typically been based on many ready-to-use methods to promote positive interdependence among group members. How these distinctions come into being will be made more apparent as we review the historical development of collaborative and cooperative learning in the next section.

With these differences in mind, it is important to remember that collaborative and cooperative learning share more similarities than differences (Kreijns et al., 2003). They both harness "peer group influence to focus on intellectual and substantive concerns" (Bruffee, 1999, p. 92) and are both student-centered pedagogies compared to traditional teacher-centered lectures. Fundamentally, they have some shared theoretical assumptions, such as: Learning is an active, constructive process; learning depends on rich contexts; learners are diverse; learning is inherently social; learning has affective and subjective dimensions (Smith & MacGregor, 1992).

Early Development in the 1960s and 1970s

Small group learning approaches such as collaborative learning and cooperative learning can be traced back to ancient times (Johnson & Johnson, 1999; Johnson & Johnson, 2021). However, modern exploration of collaborative learning and cooperative learning began in the 1960s and emerged as fields of study in the 1970s. Around this period of time, there were probably many other educators who were practicing small group pedagogies without knowing or using the labels of collaborative or cooperative learning (Gamson, 1994).

Collaborative Learning with British Origins

Research on collaborative learning originated in Britain in the 1960s (Bruffee, 1984). At the college level, Abercrombie experimented with teaching medical students to make better diagnoses through collaborative learning at the University of London (Bruffee, 1973, 1984, 1999). For secondary education, the Curriculum Laboratory at the University of London

Goldsmiths' College worked closely with local school teachers to promote collaborative learning with a strong political endeavor to establish democracy and humanity in education (Bruffee, 1984). Edwin Mason (1970) summarized the innovative work he and his colleagues in the Curriculum Laboratory did in his book *Collaborative Learning,* which was the first time this term appeared in the literature. Mason (1970) proposed to design a new educational system that could foster "authenticity in knowledge and in relationships" and "dialogue between pupils and collaboration," which he believed "can only happen if most work goes on in small groups, so conditions must also be sufficiently relaxed for teachers to allow groups to work much of the time without supervision" (p. 85). As a pioneer of collaborative learning, Mason (1970), however, deliberated not to give any definitions of collaborative learning, nor did he provide operational procedures for practicing collaborative learning.

In the early 1970s in the United States, a young American professor in English at Brooklyn College, Kenneth A. Bruffee, borrowed the term "collaborative learning" from Mason (1970), as he was trying to solve practical issues in his own teaching (Bruffee, 1984, 1999). Years later, Bruffee furthered the theorization of collaborative learning and became the leading collaborative theorist. Bruffee (1973) described his earlier attempts at collaborative learning in his literature and composition classes in the article "Collaborative Learning: Some Practical Models" published in *College English*, which became a major platform for many of the early discussions of collaborative learning.

As Bruffee (1973) observed, college students participated in a wide range of collaborative activities such as academic study groups, hobby groups, and political activist societies outside the classroom, whereas they were expected to work individually inside the classroom and collaboration was discouraged. At that time, the open admissions policy in his

institution brought about dramatic changes in the campus demographics with more minority students and students of low achievement (Bruffee, 1999). There was a need to bridge the achievement gap and racial differences, forcing him to rethink the nature of knowledge, authority, and education. Drawing inspirations from Dewey, Vygotsky, and Freire's *Pedagogy of the Oppressed*, Bruffee (1999) started to experiment with collaborative learning in his department around the idea of knowledge communities and reacculturation, but he had not yet fully uncovered the connections between these ideas and collaborative learning until the 1980s.

Cooperative Learning without a Name

In the meantime, the pioneers of cooperative learning, including David W. Johnson and Roger T. Johnson, Elliot, Spencer Kagan, Richard Schmuck, Neil Davidson, Elizabeth G. Cohen, Robert E. Slavin, and Shlomo Sharan, started their research careers on cooperative learning in the 1960s and 1970s (Davidson, 2021a). The term "cooperative learning," however, did not appear in literature until around 1980; alternative terms such as "small group learning" were used before that (Davidson, 2021a). The recently published book *Pioneering Perspectives in Cooperative Learning*, edited by Davidson (2021b), invited these leading scholars to share stories about how they developed their unique approaches to cooperative learning.

Like Bruffee, Aronson (2021) invented the now famous jigsaw method in the early 1970s in response to critical issues caused by the socio-cultural contexts, i.e., the desegregation in public schools in Texas. Aronson (2021) implemented the jigsaw method among fifth-grade students. It was a success as students learned to appreciate each other's differences, became friendly to each other, and developed a positive attitude towards the school.

David and Roger Johnson from the University of Minnesota started to train teachers on cooperative learning in the mid-1960s during a time of competition and individualism within

American society. In 1975, they published their masterpiece *Learning Together and Alone* (5th edition in 1999) (Johnson & Johnson, 1999). They grounded their research practices on social interdependence theory, cognitive developmental theory, and behavioral learning theories (Johnson & Johnson, 1999; Johnson & Johnson, 2009). Social interdependence theory was developed by Morton Deutsch in the 1940s, which "grounds the entire field of cooperative learning" (Stevahn, 2021, p. 17). Deutsch's social intercedence theory was expanded by his student David Johnson (Johnson & Johnson, 1999; Johnson & Johnson, 2009; Johnson & Johnson, 2021).

Social interdependence theory distinguishes three types of social interaction: promotive interaction (cooperation) from positive interdependence of individuals in a group; oppositional interaction (competition) from negative interdependence of group members; and no interaction (individualist efforts) from independence or no interdependence within a group. Although cooperative, competitive, and individualistic learning can all lead to constructive learning, the Johnsons argued that cooperative learning should be "the basic foundation of instruction, the underlying context on which all instruction rests" (Johnson & Johnson, 1999, p. 11). The cognitive-developmental perspective of cooperative learning is rooted in Piaget's "conceptual conflicts" and Vygotsky's "Zone of Proximal Development" (Johnson & Johnson, 1999). The behavioral learning theories by Skinner and Bandura support the use of extrinsic motivation as incentives for students to learn together "since it is assumed that students will not intrinsically help their classmates or work toward a common goal" (Johnson & Johnson, 1999, p. 186).

Further, Johnson and Johnson (1999; 2009; 2021) identified five core elements of productive cooperative learning: (1) positive interdependence (achieved by sharing goals, resources, roles, workload, and rewords); (2) individual accountability and personal

responsibility; (3) promotive interaction; (4) appropriate use of social skills; and (5) group processing. Besides building a comprehensive theoretical framework and practical guidelines for cooperative learning, the Johnsons applied their cooperative learning methods in the classrooms and conducted empirical research to validate and refine their theory (Johnson & Johnson, 1999; Johnson & Johnson, 2009; Johnson & Johnson, 2021). Many other cooperative learning scholars also conduct quantitative research, as most of them are well-trained social psychologists (e.g., David Johnson, Slavin, Sharan, Aronson, Kagan, and Schmuck) or STEM educators (e.g., Roger Johnson and Davidson).

A community of cooperative learning scholars was formed in the late 1970s. Initiated by Shlomo Sharan, the First International Convention on Cooperation in Education took place in Israel in 1979, and the International Association for the Study of Cooperation in Education (IASCE) was founded. The IASCE was active for four decades until its closure amid the Covid-19 pandemic in 2020 (Davidson, 2021a).

Coming of Age in the 1980s and 1990s

In the 1980s and 1990s, both collaborative and cooperative learning witnessed substantive growth and gained wide recognition. However, they did not develop in the same fashion or at the same pace. Having established solid theoretical foundations in the 1970s, cooperative learning has flourished in research since then and was widely adopted at all educational levels by the 1990s. Theories of collaborative learning were not established until the early 1980s, and up to that point, research on collaborative learning was lacking (Bruffee, 1986; Smit, 1989). However, collaborative learning became “a conscious and well-developed set of practices carried out by a growing number of practitioners from many disciplines” in the 1990s (Gamson, 1994).

The paths of collaborative and cooperative learning started to cross around the mid-1990s as scholars attempted to differentiate the two approaches (Bruffee, 1995; Dillenbourg, 1999; Oxford, 1997; Panitz, 1999; Smith & MacGregor, 1992). In 1995, four scholars (two representing each approach) (Matthews et al., 1995) co-authored an article, "Building Bridges between Cooperative and Collaborative Learning," published in *Change: The Magazine of Higher Learning*, emphasizing the similarities of the two approaches. This can be regarded as a critical moment for reconciling differences between the two approaches. Moreover, the field of instructional design and technology began to adopt collaborative learning as a research paradigm, using the term "collaborative learning" to broadly characterize all approaches (Koschmann, 1996).

Towards a Theory of Collaborative Learning

Bruffee first presented his theorization of collaborative learning in 1984 (Bruffee, 1984), with important extensions to the theory in 1986 (Bruffee, 1986), culminating in the publication of his book *Collaborative Learning: Higher Education, Interdependence, and the Authority of Knowledge* (first published in 1993; second edition in 1999) (Bruffee, 1999).

Bruffee (1986) introduced social constructionist theories and how they shaped his understanding of collaborative learning. Based on Vygotsky's idea that learning happens when social interactions are reflected and internalized by the learner, Bruffee (1984) argued that our thought or knowledge is not a given attribute but a social artifact constructed in the process of social interaction among communities of knowledgeable peers. Collaborative learning reflects the process of socially justifying our beliefs as we learn: "…by challenging each other's biases and presuppositions; by negotiating collectively toward new paradigms of perception, thought, feeling, and expression; and by joining larger, more experienced communities of knowledgeable

peers through assenting to those communities' interests, values, language, and paradigms of perception and thought" (Bruffee, 1984, p. 646). In these knowledge communities, the teachers' traditional role as the authority of knowledge was deconstructed, and a teacher's responsibility was shifted to introduce the new members (students) to the community (Bruffee, 1984, 1986, 1999). In collaborative learning, authority is distributed among group members, fostering interdependence on each other (Bruffee, 1999). For the students, learning comes from joining a new community with a culture different from their own, which happens when they have conversations and negotiate the boundaries of different communities (Bruffee, 1999). Therefore, learning or education is a process of reacculturation, which is fundamentally collaborative (Bruffee, 1984, 1986, 1999).

Bruffee (1984) admitted that collaborative learning was challenging to implement and that there was no one approach or "recipe" to practicing it. But he believed collaboration was essential for students to engage in intellectual pursuit through social interaction (Bruffee, 1984, 1999). Although there was no single approach, Bruffee (1999) gave examples of collaborative learning, such as consensus groups, peer tutoring, and collaborative writing. Additionally, Wiener (1986) proposed a series of elements for practitioners to consider when evaluating collaborative learning, e.g., task design, student behavior, teacher's behavior, group formation and management, and final product. However, there was a lack of evidence-based research on collaborative learning (Smit, 1989). Instead, collaborative learning scholars had to draw upon evidence from cooperative learning (Bruffee, 1986). Udvari-Solner (2012b) held a critical viewpoint that "[r]esearch regarding collaborative learning strategies is generally subsumed under broader investigations of collaborative learning. If collaborative learning strategies are

held distinct from cooperative learning, it is difficult to find studies that have extensively investigated the use of one particular strategy."

Cooperative Learning Flourishing with Research

Most prominent cooperative learning scholars are well-trained phycologists (e.g., David Johnson, Aronson, Kagan, Schmuck, Slavin, and Sharan) or have a background in STEM education (e.g., Roger Johnson and Davidson). They conducted much quantitative research on the effect of cooperative learning in the 1980s and 1990s. Johnson and Johnson (1999) asserted that "Cooperative learning can be used with some confidence at every grade level, in every subject area, and with any task…. The research on cooperative learning has a validity and a generalizability rarely found in the educational literature" (p. 192).

With a massive body of empirical research, meta-analytical studies were conducted to examine the overall effect of cooperative learning and identify conditions for successful cooperation (Johnson & Johnson, 1981, 1983; Slavin, 1983, 1999). According to Johnson and Johnson (1999), compared to competitive learning and individualist learning, cooperative learning can enhance student achievement, promote critical thinking, foster positive attitudes towards the subject area, increase interpersonal skills, decrease attrition rates, and improve students' self-esteem. Slavin (1983) focused on incentive structure and task structure, and his review of the literature revealed that group rewards (instead of individual rewards) and individual accountability (achieved by task specialization and division of labor) are critical to improving students' achievement. Although there are conflicting results in the research, Slavin (1990) summarized what was in agreement:

> There is agreement that—at least in elementary and middle/junior high schools and with basic skill objectives—cooperative methods that incorporate group goals and individual

> accountability accelerate student learning considerably. Further, there is agreement that these methods have positive effects on a wide array of affective outcomes, such as intergroup relationships, acceptance of mainstreamed students, and self-esteem. (p. 544)

Technology and Collaborative/Cooperative Learning

With the development of personal computers and the Internet, interest in supporting collaborative and cooperative learning with technology has been growing since the 1980s. The Johnsons and colleagues conducted several studies on computer-assisted cooperative learning in the late1980s (Johnson & Johnson, 1993). Johnson and Johnson (1993) confirmed the media myth (i.e., technology is only a vehicle of delivery and what matters is the instruction strategy). They suggested that developers need to have a good understanding of the five elements of cooperative learning to create effective cooperative learning experiences. Likewise, Bruffee (1999) pointed out that software developers and educators should collaborate to design "genuinely interactive" software, which might be particularly useful for distance learning by offering online learners similar experiences to residential college students.

Collaborative learning/cooperative learning was neglected by instructional technology for over two decades until the emergence of Computer-Supported Collaborative Learning (CSCL) (Dillenbourg et al., 1996). In 1989, the first workshop on CSCL, sponsored by NATO, took place in Italy, marking the beginning of CSCL as a field of research in instructional design and technology (Koschmann, 1996). It is self-evident from its name that the underlining model of CSCL is collaborative learning, but the term is used as a global description for various small group approaches (Koschmann, 1996). Furthermore, CSCL researchers learned to incorporate the strength of cooperative learning because they recognized the importance of structure (scripting) in the complex interplay of technology and collaboration and tried to strike a balance

between scripting and over-scripting (Dillenbourg et al., 2009). In this sense, I argue, CSCL is where collaborative learning and cooperative become reconciled.

The first International Conference on CSCL was held at the University of Indiana in 1995 (Koschmann, 1996) and has been held biannually ever since. One of the earliest technological tools developed for collaborative learning is the Computer-Supported Intentional Learning Environments (CSILE) or Knowledge Forum (Scardamalia & Bereiter, 2006, 2010). CSILE was created for a university course in 1983, then implemented at all levels of education. It later evolved to become Knowledge Forum, a widely used web-based tool to support asynchronous discussion using multiple representations of understanding such as texts and graphical notes (Scardamalia & Bereiter, 2006, 2010).

The Evolution of CSCL in the 21st Century

In 2006, the International Society of the Learning Sciences (ISLS) founded the International Journal of Computer-Supported Collaborative Learning (ijCSCL), which has become a significant forum for the research community of CSCL and contributed to the establishment of CSCL's "centrality to education for the future" (Stahl, 2015, p. 339). After over 30 years of development, CSCL "reached its adolescence" (Wise & Schwarz, 2017, p. 424) but has not become a mature research field because the CSCL community has not agreed upon a theory or framework to guide the research in CSCL (Wise & Schwarz, 2017). CSCL scholars (Dillenbourg et al., 2009; Stahl, 2015; Wise & Schwarz, 2017) have discussed trends in CSCL research as the field has evolved. Among these trends, there is one prominent continuing thread of CSCL research, namely collaboration scripts, which are structured scaffolding strategies or mechanisms to engage students in productive interactions (Fischer et al., 2007). Research has shown that collaboration scripts can promote knowledge gain and acquisition of collaboration

skills (Radkowitsch et al., 2020; Vogel et al., 2017). A possible explanation was that "collaboration scripts or prompts facilitated elaboration, elicitation, and knowledge externalization, and sustained in-depth discussion, which in turn promoted high-level thinking and knowledge acquisition" (Chen et al., 2018, p. 831).

As a relatively newly-established area, the CSCL community has endeavored to demonstrate the effectiveness of CSCL. Numerous studies have been devoted to this end, but results have not always been positive, perhaps due to all of the complexities of CSCL. In response, some scholars have conducted meta-analyses to examine the overall effectiveness of CSCL in different dimensions (Jeong et al., 2019; Radkowitsch et al., 2020; Sung et al., 2017; Vogel et al., 2017). For example, Chen et al. (2018) conducted a comprehensive meta-analysis, covering 356 peer-reviewed CSCL articles published between 2000 and 2016. They examined the effectiveness of three features of CSCL (collaboration, computer use, and supporting tools and strategies) on five types of learning outcomes: domain-specific knowledge, higher-order thinking skills, students' perceived satisfaction, group task performance, and social interaction. Their meta-analysis (Chen et al., 2018) showed an overall positive effect of CSCL on all types of learning outcomes. Group awareness tools stood out as the most valuable in all learning outcomes and collaboration scripts were frequently used as an instruction and guidance strategy. Despite the overall encouraging findings, Chen et al. (2018) warned that CSCL was not a "panacea" and that the design of CSCL environments should be aligned with learning objectives, learning needs, and learning activities. Careful design of CSCL environments is needed to support positive interactions (Roschelle & Teasley, 1995), for example, by scaffolding students to construct shared knowledge and by structuring collaborative learning activities (Dillenbourg et al., 2009).

Four Research Paradigms

In the past five decades, there has been a proliferation of research on collaborative learning and cooperative learning. Dillenbourg et al. (1996) outlined the evolution of research on collaborative learning, which was used as an umbrella term, and proposed three paradigms to categorize different research orientations: the "effect" paradigm, the "conditions" paradigm, and the "interaction paradigm." Each has roots from different theoretical perspectives of collaborative learning. Building upon their taxonomy, I introduce another term—the "design" paradigm to describe the design-based research in Computer-Supported Collaborative Learning (CSCL) that has emerged in the last twenty years. Thus, together there are four paradigms of research on collaborative/cooperative learning. To follow suit with Dillenbourg et al. (1996), the term "collaborative learning" is used to cover both collaborative and cooperative learning in this section. Dillenbourg et al. (1996) cautioned that this classification does not mean one paradigm is better than the other because all research paradigms are needed. However, it is important to note that there is not a clear line distinguishing one paradigm from another, given their shared theoretical underpinnings.

The "Effect" Paradigm

This paradigm seeks to answer whether collaborative learning is more efficient than learning alone (Dillenbourg et al.,1996). Researchers usually conduct experiments with control groups (working alone) and condition groups (working collaboratively) in the classrooms or laboratories to test their hypotheses. The dependent variables are usually individual learning outcomes, such as achievement, critical thinking, attitudes towards subject area, social support, self-esteem, and social skills (Johnson & Johnson, 1999; Johnson & Johnson, 2009). While there are mixed results in this type of research, meta-analytic studies have demonstrated an overall

positive effect of collaborative learning (Johnson et al., 2000; Slavin, 1980). However, Dillenbourg et al. (1996) argued that negative results or even results showing no differences should not be neglected entirely because "[s]ome negative effects are stable and well documented, for instance, the fact that low achievers progressively become passive when collaborating with high achievers" (p. 8). Furthermore, collaborative learning should not be treated as a "black box" because collaboration does not happen just by putting students into small groups (Dillenbourg et al.,1996; Johnson & Johnson, 1999). Collaborative learning per se does not enhance or inhibit learning achievement (Slavin, 1983). The better question to ask is perhaps what conditions make collaborative learning more efficient than working alone, which is the focus of the next paradigm.

The "Conditions" Paradigm

This research paradigm looks into the specific conditions that might promote collaborative learning. The research methods are similar to the first paradigm; however, researchers systematically investigate a wide range of variables, including group formation, type of tasks, communication medium, and collaboration contexts (Dillenbourg et al., 1996). For example, heterogeneous groups with varied expertise levels are generally more productive than homogeneous groups, but they have different effects on high- and low-achievers (Dillenbourg et al., 1996). A meta-analysis by Slavin (1983) focused on incentive structure and task structure. Results showed that in K-12 settings, group rewards (instead of individual rewards) and individual accountability (achieved by task specialization and division of labor) are critical to improving students' achievement (Slavin, 1983). The "conditions" paradigm helps researchers and educators better understand the mechanism of collaborative learning compared to the first paradigm. Nonetheless, in natural classroom learning environments, the condition variables

inevitably interact with other variables to impact the dependent variable, resulting in contradicting research findings (Dillenbourg et al., 2009). Some researchers explained the inconsistencies in terms of different researchers using different cooperative learning techniques, learning settings, experimental designs, learner attributes, and subject matter. However, interaction among these attributes was seldom considered (Webb, 1982). Effective collaborative learning comes from productive group interactions, and thus research should focus more on "the more microgenetic features of the interaction" (Dillenbourg et al., 1996, p. 12). Hence the third paradigm is the "interaction" paradigm.

The "Interaction" Paradigm

This paradigm divides research questions stemming from the "conditions" paradigm into two sub-questions: what conditions trigger what interactions and what effects do these interactions entail (Dillenbourg et al., 1996). The key to these questions is to identify "variables that describe the interactions and that can be empirically and theoretically related to the conditions of learning and to learning outcomes" (Dillenbourg et al., 1996, p. 12). Consequently, research becomes more process-oriented, and as a result, many researchers turn to qualitative methods such as discourse analysis and conversation analysis to identify moments of collaboration with the group as the unit of analysis (Stahl, 2006). The most studied interaction variables are explanation, argumentation or negotiation, and regulation (Dillenbourg et al., 2009). For example, Webb (1982) revealed that giving and receiving elaborate explanations (instead of simply the correct answers) were positively correlated with individual learning gains and that off-task and passive behaviors had a negative correlation with learning outcomes. On the other hand, many process-oriented studies in the "interaction" paradigm seem to answer only one of the two sub-questions (Dillenbourg et al., 1996). In other words, the relationship between

conditions of learning and learning outcomes is not always made clear by researchers. One of the challenges of the interaction paradigm is the difficulty in data analysis and interpretation because there is a lack of theoretical frameworks to analyze interactions "due to the fact that the Piagetian and Vygotskian perspectives … are simply too global to allow proper explanation" (Dillenbourg et al., 1996, p. 17).

The "Design" Paradigm

I offered "design" as a fourth paradigm to describe a unique strand of CSCL research that focuses on the design and development of "conditions in which effective group interactions are expected to occur (Dillenbourg et al., 2009, p. 6). It is easy to identify the three previous paradigms within CSCL literature (Chen et al., 2018; Radkowitsch et al., 2020). However, the CSCL community has a tradition of conducting design-based research (DBR). Researchers and practitioners collaborate to study educational phenomena in authentic educational contexts by testing and refining design principles through iterative design (Stahl & Hakkarainen, 2020). DBR is theory-driven and practice-oriented because it aims to bridge the gap between theory, research, and practice (Wang & Hannafin, 2005). A successful DBR project is the already mentioned Computer-Supported Intentional Learning Environments (CSILE) (later known as Knowledge Forum) (Scardamalia & Bereiter, 2006, 2010). Through the iterative design efforts to innovate means to support collaborative construction of community knowledge, they refined the technology, pedagogy, and theory of "Knowledge Building" (Scardamalia & Bereiter, 2006, 2010). The Knowledge Forum project and related research demonstrate the huge potential of the "design" research paradigm in CSCL. However, DBR is not free of challenges. First and foremost, there is still a lack of agreement in the field of DBR in terms of its definition, terminologies, features, and procedures (Christensen & West, 2018). This inconsistency makes it

a challenge to conceptualize and implement DBR (Christensen & West, 2018). DBR projects are usually situated in specific educational contexts and it might be difficult to expand the interventions to larger contexts (Anderson & Shattuck, 2012). On the other hand, some scholars caution that focusing on scalability and generalizability might sabotage "the designerly nature of DBR" (Svihla, 2014, p. 35). It seems to be challenging to strike a balance. On the practical level, multiple iterations of a DBR project might present challenges of time constraints (Anderson & Shattuck, 2012).

Conclusion

This paper provides a historical review of collaborative and cooperative learning, beginning with their definitions and characteristics. The practice of group-based learning can be traced back to ancient times (Johnson & Johnson, 1999; Johnson & Johnson, 2021). However, modern practices of collaborative learning and cooperative learning simultaneously and independently emerged in the 1960s, launched in the 1970s, and thrived in the 1980s and 1990s as two separate methodologies. Not until the mid-1990s did the two camps start acknowledging each other's work and bridging their differences. In the context of instructional design and technology, the two seem to be less differentiated. CSCL emerged in 1989 and witnessed rapid advancement in the last two decades. The knowledge of the historical development of collaborative learning and cooperative learning can help us understand the similarities and differences between the two and help practitioners make informed decisions about which term most applies to a given learning situation and what pedagogical strategies are best to apply. Research on collaborative learning can be described within four paradigms: the "effects" paradigm, the "conditions" paradigm, the "interaction" paradigm (Dillenbourg et al., 1996), and the "design" paradigm. While all research paradigms are important and necessary (Dillenbourg

et al., 1996), some researchers have called for more research on the “interaction” paradigm (Dillenbourg et al., 1996; Dillenbourg et al., 2009) and the “design” paradigm in the future (Stahl, 2015; Wise & Schwarz, 2017).

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Appendix

History of Collaborative Learning, Cooperative Learning, and CSCL

(Inspired by the table in Johnson and Johnson (1999, pp. 185-186)).

Timeline of Collocative learning	
1964	Abercrombie book *Anatomy of Judgment*
1970	Mason Book *Collaborative Learning* (First time the term "collaborative learning" appeared in literature)
1973	Bruffee "Collaborative Learning: Some Practical Models", *College English*
1980s	(American Association of Higher Education) AAHE's Action Community on Collaborative Leaning
1984	Bruffee "Collaborative Learning and Conversation of Mankind", *College English*
1986	Bruffee "Social construction, language, and the authority of knowledge: A bibliographical essay", *College English*
1992	*Collaborative Learning: A Sourcebook for Higher Education*, edited by Goodsell et al.
1993	Bruffee book Collaborative Learning: Higher Education, Interdependence, and the Authority of Knowledge

Timeline of Cooperative learning	
1966	David Johnson began training teachers on cooperative learning
1970	David Johnson book *Social Psychology of Education*
1976	Sharan & Sharan book *Small Group Teaching* (Group Investigation)
1978	Aronson "Jigsaw Classroom*", Journal of Research and Development in Education*
1979	First IASCE (International Association for the Study of Cooperation in Education) conference in Israel
1980	The term "cooperative learning" first appeared in literature (*Review of Educational Research)*
1985	*AERA SIG Cooperative Learning*
1995	Johnson & Johnson research review on competition and cooperation: *Learning Together and Alone*

Timeline of CSCL	
1989	First CSCL workshop held in Italy by the NATO Special Program on Advanced Educational Technology. Follow-up workshops held in 1991 and 1992.
1995	First International Conference on CSCL held at the University of Indiana. Since then, the conference has been held biannually.
1996	1996 *CSCL: Theory and Practice of an Emerging Paradigm* edited by Koschmann.
2002	*CSCL 2: Carrying forward the Conversation* edited by Koschmann, Hall, & Miyake.
2006	*The International Journal of Computer-Supported Collaborative Learning* (ijCSCL) founded by the International Society of the Learning Sciences (ISLS).

CHAPTER 3

CREATING LEARNING PERSONAS FOR COLLABORATIVE LEARNING IN HIGHER EDUCATION: A Q METHODOLOGY APPROACH[2]

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Abstract

Although collaborative learning is acknowledged as important in higher education, there are many challenges when designing and implementing collaborative learning and research has found that many college students were frustrated with group work. This study was aimed at investigating students' perspectives on various sources of frustrations in group learning and creating learner personas that can be helpful for faculty and instructional designers to design positive collaborative learning experiences. Using Q methodology, five learner personas with rich narratives were identified: goal-oriented collaborator, fairness-oriented independent learner, learning-oriented collaborator, and adapted collaborator. This paper discusses the implications, benefits, and limitations for instructional design.

Keywords: Collaborative learning, frustrations, learner personas, Q methodology, higher education

Introduction

Collaborative learning was broadly defined by Dillenbourg (1999) as “a situation in which two or more people learn or attempt to learn something together” (p. 1). Collaborative learning has been widely adopted as a student-centered active learning approach in higher education (Barkley et al., 2014). Benefits and advantages of successful collaborative learning are well-documented in research, such as fostering self-esteem, eliminating anxiety, promoting diversity, enhancing critical thinking and other higher-order skills (Gokhale, 1995; Kirschner et al., 2018; Laal & Ghodsi, 2012; Roberts, 2004). Despite the widely acknowledged importance of collaborative learning, problems and challenges of collaboration are equally common (Roberts, 2004; Roberts & McInnerney, 2007). Examples of common challenges in collaborative learning include: (1) student antipathy towards group work; (2) group selection methods, i.e., self-select, random select, or teacher-select; (3) a lack of group work skills; (4) the free-rider, i.e., group members who make no or little contributions to group work; (5) possible inequalities of student abilities; (6) the withdrawal of group members; and (7) the assessment of individuals within the groups (Roberts & McInnerney, 2007). However, most studies discussed these problems from the perspective of researchers and practitioners while research on “student criticism or dissatisfaction with group work is strangely lacking” (Barkley et al., 2014, p. 31), even though they are two sides of the same coin.

In reality, many students have frustrations or negative experiences in small group learning (Capdeferro & Romero, 2012; Feichtner & Davis, 1984; Isaac, 2012; Salomon & Globerson, 1989; Sorensen, 1981; Tucker & Abbasi, 2016), which could lead to students’ resistance towards collaborative learning (Forrest & Miller, 2003; Pfaff & Huddleston, 2003; Smith et al., 2011). Consequently, it might further contribute to ineffective group work and

frustrating learning experiences in the future, creating a vicious cycle (Forrest & Miller, 2003; Keyton et al., 1996). Therefore, research focusing more on the students' perceptions of their collaborative learning experiences is important to inform both educational research and teaching and learning practices (Saghafian & O'Neill, 2018). One of the approaches to understand student perceptions is to create learner personas. A Learner persona is the narrative about a fictionalized learner based on some common characteristics of type of learners, such as their needs, goals, values, and attitudes in the learning contexts to be designed for them (van Rooij, 2012). Well-developed personas can communicate learner information "in robust, compact, easily digestible ways that are engaging" (Zagallo et al., 2019, p. 3). Learner personas could help instructors or instructional designers to develop empathy towards learners and make informed design decisions for CL (van Rooij, 2012).

The purpose of the current study is two-fold: To understand undergraduate students' subjective perspectives on the frustrations they have experienced related to group work; and to create meaningful learner personas for collaborative learning, based on these perspectives. To achieve the research goals, this study used Q methodology—a unique mixed methods approach to investigating people's subjectivity (Ramlo, 2016, 2021).

This paper is organized in six sections: First, it provides a brief literature review on the frustrations college students experience in collaborative learning groups; the second section discusses the usefulness of learner personas; the next section further discusses how Q methodology can be used to study diverse perspectives and create learner personas; the methods section presents the data collection procedures and data analysis; the results section reports the five personas created in this study; and final section discusses the implications for instructional design and directions for future research.

Literature Review on Frustrations in Collaboration

It is worth noting that there are three types of collaborative learning groups: informal, formal, and base groups (Barkley et al., 2014; Johnson & Johnson, 1999). Informal groups are formed temporarily in class for a short period of time, such as a 10-minute group discussion to generate ideas. Formal groups work together on more complex tasks that can take from one class session to several weeks, usually referred to as group projects. Base groups, which are more like learning communities, are long-term groups that stay together for a whole semester or longer, where group members support, help, and encourage each other to learn but not necessarily to work on shared tasks. As informal groups are ad hoc and their work is seldom graded, students are less likely to be frustrated. Base groups are less used in one specific course than informal and formal groups due to the requirement of long-term membership. Therefore, literature on frustrations in group work mostly refers to formal groups or group projects.

A small strand of research was dedicated to investigating the factors causing students' negative experiences and apprehensive attitudes towards collaborative learning (Capdeferro & Romero, 2012; Gottschall & García-Bayonas, 2008; Sorensen, 1981; Tucker & Abbasi, 2016; Wilson et al., 2018). Table 3.1 summarizes research on students' negative perceptions of collaborative learning in different learning contexts. As can be seen, results in the studies shown in Table 3.1 share many similarities in terms of students' frustrating experiences in group work. These frustrations can further be categorized into five types: (1) frustrations related to the instructor, such as poor task design, confusing directions, lack of support for students, and unfair assessment; (2) frustrations related to group members, especially those who are dominating or slacking. The famous free-rider effect or social loafing (Salomon & Globerson, 1989), where one or more group members make no or little effort to contribute and leave it to others to do the

work, is arguably the most prominent frustration for college students; (3) frustrations related to the learning outcomes, such as poor quality of work and low grades; (4) frustrations related to the process of communication and interaction, such as disagreements, misunderstandings, and conflicts; (5) and frustrations related to the self, due to personal preferences or personalities, i.e., preferring to work alone, disliking depending on others for the final grade, feeling stressful working with people they don't know or like, etc.

Based on the literature on students' negative perceptions, Pauli et al. (2008) developed a 39-item instrument—Negative Group Work Experiences (NGWE) questionnaire, covering logistical, motivational, and interpersonal dimensions of collaborative learning. They also uncovered that more negative experiences were reported when problems were not addressed, compared with issues being resolved within the group or with the help of tutors (Pauli et al., 2008). The NGWE questionnaire is a comprehensive instrument to measure issues arising in group processes such as lack of group commitment, group disorganizations, and group member conflicts. However, it does not include negative experiences caused by other factors such as assessment, task design, and instructor support. The NGWE questionnaire can be used for instructors to monitor group processes, identify dysfunctional groups, or identify antecedents of negative experiences to inform the design of group tasks (Pauli et al., 2008).

To sum up, college students' frustrations in collaborative learning are complex and multi-faceted and thus call for the empathy from the instructors and instructional designers. Learner personas could be a valuable tool to help faculty and practitioners to better understand undergraduate's frustrations, attitudes, and needs in group learning.

Table 3.1

Sources of Students' Negative Perceptions of Collaborative Learning

Study	Participants	Discipline	Sources of negative perceptions
(Capdeferro & Romero, 2012)	40 online graduate students	eLearning	(1) Commitment imbalance; (2) Unshared goals; (3) Communication difficulties; (4) Negotiation problems; (5) Individual contribution imbalance; (6) Excess of time spent and workload; (7) Conflict and problems in reaching consensus; (8) Assessment imbalance; (9) Misunderstandings; (10) Lack of instructor's support or orientation
(Gottschall & García-Bayonas, 2008)	291 undergraduate students	Math, Education, Business Administration	(1) Difficult to coordinate schedules; (2) Free riders; (3) Difficult for each member to contribute equally; (4) Would rather work alone; (5) Members don't share same grade expectations; (6) Disagreements are more likely; (7) We don't all think the same; (8) Don't like being responsible for other's grades; (9) Instructors assign group work without enough direction; (10) It is more work; (11) Groups are just a way for teachers to do less work; (12) Don't like people to depend on me; (13) Can't develop my own ideas; (14) See no sense in finished product
(Tucker & Abbasi, 2016)	615 undergraduate (80%) and graduate (20%) students	Design	(1) Unequal workload contributions; (2) Individual differences; (3) Unfair or inappropriate assessment; (4) Team-process related issues,; (5) Team formation methods; (6) Lack of appropriate training and support on teamwork skills; (7) Task-design-related issues; (8) Too much teamwork in the degree program in an academic period; (9) Dominating team members.
(Sorensen, 1981)	208 undergraduate students	Speech Communication	(1) Grading concerns (e.g. All received same grade with dissimilar work; lower grade because of group members); (2) Interpersonal concerns (e.g. overbearing leader; one bad group member; arguments; afraid to view new opinion; personality conflicts); (3) Learning outcomes (e.g. Nothing gets done; poor quality final project); (4) Group organization (e.g. being assigned a group, not enough time, topics for projects are boring)
(Wilson et al., 2018)	201 undergraduate students	Science	(1) Trying to schedule team meetings; (2) Group member(s) not contributing / unfair workload distribution; (3) Relying on the work of others for a final grade; (4) Time management between group members; (5) Lack of class time allocation; (6) It's more stressful than working alone; (7) Not being able to undertake the work the way I'd like to; (8) Working with people I don't like; (9) Interpersonal conflict; (10) Peer evaluation; (11) Team members are distracting and it's hard to focus on the work

Learner Personas

Personas are generally known as “hypothetical archetypes” (Cooper, 2020) or representative characters constructed by designers at the early stage of the design process (Nielsen & Hansen, 2014) to explicate the needs, desires, beliefs, attitudes, behaviors, and goals of the targeted users (Pruitt & Grudin, 2003). Personas are useful for fostering empathy towards the users, sharing the same understanding of the user characteristics within the design team and among key stakeholders, communicating the design ideas to others, and making informed decisions in the process of design and development (Salminen et al., 2018). Compared with statistical demographic data, personas are more effective and engaging by creating vivid scenarios from a wide range of qualitative and quantitative data (Pruitt & Grudin, 2003).

Since the introduction of personas in software design and development around two decades ago, personas have become a common design strategy in many human-centered design fields (Nielsen, 2018; Nielsen & Hansen, 2014). In the context of instructional design, learner personas can be used to inform instructional designers of the diverse needs of different types of learners and create learner-centered learning experiences. Adopting an ethnographic approach, Ozkan et al. (2019) developed five learner personas to assist the design of inclusive curricula for an Electrical and Computer Engineering program. Their use of personas was able to “engage the boundaries of culture, bringing to light not only characteristics of students who are not typically present in the program, but also faculty member’s assumptions about characteristics needed for success (Ozkan et al., 2019). Baaki et al. (2017) described the iterative processes of creating authentic personas of adult learners, using multiple sources and types of data, to instill empathy and help instructional designers create a Massive Online Open Course for them. In a Computer Science course, Lilley et al. (2012) created five personas from interview data focusing on

students' motivations, challenges, preferences, and expectations for online learning. These personas were considered to be beneficial in choosing pedagogical strategies and technological tools for distance learning.

Using Q Methodology to Create Learner Personas

Different methodologies have been used to create personas (Nielsen, 2018), such as traditional interviews (Lilley et al., 2012), ethnographic inquiry (Ozkan et al., 2019), mixed methods (Baaki et al., 2017), and big data analytic methods that take advantage of computational techniques to automatically collect, process, and analyze digital data (Salminen et al., 2018). Rieber (2020b) introduced Q methodology to the field of instructional design and highlighted the huge potential of Q in many aspects of instructional design. This study used Q methodology, a unique integrated mixed methods for studying human subjectivity (Ramlo, 2016, 2021), to investigate the divergent as well as shared perspectives on frustrations in collaboration among undergraduate students and further create learner personas for collaborative learning. According to Stephenson (1978), Q methodology is "the *modus operandi* for a science of subjectivity," and the term subjectivity refers to the "condition of viewing things exclusively through the medium of one's own mind" (p. 21). Q seeks to discover meaning and understanding through the factors emerging from the Q sorts (Stephenson, 1978, 1988). It can generate rich descriptions of diverse perspectives using both quantitative and qualitative research elements. It can be useful to reveal more nuanced viewpoints than Likert-scale surveys (Brewer-Deluce et al., 2020; Ramlo et al., 2008) and thus uncover marginalized opinions (Brown, 2006). On the other hand, its use of statistical procedures can be helpful to reveal patterns of subjective viewpoints that are otherwise difficult to examine with purely qualitative methods (Brown, 2008).

The data collection method in Q methodology is the Q sorting technique, where participants are asked to rank-order a series of Q sort items designed by the researcher—which can be statements, images, audios, physical objects, or other formats (Brown, 1993; Brown, 2008; McKeown & Thomas, 2013)—from the most agree to the most disagree to fit into a pre-designed normally distributed Q sort grid (Watts & Stenner, 2012). The Q sort items (Q sample) are sampled from a concourse, defined as the universe of subjective communicability (Brown et al., 2019; Stephenson, 1978). Therefore, to determine the Q sample, the researcher first needs to create the concourse related to their research questions. The number of statements (or other forms of items) in a concourse can be infinite in theory (hundreds in practice), and the content of statements should be opinions or feelings (i.e., self-referential) rather than facts (Brown et al., 2019; Stephenson, 1978). The concourse can come from multiple sources, such as theory, literature, newspapers, social media, and interview or observation data (Brown, 1980; Brown, 1993; McKeown & Thomas, 2013; Watts & Stenner, 2012). This process usually involves qualitative techniques such as discourse analysis and grounded theory (Sneegas, 2020). Then the Q sample is selected from the concourse just like participants are sampled from a large population in quantitative research, but not in a totally random fashion. Stephenson suggested the method of structured sample, which involves the adoption of Fisher's experimental design (Brown, 1980; Brown et al., 2019; Stephenson, 1953). In this method, all items in the concourse are grouped into different categories or themes, and then representative items are sampled proportionally from these categories. The structured sample is intended to ensure the representativeness and balance of the Q sample and thus reduce research bias (Brown, 1980; Brown et al., 2019; Watts & Stenner, 2012). While a well-developed concourse potentially includes hundreds of statements, the Q sample is usually about 30-60 statements (Brown, 2008).

A participant's sort of all statements is taken as a whole to represent the viewpoint of this individual person. Its correlation with other sorts is analyzed statistically in order to identify distinctive shared perspectives of a group of participants (Brown, 1980; Watts & Stenner, 2012). These shared viewpoints are called factors, which consist of the participants whose sorts are closely correlated to each other (Brown, 1980; Watts & Stenner, 2012). Q factor analysis is an inverted version of traditional factor analysis by correlating the people instead of items or variables. Although factor analysis in Q is primarily a statistical procedure, the researcher should not entirely rely on the statistical standards. There are multiple points where the researcher needs to make subjective decisions regarding how many factors to extract and how to rotate the factors because theoretical significance is more important than statistical significance (McKeown & Thomas, 2013; Ramlo, 2015; Watts & Stenner, 2012). To make sound decisions, researchers need to refer to the qualitative data they have collected. Post-sorting surveys, focus groups, or interviews are recommended to facilitate the factor analysis and interpretation (Watts & Stenner, 2012). In interpreting the Q factors, Q methodology aims to derive detailed descriptions of the factors, which can be used as the basis of learner personas. Therefore, researchers typically incorporate Q sort results and the qualitative data synergically.

For the current study, the development of the concourse was based on research articles about collaborative learning frustrations or challenges (Capdeferro & Romero, 2012; Chiriac, 2014; Pfaff & Huddleston, 2003; Tucker & Abbasi, 2016) and my personal experiences as a student and a teacher. At first, 27 statements were formed in five thematic groups: (1) frustrations related to instructor, (2) frustrations caused by group members, (3) frustrations related to the outcome, (4) frustrations in the process of communication and interaction, and (5) frustrations related to self. It should be noted that many statements about group members might

also be relevant to the process of communication and interaction, and vice versa. There are statements of frustrations in both face-to-face collaboration and online collaboration. The concourse was reviewed by a professor in education and then tested with eight doctoral students to help identify any potentially confusing directions and statements. Then two pilot studies were conducted in different settings using different tools (see Table 3.2). Results of the first pilot study were reported in a conference proposal (Yang & Rieber, 2020). Inspired by the pilot studies, two more statements were added to the concourse. The final Q sample used for this study were the 29 refined statements, the same as the concourse in this case (see Appendix A). Although, in theory, the statements in a concourse can be unlimited (Brown et al., 2019), the sources of frustrations are limited as well-documented in literature. There might be different expressions for the same source of frustrations.

Table 3.2

Contexts of Pilot Studies and Current Study

	Preliminary test	**Pilot study 1**	**Pilot study 2**	**Current study**
Time	Spring 2019	Spring 2019	Fall 2019	Spring 2020
Context	Fellow doctoral students	Asynchronous Online course	Face-to-face course	Face-to-face course
Q sorting tool	Desktop app (Lloyd's Q sort)	Desktop app (Lloyd's Q sort)	Desktop app (Lloyd's Q sort)	Paper-based Q sort cards
# of statements	27	27	27	29
# of participants	8	28	16	24
# of interviews	NA	5	3	4

Methods

Participants

The Q sort was administered in an undergraduate course that I was teaching. This course is designed to teach preservice teachers how to effectively integrate technology in k-12 classrooms and other educational settings, where collaborative learning is an important topic of

the content as well as a method of teaching. A total of 24 students completed the Q sort activity and post-sorting survey. As “the interest of Q methodology is in the nature of the segments (of viewpoints) and the extent to which they are similar or dissimilar, the issue of numbers ... is rendered relatively unimportant” (Brown, 1993). Therefore, the number of participants in Q studies can be small (Brown, 1993; McKeown & Thomas, 2013). There were eight male students and sixteen female students with diverse academic backgrounds, such as special education, business, sports management, secondary education, linguistics, and human development. In terms of year of study, there were nine freshmen, seven sophomores, three juniors, and five senior students.

Data Collection

The Q sort was administered during class time using paper cards, taking about 20-25 minutes. Students were provided with handouts of the Q sort grid (see Figure 3.1), the statements and, step-by-step directions. Students were instructed to sort the 29 statements on the Q grid from the most frustrating to the least frustrating, based on their overall experiences of collaborative learning in either face-to-face classes or online courses. First, they sorted the statements into three general categories: high, neutral, and low (in terms of level of frustration). The next step was to take a closer look at each category and sort the statements to the Q sort grid from least frustrating (-4) to most frustrating (+4). For items that they never experienced personally, they were advised to treat them as neutral. Although none of the participants in this particular group mentioned that they had never experienced most of these frustrations, for those lucky ones, they could be advised to imagine how they would feel like if they were in those situations. After that, they could review and make necessary changes until they felt satisfied that their sort represented their viewpoint about group work. Finally, students proceeded to complete

an online survey to explain why they chose particular statements as the highest and lowest ratings and to rate their overall collaborative learning experiences in college (on a scale of -4 to +4). As all the Q statements are negative, the overall collaborative learning experience ratings can help the researcher better understand the perspectives of the participants, especially those who reported generally positive experiences in group work.

Figure 3.1

The Q Sort Sheet

Q Sort sheet: Frustrations in Collaboration

Your Name _____

Instructions: Sort the 29 statements in the grid from most frustrating to least frustrating, based on your overall collaborative learning experiences.

Least frustrating -4	-3	-2	-1	Neutral 0	1	2	3	Most frustrating 4

Students who finished the Q sort were invited to volunteer for individual interviews (30-40 minutes) to further explain their thinking processes during the Q sort activity and provide more details of specific collaborative learning experiences with an emphasis on the negative ones. Four students volunteered and were interviewed in the current study. To create vivid narratives for each learner persona, eight interviews from the pilot studies were also included as additional data source.

Data Analysis

Students' Q sort sheets were gathered and the Q sort data were manually entered in an Excel file before being imported into the web-based tool Ken-Q Analysis (Banasick, 2019). Two factor extraction methods (centroid factor analysis and principal component analysis) and two rotation methods (varimax and judgmental) are available in KenQ. Both extraction methods and both rotation methods were attempted to find the solution that makes most sense in terms of representing the students' diverse viewpoints. In addition to statistical information such as variance accounted for and eigenvalues, students' survey responses and interviews were used to guide the decision making process in data analysis. The final solution I decided to keep was a four-factor solution arising from principal component analysis and varimax rotation. Two of the factors—Factor 1 and Factor 3 were bipolar factors with Q sorts representing opposite viewpoints. Factor 1 was split into two factors for easy interpretation, as KenQ only allows one factor to be split. In short, five factors emerged from the factor analysis: Factor 1a, Factor 1b, Factor 2, Factor 3, and Factor 4.

Survey responses were not systematically analyzed but were used to assist factor analysis and facilitate factor interpretation. The interview data—collected in the current study as well as previous pilot studies— were blended to construct creative nonfiction narratives (Kim, 2015) that are most relevant, from my standpoint, to the five Q factors. Creative nonfiction narratives are based on facts of true stories but use various literary techniques to make the narratives more accessible and relatable to the readers (Kim, 2015; Levine-Rasky, 2019). Since learner personas are meant to be "hypothetical archetypes" (Cooper, 2020), they are not about facts, but they will be more realistic or credible if based on some true stories. Therefore, I blended the interview data to construct composite narratives relevant to the factors, using the original words of the

interviewees as much as possible. That is to say, each constructed narrative is like a collage consisting of pieces of information from multiple interviews. There were a few considerations for choosing this method of narrative construction: First, in the current study, there were only four interviewees (participants #3, #13, #14, and #16), who were associated with only three of the five factors (factor 3, factor 1b, factor 4, and factor 3, respectively). Second, there were no correlation between the stories of group work experiences the interviewees shared and the factors they represented—it was natural that they were not thinking about the Q factors during the interviews. Third, there were similar stories shared by the interviewees but with different details (time, place, people, emotions, and events, etc.). To give the narratives some structure, I referred to Labov's (2010) conceptualization and categorization of narrative clauses (orientation, complicating actions, resolution, evaluation, and coda). It was a useful tool to decide what details to keep or remove and how to organize these pieces in a coherent narrative. In line with the factor description, these narratives were written from the third-person point of view.

Results

Five Q Factors

A five-factor solution was derived from the Ken-Q analysis, with one split bipolar factor. In total, seventeen sorts were significantly loaded onto the five factors (see Appendix B) at the significance level of $p<.01$ (i.e., only Q sorts with a factor loading higher than 0.479 were selected and flagged). Factor 1a was labeled as "goal-oriented collaborators" (participants #22, #20, #17, #18); Factor 1b was labeled as "fairness-oriented independent learners" (participants #4, #13); Factor 2 was labeled as "learning-oriented collaborators" (participants #7, #12, #10); Factor 3 was labeled as "instruction-dependent learners" (participants #3, #16, #9, #15, #1); and Factor 4 was labeled as "adapted collaborators" (participants #14, #19, #11).

Prior to interpreting the results, factor arrays or exemplifying Q sort (McKeown & Thomas, 2013; Watts & Stenner, 2012) were created to represent the viewpoints of the five factors (see Table 3.3). Distinguishing statements are marked by * (at $p<.05$) and by ** (at $p<.01$) in the factor arrays. To avoid repetition, the interpretation of Factor 1a will be presented in detail as an illustration in this section (others can be found in Appendix C) because brief descriptions of the factors along with corresponding narratives will be presented together as the learner personas in the next section.

Table 3.3

Factor Arrays

No.	Statement	Factor Array				
		F1a	**F1b**	**F2**	**F3**	**F4**
1	The assessment is unfair for individual score vs group score.	0	4	1	1	3
2	Instructor's directions of the assignment are confusing.	2	2	3	4	4
3	The quality of work does not meet the requirements.	1**	-2	-1	-1	-2
4	Roles and responsibilities are unclear among group members.	-1**	3	3	-4**	3
5	Support from the instructor is lacking or delayed.	-1	0	-3	2	-1
6	The group assignment itself is too difficult.	3	-1	-3	3	-2
7	Time is very limited to finish the group work.	1	1	2	0	2
8	Group members have different goals for the group assignment.	-3	1	0	-2	-1
9	It is difficult to schedule meetings when everyone is available.	-1	2	2	-2	1
10	Everyone works on their own part independently and there is no real collaboration.	-3	0	4**	-4	-4
11	It is difficult to collaborate without face-to-face interaction.	-2	3*	-2	-1	1
12	I feel I learn nothing or little from the group assignment.	-1	-2	4**	-3	-3
13	Group members' contributions are imbalanced.	0	1	3	3	0
14	There is unresolved tension/conflict among group members.	1	-3*	0	0	0
15	It is difficult to communicate with group members.	1	-1	2	1	2
16	I do most of the work because teammate(s) don't pull their weight.	4**	-4**	1	2	1
17	There are misunderstandings among group members.	-2	3**	0	0	3
18	We fail to complete the group assignment on time.	2	-4	0	1	0
19	Group members are reluctant to help others.	4	-1	0	-3	4
20	Because of conflicting personalities, the group members do not get along well.	-2	-1	-1	2	0
21	I am assigned to a random group that I am not comfortable working with.	0	0	-1	4**	-3*
22	It is very time-consuming to negotiate among group members.	-4	0	-2	0	-3
23	The quality of work is worse than if I did it alone.	0	1	1	3*	2

24	My teammate(s) undermine my contribution.	3**	-3	-4	-3	-1
25	I feel stressed because my teammates are more competent than me.	-4	4**	-3	-1**	-2
26	My ideas or opinions are ignored by my teammates.	2**	-2	-4	0	-1
27	I dislike working in groups because I work better independently.	-3**	2	1	-1	0
28	Group member(s) disappear from the beginning or partway through.	3	0	-2	-2	1
29	I am left out when we are allowed to choose our own group members.	0	-3	-1	1	-4

Note. Distinguishing statement at $p<.05$ are marked by *. Distinguishing statement at $p<.01$ are marked by **

Factor 1a Goal-oriented Collaborators. Students of this factor value collaborative learning. They ranked "I dislike working in groups because I work better independently" (27: -3), significantly lower than the other factors. They are comfortable to work with people more competent than them (25: -4). A few statements related to communication and interaction among group members are also ranked relatively low (22: -4; 8: -3; 11: -2; 20: -2; 17: -2), indicating that they might have good interpersonal communicative skills. They are goal-oriented—to complete the group work on time (18: +2) with good quality (3: +1). In order to achieve this goal, they sometimes have to pick up the slack of others, but that is extremely frustrating to them. They ranked "I do most of the work because teammate(s) don't pull their weight" (16: +4) significantly higher than others. They are also easily frustrated if their teammates undermine their contribution (24: +3) or ignore their ideas and opinions (26: +2). Interestingly, statements related to the instructor are mostly neutral, which means they hold a neutral attitude towards them. It might indicate that they are capable of handling issues arising in collaboration without the support of the instructors.

Five Learner Personas for Collaborative Learning

Five composite narratives were developed as supplemental scenarios to bring the five Q sort factors into life, forming realistic learner personas for collaborative learning in higher

education. It is important to note that the narratives of the personas are fictitious, the characters in these narratives were constructed from various stories shared by the interviewees of the current study as well as previous Q sorts (see Table 3.2), and those names given to characters do not represent any specific student. What follows are the personas built from this empirical evidence.

Goal-Oriented Collaborators

These learners value collaborative learning. They are comfortable to work with people more competent than them. They value communication and interaction among group members, indicating good interpersonal communicative skills. They are goal-oriented—to complete the group work on time with good quality. In order to achieve this goal, they sometimes have to pick up the slack of others, but that is extremely frustrating to them. They are also easily frustrated if their teammates undermine their contribution or ignore their ideas and opinions.

Katie's story. As someone who loves collaboration, Katie is thankful that her teachers provided opportunities to interact with other students in an online course. But it was disappointing that she remembered more group projects being pains than being fun. Her undoubtedly worst collaboration experience was in a final project that was supposed to communicate all of their knowledge in the course and make connections between the concepts they learned. They are assigned to random groups of 3 students. Each member worked on creating a "concept map" for one of the previous three units, then combined them together to form a big concept map. On the first day that she was assigned the group, she sent an email to her group members introducing herself with contact information, expressed the unit she preferred to do, and created a shared Google Doc for them to upload their individual maps. It took five days of waiting before she heard back from group member A. He messaged that he had been

busy but was ready to work now. Since they had not heard from group member B, she decided to send him another email. He responded immediately and apologized for responding late. He said he could only meet for limited time slots. The group assignment as a group was not due for a few days. Thankfully, she and group member A were both free to meet, though it was not the ideal time. Their plan was to contribute to the Google Doc on their own time and have the assignments mostly done a day before the due date to give the last day to meet and edit it. However, their dream plan was not adhered to. While group member A contributed on time, his work was not well thought-out. She appreciated his effort, but his contributions ended up being almost entirely hers. Group member B ghosted them. Until the due day, they had not heard from him since they first met as a group. He asked what he could do, but the project was finished at that point. Needless to say, this experience was extremely frustrating because of inadequate work by teammates as well as bad communication.

Fairness-Oriented Independent Learners

These learners might prefer to work independently over group work. They feel stressed when working with more competent group members perhaps because these group members are usually more dominant in a group. Effective communication might be challenging to them. Online collaboration might be particularly more stressful without face-to-face interaction. They care much about the fairness of assessment. They are probably unwilling to pick up the slack of others because that is unfair.

Molly's story. Molly had an online class where had to do a lot of group projects and other types of collaborative learning activities. For most projects, they were allowed to choose their group members and the topics of their projects. But in an online course, not having any face-to-face interactions, she had not met anyone or made friends with anyone in the class. The biggest

issue was finding a common time that all the group members could work together, which made it very hard to distribute the workload fairly. In her experiences with working with her group members, the others had been available to collaborate at a time when she was not. By the time she was free to work with her group, they were not available, which made efficient communication very difficult. Sometimes she asked her group mates for help to explicitly understand her role in the project. Not wanting to do the wrong thing and waste time and effort, she waited to get a response. It might be until the next day that she heard back from someone, which delays her productivity and could cause her group mates to get frustrated with her for not contributing anything to the project. In one case, she never was able to communicate with her group mates at all. She was unaware someone had done her portion because they didn't think she was going to be reliable and contribute her efforts. That made her feel extremely bad because she never wanted someone to pull her weight for her. She personally felt like with an 100% online class, group projects should not be assigned. Even though her assignments were completed and she made decent/satisfactory grades, the unnecessary stress of trying to communicate with someone had been extremely challenging.

Learning-Oriented Collaborators

Learning-Oriented Collaborators want real collaboration when working in groups and meaningful learning through group work. They are most frustrated if they feel like they learn nothing from the group assignment. They are also frustrated if everyone just works on their own part without true collaboration. They prefer balanced contributions from group members and clear roles and responsibilities, just not in a manner of "divide and conquer". Much of the challenge in collaboration for them seems to come from time conflicts and communication difficulties. They seem to have less issues with group members.

Bella's story. Last semester, Bella had a terrible class with a teacher who didn't know what was going on. They were assigned to a random group that they were stuck in the whole semester. Every week, they had to find the information on a topic assigned by the teacher and put it into a presentation and then present it to the class. The teacher just gave them a topic and didn't provide any support. Bella's group did five presentations the whole semester and that was all they did. Since it was so frequent and they knew that it was a last-minute project for the teacher to put on them, they didn't really take it seriously or actually meet as a group or collaborate. One person did one slide, one person did the other slide, and then they scrambled together in the last minute and called it a thing. She had four other groups but only really communicated with one that she already knew. She felt like she wasn't really learning anything from it. She has not had a good experience in college where a real group project is the final product of it, not being a presentation. The instructor simply used student presentations to replace their own teaching. She thought the format was off, but the instructor could have used a lot more resources to help put some variety in regard to the projects. There's no way for her to describe this class that it went well.

Instruction-Dependent Learners

Many of their frustrations are related to the instructor. If the instructor gives clear directions, designs the group task at a suitable difficulty level, and provides just-in-timer support, then working in groups should not be demanding for them. They prefer to work with people they are familiar with or get along with. There needs to be more considerations on the part of the instructor when assigning groups. To get the work done, they don't mind dividing up the task and work on their own part independently, so time conflicts to schedule meetings wouldn't be

much of a problem for them. They are very frustrated if the quality of work is worse than they could have done alone.

David's story. David's frustrating group work experience was in a philosophy class. He was assigned to be in a group with two girls, who were obviously good friends. They were very chatty and went off topic easily during discussions. He felt disconnected and did not pay much attention to their group chat. He did not realize he had missed the deadline of their first task until he saw he got a zero grade for it. He was probably too busy at that time. He went back to check their group chat to see if he overlooked any reminders from the two girls. But he found nothing. And then they met in class to work on the next group assignment, the two girls seemed to ignore him. He did not blame his group members and thought he should be more organized, but he did not trust his group members any longer. Whenever he had a question, he would read the learning materials more carefully or reach out to the professor directly. Although he took all the blame himself, he thought there were some ways the professor could have made it a more positive experience. For example, the instructor randomly assigned them to groups without considering their interests and preferences; the instructor gave him a zero without bothering to ask why he didn't do his work; the instructor was also not very clear in her instructions as he saw that the two girls were also guessing what the expectations of the group assignments.

Adapted Collaborators

They are not typically stressed by frustrations arising from the process of group work because they have learned to not let them affect their grade or how they feel. Their overall collaborative learning experiences have been not so positive, but they try to make the best of the worst situation and learn to adapt themselves to make things work. Working independently with no real collaboration is not the best but ok with them. Having minor frustrations usually won't

prevent them from learning something or lead to the task being done poorly. They are most frustrated when group members are reluctant to help others or roles, there are misunderstandings, and responsibilities are unclear among group members. Their biggest frustrations are also associated with the instructor, for example, confusing directions, unfair assessment, and not allowing enough time.

Connor's story. One of the worst group collaborations he has had happened during his sophomore year. Their project was to design an app for a small business. Although it was an in-person class, much work had to be done outside of class. When the group of five students first touched base in class, he found they had very conflicting schedules and different expectations. They talked about how they could simplify the design ideas to save time and avoid unnecessary work, which was not ideal from his perspective. He knew this project was off to a rough start. So he decided to be more proactive than he used to be in groups. He went ahead and created a GroupMe group, a shared Google folder, a spreadsheet to divide up the work into subtasks with due dates. He asked his teammates to sign-up for the subtasks they want to work on. As the subtasks were supposed to build on one other, he could not start to work on his task if the previous person's (partner A) task was not finished and the person behind him (partner B) could not proceed either. When he was supposed to start his part, he found nothing to build on, so he prompted partner A in the group chat. He did not get any response from A and other group members were silent. He waited for a few more days, worrying about his own deadline. Not wanting partner B to have the same frustration, Connor told his teammates in the group chat that he decided to help partner A to finish half of his work so that he could catch up. Then partner A showed up in Google Doc, deleted Connor's work and comments, and copied it to present as if it was done by himself. At Connor's request, partner A restored the work and finished up his task

with poor quality. Connor did not want to waste time to deal with him, so he did what he thought was necessary to improve it and then complete his task on time. Connor was extremely frustrated, but he also understood there was nothing others could do to help him. They were all adults and should be responsible for their own actions, so it did not make sense to reach out to the instructor for such matters. He allowed himself to have peace in mind that he did what he could to minimize the "damage".

Discussion

Constructing learner personas is a practical way to develop designer empathy towards learners by using scenario-based narratives, which helps promote person-centered design (Baaki et al., 2017; Dinh et al., 2013). This study has generated a set of five distinct learner personas with compelling narratives from the interpretation of Q factors and the interview data. It has been demonstrated that Q methodology can be a useful tool to create engaging learner personas. The Q factors provided a skeleton for the personas, helping to decide how many personas to create, and how distinct they could be in terms of their perspectives. The composite narratives add more flesh to the personas as storytelling is an important way to build up the ability of empathy (Parrish, 2006).

The learner personas created in this study could be directly used by faculty or instructional designers to design effective collaborative learning environments. These ready-to-use personas can be used in multiple ways during the instructional design processes, "including the design phase, the design communication or documentation phase and in formative evaluation" (Parrish, 2006, p. 72). For example, during the analysis phase of instructional design processes (Branch, 2009), the learner personas can be used to conduct learner analysis: students can be asked to self-identify which persona resonates most with them. This is a convenient and

effective way understand the students' attitudes, beliefs, and preferences in terms of group work. During the design phase (Branch, 2009), the personas can be used as a criterion to assign students to different groups, in addition to considerations of demographics and learning performances. When designing the actual collaborative learning tasks, the personas can assist instructional designers to consider how to create engaging tasks that foster real collaboration so that goal-oriented collaborators like Katie do not have to pick other people's slack, or fairness-oriented independent learners like Molly are more willing to help each other in their group, or instruction-dependent learners do not just divide and conquer. There can be many other creative ways for instructional designers to use the learner personas. Future research can continue to validate the usefulness of these personas and evaluate how they will actually be used by faculty or practitioners in the instructional design processes (Nielsen & Hansen, 2014).

As a design tool, personas should be design-specific and context-specific. However, the personas developed in this study do not include a profile image or demographic information like most typical personas (Nielsen & Hansen, 2014). The is a conscious decision made for two reasons. Firstly, Q methodology focuses on subjectivity (attitudes, values, opinions, perceptions, etc.) and no connections between the factors and the demographics were found in my study; therefore, I do not hope to create stereotypes by making up some demographic information. Secondly, it is my hope to keep the personas more general so that they can be easily adapted into different design contexts.

One of the limitations of this study lies in the small size of the concourse. The concourse and the Q sample are the bases of the Q sort. An important validity issue is related to the representativeness of the concourse or more generally the multidimensions of the phenomenon of interest. Although it can be argued that the validity of the statements in this study is ensured by

being grounded in literature and by being tested and retested in practice, future research can make more efforts to include a wide range of statements in the concourse and then use the method of structured Q sample as a solution to reduce researcher bias and assure the representativeness of the Q sample (Brown et al., 2019). As abundant data have been collected in the pilot studies and the current study, such as the survey responses, group discussions, and interviews, I could use them as additional sources to identify more statements.

Conclusion

This study took a mixed methods approach using Q methodology to investigate undergraduate students' subjective perspectives on frustrations in collaborative learning. Results of the Q study showed that there were five types of distinctive perspectives: goal-oriented collaborators, fairness-oriented independent learners, learning-oriented collaborators, and adapted collaborators. Five composite narratives were constructed to enrich the description of the factors, creating a series of five learner personas for collaborative learning in higher education. These personas can help the faculty or instructional design practitioners to understand that students have different attitudes towards collaborative learning and different needs and goals in group work. Thus, they can make more informed decisions when creating and implementing collaborative learning activities to ameliorate potential frustrations from the students. Applying these personas to instructional design could encourage empathy from faculty and practitioners, bring about pedagogical improvement, and enhance student engagement and satisfaction.

This study demonstrated the applicability of Q methodology in creating learner personas, which is an important tool in instructional design and user experience design. As a robust methodology, it will be beneficial for Q to be added to the toolbox of instructional design practitioners (Yang & Xu, 2021). However, as Q requires both quantitative and qualitative

analytic skills, instructional designers who want to investigate subjectivity in their daily practice must become familiar with the complexities of Q and how to perform a Q study.

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Appendix A

Q Sample

Category	Statements
Instructor	1. The assessment is unfair for individual score vs group score. 2. Instructor's directions of the assignment are confusing. 5. Support from the instructor is lacking or delayed. 6. The group assignment itself is too difficult. 7. Time is very limited to finish the group work.
Group members	4. Roles and responsibilities are unclear among group members. 8. Group members have different goals for the group assignment. 13. Group members' contributions are imbalanced. 19. Group members are reluctant to help others. 24. My teammate(s) undermine my contribution. 28. Group member(s) disappear from the beginning or partway through.
Outcome	3. The quality of work does not meet the requirements. 12. I feel I learn nothing or little from the group assignment. 16. I do most of the work because teammate(s) don't pull their weight. 18. We fail to complete the group assignment on time. 23. The quality of work is worse than if I did it alone.
Communication and interaction process	9. It is difficult to schedule meetings when everyone is available. 10. Everyone works on their own part independently and there is no real collaboration. 11. It is difficult to collaborate without face-to-face interaction. 14. There is unresolved tension/conflict among group members. 15. It is difficult to communicate with group members. 17. There are misunderstandings among group members. 20. Because of conflicting personalities, the group members do not get along well. 22. It is very time-consuming to negotiate among group members. 26. My ideas or opinions are ignored by my teammates.
Self	21. I am assigned to a random group that I am not comfortable working with. 25. I feel stressed because my teammates are more competent than me. 27. I dislike working in groups because I work better independently. 29. I am left out when we are allowed to choose our own group members.

Appendix B

Q Sort Factor Loadings

Q Sort No.	Factor 1a	Factor 1b	Factor 2	Factor 3	Factor 4
1	-0.33	0.33	-0.25	-0.51*	0.35
2	0.13	-0.13	0.02	0.43	0.40
3	-0.07	0.07	-0.06	0.70*	0.47
4	-0.70	0.70*	0.02	0.06	0.43
5	-0.33	0.33	-0.02	0.15	0.05
6	0.50	-0.50	0.04	0.01	0.71
7	0.07	-0.07	0.88*	-0.10	0.02
8	0.02	-0.02	0.42	-0.22	0.54*
9	0.28	-0.28	0.19	0.69*	0.00
10	-0.08	0.08	0.70*	0.17	0.48
11	0.01	-0.01	0.54	0.18	0.55
12	-0.31	0.31	0.72*	-0.18	-0.04
13	-0.57	0.57*	0.05	-0.01	-0.02
14	-0.16	0.16	0.17	0.04	0.77*
15	-0.02	0.02	-0.04	0.60*	0.08
16	0.38	-0.38	0.09	0.67*	-0.15
17	0.57*	-0.57	-0.08	0.23	0.32
18	0.52*	-0.52	0.34	0.17	0.17
19	0.22	-0.22	0.02	0.10	0.73*
20	0.63*	-0.64	-0.22	0.10	0.18
21	0.11	-0.11	0.03	0.03	0.41
22	0.66*	-0.66	-0.12	-0.07	0.32
23	0.34	-0.34	-0.10	0.17	0.33
24	0.40	-0.40	0.17	0.06	0.33
% Explained Variance	14	14	11	11	16

Note. Significant factor loadings are marked by *

Appendix C

Factor Interpretation

Factor 1a Goal-oriented Collaborators. Students of this factor value collaborative learning. They ranked "I dislike working in groups because I work better independently" (27: -3), significantly lower than the other factors. They are comfortable to work with people more competent than them (25: -4). A few statements related to communication and interaction among group members are also ranked relatively low (22: -4; 8: -3; 11: -2; 20: -2; 17: -2), indicating that they might have good interpersonal communicative skills. They are goal-oriented—to complete the group work on time (18: +2) with good quality (3: +1). In order to achieve this goal, they sometimes have to pick up the slack of others, but that is extremely frustrating to them. They ranked "I do most of the work because teammate(s) don't pull their weight" (16: +4) significantly higher than others. They are also easily frustrated if their teammates undermine their contribution (24: +3) or ignore their ideas and opinions (26: +2). Interestingly, statements related to the instructor are mostly neutral, which means they hold a neutral attitude towards them. It might indicate that they are capable of handling issues arising in collaboration without the support of the instructors.

Factor 1b Fairness-Oriented Independent Learners. Factor 1b holds the opposite view of Factor 1a. Overall, they seem not as confident as Factor 1b, they feel stressed when working with more competent group members (25: +4), perhaps because these group members are usually more dominant in a group. Many of their frustrations are from the process of communication and interaction, such as misunderstandings (17: +3), unclear roles and responsibilities (4: +3), difficulty in meeting together (9: +2). But they are not so frustrated by tension between group members (14: -3), perhaps because this is not a common issue. Online collaboration might be

particularly more challenging for them as they ranked “it is difficult to collaborate without face-to-face interaction” (11: +3) much higher than other factors. In contrast to Factor 1a, they might not be willing to pick up other people’s slack (16: -4) because it is unfair to them. They care much about the fairness of assessment (1: +4). However, they are not bothered by not finishing the task on time (18: +4), probably because this seldom happens. They are also less concerned about the quality of work (3: -2). They ranked “I dislike working in groups because I work better independently higher than other groups (27: +2) slightly higher than others, indicating that they might prefer to work independently. Similar to Factor 1a, they are neutral about statements related to the instructor. It might indicate that they could be hesitant to reach out to the instructor for support when there are issues in collaboration.

Factor 2 Learning-Oriented Collaborators. This factor wants real collaboration when working in groups and meaningful learning through the group work. They are most frustrated if they feel like they learn nothing from the group assignment (12: +4). They are also frustrated if everyone just works on their own part without true collaboration (10: +4). They prefer balanced contributions from group members (13: +3) and clear roles and responsibilities (4: +3), just not in a manner of “divide and conquer”. Much of the challenge in collaboration for them seems to come from time conflicts (9: +2) and communication difficulties (15: +2). They seem to have less issues with group members. Their lowest ranked statements are “my ideas or opinions are ignored by my teammates” (26: -4) and “my teammate(s) undermine my contribution” (24: -4), because they rarely happen, as explained by two of the three sorts in this factor. Their frustrations are not usually associated with the instructor (5: -3; 6: -3). One student explained in their post-sorting survey: “Support should not be needed if instructions are clear. We usually figure it out by ourselves.”

Factor 3 Instruction-Dependent Learners. It's important to emphasize that this is a bipolar factor but it is not split because KenQ only allows one factor to be split. Here I describe the positive side of this factor, represented by participants #3, #16, #15. Many of their high-ranking statements are related to the instructor. If the instructor gives clear directions (2: +4), designs the group task at a suitable difficulty level (6: +3), provides just-in-timer support (5: +2), then working in groups should not be difficult for them. They ranked "I am assigned to a random group that I am not comfortable working with" significantly higher than other groups (21: +4). This might mean that they prefer to work with people they are familiar with or get along with. Again, there needs to be more considerations on the part of the instructor when assigning groups. To get the work done, they don't mind dividing up the task (10: -4), so time conflicts to schedule meetings wouldn't be much of a problem for them (9: -2). One participant explained that "I prefer to assign members a certain part of the project that they are responsible for. This avoids struggling to find a time when all members are available to meet". Since everyone could work on their own part independently, "group members are reluctant to help others" (19: -3) or "roles and responsibilities are unclear" (4: -4) are not big issues either. They are very frustrated if the quality of work is worse than they could have done it alone (23: +3).

Opposite to participants #3, #16, #15, two other participants (#9, #1) seem to be very confident collaborators. They enjoy working with others and don't depend on the instructor too much as long as they are given clear instructions. Participant #9 responded in the post-sorting survey that "group work is overall a good experience. It helps to understand different viewpoints and ways to go about completing a project". Participant #1 said that "I am very comfortable with people I don't know and am confident in my leadership abilities to direct a new group". They

seem to be natural leaders in a group. In class discussion, they told me that “just sign me up”, meaning they feel confident and ready to work in any group.

Factor 4 Adapted Collaborators. For Factor 4, the statements in the factor array are all over the place without any focus on certain aspects of collaborative learning. I interviewed one of the students in this group, which helps me understand their thinking. I also read and reread their survey responses. For the lowest rankings, many of them indicated that they ranked them that way because they learned to not get stressed about them and let them affect their grade or how they feel, which is not a common sorting rationale found in other factors. Therefore, I label them as “Adapted Collaborators”, which means they tried to make the best of the worst situation and learn to adapt themselves to make things work. Working independently with no real collaboration is not the best but ok with them (10: -4). Having minor frustrations usually won’t prevent them from learning something (12: -3) or lead to the task not being done on time or it having bad quality (3: -2). They are most frustrated when group members are reluctant to help others (19: +4), there are misunderstandings among group members (17: +3), or roles and responsibilities are unclear among group members (4: +3). Their biggest frustrations are also associated with the instructor, for example, confusing directions (2: +4), unfair assessment (1: +3), and not allowing enough time (7: +2).

CHAPTER 4

AN OPEN DISCUSSION ABOUT COLLABORATIVE LEARNING EXPERIENCES: ADDRESSING FRUSTRATIONS IN GROUP WORK[3]

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Abstract

This study investigated undergraduate students' frustrations in collaborative group work by providing them with the opportunity to have open discussions on their group work experiences. Informed by theories of hermeneutic phenomenology, this study used a mixed methods design based on Q methodology. Other methods included surveys and interviews. A Q sort discussion was designed as a classroom activity to create a safe space for open discussions. Specifically, the students first individually participated in a Q sort activity on their frustrations during collaborative group work. Then, based on the Q sort results, the students were divided into four small groups to discuss their Q sort results and learner persons developed in an earlier investigation on this topic. Results showed that the Q sort discussion provided a safe space for the students to share their experiences and articulate their perspectives on collaborative learning. Students indicated a deeper understanding of their own perspectives and a raised awareness of different perspectives. Results of this study also suggested strategies to overcome student frustrations in group work. This study also partially validated the learner personas by examining the students' perceptions of them. Also discussed are implications for teaching, learning, and instructional design as well as recommendations for future research.

Keywords: Collaborative learning, Q methodology, mixed methods, learner persona, hermeneutic phenomenology

Introduction

Collaborative learning has been widely adopted as a student-centered active learning approach in higher education. Although most college students acknowledge the value of collaborative learning for their academic development and future careers (Tucker & Abbasi, 2016), many of them become frustrated by negative group work experiences and may even become resistant towards group work due to past negative experiences (Capdeferro & Romero, 2012; Feichtner & Davis, 1984; Forrest & Miller, 2003; Isaac, 2012; Pfaff & Huddleston, 2003; Salomon & Globerson, 1989; Smith et al., 2011; Sorensen, 1981; Tucker & Abbasi, 2016). These negative experiences and attitudes can be internalized as students' internal collaboration scripts—the learners' internal knowledge or schema about collaboration norms and expectations (Fischer et al., 2013) that influence how they perceive and behave in future group work (Forrest & Miller, 2003; Keyton et al., 1996). While many strategies recommended in the literature are available for faculty to remedy students' frustrations, it is not possible to make every collaborative learning experience positive for all students (Miller, 1994; Tucker & Abbasi, 2016). Furthermore, not every student has experienced the same frustrations or shares the same perceptions of these frustrations. It can be argued that different viewpoints on these frustrations are reflections of their collaborative styles or, more fundamentally, their individual philosophies of collaborative learning. As Friend and Cook (1992) maintained, personal beliefs, values, attitudes, and emotions about collaboration are prerequisites for effective collaboration. It is important to give students opportunities to express frustrations they may have about collaboration because doing so may help to neutralize their initial negative perceptions of collaboration (Forrest & Miller, 2003; Tucker & Abbasi, 2016). However, for these open discussions to be meaningful and useful for students, the group discussion needs to be carefully

designed and scaffolded.

Literature Review

There is no agreed-upon definition of collaborative learning and it is generally used by many researchers as an umbrella term that does not differentiate different approaches to small-group learning methods (e.g., cooperative learning, team-based learning, project-based learning, etc.) (Yang, 2023). That said, Collaborative learning usually involves small groups of learners working jointly to create a project, solve a problem, accomplish a task, to construct meaning toward a mutual learning objective (Smith & MacGregor, 1992). Despite the fact that collaborative learning can bring many benefits when properly implemented (Gokhale, 1995; Kirschner et al., 2018; Laal & Ghodsi, 2012; Roberts, 2004), research has shown that there are many common challenges in collaborative learning (Roberts, 2004; Roberts & McInnerney, 2007). It is important to keep in mind that "the positive aspect should not be assumed to outweigh the negative aspects" (Gottschall & García-Bayonas, 2008, p. 21). For instance, Salomon and Globerson (1989) identified the four most common problems in collaborative learning among college students enrolled in a speech communication course: (1) *The "free-rider effect"* (or social loafing), where one or more group members make no or little effort to contribute, leaving it to others to do the work; (2) *the "sucker effect,"* where more committed group members eventually reduce their own effort to counter the free-rider effect, i.e., to avoid being taken advantage of by the free-riders; (3) *the "status-differential effect,"* where more competent group members dominate the group and less able members are marginalized; and (4) "*Ganging up on the task,"* where most of the group members dislike the group task, so they simply negotiate a least effort solution to finish the task. Likewise, Roberts and McInnerney (2007) summarized "seven problems of online group learning": (1) Student's aversion towards

group work in an online learning environment; (2) difficulty in assigning students to the right groups; (3) students' lack of teamwork skills to collaborate effectively; (4) free-riding group members; (5) different levels of abilities among group members; (6) withdrawing group members; and (7) challenge in grading individual students fairly. These problems are not specific to online collaboration; in other words, they apply to face-to-face collaborative learning as well.

From the students' perspective, these problems and challenges could become the sources of students' frustrations in collaboration and resistance towards group work (Capdeferro & Romero, 2012; Feichtner & Davis, 1984; Isaac, 2012; Salomon & Globerson, 1989; Sorensen, 1981; Tucker & Abbasi, 2016), which might, in turn, foreshadow future collaborative learning experiences (Forrest & Miller, 2003; Keyton et al., 1996; Pfaff & Huddleston, 2003; Smith et al., 2011). Yang (2022, under review) summarized the five emerging themes in relevant research on students' negative perceptions of collaborative learning in different learning contexts: (1) frustrations related to the instructor; (2) frustrations related to group members; (3) frustrations related to the learning outcomes; (4) frustrations related to the process of communication and interaction; and (5) frustrations related to the self. Specifically, Gottschall and García-Bayonas (2008) investigated students' attitudes towards group work across three disciplines—mathematics, education, and business administration. Their study showed a disciplinary difference: the majority of education majors held a positive or neutral attitude, whereas over half of business majors and about one third of mathematics students were negative about group work. Many students (63% math majors, 47.3% business majors, and 34.5% education majors) preferred working alone to working in groups. Nonetheless, all three majors shared similar ratings of negative aspects of group work, with the same top eight aspects: (1) Difficult to coordinate schedules, (2) free riders, (3) unequal contribution, (4) would rather work alone, (5)

unshared grade expectations, (6) disagreements, (7) don't all think the same, (8) don't like being responsible for other's grades (Gottschall & García-Bayonas, 2008).

In a more recent study, Tucker and Abbasi (2016) conducted two large-scale surveys on students' collaborative learning experiences with 197 and 418 participants, respectively, the majority of whom were undergraduate students. Tucker and Abbasi (2016) identified nine critical factors for negative collaborative experiences among design majors at Australian universities, listed in descending order: (1) unequal workload contributions, (2) individual differences, (3) unfair or inappropriate assessment, (4) team-process related issues, (5) team formation methods, (6) lack of appropriate training and support on teamwork skills, (7) task design-related issues, (8) too much teamwork in the degree program in an academic period, and (9) dominating team members.

Based on the literature on frustrations in collaborative learning, I have developed five learner personas for collaborative learning in my earlier investigation on this topic (Yang, 2022, under review), combining Q methodology and narrative inquiry. A short version of the personas is provided in Table 4.1. These learner personas could be useful in many aspects of instructional design. However, they still need to be validated in further research.

Table 4.1

Five Learner Personas for Collaborative Learning in Higher Education

Persona	Description
Goal-Oriented Collaborators	They value collaborative learning. They are comfortable working with people more competent than them. They value communication and interaction among group members, indicating good interpersonal communicative skills. They are goal-oriented—to complete the group work on time with good quality. In order to achieve this goal, they sometimes have to pick up the slack of others, but that is extremely frustrating to them. They are also easily frustrated if their teammates undermine their contribution or ignore their ideas and opinions.
Fairness-Oriented	They prefer to work independently over group work. They feel stressed when working with more competent group members perhaps because these group members are usually more dominant in a group. Effective communication might be challenging to

Independent Learners	them. Online collaboration might be particularly more stressful without face-to-face interaction. They care much about the fairness of assessment. They are probably unwilling to pick up the slack of others because that is unfair.
Learning-Oriented Collaborators	They want real collaboration and meaningful learning through group work. They are most frustrated if they feel like they are learning nothing from the group task. They are also frustrated if everyone just works on their own part without true collaboration. They prefer balanced contributions from group members and clear roles and responsibilities, just not in a manner of "divide and conquer." Much of the challenge in collaboration for them seems to come from time conflicts and communication difficulties. They seem to have fewer issues with group members.
Instruction-Dependent Learners	Many of their frustrations are related to the instructor. If the instructor gives clear directions, designs the group task at a suitable difficulty level, and provides just-in-timer support, then working in groups should not be demanding for them. They prefer to work with people they are familiar with or click with. They don't mind dividing up the task and working on their own part independently, so time conflicts encountered when scheduling meetings wouldn't be much of a problem for them. They are very frustrated if the quality of work is worse than they could have done alone.
Adapted Collaborators	They are not typically stressed by frustrations during group work because they have learned to not let them affect their grade or how they feel. Their overall collaborative learning experiences have been negative, but they try to make the best of the worst situation and learn to adapt themselves to make things work. Working independently with no real collaboration is not the best but ok with them. Having minor frustrations usually won't prevent them from learning something or lead to the task being done poorly. They are most frustrated when group members are reluctant to help others or roles and responsibilities are unclear among group members. Their biggest frustrations are also associated with the instructor, for example, when confusing directions are given or the instructor not allowing enough time.

To ameliorate college students' frustrations in collaborative learning, some researchers have recommended specific strategies for instructors to consider when they design and implement collaborative learning activities (Ashcraft & Treadwell, 2008; Burke, 2011; Hansen, 2006; Pfaff & Huddleston, 2003; Tucker & Abbasi, 2016) (see Table 4.2). These strategies cover almost all aspects of collaborative learning, such as group formation, group processes, and assessment. The book *Collaborative Learning Techniques A Handbook for College Faculty*, written by Barkley et al. (2014), is also a valuable resource and includes suggestions for both face-to-face and online collaborative learning groups.

Table 4.2

Strategies to Minimize Students' Negative Perceptions of Collaborative Learning

Study	Recommended strategies
(Ashcraft & Treadwell, 2008)	• Make individual team member contributions identifiable. • Minimize group size. • Encourage collaborative—rather than cooperative—work. • Increase students' commitment. • Encourage extensive communication. • Increase team cohesion. • Introduce superordinate goals (that can only be achieved by all group members). • Encourage distributed leadership.
(Feichtner & Davis, 1984)	• Communicate the rationale of using group learning to students. • Help students to establish realistic expectations about the group assignment. • Listen in while groups are working. • Provide immediate feedback on group projects. • Group activities and assignments should be relevant to the course content.
(Hansen, 2006)	• Emphasize the importance and relevance of teams and teamwork. • Teach team development and teamwork skills. • Conduct team-building exercises for cohesive groups. • Determine method of team formation. • Assign a reasonable workload and establish clear goals. • Require team members to have specific and assigned roles. • Provide some class time for team meetings. • Require individual team members to. • Keep personal contributions file. • Use detailed peer evaluations as a part of grading team effort.
(Pfaff & Huddleston, 2003)	• Emphasize the relevance of group work. • Assign a reasonable workload. • Allow some class time to work on group projects. • Use peer evaluations. • Monitor free riding.
(Tucker & Abbasi, 2016)	*Assessment of teamwork* • Differentiate assessment of teamwork performance and teamwork skills. • Use self- and peer-assessment. • Assess students' perception of fairness. *Team formation* • Decide on the formation criteria and communicate the rationales the students. • Complete a learning style test and discuss the results at the outset of teamwork. • International students should not be isolated with culturally dissimilar teammates, unless they are comfortable. *Teaching teamwork skills* • Establishing ground rules.

- Assigning roles and responsibilities.
- Effective communications.
- Planning.
- Decision-making.
- Conflict management.

Both the problems and the solutions presented above are not surprising, as Riebe et al. (2016) discovered through their systematic review: "Although there is a proliferation of information available to educators on teamwork pedagogy, the same types of practices are presented, with no real discernible innovation or advancement in the teamwork pedagogy domain" (pp. 633-634). Although adopting the recommended practices may ameliorate many of the sources of frustrations in collaboration, "it is almost impossible to ensure only positive experiences for all students" (Tucker & Abbasi, 2016, p. 14). To break the vicious cycle of prior negative group learning experiences and adverse attitudes towards future group work, Tucker and Abbasi (2016) recommended student reflections on both positive and negative collaborative learning experiences at the beginning and end of group work. In a similar vein, Forrest and Miller (2003) suggested an open discussion about students' prior group experiences at the outset, allowing the professor to suggest effective collaboration strategies and allowing the students to hear each other's experiences and reevaluate their own perceptions and attitudes.

Theoretical Framework

Two theories are helpful in understanding students' perspectives on collaborative group work, namely hermeneutic phenomenology (Freeman & Vagle, 2013; Kafle, 2011; van Manen, 2017) and the theory of collaboration scripts (Fischer et al., 2013).

Hermeneutic Phenomenology

Mayoh and Onwuegbuzie (2015) conceptualized phenomenology as a theoretical framework for mixed methods. They defined mixed methods phenomenological research as

"research that combines phenomenological methods with methods grounded in an alternative paradigm within a single study" (Mayoh & Onwuegbuzie, 2015, p. 103). Hermeneutic phenomenology can be considered a fusion of traditional phenomenology and hermeneutics: the former focuses on describing the essence structure of lived experience (being), and the latter on interpreting the lived experience (Freeman & Vagle, 2013). Hermeneutic phenomenology, represented by philosophers like Heidegger, Gadamer, and van Manen, rejects the method of bracketing (i.e., removing one's subjectivity or bias when describing a phenomenon), a key concept in traditional descriptive phenomenology (Freeman & Vagle, 2013; Valentine et al., 2018). To hermeneutic phenomenologists, bracketing is not only impossible but also unnecessary (Freeman, 2008) because our subjectivity, although comprised of prejudices and presumptions, provides points of connection to the past and to other people, creating possibilities of new understanding that can extend our horizon (Freeman, 2008; Valentine et al., 2018). Therefore, hermeneutic phenomenology is a philosophy about people's everyday experiences as they are living them. In other words, it describes and interprets the phenomenal experiential meanings influenced by people's consciousness, use of language, ways of thinking, and various presumptions (Adams & van Manen, 2008).

Although we cannot step away from our subjectivity, there are ways to eliminate misunderstandings through extensive exposure to multiple perspectives (Freeman, 2008). Gadamer used the metaphor of "horizon" for a person's subjective perspective—our horizon is what we can see from a certain standpoint (Newberry, 2012; Valentine et al., 2018; Vessey, 2009). Our horizon is shaped by our previous experiences and cultural background and, in return, shapes the way we perceive and interpret the world. In collaborative group work, students may have positive or negative experiences, and their perceptions of these experiences might differ

based on their subjectivity. Fusion of horizons can occur when our perspectives are merged and our understandings are expanded through conversations with people or with texts, creating new perspectives and new understandings (Newberry, 2012; Valentine et al., 2018; Vessey, 2009). Therefore, to create a space for fusions of horizons, it is important to have open discussions about group work experiences in order to reveal students' various perspectives and to provide an opportunity for them to gain new understandings of both their own and their peers' perceptions of frustrations in collaboration.

Collaboration Scripts

Generally speaking, collaboration scripts are structured guidance to scaffold learners' collaboration activities in both face-to-face and online settings (King, 2007). Research has shown that collaboration scripts can promote high-level knowledge construction and acquisition of collaboration skills (Radkowitsch et al., 2020; Vogel et al., 2017). King (2007) explains the reason why collaboration scripts are needed:

> Because giving explanations, asking thoughtful questions, elaborating on content, argumentation, and engaging in exposing and reconciling cognitive discrepancies are known to be effective in collaborative learning but do not generally occur spontaneously, scripted collaboration approaches focus on structuring group interactions so as to elicit these and other kinds of effective activity. (p. 23)

Fischer et al. (2013) proposed "the scripted theory of guidance" as a coherent theoretical framework for research using collaboration scripts. Fischer et al. (2013) used the analogy of theater to define the four components of collaboration scripts: "play" refers to knowledge about the whole collective task; "scene" refers to knowledge about a given situation within the task; "scriptlet" refers to the procedures of learning activities within a scene; and "role," which

interplays with the former three components, refers to knowledge about the role of a specific learner should play at different levels. Further, Fischer et al. (2013) conceptualized *internal scripts* (the learners' internal knowledge/ schema about collaboration norms and expectations that are dynamically formed in the collaboration process) and *external scripts* (collaboration guidance presented by external sources such as technological tools and teacher's directions). In light of this taxonomy, students' prior collaborative experiences and attitudes, which have an impact on how they behave in group assignments, can be considered an integral part of their internal collaboration scripts.

More importantly, the relationship between internal scripts and external scripts is considered to be interdependent and dynamic (Fischer et al., 2013). The forming and reforming of internal scripts are triggered by the learner's collaborative practices and may be facilitated or inhibited by external scripts; in specific contexts, external scripts should vary in terms of the three levels (i.e., play, scene, and scriptlet) according to learner's level of internal scripts. That is to say, external scripts only work when learners cannot perform well without them and external scripts should fade away when learners' internal scripts are sufficient to guide their collaboration processes (Fischer et al., 2013). In addition, some external collaboration scripts in face-to-face situations are expected to be internalized by students (King, 2007) when these standard collaboration procedures are practiced repeatedly and become automatic self-regulated learning activities (Johnson & Johnson, 1999).

Collaboration scripts are widely used to support cognitive, metacognitive, and socio-emotional aspects of CSCL (Alharbi et al., 2018; Lee, 2015; Mende et al., 2017; Miller & Hadwin, 2015; Popov et al., 2019). However, most of these studies only designed and examined external collaboration scripts and rarely touched upon learners' internal scripts (Vogel et al.,

2017). This study attempts to address both the internal and external scripts. The design of the external scripts for student discussion of their frustrations with collaboration is informed by Q methodology, as elaborated in the next section.

Q Methodology

The theory and philosophy underpinning Q methodology provide a strong rationale for its use as a mixed methods research methodology to study student frustration stemming from collaborative activities. As a systemic methodology with its own philosophy, epistemology, and methods, the primary concern of Q methodology is any topic related to human subjectivity, such as attitudes, beliefs, values, perceptions, and experiences (Brown, 1993; Brown, 1980; Stephenson, 1953; Watts & Stenner, 2012). Q can be considered as an alternative phenomenological research method because it is aimed at "seeking meaning through exploring subjective accounts of phenomena from participants' perspectives, attempting to identify broad categories and common themes and a commitment to a collaborative engagement with participants" (Shinebourne & Adams, 2007, p. 107). For example, Hodges (1999) conducted a phenomenological study with Q methodology to explore the beliefs of creativity held by professional artists and non-artists who identified themselves as creative individuals.

The underlying epistemology of Q methodology is constructivism/interpretivism, as it concerns people's intersubjectivity on a specific topic, but the analytical method is an unconventional use of factor analysis, one of the most commonly used quantitative methods (Ramlo, 2015, 2016; Ramlo & Newman, 2011). However, due to this qualitative-driven nature, there are multiple points in data analysis and data interpretation where the researcher needs to make subjective decisions, not completely relying on the statistical standards (Ramlo, 2015). To help make these decisions sound and valid, the researcher usually collects qualitative data such

as interviews, open-ended surveys, and focus groups (Ramlo, 2015). Therefore, Q particularly aligns well with hermeneutic phenomenology (McKeown, 1998). As hermeneutic phenomenologists do not provide specific procedures for research (Valentine et al., 2018; van Manen, 2017), Q methodology can fill this gap (McKeown, 1998).

As a unique mixed methodology, Q methodology has its own standard procedures. The first step is to create the concourse related to the research question. The concourse, defined as the universe of subjective communicability (Brown et al., 2019; Stephenson, 1978), is comprised of a comprehensive series of statements (or visual/audial/ alternatives) that are self-referential (Brown et al., 2019; Stephenson, 1978), i.e., the content of statements should be opinions or feelings rather than facts. The concourse can have hundreds of statements that come from multiple sources, such as theory, literature, newspapers, social media, and interview or observation data (Brown, 1980; Watts & Stenner, 2012). Then the Q sample of representative statements are purposefully drawn from the concourse for the Q sort activity in the next step. For the Q sort activity, the participants rank these Q sort statements according to some perspective (e.g., from most agree to the most disagree, most prefer to least prefer, etc.) to fit into a pre-designed normally distributed grid (Watts & Stenner, 2012). The Q sorting technique was created as a probe to make the participants' subjectivity operant through the operation of Q sort statements so that it can be observed by the researcher (Brown, 1980; Stephenson, 1953; Watts & Stenner, 2012). Next, participants' Q sort data are factor analyzed to identify convergent and divergent viewpoints, i.e., Q factors (Watts & Stenner, 2012). Q factor analysis is an inverted version of traditional factor analysis by correlating the people instead of items or variables. Although factor analysis in Q is primarily a statistical procedure, the researcher should not entirely rely on the statistical standards (Ramlo, 2015; Watts & Stenner, 2012). Thus, to make

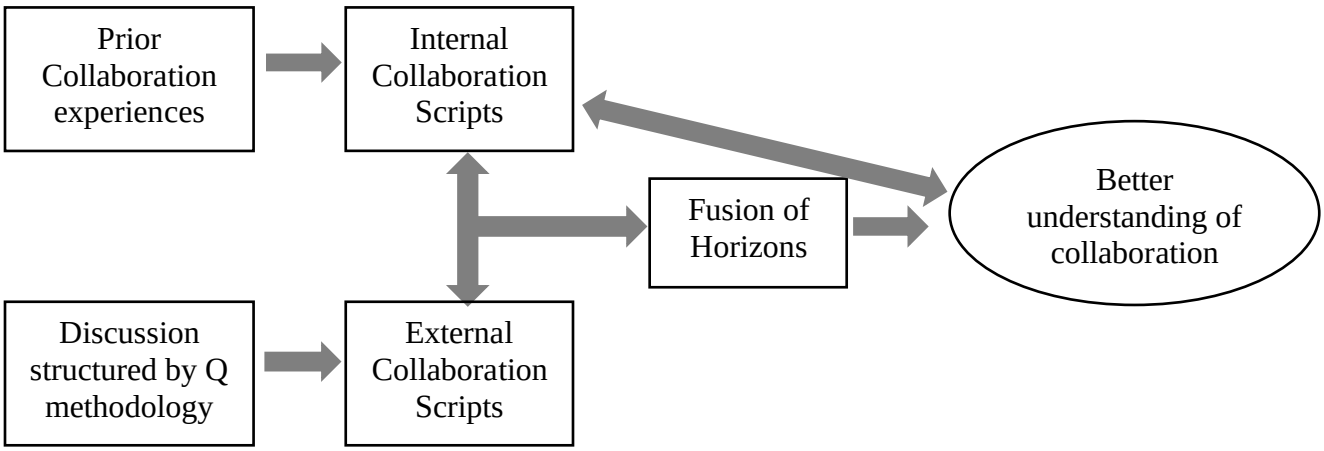
sound decisions in Q factor analysis, the researcher usually collects qualitative data along with the Q sort data, such as interviews and focus groups that allow the participants to expand their Q sorting rationale (Ramlo, 2015; Watts & Stenner, 2012). The researcher then interprets these factors to derive rich descriptions of the perspectives of the factors, incorporating Q sort results and the qualitative data synergically.

Conceptual Map

A conceptual map (see Figure 4.1) is presented to illustrate the interactions of the theoretical constructs informing my research. For successful collaborative learning, students need both internal and external collaboration scripts. Students' previous collaborative learning experiences shape their internal collaborative scripts during collaboration. The external collaborative scripts of group discussion are prescribed by the procedures and results of Q sort. Together the internal and external scripts interact with each other during the group discussion, leading to a better understanding of collaborative learning by the students, instructor, and researcher. This enhanced understanding will further shape students' internal scripts for future collaboration and the researcher's future design of collaborative learning activities.

Figure 4.2

Conceptual Map



The Current Study

The purpose of the study was: (1) to better understand the students' frustrations of collaboration; (2) to help students better understand their own perceptions of collaborative learning and those of their peers, with the hope of providing insights into teaching and learning with small groups; and (3) to validate the learner personas for collaborative learning developed in previous research (Yang, 2022, under review). This research was guided by the following questions:

RQ1: What are the students' perspectives on different sources of frustrations in collaboration? (Mixed)

RQ2: What do students report learning from the Q sort discussion? Is there evidence of "fusion of horizons"? (Qualitative)

RQ3: How do the students resonate with the learner personas? (Quantitative)

RQ4: What are the behaviors that students reported while working in collaborative groups after the Q sort discussion? (Mixed)

This study focused on the college students' learning experiences from their own perspective, instead of from the perspective of instructors and researchers. This study used Q methodology as a mixed methods approach, contributing to the expansion of the field of mixed methods as well as introducing Q to a broader range of researchers (Ramlo, 2016). Q methodology was used not only as a research tool but also as an instructional tool, as a response to the call of (Rieber, 2020b). The mixed nature of Q methodology makes it flexible for different various theoretical frameworks, such as feminism (Kitzinger, 1999), post-colonial theory (Burke,

2015), social constructionism (Watts & Stenner, 2012), and critical dialogic accounting (Sorola, 2022). Situating Q in a framework of hermeneutic phenomenology will shed light on how Q can be adapted for diverse theoretical frameworks.

Methods

Mixed methods research "combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques)" (Johnson et al., 2007, p. 123). This study uses a mixed methods approach in order to "create deeper understandings of the phenomenon of interest than the understanding a researcher might expect from looking at qualitative or quantitative data separately (DeCuir-Gunby & Schutz, 2016, p. 38). In this case, the combination of a Q sort activity, group discussion, surveys, and interviews can lead to better understandings of college students' perspectives on collaborative learning. Table 4.3 shows the research questions, data sources, and data analysis.

Table 4.3

Research Questions, Data Collection, and Data Analysis

Research Questions	**Data Sources**	**Data Analysis**
RQ1: What are the students' perspectives on different sources of frustrations in collaboration? (Mixed)	Q sort, post-sort survey, group discussion recordings and notes	Factor analysis, abductive analysis
RQ2: What do students report learning from the Q sort discussion? Is there evidence of "fusion of horizons"? (Qualitative)	Post-discussion survey (reflection)	Thematic analysis
RQ3: How do the students resonate with the learner personas? (Quantitative)	Post-discussion survey (reflection)	Descriptive statistics
RQ4: What are the behaviors that students report while working in collaborative groups following the Q sort discussion? (Mixed)	Post-project survey, post-project interview	Thematic analysis, descriptive statistics

To provide a safe environment for the students to have a meaningful conversation with each other, I organized small group discussions scaffolded by Q methodology, a qualitative-driven mixed methods studying people's subjective viewpoints (Ramlo, 2015). Following Q methodology procedures, an online Q sort was first completed by students individually to capture their perceptions of various sources of frustration. This Q sort was a refined version of the Q sort used in my previous Q study (Yang, 2022, under review). Using the method of structured Q sample suggested by (Brown et al., 2019), the 31 statements of the Q sort (see Appendix A) were drawn from a concourse of 169 statements (see Appendix B) that were developed based on the literature on group work frustrations and interviews from pilot studies. Based on the results of the Q sort, the students were grouped according to similar perspectives to discuss the Q sort results and the learner personas (Yang, 2022, under review). The Q sort and discussion were designed as a class activity before the students were assigned to a group project by their instructor. After the group project, the students were asked to fill out a survey to report their behaviors during the group project. These behaviors were compared with their Q sort results to see whether their viewpoints on collaborative learning and their actual behavior in group work were consistent. Individual interview was also conducted to get more in-depth information about their group work experience. It should be acknowledged that the nature and design of the group project could have a great impact on the students' group work experiences. Nevertheless, since the content of the group project was not the focus of this study, the group project was meant to conform to whatever the instructor had planned in her teaching schedule around the time of data collection without researcher interference. That is to say, I did not know what the group project would be until I started the data collection.

In short, the Q sort was used both as a research tool (for data collection) to serve the first and third purposes of the study and as an instructional tool (to structure group discussion) for the second purpose. The group discussion was externally scripted by the Q sort in three ways. First, the Q sort prescribed the procedures (i.e., scriptlets): Students needed to complete individual sort first following the step-by-step guidelines provided to them and then were engaged in group discussions about their viewpoints. Second, the Q sort determined group formation of the discussion (i.e., roles); that is, students who shared similar perspectives were arranged into a group. Third, the Q sort provides the discussion prompts, which were based on the Q sort results (i.e., factors).

I conducted a pilot study in Spring 2022 in an undergraduate course on design thinking. I made a few changes to the research design based on the students' reactions. First, I reduced the number of Q sort statements from 34 to 31 because one student expressed that all the statements were negative and that he was "irritated" by them. Second, I improved the online Q sot experience by using the latest template of EQ Web Sort (Banasick, 2022) with a new design that was more fluid and fixed a bug in the old version. Third, I made some minor changes to the discussion prompts, post-project survey questions, and the interview protocol. Finally, I recorded a demonstration video of the Q sort website so that students who missed the class could do the Q sort after class with the help of the video.

Participants

This research was purposefully conducted in a class of a face-to-face undergraduate-level course on technology integration in education because collaborative learning was not only one of the topics in the course content but also a method of teaching in this course. The instructor of this course was a first-year doctoral student in learning, design, and technology, who was teaching it

for the second semester. She assisted with the logistic aspects of data collection but was not directly involved in my research. Twenty-three students enrolled in this course in spring 2023 took part in the Q sort activity, nineteen of whom participated in the group discussion and reflection, twelve responded to the post-project survey, and one volunteered for the individual interview (see Table 4.4). Among the twenty-three students, there were eighteen females (78.3%) and five males (21.7%); four of them were freshmen (17.4%), eleven sophomores (47.8%), six juniors (26.1%), and two seniors (8.7%). The majority of the participants were education-related majors (65.2%), such as communication sciences and disorders, elementary education, family & consumer sciences, and exercise & sports science; the others were from the School of Business (30.4%) and the Department of Advertising (4.3%).

Table 4.4

Student Participation in Data Collection

Student No.	**Q sort & survey**	**Group discussion**	**Reflection**	**Post-project survey**	**Post-project interview**
1	x	x	x		
2	x	x	x	x	
3	x	x	x	x	
4	x				
5	x	x	x	x	
6	x	x	x	x	
7	x	x	x		
8	x	x	x	x	
9	x	x	x	x	x
10	x	x	x	x	
11	x	x	x		
12	x	x	x		
13	x	x	x	x	
14	x	x	x	x	
15	x	x	x		
16	x	x	x		

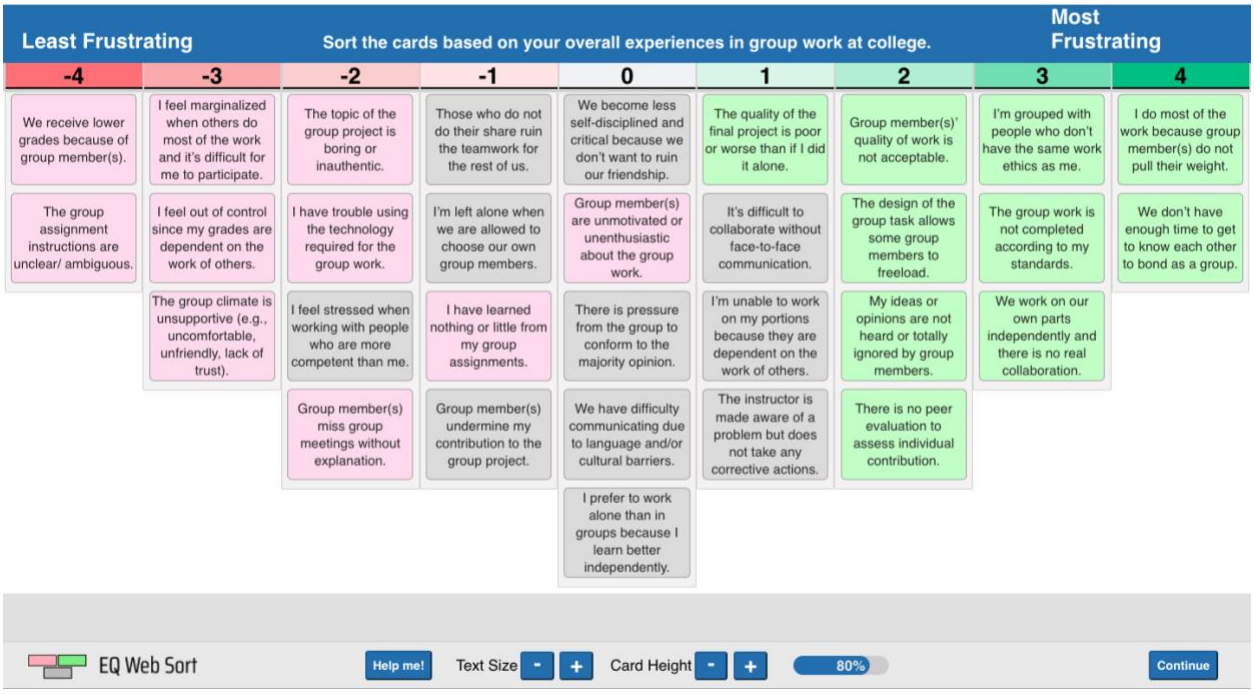
17	x	x	x	
18	x	x	x	x
19	x	x	x	x
20	x			
21	x	x	x	x
22	x			
23	x			

Procedures

To answer the research questions, this study was designed as a multi-phase mixed methods study (DeCuir-Gunby & Schutz, 2016), where the data collection was divided into two phases: Phase I, before students were assigned to a group project and Phase II, after the group project. During Phase I, the Q sort activity and group discussion were done during class time in two separate sessions. The Q sort was administered on a specially designed website (https://xiguiyang.com/collaboration-qsort-2023). I joined their class via Zoom, with the students attending class in person, to introduce myself and my research to the students. I demonstrated how to use the Q sort website and waited to answer any questions asked by the students during the Q sort. Based on their overall collaborative learning experiences at college, the students sorted the 31 statements from least frustrating to most frustrating into a grid (see screenshot in Figure 4.2). At the end of the Q sort, students were asked to complete a survey (see Appendix C) (embedded in the Q sort website) to elaborate on their sorting process. The Q sort and post-sort survey took about fifteen minutes.

Figure 4.3

Screenshot of the Q Sort Grid



The Q sort data were factor analyzed using the Ken-Q analysis statistical software (Banasick, 2019). Post-sort survey responses were used to help make decisions for the factor analysis, such as the number of factors. The post-sort survey responses were also used to assist in the interpretation of the factors in order to answer the first research question: What are the students' perspectives on frustrations in collaboration? Once the factors were identified, students were assigned to groups corresponding to the factor that represented their viewpoints. Students then participated in group discussions and were given the task of interpreting and describing their group's viewpoint. To aid them in this task, they were provided a composite Q that represented a weighted average of the group's collective Q sorts. They were also asked to compare their individual Q sort with the learner personas developed in my previous research (Yang, 2022, under review). Appendix D shows the group discussion prompts. I met with the students in

person to facilitate the group discussion. The group discussions were audio recorded and participants were also instructed to take notes on a shared Google Doc during their discussions. The group discussion data were used to assist in the interpretation of the factors as well. Typically, Q researchers conduct interviews or focus group discussions for member checking. I took the opportunity of interacting with the students in the group discussion as an alternative means to member checking. In addition, student comments found in the recordings of their group discussions were used as evidence of verifying my assertions.

At the end of their group discussion, the participants completed an online survey (see Appendix E) to reflect upon what they had learned from the Q sort discussion and what they thought of the learner personas. The process of discussion and reflection (including whole class debriefing) took about one hour. Student responses to the open-ended questions in the reflection survey were thematically analyzed (Braun & Clarke, 2012) to answer research question 2 (What do students report learning from the Q sort discussion? Is there evidence of "fusion of horizons"?). NVivo 12 was used to code the discussion notes and reflection responses. In the initial coding, I used a combination approach (Braun & Clarke, 2012) of both inductive coding (discovering codes from the data) and deductive coding (using pre-set codes from my understanding of "fusion of horizons"). Then common themes generated from the initial codes were evaluated and labeled (Braun & Clarke, 2012). The discussion notes and responses to Likert-scale items in the reflection survey were integrated to answer research question 3 (How do the students resonate with the learner personas?).

After the Q sort discussion and reflection, students were assigned to a group project designed by their instructor. This group project was called *UDL Redesign*, where students worked in groups to identify challenges a teacher had in their classroom and then used the

principles of Universal Design for Learning to redesign the teaching and learning practices to help the teacher overcome these challenges. Time during class was provided for students to work collectively on this project, but they were expected to meet after class to finish the larger part of the project. The UDL Redesign project lasted about a week. When students finished the UDL Redesign group project, they took an online survey with both closed-ended and open-ended questions to report their collaborative behaviors during the group project. Most of the survey questions were adapted from the Q sort statements related to group processes and learning outcomes (see Appendix F). Participants were also invited to volunteer for a semi-structured interview to have further conversations about their experiences during the UDL Redesign group project (see interview protocol in Appendix G). The interview and the survey data were integrated to answer research question 4: What are the behaviors that students report while working in collaborative groups after the Q sort discussion? As only one interviewee was recruited, the original plan to conduct a thematic analysis of the interview data had to be revised. The interview transcript, together with a summary of what I wrote about her story, was emailed to the participant for member checking. The participant agreed that my report was consistent with what she said in the interview and what she still believed.

Results

Research Question 1: What are the students' perspectives on different sources of frustrations in collaboration?

My assumption prior to the start of this research study was that not all students have negative collaborative learning experiences at college or do not like group work per se, but only that all students likely have experienced some sort of frustrations on occasion. Consequently, I assumed that what makes a difference in their attitudes towards collaboration is how they

perceive these frustrations. Survey results showed that most of the students had overall positive learning experiences at college, with an average rating of 6.96 out of 10 (*SD = 2.12, N = 23*). Still, four students had very low ratings for their group work experiences, 1, 3, 4, and 4, respectively. To reveal the nuances of the students' perspectives on frustrations in group work, a four-factor solution was chosen after comparing different possible solutions to the Q sort data analysis. This four-factor solution was derived from principal component analysis and varimax rotation. A total of 62% of the variance was explained by the four factors. Three sorts were significantly loaded on factor 1, two sorts on factor 2, five sorts on factor 3, and three sorts on factor 4. Not all sorts were significantly loaded on a factor and there were a few confounding sorts that shared the perspectives of two factors. However, for the purpose of group discussion, these participants were grouped based on their highest factor loading. The factor arrays in Table 4.5 show the composite Q sort of each factor.

Table 4.5

Factor Arrays

Statement	**Factor Arrays**			
	F1	**F2**	**F3**	**F4**
1. Group member(s)' quality of work is not acceptable.	3	2	2	2
2. Group member(s) are unmotivated or unenthusiastic about the group work.	1	1	-2**	2
3. Group member(s) miss group meetings without explanation.	2	1	1	1
4. Group member(s) undermine my contribution to the group project.	1	4**	1	-1
5. Those who do not do their share ruin the teamwork for the rest of us.	-1	1*	4*	-1
6. I'm grouped with people who don't have the same work ethics as me.	3	3	0	1
7. It's difficult to collaborate without face-to-face communication.	1	-2	2	-3
8. There is pressure from the group to conform to the majority opinion.	0	-1	-1	0
9. The group climate is unsupportive (e.g., uncomfortable, unfriendly, lack of trust).	0	0	3	2
10. We have difficulty communicating due to language and/or cultural barriers.	-4	-1	-1	-2
11. We become less self-disciplined and critical because we don't want to ruin our friendship.	-2	-2	-2	0

12. My ideas or opinions are not heard or totally ignored by group members.	2	0	1	0
13. We work on our own parts independently and there is no real collaboration.	-2	-3	-2	-1
14. I'm unable to work on my portions because they are dependent on the work of others.	2	1	0	-3**
15. The instructor is made aware of a problem but does not take any corrective actions.	-2**	4	3	4
16. There is no peer evaluation to assess individual contribution.	0	-1	-4**	1
17. We don't have enough time to get to know each other to bond as a group.	-3	0*	-2	-4
18. The topic of the group project is boring or inauthentic.	-4	2	-3	0
19. The design of the group task allows some group members to freeload.	4**	-2	-4	1**
20. The group assignment instructions are unclear/ ambiguous.	-3**	3	3	2
21. We receive lower grades because of group member(s).	4	2	4	4
22. I have learned nothing or little from my group assignments.	-2	0	-3	3**
23. The quality of the final project is poor or worse than if I did it alone.	0	0	2	3
24. I do most of the work because group member(s) do not pull their weight.	2	3	0	-2
25. The group work is not completed according to my standards.	0	-1	1	-2
26. I have trouble using the technology required for the group work.	-3	2	-3	0
27. I feel out of control since my grades are dependent on the work of others.	1	-3**	0	3**
28. I prefer to work alone than in groups because I learn better independently.	-1	-3	-1	-4
29. I'm left alone when we are allowed to choose our own group members.	3	-4	2	-3
30. I feel stressed when working with people who are more competent than me.	-1	-4**	-1	-1
31. I feel marginalized when others do most of the work and it's difficult for me to participate.	-1	-2	0*	-2

Note. Distinguishing statements at $p<.05$ are marked by *. Distinguishing statements at $p<.01$ are marked by **

Factor 1 (Students #16, #2, #9): "Be the Teammate That You Want to Work With"

Like many college students, students associated with factor 1 are frustrated if their grades suffer because of some group members (21: +4) who try to freeload (19: +4), do not create quality work (1: +3), or do not have the same work ethics (6: +3). They find it frustrating when not all of the work is equal (24: +2) and their work is not appreciated (12: +2; 4: +1). In the group discussion they mentioned: "*We think at that point the purpose of group projects, which is*

to collaborate and learn from each other, does not matter and it might as well be an individual assignment." They think that the instructor needs to play a larger role in group work and set the project up so that students have to collaborate (19: +4), but they also realize that "*Sometimes there is a gap between the professor's intention of group projects and what the students would do to pass or get an A.*" They do not think the topic of the project should impact the quality of work (18: -4). As student #9 explained: "*The topic is often one that we are unable to choose. Therefore, whatever is assigned is expected and must be completed to the best standard no matter what.*" They seldom find instructions of assignments unclear or ambiguous (20: -3). Student #16 indicated "*When this is the case though, I am typically able to discuss it with my group members and figure out the issue.*" They are not as focused on their relationships with their partners (17: -3), but instead learning from each other and getting their work done. They believe they can get past the little issues (such as language/cultural barriers (10: -4) and technological issues (26: -3), as long as the group can collaborate and do work efficiently. Student #2 explained: "*If I have a language or cultural difference with a group member, it most likely means that my language or culture is not very familiar to the group member either. Therefore I don't think it would be fair to have much frustration with overcoming communication issues.*"

Factor 2 (Students #22, #7): "Be Smart and Do Your Part"

These students prefer to work independently instead of in groups (28: -4). They value work ethic (6: +3) and fairness in group work. They think their contribution to the group work should be recognized by group members (4: +4) and graded fairly or individually (21: +3) even if it is done in a group setting. Student #7 indicated: "*Everyone needs to put in the same amount of work to receive the same grade. students who freeload a group project should receive a zero.*"

They recognize the important role of the professor in a classroom, such as taking corrective actions (15: +4) to resolve problems like freeloading (24: +3), because "*the professor is the person with the authority in the classroom and the only person who can create change.*" Therefore, they are more likely to reach out to the professor about such problems and feel very frustrated if their communication is ignored by the professor (15: +4). They believe they can work with anyone in a professional manner and would not feel left out (29: -4) or stressed by more competent group members (30: -4) because they can learn from them. Sometimes, they might have trouble using technology (26: +2). Student #22 wrote: "*I rage when technology doesn't work and I am not very good at it.*" They do not mind working on their own parts without real collaboration (13: -3). In their own words, "*We are less likely to be upset at the value of the other group members' work and how well the group works together. We work smarter, not harder, and with the least amount of effort.*"

Factor 3 (Students #1, #11, #13, #23, #6): "Teamwork Makes Dreamwork"

Students associated with Factor 3 care about their grades (21: +4) as well as group dynamics (5: +4; 9: +3). Fairness in grading is important to them, as student #11 commented: "*My grade and college career should not be put in jeopardy due to the lack of effort of someone I probably hardly know.*" Although they might prefer to work independently (28: -1), they would hope to communicate well with their groupmates (7: +3) and be supportive of each other (9: +3) when they are put in a group. In the group discussion, they agreed that "*we all are more trying to pull the most weight in the group project than being the one that does nothing. We always give ourselves the hardest part when splitting up group assignments.*" Similar to factor 2, the topic of the group task does not matter too much to them (18: -3) because they know they still have to do the work even if they do not enjoy the topic. They do not object if a group project does not teach

them anything new (22: -3) because "*not every situation in school is a learning situation.*" They disagree on the use of peer evaluation. Most of them think that having a peer evaluation can be valuable to ensure fairness; however, student #11 reported disliking peer evaluation because oftentimes it does not seem to work, so it does not bother her if there is no peer evaluation (16: -4). They think technology is important, but "*college kids now are so tech savvy that it is easy for us to figure out our problems on our own so that we don't have to really worry about this issue.*" (26: -3). Additionally, they think it is difficult to collaborate without face-to-face communication (7: +2).

Factor 4 (Students #15, #21, #10): "Communication Is Key"

These students prefer independent work (28: -4) because it allows them better control of their own grades (27: +3; 21: +4) and better ability to focus on the topic at hand and work efficiently. Student #15 indicated that: "*Collaboration is great sometimes, but if you are constantly having to assign tasks and make sure everyone else is pulling their weight, it distracts from the learning.*" They think the professor should make clear instructions for the group work (15: +4) and be responsive to provide just-in-time support if there are any issues (20: +2). They said in the group discussion that: "*It undermines the point or effectiveness of the group work if there is a fundamental issue with the way it is carried out. If the instructor makes no effort to make the group work actually effective, it feels like a waste of instructional time*." Apart from getting a good grade, they also care about the quality of their final project (23: +3) and actually learning something from the group assignment (22: +3). They are bothered by unsupportive group dynamics (9: +2; 2: +2) and power imbalances (8: +1) because they prevent effective group work. They feel bonding with their group is not totally necessary (17: -4) because they think: "*We are more concerned about getting the work done. If the assignment is a longer*

project, we feel as if we will get close with our members anyways." They value the key role of communication in group work and do not usually have difficulty with communication (7: -3; 10: -2). They are not bothered by the absence of face-to-face communication, as evidenced by what they shared in the group discussion: "*The excess stress of scheduling meeting times, methods of communication, assigning of tasks to members is not necessary.*" They acknowledge that technology allows effective communication and better independent learning, so it frustrates them if they have difficulty using the technology for group work (1: +1).

Consensus Statements

There were certain aspects where all groups held similar positions based on the factor array. Table 4.6 shows the consensus statements, which do not distinguish between any pair of factors. As can be seen, all factors are very frustrated by statement #21 (We receive lower grades because of group member(s).), #1 (Group member(s)' quality of work is not acceptable.), and statement #3 (Group member(s) miss group meetings without explanation). These three statements are all pointing to slacking group members. It seems that social loafing or free-loading is the biggest or most common frustration in group work. In contrast, groups responded similarly to statement #13 ("We work on our own parts independently and there is no real collaboration."). This indicates that the students focused more on getting the work done than interacting with each other.

Table 4.6

Consensus Statements

No.	Statement	F1 Rank	F2 Rank	F3 Rank	F4 Rank
1*	Group member(s)' quality of work is not acceptable.	3	2	2	2
3*	Group member(s) miss group meetings without explanation.	2	1	1	1
8*	There is pressure from the group to conform to the majority opinion.	0	-1	-1	0

12	My ideas or opinions are not heard or totally ignored by group members.	2	0	1	0
13*	We work on our own parts independently and there is no real collaboration.	-2	-3	-2	-1
21	We receive lower grades because of group member(s).	4	2	4	4
31	I feel marginalized when others do most of the work and it's difficult for me to participate.	-1	-2	0	-2

Note. All listed statements are non-significant at $p>.01$, and those marked by * are also non-significant at $p>.05$.

Research Question 2: What do students report learning from the Q sort discussion? Is there evidence of "fusion of horizons"?

In the individual reflection after the Q sort and discussion, the students were asked to reflect upon how they liked it and what they learned from it. Results showed that all students enjoyed the Q sort and discussion. Some of them appreciated the opportunity to talk about group work experiences with people sharing similar viewpoints. For instance, student #3 indicated that "*I like it. It was cool to talk with other people about what we like about group work and also talk through our frustrations and how to overcome them. I liked how we were paired with like-minded individuals."* Some of them embraced the chance to reflect upon their own perspectives on collaboration. For example, student #14 shared that "*I found the Q sort activity very thought-provoking. It made me think about the way I work in a group project and helped me reflect on my previous experiences working in groups."* Student #18 even suggested how this activity can be useful for the professor: *"I felt that it was a good exercise in thinking about what aspects of group work frustrate me most, and I think professors having a better idea of students' frustrations could lead to better group work in the future."*

Thematic analysis of the reflections revealed four major themes in terms of what the students learned from the Q sort and discussion, as shown in Table 4.7: (1) Understanding of own perspective; (2) understanding of different perspectives; (3) shared feelings; and (4)

strategies to over frustrations in group work. Many students indicated that they became more aware of their own perspectives towards collaboration and learned about others' different perspectives as they talked through the Q sorts and learner personas. They felt they were not alone because they found out that they shared similar feelings towards certain sources of frustrations with other students, especially those with whom they were grouped during the Q sort discussion. But at the same time, they realized that people learned differently and had different feelings towards group work. They reflected deeply upon their previous learning experiences and what they could do to prevent frustrations in future collaboration. These are strong evidence that fusion of horizons occurred during the discussion as the students gained a better understanding of their own perspectives, expressed shared feelings with others, and became more aware of different perspectives. The results also provide some evidence that the students had the desire to express their opinions and feelings about collaborative learning and were deeply engaged in the Q sort discussion.

Table 4.7

Themes Emerging from Student Reflections

Theme	Count	Exemplar Quotes
Understanding of own perspective	10	• I learned that I don't mind collaboration in groups as long as everyone participates and does their part of the assigned work so the group as a whole benefits. • I learned how I am much more of an independent worker I am. • I was able to visualize what I value in team-centered environments and how that may reflect on my goals and personality. • I learned that I actually do enjoy group work more than I originally thought that I did. • I have learned what type of learner I am and the expectations I have for group projects.
Understanding of different perspectives	11	• I have learned that people need to be treated differently in group projects because not everyone works the same way. • I learned about my classmates' preferences. • That everyone is different and has different feelings towards group work.

		• Everyone is frustrated by lower grades but some people will go to different lengths to keep them from being low. Sometimes people do the work themselves others go to their teachers. • That everyone is different and learns differently. I gained more perspectives whenever we did the big group discussion.
Shared feelings	7	• I learned that there are a lot of people who are very similar to me in how they work in. • I have learned that my frustrations are not uncommon. • I realized I am not the only person who feels this way. • That in general most people agree on what is helpful versus frustrating in group work. • It was interesting… to find that most students feel the same way that I do about collaborating.
Strategies to overcome frustrations	4	• I have learned strategies to prevent frustrations within group projects. • I learned that… we need to delegate roles and do peer reviews in order to prevent people from slacking off in group work. • Although it can be frustrating, I need to learn to be more patient with people who ask to do things differently. • I learned how to set standards within a classroom setting group project.

Research Question 3: How do the students resonate with the learner personas?

The second part of the group discussion asked the students to compare their individual Q sort to each of the five learner personas—both the short descriptions and the narratives—and share within their group which one they resonated with the most and similar stories they might have. The students had no difficulty choosing one learner persona that best represented their perspective on collaborative learning, although a few of them felt they were a mix of two of the five personas. When restricted to choose only one of the personas, five of them self-identified as goal-oriented collaborators, four as fairness-oriented independent learners, five as instruction-dependent learners, and five as adapted collaborators. Below are a few exemplar quotes of students articulating their rationale for choosing their persona:

> *I feel like I am an adapted collaborator. Most of my group project experiences have not gone well as I feel like a lot of the time my group members do not care and often do not pull their weight. There are usually one or two people who care and the rest usually are*

stragglers. However, I do not get too stressed and have just learned to work through this and do my best. I think peer evaluations are good for explaining these frustrations. (Student #10)

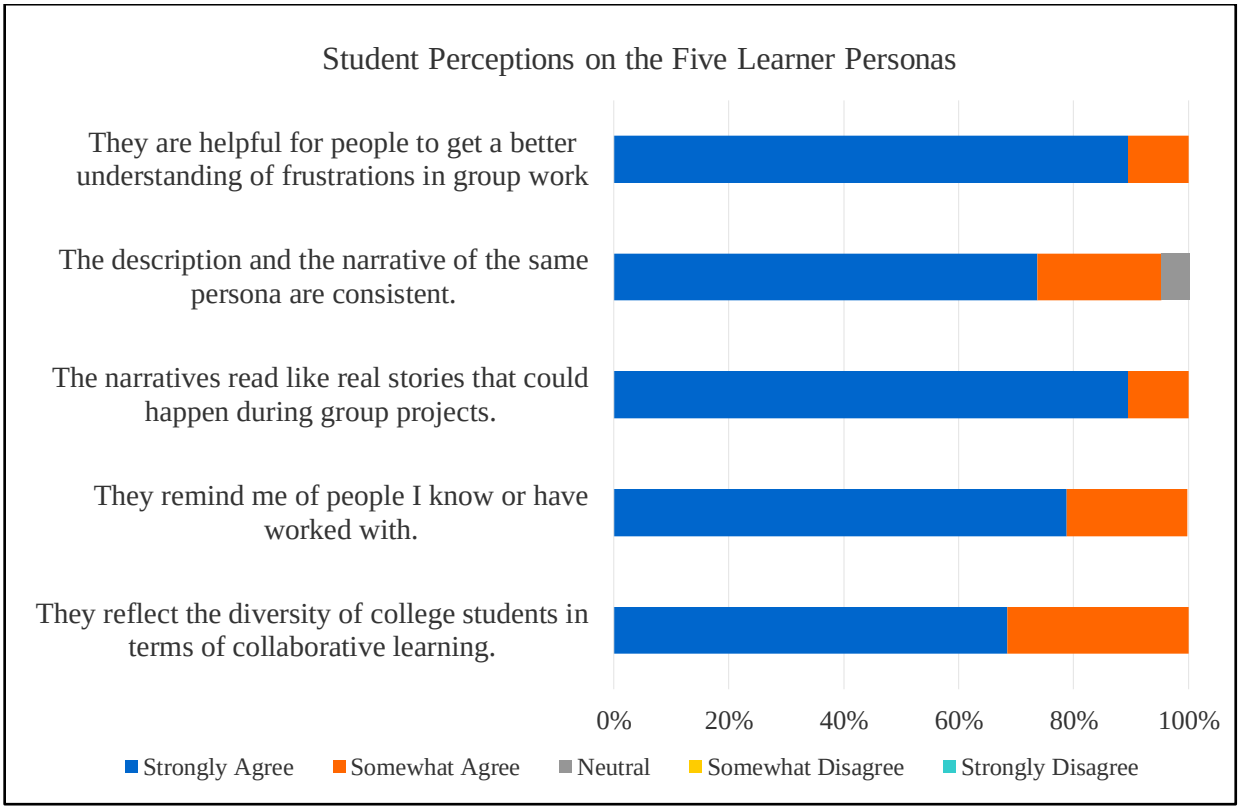
The persona that most resonates with me is the Fairness-Oriented Independent Learners. I am fine with doing individual work because I don't like to pick up other group members' slack if they do not contribute much to the group project. I prefer fairness in the sense that everyone does an equal amount of work. (Student #1)

Interestingly, students who belonged to the same factor resonated with the same learner persona. No student resonated with the persona of learning-oriented collaborators, which does not necessarily mean this type of students does not exist in the larger body of college students.

In the reflection after the discussion, there were five Likert-scale questions to measure the usefulness, consistency, vividness, relatedness, and representativeness of the learner personas. As shown in Figure 4.3, almost 90 percent of the students strongly agreed that the learner personas are helpful for people to get a better understanding of frustrations in group work, and the narratives read like real stories that could happen during group projects. Around 80 percent of them strongly agreed that the personas remind them of people they know or have worked with. Around three-quarters of the students strongly agreed that the short description and the narrative of the same persona are consistent. Over two-thirds of them strongly agreed that the personas reflect the diversity of college students in terms of collaborative learning. None of the students disagreed with the abovementioned aspects of the personas. This evidence provides support to the conclusion that the five personas are well-developed and resonate well with the students.

Figure 4.4

Student Perceptions of the Five Learner Personas



Research Question 4: What are the behaviors that students reported while working in collaborative groups after the Q sort discussion?

The last research question examined the students' actual behavior or learning experiences during the UDL Redesign group project after the Q sort and discussion. Twelve students responded to the post-project survey and one participated in a one-on-one interview. In the post-project survey, nine Likert-scale items were adapted from the Q sort statements. These items focused on the learning outcomes (such as quality of work and teamwork skills development) and group processes (setting goals, delegating roles and responsibilities, communication, group climate, and work distribution). The average ratings of the nine items indicated how positive or

negative the group work experience was perceived by the students. Meanwhile, the students were also asked how they would describe their overall group work experience: positive, negative, or neutral. A few open-ended questions asked the students to explain what factors had contributed to their positive/negative/neutral experiences and what changes they might want if they had to work with the same group again.

Table 4.8

Student Responses to Post-Project Survey

Student No.	**#2**	**#3**	**#5**	**#6**	**#8**	**#9**	**#10**	**#13**	**#14**	**#18**	**#19**	**#21**
1. We had shared goals for the group assignment.	5	5	4	5	5	5	5	5	5	4	4	5
2. We had clear roles and responsibilities for the group assignment.	4	4	5	3	5	4	5	4	4	2	4	5
3. We communicated promptly and effectively.	5	5	5	5	5	4	5	4	5	4	4	5
4. The group climate was friendly and supportive.	5	5	5	5	5	5	5	5	4	5	4	5
5. Everyone contributed a fair share to the group assignment.	5	4	5	4	5	5	5	5	4	2	4	5
6. We had real collaboration, not just divide and conquer.	5	4	5	3	5	4	5	5	5	4	4	5
7. I have learned more than I could have if I had done it alone.	4	3	5	3	4	4	5	4	5	1	4	4
8. The quality of work was better than if I had done it alone.	5	2	5	4	4	4	5	5	5	3	4	4
9. The group project helped me develop my teamwork skills.	5	4	5	4	4	4	5	5	3	3	4	5
Mean	4.8	4.0	4.9	4.0	4.7	4.3	5.0	4.7	4.4	3.1	4.0	4.8
SD	0.4	0.9	0.3	0.8	0.5	0.5	0.0	0.5	0.7	1.2	0.0	0.4
How would you describe your group work experience in the UDL Redesign project?	P	P	N	P	P	P	P	P	P	P	P	P

Note. Strongly agree = 5, somewhat agree = 4, neutral = 3, somewhat disagree = 2, strongly disagree = 1. P refers to positive and N refers to neutral.

As shown in Table 4.8, most respondents had a relatively high average score ranging from 4 to 5, whereas only one student (#18) had a lower score of 3.1, a neutral rating on a scale of 1-5. Interestingly, student #18 selected "It has been a positive experience for me," and her explanation was "*no issues or arguments, the work got done*." However, she wished that "*everyone would contribute the same efforts*." This makes sense with the information that she was a self-identified goal-oriented collaborator. On the other hand, student #5 had an average score as high as 4.9 but had no strong feelings about the group work. She thought "*the group did seem to be of like-minded people in relation to group work*," but "*some members did not participate as much as others*." She seemed to feel as if she had some responsibility for this, as she stated, "*I should have encouraged quieter members to speak up more*." She identified herself as an adapted collaborator. Although there was slacking group member(s) in both cases of student #18 and student #5, they felt quite differently about it.

The other respondents not only had high ratings but also explicitly expressed they had a positive experience in the group project. When asked what factors had contributed to their positive experience, some of them indicated that working with students who had similar values or views on collaborative learning made it easier to communicate and collaborate. For example, student #21 explained that "*being in a group that had similar viewpoints helped us to relate quickly and collaborate effectively."* It seems that the Q sort and discussion have made the students more aware of each other's perspectives on collaboration and it has had an impact on how they behaved in collaborative groups. For instance, student #10 indicated how it positively influenced their group: "… *everyone was learning about how to be a good group member with this study, so we tried to use what we learned to be a good team."*

Student #9 (pseudonym Hannah) participated in an interview to provide more detail about her group work experience in the UDL Redesign group project in order to clarify her survey responses. From the survey responses, Hannah had an overall positive experience, but her ratings of the Likert-scale items (4.3) were lower than the average of 4.4 of all twelve respondents. She worked with students #11 (pseudonym Mary) and #12 (pseudonym Nancy), who were sitting at the same table. They had discussed the group assignment in class and assumed they would work together, but they did not actually say they were going to do it as a group. Hannah reached out to Mary and Nancy via GroupMe, asking if they wanted to be a part of a group and made a shared Google slide so that they could collaborate on it. She suggested that each of them could work on one of the three parts of the assignment. One night, however, Mary did essentially the entire project without consulting with the rest of the group. Hannah and Nancy went back afterwards to add some changes so that the final product was something all of them could agree on. Hannah said that: "… *even though it was like a group assignment, there was like one person that did the majority of it, that was like also her decision to do that… that's fine, but like, she just took it upon herself to like do it.*"

It sounded like her enthusiasm to participate in the project was hurt by Mary, so I asked her how she felt about the Q sort statement, "I feel marginalized when other group members do the majority of the work and it's difficult for me to participate." She answered: "*I think it's definitely true. Like I feel like my contribution wasn't as much as hers was, but like there was nothing I could really do to change that.*" However, she did not blame Mary because she thought Mary did not do it intentionally, but rather it was due to her misunderstandings of the instructor's directions: "… *it wasn't like Mary was mad that she did most of the work. Like she was like, oh, I, I don't remember exactly what she [i.e., the instructor] said, … I think I misread it wrong …*

Like she was open to like having us look at what she had done and like improve it or like give feedback." Hannah learned from this experience that it was crucial to establish the group before leaving the classroom and ensure everyone was on the same page about what they needed to do. Reflecting upon what could have been done to make a difference, she thought building a relationship with her group members would benefit the process of communication and collaboration. I asked her to clarify her following survey response: "*I also wish there was an activity to get to know each other before doing the group work.*" She responded with the following:

> *...we sit at the same table but we don't really know anything about each other. So it's like, it's sometimes hard to like tell someone like certain things when you are afraid like you're gonna hurt their feelings or like say something that'll upset them. So I think it would've been like valuable if, um, there was like somewhat of a relationship there between like group members. So like we could like communicate with each other instead of like, just not saying anything at all till like the last minute.*

I agreed with her that it was important to bond with each other. However, this seemed to be inconsistent with her own Q sort as well as the Q factor she was associated with—Factor 1. Thus, I reminded her that in the group discussion, some students suggested that bonding with group members was not necessary and some of them even said it was a waste of time to bond with each other. In response, Hannah said:

> *I don't think it's a waste of time. I think like if you bond with your group members, you're more open to like sharing your opinions... They'll like be more open to hearing what you have to say. And I think like the quality of your work could be better if, um, you have like a relationship with the other group members. And like kind of know them so you know*

what their like strong suits are, like what they're good or what they're bad at. So when you like, come to like, make your final, um, work or whatever, like people can be assigned to different things based on what you know about them.

Discussion

The Common Free-Riding Issue

The specific group of participants in this study had many similarities in their viewpoints on group work, as indicated by the consensus statements from the Q factor analysis. Generally speaking, the slacker issue was still the most common and biggest frustration for the participants (Gottschall & García-Bayonas, 2008). Most of them indicated a preference for division of labor in group work, which they thought was the most reasonable and effective way to minimize slacking or unequal workload. Free-riding is well-documented and extensively studied (Aggarwal & O'Brien, 2008; Dommeyer, 2007; Hall & Buzwell, 2013; Jassawalla et al., 2009; Lam, 2015; Ying et al., 2014). It is a complicated issue intertwined with many other issues in group work. Many students deem it as poor work ethics, but there could be many other explanations (Dommeyer, 2007; Hall & Buzwell, 2013; Jassawalla et al., 2009), for instance, low self-esteem, lack of incentive, dominating group members, the sucker effect, high benefits-to-costs ratio of slacking, language and cultural differences, physical difficulties, learning disabilities, mental issues, and time constraints (Dommeyer, 2007). The implication for the students is that by realizing that free-riding might be involuntary due to many reasons beyond laziness, the students may become less frustrated when free-riding happens in their group and show more empathy towards the less contributing group members. And thus, they might choose more constructive strategies to deal with this issue. For example, as a special case discussed in the results section, student #18 seemed to be less frustrated (compared to student #5) by group

members' unequal contribution in the UDL group project, and she thought she should have encouraged the quieter teammates to speak more.

A recommendation for instructors who wish to reduce the free-riding effect is to make individual contributions identifiable (Ashcraft & Treadwell, 2008) and keep the students accountable with peer evaluations (Aggarwal & O'Brien, 2008; Davies, 2009; Feichtner & Davis, 1984; Hansen, 2006; Tucker & Abbasi, 2016). More importantly, the faculty should design group tasks that require real collaboration (Barkley et al., 2014; Tucker & Abbasi, 2016), as suggested by students associated with Factor 1. The task should be complex enough that it cannot be completed by just one or some of the group members (Davies, 2009; Janssen et al., 2010), and "[e]ach section of a group assignment should form part of a larger whole in which each of the parts is indispensable to the completion of the exercise" (Davies, 2009, p. 576). Lotan (2003) put forward five design principles for teachers and instructional designers who want to design a "group-worthy" task: (1) It should be open-ended for complex problem-solving"; (2) allow different ways to demonstrate competence; (3) the content should be of importance and relevance to the discipline and the students; (4) it requires positive interdependence and individual accountability; and (5) it has clear assessment criteria.

An Example of Q Pedagogy

The Q sort discussion in this study can be regarded as an example of "Q pedagogy" developed by Rieber and colleagues (Rieber, 2020b, in press; Rieber et al., 2022). Q pedagogy is a classroom adaptation of Q methodology with the goal of using Q sorts as a routine classroom activity to reveal student subjectivity on topics relevant to the course content. Classes activities are based on the Q sort results. Group discussion, such as the Q sort discussion on group work

experiences, has been the most explored form of class activity following the Q sort, but instructors are encouraged to be creative to explore different possibilities (Rieber, in press).

The Q sort and discussion turned out to be a meaningful learning experience for the students as fusion of horizons happened naturally among them in the process. My final interpretation of the Q sort results was heavily facilitated by the students' own interpretation in the group discussion, apart from the post-sort survey responses. This was fusion of horizons between my subjective perspective as the researcher and the students' own viewpoints (Bartley & Brooks, 2021). Through individual engagement in the Q sort, students had the opportunity to reflect independently on their own perspectives on collaborative learning or their existing internal collaboration scripts (Fischer et al., 2013). Then, the group discussion on the Q factors, with external collaboration scripts (Fischer et al., 2013), allowed them to hear from others and gain a better understanding of both similar and diverse viewpoints on collaborative group work. Students showed high-level engagement when doing the Q sort and deep reflection on their own experiences and feelings during the discussion. The fact that all participants enjoyed the Q sort discussion indicated that it did provide a safe environment for the students to articulate their feelings and opinions on group work, as students were grouped with people holding similar viewpoints (Rieber et al., 2022). One of the implications for teaching and learning is that external collaboration scripts can be used in the design of collaborative learning activities (e.g., the Q sort discussion), by providing some structure for the group tasks, to promote effective collaboration and reduce unnecessary frustrations (King, 2007).

The Q sort discussion in this study could be used in any college-level courses, either online or face-to-face, that include collaborative group work, not only because the statements are comprehensive enough to represent both situations but also because there are available tools and

platforms to administer the Q sort activity conveniently, such as *EQ Web sort* (Banasick, 2022) and *Lloyd's Q Sort Tool* designed by Q pedagogy proponent Rieber (2020a). The best timing for the Q sort discussion is perhaps before students are assigned to a group project to encourage open discussion about the frustrating experiences and the solutions to overcome them. The Q sort discussion can facilitate mutual understanding among students and bring about the best work ethics of students as they become more aware of potential issues.

The Learner Personas

When comparing the Q factors in this study with the students' self-identified learner personas, which were Q factors identified with an old version of Q sample in my previous Q study (Yang, 2022, under review), there was a high level of alignment: Factor 1 students all resonated with the persona of goal-oriented collaborators, Factor 2 related to instruction-dependent learners, Factor 3 fit the profile of fairness-oriented independent learners, and Factor 4 leaned towards adapted collaborators. This coincidence of alignment implied that both Q samples were equally useful in revealing divergent perspectives on the topic at issue and both Q factor analyses produced valid results based on empirical evidence.

There are many ways the learner personas can be used by faculty and instructional design practitioners to design and develop positive collaborative learning experiences for college students (Yang, 2022, under review). For example, the learner personas are a convenient tool for conducting learner analysis at the beginning of an instructional design project to understand the learners' group work styles and preferences and foster empathy towards the learners (van Rooij, 2012). The learner personas may also be a useful criterion for group formation. As some of the participants in this study indicated, having similar views on group work might make

communication and collaboration easier[4]. Also, students with the same learner personas can be assigned to the same group. However, instructors can also form heterogeneous groups with students resonating with different personas, depending on the learning context and objectives. As demonstrated in this study, the learner personas can also be used directly for group discussions on collaboration. The learner personas stimulated the students to share their own stories of good and bad group work experiences, making the group discussion more interesting and relaxing.

Limitations and Future Research

This study focused on students' perceptions of various sources of frustrations and had an in-depth discussion of their perspectives and experiences in collaborative group work. Students indicated a raise of awareness of different perspectives and reflected on how they could be a contributing group member in future collaborations. Results of this study provided some promising evidence that the Q sort discussion might have a positive impact on the students' learning behavior in future group work. However, the evidence was still limited, as the results were based on self-report data from a small number of students. Further research needs to be done to investigate the actual effect of the Q sort discussion on students' conceptual change and behavioral change in terms of collaborative learning. To examine students' conceptual change after the Q sort discussion, the Q sort activity (with the same statements) can be administered again after some period of time, for example, after the students complete a major group project. Pair analysis of the pre- and post- Q sorts can reveal patterns of change in the participants' viewpoints (Morea, 2022). It is also recommended to future researchers to collect more observational data, such as group work progress reports (Laal & Ghodsi, 2012; Wang, 2010),

[4] As the UDL redesign group project was independent from my research, the students were not grouped based on their self-identified learner personas. In fact, they self-selected their group members. It was likely that some of the students chose like-minded peer as their teammates.

peer evaluation data, instructor's input on student behavior, or any other forms of trackable data, to identify the students' behavior change in the group settings.

This study has provided partial validation that the five learner personas constructed in my earlier Q study are useful for students and faculty to understand students' different perspectives on collaborative learning. The short descriptions and the narratives provide a vivid account of different learner profiles. The participants in this study personally resonated with four of the five personas. However, this study validated the learner personas only by examining the students' perception of the learner personas. Future research should continue to evaluate how other end-users, such as faculty and instructional designers, perceive these learner personas (Salminen et al., 2020), use them in their instructional design practices (Baaki et al., 2017), and how using the personas may influence their design decision making.

As discussed earlier, the Q sort discussion designed in this study has great potential for instructional purposes. However, it requires the faculty who would like to implement it in their classroom to familiarize themselves with Q methodology, especially the factor analysis process (Rieber, in press; Rieber et al., 2022). However, gaining a working knowledge of Q should not be challenging and the factor analytical aspect is much simplified by specialized software such as KenQ (Rieber, in press; Rieber et al., 2022). For instructors who still feel intimidated by learning a new methodology, the learner personas can be used alone as an alternative for group discussion on collaborative learning experiences. Future research can focus on how to eliminate this barrier for faculty who are interested in using this learning activity. Efforts can be made to develop an integrated website that allows instructors to administer the Q sort, analyze the Q sort data, and facilitate the group discussion all in one place, without having to use multiple platforms and import/export data manually. Ideally, this one-stop website can afford automatic or semi-

automatic Q factor analysis with just a few clicks, which is feasible for practical applications of Q methodology in classroom settings.

Conclusion

Using techniques and methods of Q methodology—Q sorting and Q factor analysis—within a theoretical framework of hermeneutic phenomenology, this study addressed the issue of group work frustrations among college students by revealing the students' subjective viewpoints on collaborative learning and providing a safe space for open discussion on collaborative learning experiences. Results showed that there were four distinct viewpoints on group work as well as some shared perspectives among all participants. The four factors were labeled as: (1) be the teammate that you want to work with, (2) be smart and do your part, (3) teamwork makes dreamwork, and (4) communication is key. The students' viewpoints differ in how they view the role of the instructor, fairness in grading, the importance of group dynamics, technological issues, and so on. However, they all feel frustrated by the free-riding issue and do not mind working independently on their own part without real collaboration.

This study demonstrated that Q sorts could be used as an instructional tool in the classrooms of higher education as it provided a channel for students to articulate their viewpoints and experiences regarding collaboration. Fusion of horizons occurred as the students reflected upon their own perspectives, exchanged shared feelings, and became more aware of the diverse viewpoints of their fellow students. This study has also validated that the five learner personas developed in my previous study were helpful for the understanding of diverse perspectives on collaborative learning.

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Appendix A

Q Sample

No.	Statements	Theme
1	Group member(s)' quality of work is not acceptable.	Group members
2	Group member(s) are unmotivated or unenthusiastic about the group work.	Group members
3	Group member(s) miss group meetings without explanation.	Group members
4	Group member(s) undermine my contribution to the group project.	Group members
5	Those who do not do their share ruin the teamwork for the rest of us.	Group members
6	I'm grouped with people who don't have the same work ethics as me.	Group members
7	It's difficult to collaborate without face-to-face communication.	Group processes
8	There is pressure from the group to conform to the majority opinion.	Group processes
9	The group climate is unsupportive (e.g., uncomfortable, unfriendly, lack of trust).	Group processes
10	We have difficulty communicating due to language and/or cultural barriers.	Group processes
11	We become less self-disciplined and critical because we don't want to ruin our friendship.	Group processes
12	My ideas or opinions are not heard or totally ignored by group members.	Group processes
13	We work on our own parts independently and there is no real collaboration.	Group processes
14	I'm unable to work on my portions because they are dependent on the work of others.	Group processes
15	The instructor is made aware of a problem but does not take any corrective actions.	Instructor
16	There is no peer evaluation to assess individual contribution.	Instructor
17	We don't have enough time to get to know each other to bond as a group.	Instructor
18	The topic of the group project is boring or inauthentic.	Instructor
19	The design of the group task allows some group members to freeload.	Instructor
20	The group assignment instructions are unclear/ ambiguous.	Instructor
21	We receive lower grades because of group member(s).	Learning outcomes
22	I have learned nothing or little from my group assignments.	Learning outcomes
23	The quality of the final project is poor or worse than if I did it alone.	Learning outcomes
24	I do most of the work because group member(s) do not pull their weight.	Learning outcomes
25	The group work is not completed according to my standards.	Learning outcomes
26	I have trouble using the technology required for the group work.	Self
27	I feel out of control since my grades are dependent on the work of others.	Self
28	I prefer to work alone than in groups because I learn better independently.	Self
29	I'm left alone when we are allowed to choose our own group members.	Self
30	I feel stressed when working with people who are more competent than me.	Self
31	I feel marginalized when others do most of the work and it's difficult for me to participate.	Self

Appendix B

Concourse of Frustrations in Collaboration

Source	Statements	Theme
Capdeferro and Romero (2012)	Group members have differences in the objectives to be achieved.	Group members
	It's difficult to coordinate among group members with different time management habits.	Group processes
	I tend to do more than I can to compensate for those who do nothing.	Self
	Some group members expect others to take the lead and do all the work.	Group members
	I feel stressed when working with people who are more competent than me.	Self
	Working in a group means to depend all the time on members' messages, communications, and timing.	Group processes
	Some group members are intolerant with different opinions and have no intention to reach consensus.	Group members
	Assessment focuses only on the final product while individual participation were not taken into account.	Instructor
	The instructor never interacts with the group.	Instructor
	There is a lack of any type of orientation or guidance from the instructor.	Instructor
	The presence of an expert and dominant group member impedes the development of shared understanding and effort.	Self
	There is a lack of member attributes that foster relationship building, such as amiability, openness, and respect for others.	Group members
	It's difficult to collaborate without face-to-face communication.	Group processes
	I desire to work on my own and feel frustrated by the time required to work in a small group.	Self
	Group members' contributions are imbalanced.	
	The instructor is made aware of a problem but does not take any corrective actions.	Instructor
Burke (2011)	There is pressure from the group to conform to the majority opinion.	Group processes
	Dominating group members make others feel alienated in the decision making process.	Group members
	Some members rely too heavily on others to do the work.	Group members
	It takes more time to work in a group than to work alone.	Self
Hadwin et al. (2018)	Group members have different goals/standards for our work.	Group members
	Group members have different ideas about how to organize our time.	Group members
	Group members have different ideas about how to work together.	Group members
	Group members have different understandings of what we need to do.	Group members
	Group members have different levels of commitment to the task.	Group members

	Group members have different understandings of the course material.	Group members
	Group members have different working styles.	Group members
	Group members have trouble staying on task.	Group members
	I have trouble using the technology required for the group work.	Self
	There are misunderstandings among group members.	Group processes
	We do not have enough time to finish the group work.	Group processes
	Group members have different ideas about when and how to check progress.	Group processes
	Group members have different ideas about what to do when we run into problems.	Group processes
	The group climate is unsupportive (e.g., uncomfortable, unfriendly, lack of trust).	Group processes
	Group members have different styles of interacting (e.g. quiet, bossy, confrontational).	Group members
	We have difficulty communicating due to language and cultural barriers.	Group processes
Donelan and Kear (2018)	Group member(s) disappear from the beginning or partway through.	Group members
	We work on our own parts independently and there is no real collaboration.	Group processes
	There are personality clashes in the group.	Group processes
	The prospect of small group collaboration causes anxiety to me.	Self
	The group task and the tools provided to accomplish the task are not authentic.	Instructor
Hammar Chiriac (2014)	The group work is ineffective due to loss of focus and the presence of conflicts.	Learning outcomes
	We sometimes are out of focus in the discussion and get side-tracked instead of considering the task.	Group processes
	Sometimes there is too little task and collaboration is unnecessary.	Instructor
	Communication and negotiation with the group is time consuming.	Group processes
	It's difficult to come to an agreement and the need to compromise hampers individual learning.	Group processes
	A great fear of conflicts sometimes raises an oppressive atmosphere.	Group processes
	There was not enough time to get to know each other before or during the group work.	Instructor
	The group's life is too long, leading to group members wearing each other out and negatively affect each other's mood.	Group processes
	Some don't do anything while others pull the heaviest burden.	Group members
	Everybody does not contribute just as much.	Group members
	There is always someone who just glides along and doesn't take part.	Group members
McCorkle et al. (1999)	The design of the group task does not require each member to contribute equally.	Instructor
	Some group members tolerate others' freeloading behaviors.	Group members

	I feel like a fool for doing most of the work for the group.	Self
	The design of the group task allows some group members to freeload.	Instructor
	The design of the group task promote laziness in some group members.	Instructor
	It is difficult to coordinate time schedules for group meetings.	Group processes
	Group members are unprepared for group meetings.	Group members
	Group members waste time during group meeting.	Group members
	It is difficult to coordinate work of group members.	Group members
	Group members' quality of work is not acceptable.	Group members
	Group members are unmotivated or unenthusiastic about the group work.	Group members
	Group members procrastinate.	Group members
	Group members are late to group meetings.	Group members
	The group has overall very poor planning and organization.	Group processes
	Group members make excuses for not being prepared.	Group members
	There is a lack of understanding of what was going on due to excessive class absences by members	Group processes
	There is a lack of group leadership.	Group processes
	There are premature ideas or solutions from the group.	Group processes
	The group work is not completed according to my standards.	Learning outcomes
	There's always been at least one member not come through.	Group members
	Some group members created lots of last minute work.	Group members
Medaille and Usinger (2020)	I have learned nothing or little from my group assignments.	Learning outcomes
	I'm grouped with people who do not have the same work ethics as me.	Group members
	I feel out of control since my grades are dependent upon other students.	Self
	I'm unable to work on my portions of group projects because my parts are dependent upon the work of others.	Group processes
	I prefer to work alone than in groups because I learn better independently.	Self
	Participation in groups forced me to perform a kind of sociality, which served as a source of discomfort and anxiety.	Self
	I was left alone when we were allowed to choose our own group members.	Self
	We just divide the project into parts and pull it together at the end with minimal interaction.	Group processes
	I have to take the lead because other group members did not care or did poor work.	Self
	I feel afraid of being judged or uncomfortable opening up to others that I do not know well.	Self

	In group discussions, I tend to express agreement even if this does not represent how I feel.	Self
Pauli et al. (2008)	Group members miss group meetings arranged outside timetabled sessions without explanation	Group members
	Group members do not complete the allocated work.	Group members
	It is difficult to contact a group member.	Group members
	Group members not doing their share by the agreed deadline.	Group members
	Some group members are not available to meet.	Group members
	There is difficulty finalizing a piece of work.	Group processes
	It is difficult to divide up the work for the group task fairly.	Group processes
	It is difficult to keep the whole group focused on the task.	Group processes
	Group problems seem to arise as deadline stress looms.	Group processes
	There are arguments (including, e.g., shouting) in the group.	Group processes
	Other members fall out with each other.	Group members
	There is gossiping in the group about another group member behind their back.	Group processes
	Some group members are inflexible when their work needs to be changed.	Group members
	I fall out with another group member	Self
	I feel isolated or excluded by my group.	Self
	We have difficulty in deciding roles (e.g., who leads).	Group processes
	There are fractions or tensions developing in the group.	Group processes
	Group members turn on me or pick on me.	Group processes
	Group members do not talk to each other over a sustained period.	Group processes
Pfaff and Huddleston (2003)	Some group members do not contribute their full potential.	Group members
	There is a “leader” who takes over and works independently, discouraging the participation of others.	Group members
	Group members disrupt team dynamics so that other members are prevented from performing their tasks.	Group processes
	There is no peer evaluation to assess individual contribution.	Instructor
	The team project accounts for too large a portion of the final grade.	Instructor
	The group worked together on too many projects during the semester.	Instructor
	We do not have enough projects together to bond as a group.	Instructor
	We do not have enough class time to work on our project.	Instructor
	Those who don’t do their share ruin teamwork for the rest of us.	Group members
	A few people did the majority of the work.	Learning outcomes
	I dislike teamwork because there are always people who do not do their share.	Self
	I feel marginalized when others do most of the work and it is difficult for me to participate.	Self

Le et al. (2018)	High-status students underestimate the intellectual capacity of low-status members and dominate the group.	Group members
	I'm afraid to share my ideas because I think they are not good enough.	Self
	In friendship groups, we become less self-disciplined and critical because we don't want to ruin our friendship.	Group processes
	In friendship groups, we often talked outside the assigned topic without taking time management and group planning into consideration.	Group processes
Tucker and Abbasi (2016)	Those students who don't contribute aren't really held accountable.	Group processes
	It's unfair to assign the same team mark to different team members whose contributions may have not been the same.	Instructor
	My ideas or opinions are not heard or totally ignored by other group members.	Group processes
	The group size is too big, making it difficult for group organization and equal distribution of work.	Instructor
Gottschall and García-Bayonas (2008)	Group member do not share the same grade expectations.	Group members
	Group members do not think the same and it's difficult to come to an agreement.	Group processes
	I do not like being responsible for others' grades.	Self
	Instructors assign group work without enough direction.	Instructor
	It is more work than working alone.	Instructor
	The instructor uses group assignments to do less work.	Instructor
	I do not like people to depend on me.	Self
	I cannot develop my own ideas in the group.	Self
	I see no sense of self in the finished product.	Self
Sorensen (1981);	Everyone received the same grade for dissimilar work.	Learning outcomes
	We got lower grade because of group members.	Learning outcomes
	I'm afraid to voice new or differing opinions.	Self
	There is limited self-expression in the group project.	Instructor
	Group members are not willing to compromise.	Group processes
	I was embarrassed of my own opinion.	Self
	Other groups members are only interested in socializing.	Group processes
	I do not like to lead in group work.	Self
	There is a sense of competition within the group.	Group processes
	The quality of the final project is poor or worse than if I did it alone.	Learning outcomes
	The group are very slow to accomplish tasks.	Group processes
	It seems hopeless to get the group project done.	Group processes
	Other group members just want to get the job done.	Group members
	I am assigned to a group instead of have the freedom to choose my own group.	Instructor
	The topics for the group project are too boring.	Instructor

	We are forced to work in the group (there is no option for individual work).	Instructor
	Roles and responsibilities are not clear among group members.	Group processes
Wilson et al. (2018)	Team members are distracting and it is hard to focus on the work.	Group members
	There is no peer evaluation or peer evaluation is ineffective.	Instructor
	I'm unable to undertake the group work in the way I would like to.	Self
	It is more stressful working in groups than working alone.	Self
	Time management of the group is challenging (some prefer to start early while others wait until the last minute).	Group processes
	I have to rely on the work of other students for a final grade.	Self
	It is difficult to find time outside of class time for group meetings when we have different timetables.	Group processes
	The lack of involvement of one group member can be demoralizing and damaging to the group as a whole.	Group members
	The format of the group assignment makes tasks difficult to negotiate.	Instructor
	The assignment instructions are unclear/ ambiguous.	Instructor
Other (Pilot studies)	Group members are reluctant to help others.	Group members
	Support from the instructor is lacking or delayed.	Instructor
	Group member(s) disappear from the beginning or partway through.	Group members
	The group assignment itself is too difficult.	Instructor
	Time is very limited to finish the group work.	Instructor
	The assessment is unfair for individual score vs group score.	Instructor
	Because of conflicting personalities, the group members do not get along well.	Group processes
	I am assigned to a random group that I am not comfortable working with.	Self
	We fail to complete the group assignment on time.	Learning outcomes
	There is unresolved tension/conflict among group members.	Group processes
	Group member(s) undermine my contribution to the group project.	Group members
	I do most of the work because group member(s) do not pull their weight.	Learning outcomes

Appendix C

Post-Sort Survey

1. Please explain why you chose the following two statements for your highest ratings (+4).
2. Please explain why you chose the following two statements for your lowest ratings (-4).
3. Please rate your overall collaborative learning experiences so far in college (from 1-10 with 10 being most positive).
4. Please provide any other comments you wish to help explain your thinking when completing the Q sort.
5. Demographic questions (name, gender, year of study, major)

Appendix D

Group Discussion Prompts

Students will be divided into groups based on the Q sort factor analysis. They will be provided the factor analysis results (composite Q sorts) and directed to interpret them in their groups. They will also be provided with their own Q sort to compare with the learner personas. Students will take notes using Google Doc or an alternative collaborative tool. Discussion prompts are as follows:

Part A: The Composite Q sort:

1. First look at the right side of the composite Q sort of your group (the high ratings), what does that tell about your group?
2. Then look at the left side of the composite Q sort of your group (the low ratings), what does that tell about your group?
3. Then look at the middle part, what does that tell about your group?
4. What might be some useful strategies for your group to prevent or resolve frustrations?

Part B: Learner Personas

1. Look at your own Q sort and read through the descriptions of the five learner personas. Share within your group: Which persona resonates with you the most or which one best represents your perspective on collaborative learning? Explain why.
2. Read the narrative of the persona that resonate with you the most. Share within your group: Have something like this happened to you before? What was your best/worst collaborative learning experience?

Appendix E

Post-Discussion Survey

1. What is your name?
2. How did you like the Q sort activity? Why?
3. What have you learned from the Q sort activity and discussion?
4. Which one of the five learner personas can best represent your perspective on collaborative learning?
5. What do you think of the five learner personas (short descriptions & narratives) for collaborative learning? (Likert scale, agree/disagree)
    a. They reflect the diversity of college students in terms of collaborative learning.
    b. They remind me of people I know or have worked with.
    c. The narratives read like real stories that could happen during group projects.
    d. The description and the narrative of the same persona are consistent.
    e. They are helpful for people to get a better understanding of frustrations in group work.
6. Any other thoughts or comments?

Appendix F

Post-Project Survey

1. What is your name?
2. We had shared goals for the group assignment. (Likert-scale, agree/disagree)
3. We had clear roles and responsibilities for the group assignment. (Likert-scale, agree/disagree)
4. We communicated promptly and effectively. (Likert-scale, agree/disagree)
5. The group climate was friendly and supportive. (Likert-scale, agree/disagree)
6. Everyone contributed a fair share to the group assignment. (Likert-scale, agree/disagree)
7. We had real collaboration, not just divide and conquer. (Likert-scale, agree/disagree)
8. I have learned more than I could have if I had done it alone. (Likert-scale, agree/disagree)
9. The quality of work was better than if I had done it alone. (Likert-scale, agree/disagree)
10. The group project helped me develop my teamwork skills. (Likert-scale, agree/disagree)
11. How would you rate your experience when working with your group member? (Likert-scale, positive / negative)
12. If positive:
    a. What factors have contributed to the positive group experience?
13. If negative:
    a. What factors have contributed to the negative group experience?
    b. Were there any problems or conflicts during group work? Were they resolved, if any?
14. If neutral:
    a. What went well in your group?
    b. What did not go so well in your group?
15. Is there anything that you wish to be different if you had to work with this group again?
16. Do you have any other thoughts or comments?
17. Would you like to volunteer for a follow-up interview?

Appendix G

Interview Protocol

Interview focus: Students' group work experience during the group project.

Interview time: around 30 minutes.

Interview questions:

1. Tell me who you were working with for the group project.
2. Tell me your experience in your group project. How did you feel?
3. What was your goal for the group project? What did you do to reach this goal?
4. How effective was the communication with your group?
5. How did you hold each other accountable in your group?
6. How would you describe your own contribution to the group project? How about others?
7. What are your biggest takeaways from the group project?

CHAPTER 5

CONCLUSION

This dissertation investigated the phenomenon of frustrations arising in the process of collaborative learning from the subjective perspectives of college students. This dissertation is organized using the manuscript format with three manuscripts. Chapter One is a brief introduction to the entire dissertation, providing the research background, rationale for using Q methodology, and my subjectivity and presumptions as a researcher. Chapter Two presented a historical review of collaborative learning and cooperative learning, setting the stage for using "collaborative learning" as an umbrella term in the following chapters. Chapter Three reported a research study on creating learner personas for collaborative learning, based on results of Q sorts and intensive interviews. Based on the results and insights gained from the research reported in Chapter Three, Chapter Four refined the Q sort and used it for instructional purposes to provide the participants with the opportunity to have an open discussion on their collaborative learning experiences. It also further validated the five learner personas developed in Chapter Three. This final chapter will reiterate the main points of each manuscript, summarize their implications, and discuss my personal reflections when conducting this dissertation study.

The Core of the Dissertation

This section provides a brief overview of the three manuscripts in this dissertation, i.e., Chapters Two, Three, and Four.

Chapter 2: Collaborative Learning Versus Cooperative Learning

Collaborative learning and cooperative learning originated separately around the same time in the 1960s and 1970s by different groups of educators and researchers, but their paths of development have been intertwined, which makes their relationship confusing to people (Bruffee, 1999). To make clear the similarities and differences between collaborative learning and cooperative learning, Chapter Two reviewed their historical development in theory and research in the last five decades.

Collaborative learning emerged in higher education in the 1960s and 1970s by British scholars, such as Bruffee Bruffee (1999), aiming to shift authority from the processors towards the students. On the other hand, cooperative learning was established in K-12 education in the 1960s by social psychologists and STEM educators in the United States, represented by Johnson and Johnson (1999), to overcome the drawbacks of individualism and competitive culture in schools and society. With different philosophical and theoretical foundations, collaborative and cooperative learning promote different methods in teaching and learning practices. In general, collaborative learning methods involve more open-ended tasks without much instructor intervention in the group processes and thus often more appropriate for more mature learners such as college students. Cooperative learning methods are more structured in order to foster positive interdependence and ensure accountability of group members. As such, cooperative learning methods are more frequently used with younger learners. As both collaborative and cooperative learning witnessed rapid development in the 1980s and 1990s, the boundaries between the two teaching methodologies became less and less clearcut. With the advancement of technology, Computer-Supported Collaborative Learning (CSCL) emerged in 1989 (Koschmann, 1996) and evolved into an interdisciplinary field of research in the 21st century. CSCL adopted the name of collaborative learning but tried to integrate the advantages of both collaborative

learning and cooperative learning by balancing the use of collaboration scripts, which helps to structure group learning tasks and promote accountability, and overuse of collaboration scripts, which hinders learner autonomy (Dillenbourg et al., 2009). Nowadays, collaborative learning is generally used as an overarching term to refer to all kinds of small-group learning methods (Koschmann, 1996), as is the case for Chapter Three and Chapter Four.

In terms of research, there are four major paradigms of research on collaborative/cooperative learning—the "effect" paradigm, the "conditions" paradigm, the "interaction" paradigm, and the "design" paradigm. According to Dillenbourg et al. (1996), the "effect" paradigm investigates whether learning in group conditions is more effective than learning alone. The "conditions" paradigm seeks to identify what conditions make group-based learning more effective than learning alone. The "interaction" paradigm focuses more on the interactions among group members during the learning processes than the learning outcomes. I proposed the "design" paradigm to describe the relatively new strand of research in CSCL that focuses on the design and development of effective collaborative/cooperative learning environments. Nevertheless, the classification of these paradigms is general without any clear delineations between them, and all research paradigms are important and necessary (Dillenbourg et al., 1996).

Chapter 3: Five Learner Personas for Collaborative Learning

Learner personas provide a vivid account of the characteristics of target groups of learners, such as their beliefs, attitudes, goals, and preferences (Pruitt & Grudin, 2003). Learner personas are a useful design tool to promote empathy towards the learners, which can help the instructional designer to make sensible design decisions with the needs of the learners in mind (Salminen et al., 2018). Learner personas are usually research-based with various sources of

data. Chapter Three combined the results of Q sort data and interview data to investigate college students' diverse perspectives on frustrations in collaboration and create learner personas for collaborative learning. Q methodology, which is an inherent mixed methods for the study of people's subjective viewpoints (Ramlo, 2016, 2021), was chosen for this study because it can identify more nuances in participants' perspectives than traditional Likert-scale surveys (Brewer-Deluce et al., 2020; Ramlo et al., 2008).

The Q sort statements (also known as the Q sample or Q set) in this chapter were developed from a few relevant research articles and my personal experiences as a teacher and student. The Q sample was tested and refined through multiple rounds of pilot studies. The Q sort activity required the participants to sort 29 statements related to group work frustrations from most frustrating to (+4) least frustrating (-4) into a normally distributed Q sort grid. The Q sort data were factor analyzed and produced five distinct factors or viewpoints. Interpretation of these Q factors generated a brief description of each factor. Intensive interview data were also collected to construct narratives corresponding to the factors. The combination of the Q factor interpretation and narratives resulted in five engaging learner personas with vivid scenarios. The five learner personas were labeled as goal-oriented collaborators, fairness-oriented independent learners, learning-oriented collaborators, instruction-dependent learners, and adapted collaborators.

In essence, goal-oriented collaborators focus on reaching their goal for group work—getting the work done with good quality and receiving a good grade—and might not mind picking up the slack of other group members. By contrast, fairness-oriented independent learners prefer working alone than in groups, care more about fairness in grading, and thus might not be willing to pick up other people's slack. Learning-oriented collaborators think it is important to

learn something from the group work and prefer more authentic group projects. Instruction-dependent group members prefer that the instructor provides more structure to the group work, gives clear directions, and offers just-in-time support. The adapted collaborators generally had very negative experiences in previous collaborative learning, but they managed to not be frustrated by them.

Chapter 4: An Open Discussion about Frustrations in Collaboration

Based on the results of the Q sort activity used in Chapter Three, Chapter Four took a step further to address frustrations in group work through group discussions using the Q sort results and learner personas. With a hermeneutic phenomenological orientation, the substantive theory supporting this research is the theory of collaboration script (Fischer et al., 2013), and Q methodology provides the core methodological guidelines.

The Q sort results revealed four distinctive viewpoints on collaborative learning among the participants. The interpretation of the Q factors integrated post-soring survey responses and group discussions. The factors were labeled using the students' own words: Factor 1 was labeled as "Be the Teammate that You Want to Work with," Factor 2 as "Be Smart and Do Your part," Factor 3 as "Teamwork makes Dreamwork," and Factor 4 as "Communication is Key." The consensus statements showed that the participants had some shared perspectives. For example, free-riding seems to be the most common frustration for all students. Students do not mind the strategy of divide and conquer without real collaboration.

All students responded positively about the Q sort and discussion, specifically the task of interpreting their Q factor and comparing their own Q sort with the learner personas. Their reflections showed that through the Q sort discussion, they better understood their own perspectives on group work and had greater awareness of different perspectives of other students.

They shared feelings towards collaboration with those assigned to the same group for the Q sort discussion. They also learned useful strategies to deal with potential frustrations in future group work. Thus, when the students were exposed to the different perspectives and reflected upon their own experiences in collaborative groups, fusion of horizons naturally occurred during the Q sort discussion as they expanded their understanding of collaborative learning (Newberry, 2012; Valentine et al., 2018; Vessey, 2009). The students also self-identified the learner persona that best fit their attitudes toward group work. Their perceptions of the learner personas showed that the learner personas were well constructed with a high level of vividness, representativeness, consistency, relatedness, and perceived usefulness.

After the Q sort discussion, the students were assigned a group project designed by their instructor. They completed a survey to report their learning behaviors during the group project. Results showed that the majority of the respondents had a positive group work experience and only one student indicated a neutral feeling about the group work experience. Some of them mentioned their positive experience working with their group members could be attributed to the fact that having the same viewpoints on group work enabled efficient communication and collaboration.

Implications

Although in the two Q sort studies included in this dissertation, I used the term collaborative learning to cover a range of small group learning methods, including cooperative learning, it was necessary to understand the differences between collaborative learning and cooperative learning and how collaborative learning has become an umbrella term for both. In practice, it is difficult to separate collaborative learning and cooperative learning because the process of group work usually involves both collaboration and cooperation (Jeong & Hmelo-

Silver, 2016). In theory, however, it is important to discriminate the two terms so that researchers have a clear understanding as to which term to use and what it implies. The historical review of collaborative and cooperative learning provides information for practitioners to decide what group learning approach is most appropriate for a specific learning context.

The learner personas, created in Chapter Three and validated in Chapter Four, are ready-to-use tools for the design and development of effective collaborative learning environments. These learner personas can be used in different stages of instructional design and practitioners can be creative when using the personas. For example, the learner personas can be used during the design phase to carry out learner analysis simply by asking the students to identify the persona that best represents their perspectives on collaboration. Then, students can be assigned to different groups based on their personas. The personas can also be used as reading materials for group discussions on collaborative learning, as demonstrated in Chapter Four.

As Rieber (2020b) suggested, Q methodology can be useful in many aspects of instructional design. Chapter Three has demonstrated that Q methodology can be a convenient tool for creating effective learner personas for learner-centered design. The Q factors dictated the number of personas and generated detailed descriptions of the personas. The narratives provided even more vivid scenarios, making the personas more exciting and engaging. Chapter Four has demonstrated that Q methodology can be used for instruction where it involves exploring student subjectivity on a given topic (Rieber, in press). The group discussion facilitated by Q methodology engaged the students in personal reflection and deep conversation with each other.

Interviews are commonly conducted in Q studies to solicit further clarification and explanation of Q sort items from the participants, which has a very narrow scope (Wolf, 2014). The interviews are generally used as supporting materials for factor analysis and interpretation.

Therefore, they are seldom analyzed systemically and results are rarely reported comprehensively (Wolf, 2014). In other words, they are treated like a “black box” in most Q studies (Sneegas, 2020). In Chapter Three, the interviews after the Q sort were conducted in a broader sense, focusing more on the interviewees’ collaborative learning experiences than on the Q sort items. I took a narrative inquiry approach, an interdisciplinary qualitative research approach by means of storytelling (Kim, 2015), to guide my interview data interpretation and construct creative narratives relevant to the factors. This study indicates that the interviews can be an extension of the Q sort and that narrative inquiry has the potential to enhance Q methodology.

Personal Reflections

I still remember vividly how I first got started with the research topic of group work frustrations using Q methodology. Back in the spring of 2019, when I was supposed to decide on a research direction for my dissertation study, I knew I was interested in collaborative learning but felt lost in the colossal volume of literature trying to identify problems that I wanted to investigate. I was taking a seminar course on Q methodology that semester and we were required to conduct a few practice Q sorts. I enjoyed the course and doing the Q sorts. Because they were meant to be just “practice” Q sorts, I just followed my curiosity and my instinct without stressing myself with theories and literature. That semester, I was also helping faculty in the Department of Academic Enhancement (DAE) to design a new online course for undergraduate students on online learning strategies. With the support of the DAE faculty, I designed a Q sort activity on frustrations in collaborative learning, which was also a practice Q sort for my Q course. I implemented the Q sort activity with the students enrolled in the online course. I was amazed by the students’ reactions as I could see that they were deeply engaged in the Q sort discussion and

had the desire to share their opinions. That Q sort activity turned out to be the very first pilot study of my dissertation.

In the following semesters, I became a teaching assistant and incorporated the Q sort activity in all the classes I was teaching. I had the students do the Q sort activity on paper and using different digital tools. I tried giving varied conditions of instruction. I also experimented with various techniques of Q factor analysis. I kept collecting Q sort data, interviewing students, and building the concourse. I enjoyed the interaction with the students in this process and appreciated the opportunity I had to just play with Q methodology. After conducting twelve interviews, I had the idea of creating learner personas, which was inspired by a graphic design course and a narrative inquiry course. Additionally, the mixed methods course forced me to think of the theoretical framework for my research. It took me some time to digest the theories of phenomenology and identify the intersection of Q methodology, phenomenology, and mixed methods. Reflecting upon the journey of my dissertation, I realized that the dots were connected little by little through the courses I took and the courses I taught.

Thinking ahead of future efforts to develop the Q studies further, I have some immature ideas to make the Q sort discussion on collaborative learning more accessible to other instructors who might not be familiar with Q methodology. The Q sorting, the Q factor analysis, and the group discussion should be integrated on one website so that the individual Q sorting and group discussion on the Q factors do not have to take place in two separate class sessions (which was necessary to allow time for Q factor analysis). The key to making this happen is to automate, or at least half automate, the process of Q factor analysis, which is possible with principal component analysis and varimax rotation. Although this analytic approach is not recommended by some Q methodologists who prefer centroid factor analysis and judgmental rotation, it is used

by many other researchers (Dieteren et al., 2023; Ramlo, 2017). In my own limited experiences of conducting Q studies, I always compare different approaches and then choose the solution that generates factors that are the most distinctive and easiest for interpretation, which is described as the “comparison” method by Ramlo (2017). In most cases, I find myself satisfied with the solution derived from principal component analysis and varimax rotation. Practically speaking, the differences between centroid and principal component as well as hand and varimax rotation are less important for classroom activities than for research studies.

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