

ASSOCIATIONS BETWEEN COLLABORATIVE LEARNING AND PERSONALITY/COGNITIVE STYLE
AMONG ONLINE COMMUNITY COLLEGE STUDENTS

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This research study investigated associations between online community college students' personal characteristics and experiences in online courses ($n = 123$). Specifically, students' personalities and cognitive styles were examined alongside the perceived quality and outcomes of collaboration. Negative correlations were found between the conscientiousness personality style and both the quality of collaboration ($p = .09$) and the outcome of collaboration ($p = .05$). This finding indicates that conscientious students who, according to the literature tend to have higher academic achievement than other students, perceive negative experiences in online collaborative environments. Conversely, a positive correlation was discovered between the extraversion personality type and the perceived outcomes of collaboration ($p = .01$). Thus, students with a strongly extraverted personality tend to perceive that they benefit from collaborative learning. Approximately 11% of the variance in the collaborative experience was explained by the combined personal characteristics. The reported frequency of collaboration was positively correlated with both the quality ($p < .01$) and the outcomes of collaboration ($p < .01$). While not generalizable, these results suggest that not all students perceive benefits from online collaborative learning. It may be worthwhile to teach students traits associated with the extraversion type like flexibility which is important for collaborative learning. Also, teaching students to adopt traits associated with conscientiousness that improve academic achievement like self-regulation may help improve perceptions of collaborative experiences.

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CHAPTER 1

INTRODUCTION

Technology is taking an increasingly larger role in the facilitation of learning and in the scaling up of class sizes. With heavy demands for instructors, learners and instructors may have less direct interaction. Student-to-student interactions may become a mainstay of the education as a way to humanize the learning experience. Researchers of online learning environments have recently drawn attention to the importance of community, social presence, rapport, interaction, etc. As one form of learner-learner interaction, collaborative learning among online students may hold great benefits for learners and institutions.

Moore (1989) described 3 forms of interaction: learner-content interactions, learner-instructor interactions, and learner-learner interactions. The first two types of interactions were present in distance education long before the Internet. With the advent of online technologies, learner-learner interactions are not only possible, but may hold potential to approximate the same type of peer interactions that occur in face-to-face classrooms. Collaborative learning among peers falls under Moore's category of learner-learner interaction.

This study drew on the research in interaction, specifically the interaction equivalency theory (Anderson, 2003) which builds on Moore's (1989) forms of interaction (learner-learner, instructor-learner, and learner-content) suggesting that one of the three forms of interaction can take precedence and still lead to "deep and meaningful learning" (Anderson, 2003, p. 4). This study was concerned with examining some of the variables that may be involved in developing "deep and meaningful learning" experiences through learner-learner interactions.

This study also drew on the research about community and presence as presented in the Community of Inquiry (CoI) framework (Garrison, Anderson, & Archer, 2001). The Garrison, Anderson, and Archer (2001) model describes social presence as one key tenet in supporting and creating “critical, practical inquiry” (p. 7). Social presence is “the degree to which a person is perceived as ‘real’ in mediated communication” (Gunawardena & Zittle, 1997, p. 8). It is a measure of “affective expression, open communication and group cohesion” (Akyol & Garrison, 2014, p. 4), and aligns well with collaborative learning practices. In a seminal research study, social presence was found to account for 60% of the variance in students’ satisfaction in a text-based learning environment (Gunawardena & Zittle, 1997).

Socially-oriented learning theories, notably social constructivism (Keaton & Bodie, 2011), argue that learning takes place as individuals express personal understanding of their experiences and work toward social understanding (Driscoll, 1994). Social sharing is a vital aspect of these theories: “Many versions of [social constructivism] maintain that objects exist only after they enter communicative space” (Keaton & Bodie, 2011, p. 192). When this sharing takes place, the meaning of experiences must be negotiated (Ertmer & Newby, 1993). This negotiation is challenging, but beneficial. Conflicting understandings may cause changes to individual cognitive structures causing refinement of learners’ ideas and mental models (Driscoll, 1994).

Social learning benefits not only individuals, but also organizations. Wenger (2000) argued that the key to successful organizations is the establishment of social learning systems. Social learning systems provide a venue for socially constructed learning to take place. Collaborative learning, especially in online learning environments in which social interactions

are limited, could be considered an aspect of a social learning system that may enhance learning and organizational success.

Collaborative learning is a popular form of social learning. The literature describes diverse benefits of collaborative learning including a positive impact on academic achievement and attitudes (Kyndt et al., 2013; Springer, Stanne, & Donovan, 1999; Wardrope & Bayless, 1999) and improved social skills (Kendall, 1999; S. A. Myers et al., 2009; Winter & Neal, 1995), along with improved career skills (Page & Donelan, 2003; Payne & Monk-Turner, 2006). Despite these advantages, research indicates that online students may prefer individual work to collaboration (Nummenmaa & Nummenmaa, 2008; Smith et al., 2011).

Individuals' cognitive styles or personalities may contribute to these preferences. Understanding potential associations between cognitive styles, personalities, and collaborative learning experiences may help educators and institutions better manage student-student interactions. There is a need to better understand student traits as related to perceptions of collaborative learning (S. A. Myers et al., 2009).

1.1 Statement of the Problem

This study was designed to describe the characteristics of online students, specifically their cognitive styles and personality dimensions, and to examine students' perceived collaborative experiences. The specific research questions (RQ) guiding this study were:

- *RQ1*. Is there an association between the perceived quality of collaborative learning and the perceived outcomes of collaborative learning?

- *RQ2*. Is there an association between cognitive style and the perceived quality of collaboration?
- *RQ3*. Is there an association between cognitive style and the perceived outcomes of collaboration?
- *RQ4*. Is there an association between personality and the perceived quality of collaboration?
- *RQ5*. Is there an association between personality and the perceived outcomes of collaboration?
- *RQ6*. To what degree can cognitive style and personality together explain the perceptions of collaboration (i.e., the combined perceived outcomes and quality of collaboration)?

1.2 Hypotheses

The following statements are the null hypotheses (H_0) and alternative hypotheses (H_A) of the proposed investigation.

1.2.1 Perceived Quality of Collaboration and Perceived Outcomes of Collaboration

H_0 RQ1: For online community college students, there is no association between their perceptions of the quality of collaboration and their perceptions of the outcomes of collaboration.

H_A RQ1: For online community college students, there is a correlation between students' perceptions of the quality of collaboration and students' perceptions of the outcomes of collaboration.

1.2.2 Cognitive Style and Collaboration

H₀ RQ2: For online community college students, there is no association between students' cognitive styles and student's perceptions of the quality of collaboration.

H_A RQ2: For online community college students, there is an association between students' cognitive styles and student's perceptions of the quality of collaboration.

H₀ RQ3: For online community college students, there is no association between students' cognitive styles and students' perceptions of the outcomes of collaboration.

H_A RQ3: For online community college students, there is an association between students' cognitive styles and students' perceptions of the outcomes of collaboration.

1.2.3 Personality and Collaboration

H₀ RQ4: For online community college students, there is no association between students' personality type and students' perceptions of the quality of collaboration.

H_A RQ4: For online community college students, there is an association between students' personality type and students' perceptions of the quality of collaboration.

H₀ RQ5: For online community college students, there is no association between students' personality type and students' perceptions of the outcomes of collaboration.

H_A RQ5: For online community college students, there is an association between students' personality type and students' perceptions of the outcomes of collaboration.

1.2.4 Personal Characteristics and the Perceptions of Collaboration

H₀ RQ6: Community college students' personalities and cognitive styles cannot be used together to explain the perceptions of collaboration experienced (i.e., the combined perceived outcomes and quality of collaboration).

H_A RQ6: Community college students' personalities and cognitive styles can be used together to explain the perceptions of collaboration (i.e., the combined perceived outcomes and quality of collaboration).

1.3 Conceptual Framework

This study drew on the research about community and presence as presented in the Communities of Inquiry (CoI) framework (Garrison & Akyol, 2009). In online learning, a community of inquiry "supports individuals constructing meaning and collaboratively testing understanding through discourse" (Garrison & Akyol, 2009, p. 23). Collaborative learning involves interaction between learners, described by Moore (1989) as learner-learner interaction. As described in the Interaction Equivalency Theorem, learning environments with high levels of quality learner-learner interaction are expected to have high levels of learner satisfaction and sustain "deep and meaningful learning" (Anderson, 2003, p. 4).

1.4 Limitations and Delimitations

This study examined characteristics and experiences of community college students. The results of this study may not be applicable or relevant beyond the community college population.

Surveying may result in a biased population of those who enjoy filling out surveys. To encourage participation from a wider audience, the survey took fewer than 15 minutes to complete.

Surveying via the Internet may result in a biased population of participants who are more comfortable using technology. Comfort of technology was not examined in this study, and therefore this limitation is expected to be of small consequence.

Self-reported data was collected in this study. As such, socially desirability bias may be expressed in the responses. That is, respondents may report answers that they believe to be socially desirable.

Student memory of collaborative experiences, GPA, grade, course completion may not be accurate. To reduce recall errors, the survey questioned students about the most recent online course they had taken.

Perceptions of cognitive style and personality collected by survey instruments may not be valid and reliable. Care was taken in the selection of the instruments to ensure a high level of reliability. The Cognitive Styles Indicator (CoSI) (Cools & Van den Broeck, 2007) and the Single Item Personality Measure (SIMP) (Woods & Hampson, 2005) were both found to have good reliability.

This study examined a limited number of variables. The researcher recognized that other variables may influence the associations between quality and outcomes of collaboration. This study brought to light other related variables for future study. Other possible variables are presented as recommended areas for future research.

1.5 Definitions of Terms

Several terms are defined below. These definitions are operational, and are provided to add clarity in the context of the study.

- *Cognitive style*: “The way a person acquires, stores, and uses knowledge” (Hayes & Allinson, p. 53).
 - *Creating*: A cognitive style describing someone who is drawn to possibilities, innovation and impulsivity. A creating person thinks in an open-ended, creative, and inventive way (Cools & Van den Broeck, 2007).
 - *Knowing*: A cognitive style describing someone who is concerned with the facts, details, precision. A knowing person tends to be logical, reflective, and have an objective perspective (Cools & Van den Broeck, 2007).
 - *Planning*: A cognitive style describing someone who is conventional, structured, organized, and systematic. A planning person likes to plan and values routine (Cools & Van den Broeck, 2007).
- *Collaborative learning*: Working together with peers on class-related activities.
- *Community college*: A school which defines itself as a community college. A community college is typically a two-year institution serving the local community.

- *Personality*: Broad domains that are used to describe personal traits.
 - *Agreeableness*: A personality trait describing “someone who is generally trusting and forgiving, is interested in people, but can be taken for granted and finds it difficult to say no” (Woods & Hampson, 2005, p. 388).
 - *Conscientiousness*: A personality trait describing “someone who likes to plan things, likes to tidy up, pays attention to details, but can be rigid or inflexible” (Woods & Hampson, 2005, p. 388).
 - *Emotional Stability*: A personality trait describing “someone who is relaxed, unemotional, rarely gets irritated, and seldom feels blue” (Woods & Hampson, 2005, p. 388).
 - *Extraversion*: a personality trait describing “someone who is talkative, outgoing, is comfortable around people, but could be noisy and attention seeking” (Woods & Hampson, 2005, p. 388).
 - *Openness*: A personality trait describing “someone who spends time reflecting on things, has an active imagination, and likes to think up new ways of doing things, but may lack pragmatism” (Woods & Hampson, 2005, p. 388).
- *Online course*: a college level course delivered entirely over the Internet
- *Online student*: a learner enrolled in an online course

1.6 Importance of the Study

Evidence indicates that, in general, collaborative learning benefits online students. It is not clear, however, if the benefits apply to all types of students or if the outcomes are different

for students with particular personalities or cognitive traits. This study contributes to the literature regarding students' experiences with collaborative online and associations with personality and cognitive style.

1.7 Summary of Chapter 1

There are many benefits to collaborative learning, yet many online students prefer not to engage in collaborative experiences. There is a need to investigate the variables related to successful collaborative learning. This study helps to fill that gap by examining the associations of two variables (personality and cognitive style) with the perceived quality and outcomes of collaboration.

CHAPTER 2

LITERATURE REVIEW

2.1 Collaboration

Working together can be classified into three different forms: cooperation, coordination, and collaboration (Mattessich & Monsey, 1992). In this paper, these three forms of working together are collectively referred to as collaboration. Collaborative learning is a learner-learner interaction (Moore, 1989). Learner-learner interactions can help build social presence in an online course which is important in supporting cognitive presence (Garrison et al., 2001). This form of interaction was not present in the early days of distance education, but came about as technologies advanced and interactions between students became possible. Technological advances made it possible for learner-learner interactions to take prominence in the online learning environment. As postulated by Anderson (2003), learning environments that focus on high quality learner-learner interactions (or any of the three interaction types) may be able to support high levels of learning. Social learning scholars argue that “group-based collaborative learning enables development of learning communities in the short term and communities of practice in the longer term” (Moore & Kearsley, 2012, p. 216).

Many have attempted to identify the factors influencing successful collaboration (see Table 2.1). In particular, Mattessich and Monsey (1992), reviewed the literature on collaborative learning highlighting the commonly cited factors influencing successful collaborative learning environments. The following were the top four factors cited in their literature review.

- Open and frequent communication
- Mutual respect, understanding, and trust
- Appropriate cross section of members
- Members see collaboration as in self-interest
- Members share a stake in both the process and the outcome (Mattessich & Monsey, 1992, p. 15-16)

Table 2.1

Attributes of Successful Collaborative Groups

| Student | Group | Teacher | Task | Community |
|--|---|---|---|---------------------------------------|
| Affection ^e | Social presence ^f | Moderating ^b | Collaborative ^b | History of collaboration ^d |
| Inclusion ^e | Negotiation ^{c, f} | Supporting ^b | Cognitive ^b | Group seen as a leader ^d |
| Non dominating ^e | Persuasion ^c | Consolidating ^b | Metacognitive ^b | Favorable climate ^d |
| Recognize as in self-interest ^d | Solidarity ^e | Planning ^b | Clear role, policy, and guidelines ^d | |
| Ability to compromise ^d | Open/frequent communication ^d | Reflecting ^b | Adaptability ^d | |
| Stake in process/outcome ^d | Shared conception ^{d, f} | Clear instruction and guidance ^e | Unique purpose ^d | |
| Offer insightful sentiments ^g | Mutual respect, understanding, trust ^d | | Sufficient funds ^d | |
| Flexibility ^d | Synthesis of viewpoints ^e | | Concrete, attainable goals ^d | |
| | Diverse members ^d | | Multiple layers of decision making ^d | |
| | Planning regulation ^a | | | |
| | Collaboration regulation ^a | | | |

Note. ^a Janssen, Erkens, Kanselaar, & Jasper (2007), ^b Kaendler, Wiedmann, Rummel, & Spada (2015), ^c Kolikant & Pollack (2015), ^d Mattessich & Monsey (1992), ^e Moore & Kearsley (2012), ^f Oliveira et al. (2011), ^g Zheng & Huang (2016).

In the face to face environment, collaboration was associated with better attitudes toward learning, increased academic achievement, and increased persistence in courses and programs of study (Springer et al., 1999). Other recognized benefits of collaborative learning include increased understanding and retention (Wardrope & Bayless, 1999), enhanced social skills (Kendall, 1999; S. A. Myers et al., 2009; Winter & Neal, 1995), and improved career skills (Page & Donelan, 2003; Payne & Monk-Turner, 2006). Collaborative learning can serve as a form of peer support. In this way, learners assist one another through such means as emotional, motivational, and instructional support in the learning journey (Buissink-Smith, Hart, & van der Meer, 2013; Chu & Chu, 2010; Kiley, 2005; Lindsay, Smith, & Bellaby, 2008). Collaborative learning is positively associated with help-seeking among online students (Du, Xu, & Fan, 2014) which, in turn, is a predictor of a student achievement (Ryan & Shim, 2006). Collaborative learning also facilitates teamwork and productivity (Du & Xu, 2010; Winter & Neal, 1995).

Students in online collaborative settings have more negative perceptions of collaboration than those in face-to-face collaborative environments (Smith et al., 2011). Myers and colleagues (2009) found that perceptions of positive attributes of collaborative learning were positively associated with social skills (i.e., tolerance for disagreement and conversational sensitivity) as well as problem solving skills (i.e., tolerance for ambiguity, cognitive flexibility) whereas perceptions of negative attributes of collaborative learning were only positively correlated with conversational sensitivity.

Students report a wide range of preferences for and experiences with collaborative learning (Winter & Neal, 1995). Significant numbers of students recognizing the benefits of collaboration (Payne & Monk-Turner, 2006), however, substantial numbers of students view

collaborative learning as inefficient or even counterproductive: “Get rid of it”, “Nothing can be done to improve it”, and “There’s always going to be problems” (Payne, Monk-Turner, Smith, & Sumter, 2006, p. 445). Some students may simply be incompatible with collaborative learning (Thanh, Gillies, & Renshaw, 2008). With such disparity in the literature between the benefits of collaborative learning and the negative perceptions of it, there is a critical need to investigate factors associated with online students’ appreciation of and preference for collaborative learning (Du, Xu, & Fan, 2013).

Students who dislike collaborative learning may dislike it because they benefit less from such interaction than students who prefer collaborative experiences. If that is the case, collaborative assignments may be made optional. It is also possible, however, that despite students’ dislike of collaborative learning, they may benefit from the added challenges inherent in collaboration (e.g., discourse, debate, sharing of perspectives, etc.). If this is the rule, course designers may incorporate some collaborative assignments. Additional research may be needed to examine how best to support collaborative learning. Alternately, those who prefer collaboration may do so because it benefits them or because collaboration allows for others to take primary responsibility for the assignments, thus leading to a lighter workload, and consequently a shallower learning experience.

The disconnect between the touted benefits of collaborative learning and online student’s preferences for collaboration suggest that online students don’t recognize the benefits of collaboration, they don’t experience these benefits, or they don’t care about the benefits of collaboration.

2.2 Groupwork

Collaboration among learners is sometimes referred to as groupwork. Winter and Neal (1995) found that the majority (55%) of students felt they were more productive as a group, but one quarter of the students (25%) believed they would have been more productive working alone. Similarly, they found that one third (33%) believed they produced a higher quality product as a group than alone, while 15% believed they would have created something better independently.

When groups include many different types of students, some types of students tend to take on certain roles. It is possible that those who feel groupwork is inefficient are the students who contribute the most. As others have found, “slackers” detract from group mates’ perceptions of groupwork (Payne & Monk-Turner, 2006, p. 132). In one face-to-face setting, almost half (43%) of the students reported having a slacker in their group (Payne & Monk-Turner, 2006). Other literature referred to the slacker concept as the free-rider effect (Slavin, 1990) or social loafing (Kyndt et al., 2013). Imbalanced contributions from group members may influence perceptions of outcomes and quality of groupwork.

Managing the logistics of groupwork in the online environment is difficult (Smith et al., 2011). This challenge may be intensified by the expectation that online learners can learn anytime and anywhere (Smith et al., 2011). In reality, if online students want or need to work together, they are likely to struggle with even less flexible schedules than face to face students because, in addition to planning around class and work schedules, group members also have to work around time zones.

2.3 Peer Support

Although peer support falls under many names (i.e., community, support, bonding, network), the concept that learners can assist one another through such means as emotional, motivational, and instructional support in the learning journey is well supported in the literature (Buissink-Smith et al., 2013; Chu & Chu, 2010; Kiley, 2005; Lindsay et al., 2008). The term peer support is defined as “a system of giving and receiving help founded on key principles of respect, shared responsibility, and mutual agreement of what is helpful” (Mead, Hilton, & Curtis, 2001, p. 135). Educational researchers describe the element of peer support as being both emotionally and academically beneficial (Chu & Chu, 2010). The fitting definition by Mead, Hilton, & Curtis (2001) emphasizes the mutually beneficial attitudes and behaviors of group members.

The small, but growing body of literature in education describes the benefits of peer support. Peer support groups may assist learners to overcome challenges or roadblocks along especially challenging educational paths like doctoral programs (Kiley, 2009). Peer support groups may be especially beneficial for learners who feel isolated (Buissink-Smith et al., 2013) as well as online learners with less advanced technical skills (Lindsay et al., 2008).

2.4 Flexibility and Turbulence of Collaborative Groups

Studies on the compatibility of cognitive style and personality indicate two directions for successful collaboration. Allison and Hayes (1998) summarize the differences. First, groups may contain individuals with homogeneous personal characteristics (e.g., cognitive styles and personalities). Members of homogeneous groups may work quicker and make decisions easier

due to their shared perspectives. They also tend to have fewer conflicts. Members of homogeneous groups, however, are at risk of fostering stereotyped perspectives because of the narrow experience base of the group. Additionally, when all group members' cognitive styles are similar, members may experience entrenchment where skills are finely honed in a single direction. This reduces the flexibility and adaptability of individuals to new environments.

Allison and Hayes (1998) go on to explain that members of heterogeneous groups tend to have more conflicts and turbulence. Communication among group members is more difficult and members may benefit from heightened awareness of communication challenges and strategies. However, the diversity of heterogeneous groups increases the groups' flexibility and adaptation because the presence of mixed styles increases the chances that one group member's cognitive style will match new task requirements. This match between a single individual and the new context facilitates an easier transition for the entire group. In the interest of student growth and development, heterogeneous groups are recommended.

The description above is echoed in this statement: "Compatibility, as identified by these scales, has been shown to be related to group cohesiveness (Yalom and Rand, 1966), reported hostility in groups (Smith and Haythorn, 1972), and group effectiveness (Reddy and Byrnes, 1972; Sapolsky, 1960; Schutz, 1955, 1958)" (as cited in Shaw & Webb, 1982, p. 556).

2.5 Personalities and Cognitive Styles

Personality and cognitive style have been identified as influential aspects of successful collaboration (Allison & Hayes, 1998; Armstrong, Cools, & Sadler-Smith, 2012; Cools, Armstrong, & Verbrigghe, 2014). The research on personalities suggests that personality can help explain

many phenomena like life satisfaction (Boyce, Wood, & Powdthavee, 2013) and academic effort and outcomes (Digman & Takemoto-Chock, 1981; Nofle & Robins, 2007). The most commonly agreed upon personality type taxonomy is the Big Five personality dimensions (John & Srivastava, 1999). The Big Five include five bipolar dimensions.

- *Extraversion*: talkative, assertive, energetic
- *Agreeableness*: good natured, cooperative, trustful
- *Conscientiousness*: orderly, responsible, dependable
- *Emotional Stability versus Neuroticism*: calm, not neurotic, not easily upset
- *Openness to new experiences*: curious, imaginative, excitable, unconventional (John & Srivastava, 1999, p. 6, 60)

Cognitive style is an aspect of one's personality (Streufert & Nogami, 1989). Cognitive style is an individual's consistent preference for particular information processing strategies. In other words, it is "a person's preferred way of gathering, processing, and evaluating information," which "influences how people scan their environment for information, how they organize and interpret this information, and how they integrate their interpretations into the mental model and subjective theories that guide their actions" (Allison & Hayes, 1998, p. 850).

Cognitive styles are the consistent processing behavior expressed in a variety of situations (Kogan, 1980; Messick, 1976; & Robertson, 1985). Context, however, can determine which preferred processing styles are used (Bruner, Goodknow, & Austin, 1960; Laurillard, 1979; & Streufert & Nogami, 1989). A less preferred or less automatic cognitive strategy may be used when circumstances limit the employment of preferred strategies (Hayes & Allinson, 1994; Messick, 1976). This temporary strategy is referred to as a coping behavior (Kirton, 1989).

Cognitive styles are not easily changed, however, it is suggested that people and groups learn about their cognitive style in order to more deliberately save and store important information at an individual and group level (Allison & Hayes, 1998).

When individual group members understand how they store and use information, they recognize and compensate for their processing shortcomings. For example, Scott and Bruce (1995) identified five decision making styles: rational, intuitive, dependent, avoidant, and spontaneous. Decision making styles are "reflective of individual cognitive styles" (Scott & Bruce, 1995, p. 829). Rational decision makers approach problems, whereas avoidant decision makers avoid problems. Without recognition of this tendency, group decision making would likely be dominated by the rational decision makers. Group cognizance of members' cognitive styles is likely to enhance group functioning by capitalizing on member strengths and compensating for individual differences. Important information is often filtered out because of an ignorance of one's cognitive style (Allison & Hayes, 1998). Individual members' recognition of their personal cognitive style may help bolster out their information processing skills by identifying underutilized processing strategies.

Witkin and colleagues (1977) note that having a stronger or weaker affinity for a particular cognitive style does not equate to being better or worse. Cognitive styles have differentiated values rather than directional value: the benefit of a particular cognitive style will depend on particular circumstances (Witkin et al., 1977).

Several cognitive style dimensions have been proposed (Hayes & Allinson, 1994). Those include analytical/non-analytical conceptualizing, impulsivity/reflectiveness, risk taking/cautious, etc. At least one dimension (i.e., verbalizer/visualizer) is reminiscent of

learning style. The differentiation between learning styles and cognitive styles is indistinct in some areas (Cools et al., 2014).

Cools and Van den Broeck (2007) attempted to compile and reconstitute the many classifications of cognitive styles into a single short measure specifically to reduce the complexity of cognitive styles for educators and practitioners. They developed a scale that included three styles:

- *Knowing*: “People with a knowing style look for facts and data. They want to know exactly the way things are and tend to retain many facts and details. They like complex problems if they can find a clear and rational solution.
- *Planning*: “People with a planning style are characterized by a need for structure. Planners like to organize and control and prefer a well-structured work environment. They attach importance to preparation and planning to reach their objectives.
- *Creating*: “People with a creating style tend to be creative and like experimentation. They see problems as opportunities and challenges, and they like uncertainty and freedom” (Cools & Van den Broeck, 2007, p. 363-364).

These scales were validated against some of the most common cognitive style classifications like the Myers Briggs Type Indicator (I. B. Myers, McCaulley, Quenk, & Hammer, 2003), the Kirton Adaptor-Inventor Inventory (Kirton, 2003), the Rational-Experiential Inventory (Edwards, Lanning, & Hooker, 2002), and the Single-Item Measure of Personality (Woods & Hampson, 2005).

Alfonseca, Carro, Martín, Ortigosa, and Paredes, (2006) classified learning styles as a subcategory of cognitive styles. Streufert and Nogami (1989) classified learning styles as a

personality trait. Learning styles have been defined as consistent responses to educational stimuli (Keefe, 1986). Keefe described some cognitive and affective dimensions as learning style behaviors.

A once popular theory of matching learner's learning style with the teacher's teaching style, called the meshing hypothesis, has recently been called into question (Pashler, McDaniel, Rohrer, & Bjork, 2009). In a review of the literature, Pashler and colleagues found little empirical evidence to support the practice of matching learning style to teaching style increased learning outcomes. Instead, they found that selecting an appropriate teaching style for the content had a greater impact on learning outcomes.

Cognitive styles are considered by some to be an important factor in group functioning (Allison & Hayes, 1998; Armstrong et al., 2012; Cools et al., 2014). Although publications in the field of cognitive styles are growing (Armstrong et al., 2012), the rate of publications is decreasing (Cools et al., 2014; Kozhevnikov, 2007). For more detailed information on cognitive styles including the classification of 22 dimensions of cognitive style, refer to the review by Hayes and Allinson (1994).

2.6 Summary Chapter 2

Collaborative learning is believed by many researchers to be an effective way to support learning, develop social presence, and enhance peer-support. Yet, many online students prefer to work individually believing collaboration to be complicated, difficult, and a waste of time. Scholars have identified many factors influencing the success of a collaborative experience. In particular, mutual respect, understanding, and trust is believed to be important as well as

diversity of group members, open and frequent communication, and members' recognizing that they each share a stake in the process and outcome of the collaborative experience.

Heterogeneous groups are preferred over homogeneous groups. Personality and cognitive style compatibility is not necessarily desirable. When less compatible members collaborate, they invest more in negotiation and persuasion.

CHAPTER 3

METHODOLOGY

This descriptive study involved an attempt to understand students' personalities and cognitive styles and compare that with students' perceptions of the collaborative experience. Particularly, whether there were associations between collaborative experiences and students' individual personality traits and cognitive styles.

3.1 Procedure

First, I executed a pilot study whereby online students ($n = 18$) from a large university in the United States completed a questionnaire measuring students' personality, cognitive style, and perceptions of the collaborative experience. The two goals of the pilot study were a) to ensure that the survey questions were clear and appropriate for a broad demographic of respondents, and b) to begin to examine the data and whether the data met the assumptions of the proposed data analysis techniques. Participants were asked about the clarity of the questions and were invited to provide feedback as appropriate. The responses were analyzed using quantitative methods including Cronbach's alpha, factor analysis, Spearman's rank order correlation, and linear regression. Next, the survey was distributed to the intended audience of community college students for the full scale data collection.

3.2 Research Design

Data was collected through a cross-sectional Internet survey (Fowler, 2009) using Qualtrics online survey software. A survey was the preferred way to collect data for several

reasons. Student qualities, such as personality and cognitive style, are commonly collected using surveys. Additionally, a short Internet survey could conveniently be taken by hundreds of students with little interference to their daily lives. An Internet survey was used rather than a mail or telephone survey because of the ease and affordability of distributing the survey and retrieving the responses. Evidence suggests that Internet surveys result in similar responses as paper surveys conducted face-to-face (Gosling, Vazire, Srivastava, & John, 2004). Respondents were offered a \$5.00 gift certificate for completing the survey.

3.3 Population

The population for this study consisted of community college students who were 18 years of age and older and who were currently taking or had previously taken online courses. Respondents came from three community colleges across the United States. I selected the three community colleges because I had acquaintances at each school. Students fitting the criteria of the population at each university were sent an email invitation to complete the optional study by their professors, or in one case, by faculty in the school's research office.

3.4 Instrumentation

The perceived quality of collaboration was measured by key indicators of successful collaborative groups (Mattessich & Monsey, 1992). These indicators are supported in current literature as well (Allison & Hayes, 1998; Moore & Kearsley, 2012; Roblyer & Wiencke, 2003). Based on a review of the literature, Mattessich and Monsey (1992) identified 19 key indicators of successful collaborative groups. Of those, four indicators were selected for this study based

on their relevance to collaborative learning and their prominence in the literature. Those four indicators are (a) “open and frequent communication,” (b) “mutual respect, understanding, and trust,” (c) “appropriate cross-section of members,” and (d) “members share a stake in both the process and the outcome” (Mattessich & Monsey, 1992, pp. 15–16). The following questions in the survey instrument measured the perceived quality of collaboration on a Likert scale:

- How often did you collaborate (work together) with your classmates on class-related activities throughout the course? (**frequency**)
- The members in my collaborative group(s) showed **mutual respect** for one another.
- The members of my collaborative group(s) came from a variety of **backgrounds** and/or had differing **perspectives**.
- Each group member had a **valued and important** role in the collaborative group(s).

The perceived outcomes of collaboration were measured by three questions aimed at collecting the perceived learning advances, benefit in terms of learners’ goals, and satisfaction.

- I **learned more** from participating in the collaborative group experience than I would have on my own.
- The collaborative experiences helped me **reach my goals** for the course.
- I **enjoyed** the collaborative group experience.

In addition to the collaborative experiences questions, the survey contained two instruments plus demographic questions (see Appendix A). The first instrument was the Cognitive Style Indicator (CoSI) (Cools & Van den Broeck, 2007). The reliability of the CoSI was compared with the reliability of existing cognitive style measures: the Kirton Adaptation-Innovation Inventory (KAI) and the Rational-Experiential Inventory (REI) (Cools & Van den

Broeck, 2007). When compared with the 32-item KAI, the Cronbach's coefficient was good ($\alpha = .85$) (DeVellis, 2012). Likewise, a comparison with the REI (40-item) revealed good reliability for the 20-item Rationality scale ($\alpha = .79$) and the 20-item Experientiality scale ($\alpha = .88$). The reliability of the CoSI as measured by the Cronbach's coefficient in 3 separate studies was good: alpha of .73, .79, and .76 for the 4-item Knowing scale, alpha of .81, .84, and .85 for the 7-item Planning scale, and alpha of .79, .82, and .78 for the 7-item Creating scale (Cools & Van den Broeck, 2007).

The second instrument is the Single Item Measure of Personality (SIMP) (Woods & Hampson, 2005). In a study of 791 participants, in which two forms of Goldberg's trait descriptive adjectives were used to examine the reliability of the instrument, the reliability was revealed to be acceptable ($\alpha = .87$ and $.83$) (Woods & Hampson, 2005). When compared with other personality tests, the reliability was good: analyzed with the Mini Markers test the alpha was $.80$; compared with the Big Five Inventory, the alpha was $.83$ (Woods & Hampson, 2005). The CoSI and SIMP instruments were selected for their good reliability as well as their brevity.

This survey was intended to measure perceptions of the quality of collaboration and perceptions of the outcomes of collaboration. In the remainder of this paper, these perceptions are simply referred to as the quality of collaboration and outcomes of collaboration.

3.5 Treatment of the Data

A total of 293 survey responses were collected. Of those, it was clear that some of the responses did not represent accurate data. Specifically, in some cases the survey was completed so quickly that respondents would not have had adequate time to read and

comprehend the questions. In other cases, respondents selected the same answer for most of the questions. In order to have a more accurate data set for the initial analysis, the fastest 23% of survey responses (those responding under 3 minutes and 35 seconds) were eliminated along with any response containing 11 repeated answers in a row.

These cut off points were based on natural breaks in the data. For example, there was a lag in the completion time between 2:35 minutes and 2:41 minutes. Regarding the repeated answers, it was decided that 11 repeated responses in a row would be sufficient because of the nature of the scales within the survey. Some scales included multiple items without reversals measuring a single phenomenon or trait. The scales ranged from 3 to 7 questions each. Thus, it would be reasonable for someone to repeat the answers to 7 questions in the same scale because each of the questions would be an attempt to measure the same thing. The data had a natural gap between 9-11 repeated answers. Special attention was paid to responses to the CoSI questions as these were more tedious than the others, meaning, these 18 questions were arranged in a single matrix and seemed particularly susceptible to repeated answers. Incomplete responses were also removed. In this manner, the data set was reduced to 157 responses. See Appendix B for more information about the data selection.

SPSS version F21 was used to analyze the data using various statistical techniques including Cronbach's alpha, factor analysis, Spearman's correlation, and linear regression. The research questions and rationale for the chosen data analysis techniques are outlined below.

RQ1: Is there an association between the perceived quality of collaboration and the perceived outcomes of collaboration?

This question was analyzed in two steps. The first step was to determine whether the Quality of Collaboration items and the Outcomes of Collaboration items could be treated as scales or whether each item should be correlated independently. Second, the Quality of Collaboration and the Outcomes of Collaboration scales were examined to identify any relationship between the two sets of questions.

A Cronbach's alpha calculation was conducted for the Quality of Collaboration items and then again for the Outcomes of Collaboration items to identify the degree of internal consistency among the two sets of questions. A Pearson's correlation and R^2 calculation also helped to identify items that did not fit well within each scale. A factor analysis was also calculated to find factor loadings within each scale. Next, a Spearman's rank-order correlation was chosen to measure any correlation between the Quality of Collaboration scale and the Outcomes of Collaboration scale. The Spearman's correlation is an appropriate method for measuring correlations among ordinal data.

RQ2: Is there an association between cognitive style and the perceived quality collaboration?

Analyzing this question involved a) determining the reliability of the CoSI, and b) measuring the relationship between the CoSI cognitive styles and the Quality of Collaboration scale. A Cronbach's alpha calculation was used to measure the reliability of the scale. A factor analysis described the underlying constructs of the scale. Pearson's correlation coefficient and R^2 were calculated for the individual items to help identify items that were not consistent with the scale.

The Spearman's correlation was chosen for measuring the association because of the ordinal nature of the data. One assumption of a Spearman's correlation is that the variables have a monotonic relationship. The monotonic relationship was visually inspected using bubble plots. Then, the Spearman's correlation was calculated to measure the association between the CoSI cognitive styles and the Quality of Collaboration scale.

RQ3: Is there an association between cognitive style and the perceived outcomes of collaboration?

The relationship between the two variables was examined visually with a bubble plot to determine the presence of a monotonic relationship. The association between the CoSI cognitive styles and the Outcomes of Collaboration was examined using a Spearman's correlation coefficient. The Spearman's correlation was appropriate because of the ordinal nature of the data.

RQ4: Is there an association between personality and the perceived quality of collaboration?

The correlation between the individual SIMP personality types and the Quality of Collaboration was measured by calculating the Spearman's correlation coefficient. This test was appropriate because of the ordinal nature of the data.

RQ5: Is there an association between personality and the perceived outcomes of collaboration?

The correlation between the individual SIMP personality types and the Outcomes of Collaboration was measured using a Spearman's correlation coefficient. Again, this test was appropriate because of the ordinal nature of the data.

RQ6: To what degree can cognitive style and personality together explain the perceptions of collaboration (i.e., the combined perceived outcomes and quality of collaboration)?

The data needed to address this problem is the CoSI cognitive style and the SIMP personality types as well as the scores of the Outcomes of Collaboration and the Quality of Collaboration scales. The cognitive style and personality were treated as the independent variables while the Outcomes and Quality of Collaboration were considered the dependent variables.

A linear regression analysis was conducted to examine the degree to which the Personal Characteristics (i.e., personality and cognitive style) can account for the Perceptions of Collaboration (i.e., combined Outcomes of Collaboration and Quality of Collaboration scales).

3.6 Summary of Chapter 3

A descriptive survey study was conducted to try to understand how different types of online community college students feel about their collaborative learning experiences. The personal characteristics of students were measured by CoSI cognitive styles and SIMP personality types. Collaborative experiences were measured by a series of questions targeted at identifying students' perceptions of the Quality of Collaboration and the Outcomes of Collaboration.

Reliability statistics were applied to measure the internal consistency of the Quality of Collaboration and Outcomes of Collaboration scales as well as the CoSI. Correlational statistics were calculated to measure the potential relationships between the personal characteristics and the Perceptions of Collaboration (i.e., combined Quality of Collaboration and Outcomes of Collaboration).

CHAPTER 4

FINDINGS AND ANALYSIS

4.1 Overview

This study examined how students' personalities and cognitive styles related to their perceptions about the quality and outcomes of collaborative online learning. The Single-Item Personality Measure (SIMP) was used to measure students' personalities (Woods & Hampson, 2005). Cognitive styles were measured by students' responses to the Cognitive Style Indicator (CoSI) (Cools & Van den Broeck, 2007). Correlational methods were applied to identify relationships between the personal characteristic variables (i.e., personality types from the SIMP and cognitive styles from the CoSI) and the collaborative experience variables (i.e., responses to the Quality of Collaboration items and the Outcomes of Collaboration items) (Cools & Van den Broeck, 2007; Woods & Hampson, 2005).

4.2 Pilot Study

For the pilot study, the survey instrument was distributed to online students at a large research university. The small sample population ($n = 18$) provided feedback regarding the clarity of the instrument items and to help the survey better fit a wider range of individual experiences. The data was examined using descriptive, reliability, and correlational statistics to confirm the appropriateness of these methods for the data. Once the results of the pilot study were examined, the full-scale study was initiated.

4.3 Descriptive Statistics

The final data set consisted of 157 responses from community college students. Some of the respondents ($n = 34$) did not collaborate in their coursework, so they were not able to respond to questions about the quality and outcomes of collaboration. The remaining respondents ($n = 123$) completed all the survey questions.

Nearly half of the respondents (45%) from this sample ($n = 157$) were between the ages of 18-24. Another 27% were between 25-34 years old. The remaining students (18%) were mostly between 35-44. Thus, three quarters (73%) of the respondents were under the age of 34.

The majority of students (70%) reported having a GPA between 3.0 and 4.0. One quarter (24%) of the students reported a GPA between 2.0 and 2.9. Only 3% of the students reported a GPA of 1.0-1.9. Some (3%) chose not to report their GPA.

Students were asked to identify a recent online course to consider while answering the questions. Just under half (40%) had already completed the course while just over half (59%) were currently taking the course. Referring to the online course the respondents had identified, the average course grade from the 81 respondents who had already completed the course was B+. The grades ranged from A to C with one person preferring not to answer.

Respondents varied in the number of online courses previously taken. The average student from this sample reported taking between 25-50% of their college courses online. Nearly one fifth of the students (20%) were taking about 100% of their courses online. Table 4.1 shows a summary of respondent demographics.

Table 4.1

Demographic of Participants (n = 157)

| Characteristic | <i>n</i> | % |
|-------------------------------|----------|----|
| Age | | |
| 18-24 | 71 | 45 |
| 25-34 | 43 | 27 |
| 35-44 | 28 | 18 |
| 45-54 | 11 | 7 |
| 55-64 | 2 | 1 |
| 65+ | 0 | 0 |
| Prefer not to answer | 2 | 1 |
| Gender | | |
| Male | 27 | 17 |
| Female | 128 | 82 |
| Prefer not to answer | 2 | 1 |
| Ethnicity | | |
| White | 82 | 52 |
| Black | 43 | 27 |
| Hispanic | 15 | 10 |
| Asian | 4 | 3 |
| Native American | 1 | 1 |
| Other | 8 | 5 |
| Prefer not to answer | 4 | 3 |
| GPA | | |
| 0.0-.09 | 0 | 0 |
| 1.0-1.9 | 4 | 3 |
| 2.0-2.9 | 38 | 24 |
| 3.0-4.0 | 110 | 70 |
| Prefer not to answer | 5 | 3 |
| Course completed | | |
| Yes | 63 | 40 |
| No | 2 | 1 |
| Currently taking | 92 | 59 |
| Course grade (<i>n</i> = 63) | | |
| A | 41 | 65 |
| B | 17 | 27 |
| C | 4 | 6 |
| D | 0 | 0 |

(table continues)

Table 4.1 (continued).

| | | |
|--|----|----|
| F | 0 | 0 |
| Prefer not to answer | 1 | 2 |
| Percent of courses online | | |
| 0% | 19 | 12 |
| 10% | 34 | 22 |
| 25% | 21 | 13 |
| 50% | 24 | 15 |
| 75% | 28 | 18 |
| 100% | 31 | 20 |
| Number of online courses prior to current semester | | |
| 0 | 29 | 19 |
| 1 | 11 | 7 |
| 2-3 | 40 | 26 |
| 4-5 | 27 | 17 |
| 5+ | 50 | 32 |

Note. Percentage totals may not total 100% for each characteristic because of rounding.

In response to the item “How often did you collaborate (work together) with your classmates on class-related activities throughout the course?”, the average student reported collaborating “sometimes” in their coursework (see Table 4.2). Responses to the Quality of Collaboration items and the Outcomes of Collaboration were moderately positive. Students tended to rate the collective Quality of Collaboration items higher than the collective Outcomes of Collaboration items (see Figure 4.1 and Figure 4.2). Thus, most respondents agreed that their collaborative groups were respectful, diverse, and that group members felt valued and important, yet many did not feel that they benefitted much from the collaborative experience. Some (19%) generally disagreed or strongly disagreed with the Outcomes of Collaboration questions suggesting that they believed that they would have benefitted more without collaboration.

Table 4.2

Frequency, Quality, and Outcomes of Collaboration

| | N | Minimum | Maximum | Mean | Std. Deviation |
|------------------------------|-----|---------|---------|------|----------------|
| Frequency of collaboration | 157 | 1 | 5 | 2.69 | 1.19 |
| Quality - Respect | 123 | 1 | 5 | 4.16 | 0.92 |
| Quality - Diversity | 123 | 1 | 5 | 4.17 | 0.91 |
| Quality - Valued Important | 123 | 1 | 5 | 3.93 | 1.01 |
| Outcome - Learned more | 123 | 1 | 5 | 3.42 | 1.11 |
| Outcome - Helped reach goals | 123 | 1 | 5 | 3.38 | 1.08 |
| Outcome - Enjoyed | 123 | 1 | 5 | 3.37 | 1.19 |

Note. For the Frequency of collaboration, 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always. For all other questions, 1 = Strongly Disagree, 2= Disagree, 3 = Neither Agree Nor Disagree, 4 = Agree 5 = Strongly Agree.

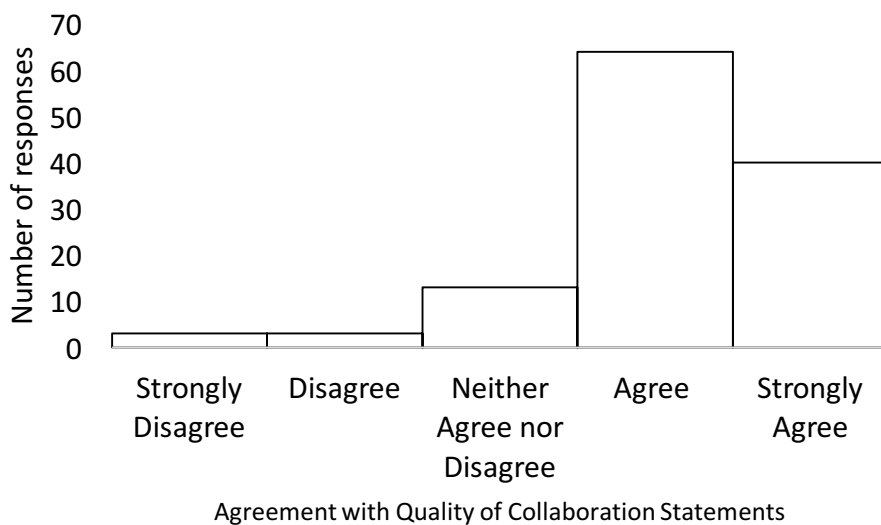


Figure 4.1. Cumulative responses to the series of questions rating the Quality of Collaboration.

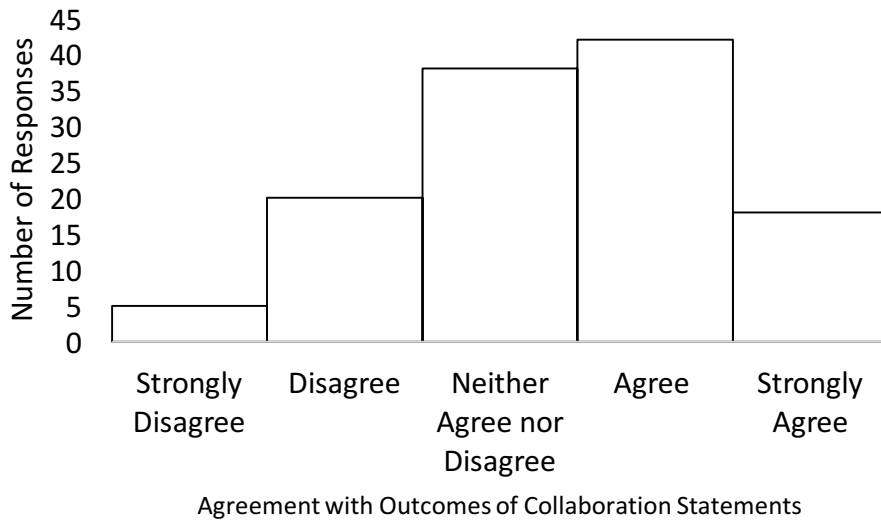


Figure 4.2. Cumulative responses to the series of questions rating the Outcomes of Collaboration.

Respondents who did not collaborate ($n = 34$) were asked whether they wished that they could have collaborated with classmates. The majority did not wish to collaborate (see Table 4.3).

Table 4.3

Wish to Collaborate

| Characteristic | <i>n</i> | % |
|---------------------|----------|-----|
| Wish to collaborate | | |
| No | 22 | 65% |
| Maybe | 6 | 18% |
| Yes | 6 | 18% |

Note. Only those who reported never collaborating in their online course were given the opportunity to respond to this question. Percentage totals do not total 100% because of rounding.

4.4 Personality and Cognitive Style Distribution

Participants from the study reported affiliation with a range of personalities and cognitive styles (see Table 4.4 and Table 4.5). There was no dominant type or style within the group (see Figure 4.3 to Figure 4.10).

Table 4.4

Distribution of Cognitive Styles Among Participants

| | Mean | SE of the Mean | SD | Min. | Max. |
|----------|------|----------------|-----|------|------|
| Knowing | 4.24 | .05 | .68 | 2 | 5 |
| Planning | 4.21 | .04 | .51 | 2 | 5 |
| Creating | 3.76 | .05 | .57 | 2 | 5 |

Note. n = 157

Table 4.5

Distribution of Personalities Among Participants

| | Mean | SE of the Mean | SD | Min. | Max. |
|---------------------|------|----------------|------|------|------|
| Extraversion | 5.42 | .22 | 2.78 | 1 | 10 |
| Agreeableness | 6.42 | .21 | 2.63 | 1 | 10 |
| Emotional Stability | 4.99 | .21 | 2.58 | 1 | 10 |
| Conscientiousness | 6.49 | .20 | 2.52 | 1 | 10 |
| Openness | 6.02 | .19 | 2.42 | 1 | 10 |

Note. n = 157

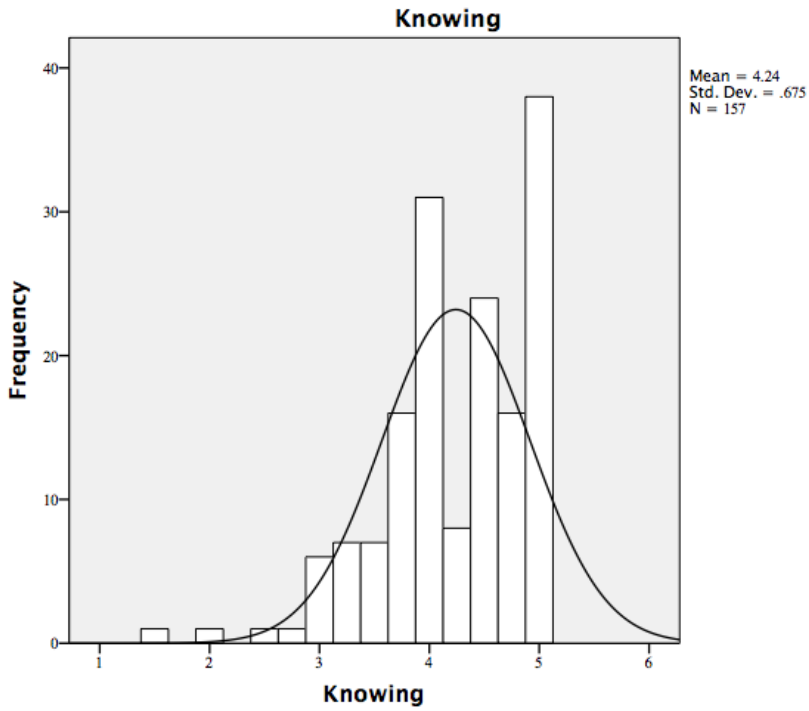


Figure 4.3. Distribution and frequencies of responses on the Knowing scale.

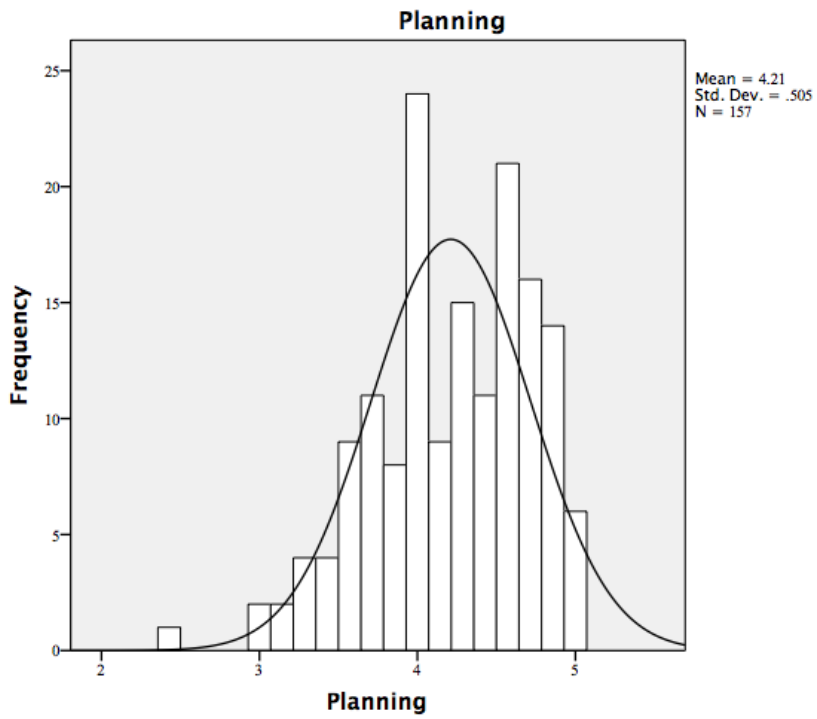


Figure 4.4. Distribution and frequencies of responses on the Planning scale.

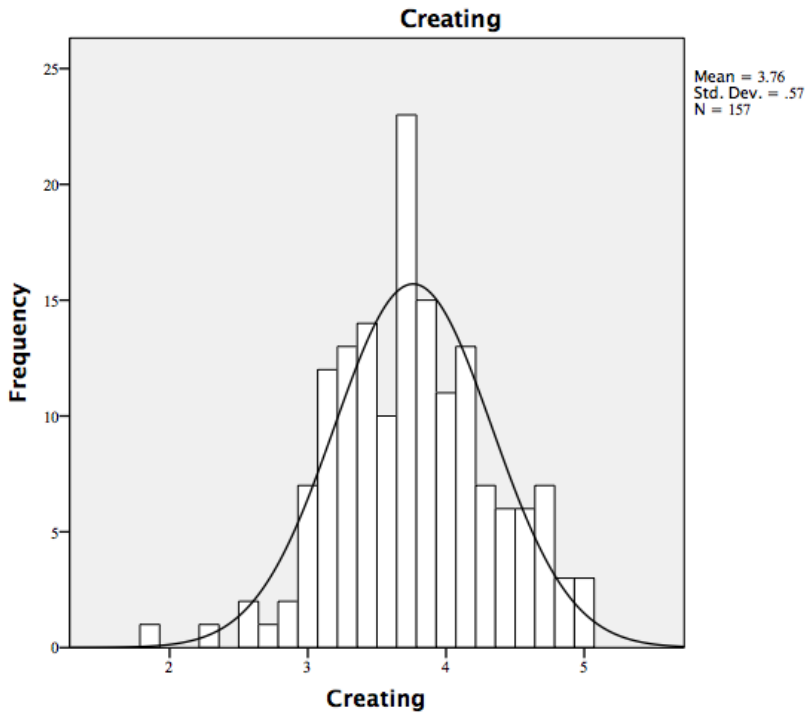


Figure 4.5. Distribution and frequencies of responses on the Creating scale.

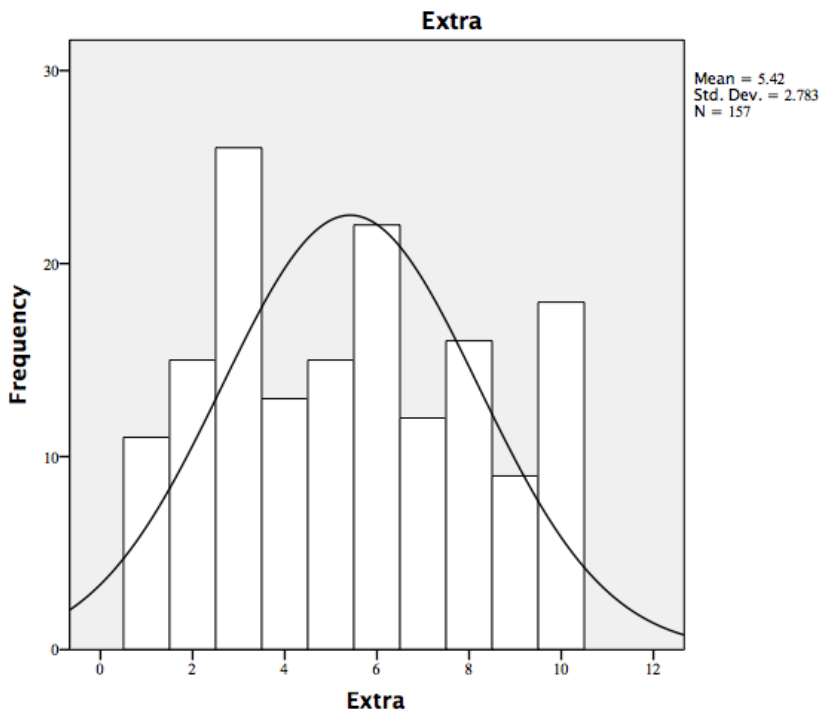


Figure 4.6. Distribution of responses on the Extraversion bi-polar item.

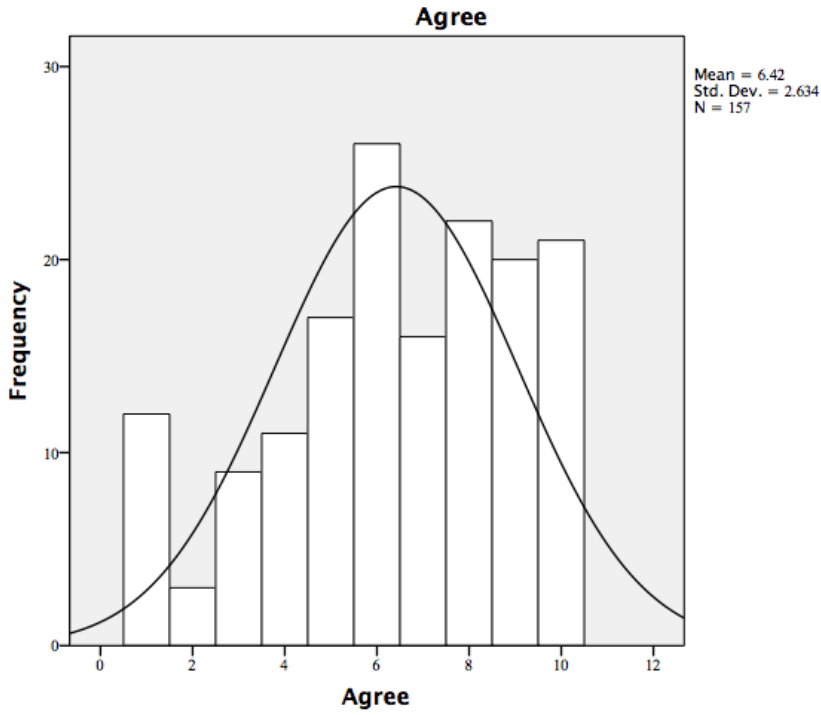


Figure 4.7. Distribution of responses on the Agreeableness bi-polar item.

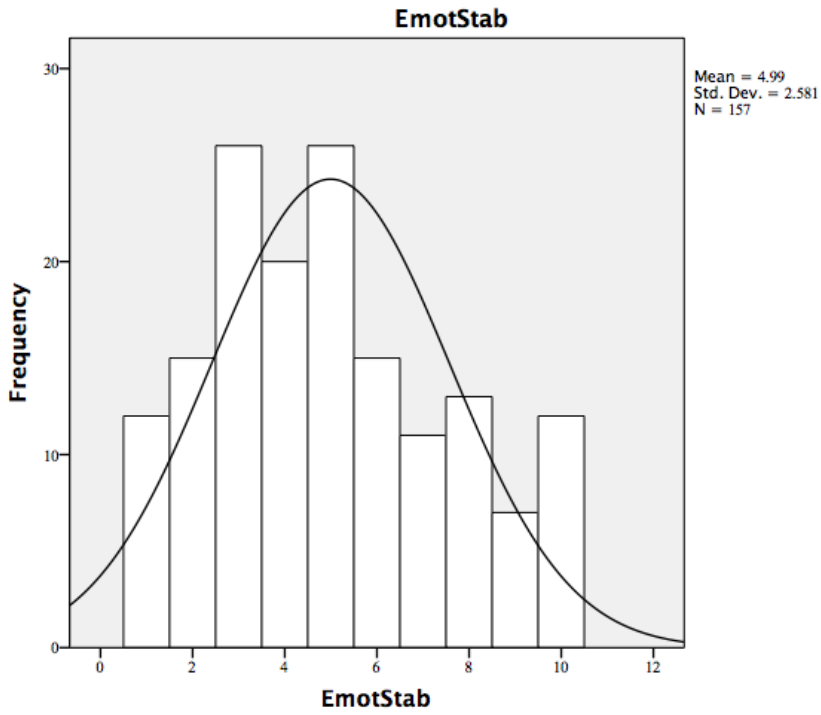


Figure 4.8. Distribution of responses on the Emotional Stability bi-polar item.

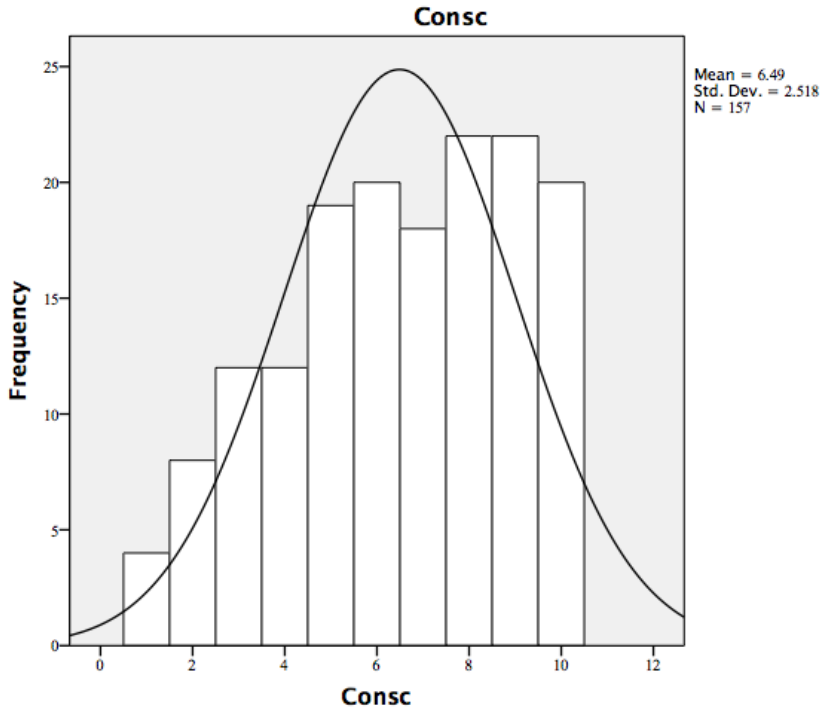


Figure 4.9. Distribution of responses on the Conscientiousness bi-polar item.

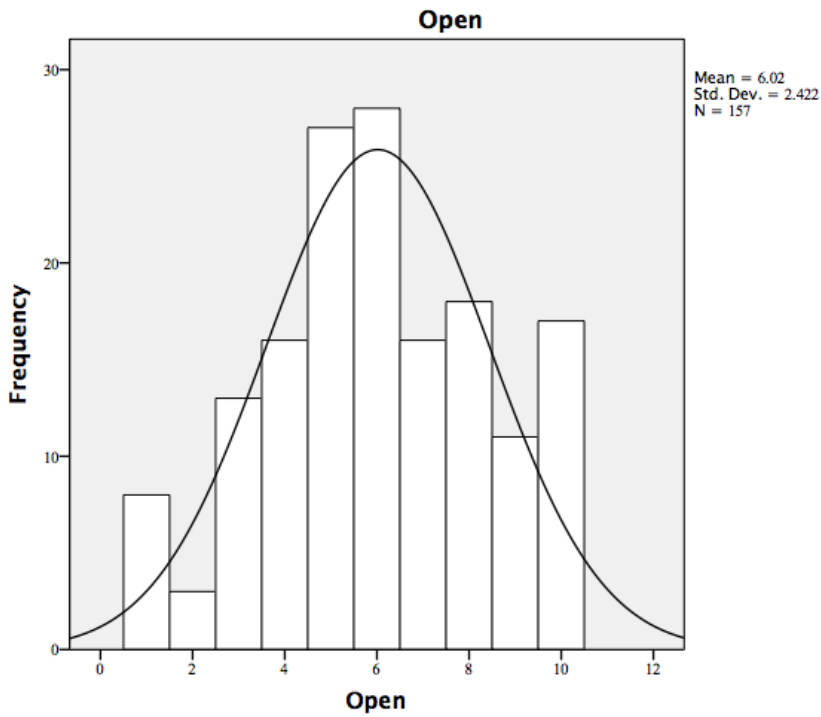


Figure 4.10. Distribution of responses on the Openness bi-polar item.

4.5 Reliability of Instrumentation

The various scales incorporated in the survey instrument were analyzed to test for internal consistency. Specifically, the items measuring the quality of collaboration and the items measuring outcomes of collaboration were examined to determine if they were related and reliable enough to be treated as two scales (i.e., the Quality of Collaboration scale and Outcomes of Collaboration scale respectively). The CoSI was also tested for reliability.

4.5.1 Quality of Collaboration

Four items were included in the survey instrument to measure the quality of collaboration. Those items were:

- How often did you collaborate (work together) with your classmates on class-related activities throughout the course? (**frequency**)
- The members in my collaborative group(s) showed **mutual respect** for one another.
- The members of my collaborative group(s) came from a **variety of backgrounds** and/or had differing **perspectives**.
- Each group member had a **valued and important** role in the collaborative group(s).

A Cronbach's Alpha was calculated to determine the internal consistency of these items ($n = 132$). The frequency item was less related to the scale than the other three items (see Table 4.6 and Table 4.7). When the frequency item was included in the reliability analysis, the Quality of Collaboration scale had an adequate level of internal consistency ($\alpha = .74$) (DeVellis, 2012;

Kline, 2005). When the frequency item was deleted, the Cronbach's Alpha reached a good level of reliability ($\alpha = .83$).

Table 4.6

Internal Consistency of Quality of Collaboration Items Including Frequency of Collaboration

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Pearson's <i>r</i> | R ² | Cronbach's α if Item Deleted |
|--------------------|----------------------------------|--------------------------------------|--------------------|----------------|---|
| Frequency | 12.27 | 6.05 | .23 | .06 | .83 |
| Respect | 11.26 | 4.28 | .72 | .61 | .57 |
| Diversity | 11.25 | 4.60 | .62 | .51 | .63 |
| Valued & important | 11.49 | 4.27 | .62 | .44 | .63 |

Note. Alpha = .74.

Table 4.7

Internal Consistency of Quality of Collaboration Items Excluding Frequency of Collaboration

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Pearson's <i>r</i> | R ² | Cronbach's α if Item Deleted |
|------------------|----------------------------------|--------------------------------------|--------------------|----------------|---|
| Respect | 8.11 | 2.82 | .78 | .61 | .69 |
| Diversity | 8.10 | 3.06 | .68 | .51 | .79 |
| Valued Important | 8.33 | 2.86 | .64 | .43 | .83 |

Note. Alpha = .83.

The Pearson’s correlation coefficient between frequency and the other items was particularly low ($r = .23$) (Laerd Statistics, 2015). This indicates that frequency did not belong on the same scale as the other items. Similarly, the R^2 value representing the variance shared between frequency and the other Quality of Collaboration items was low ($R^2 = .06$), providing additional evidence that this item did not fit in the Quality of Collaboration scale (Laerd Statistics, 2015).

A factor analysis revealed that all items loaded on a single construct. The frequency item had the lowest weight on a principal component extraction (see Table 4.8). Frequency was removed from the Quality of Collaboration for the remainder of the data analysis.

Table 4.8

Factor Loading of the Quality of Collaboration Scale

| | Component 1 |
|------------------|-------------|
| Frequency | .37 |
| Respect | .90 |
| Diversity | .84 |
| Valued Important | .83 |

Note. Extraction method: Principal Component.

4.5.2 Outcomes of Collaboration

The instrument included three items to measure the Outcomes of Collaboration. These items were:

- I **learned more** from participating in the collaborative group experience than I would have on my own.
- The collaborative experiences **helped me reach my goals** for the course.
- I **enjoyed** the collaborative group experience.

The internal consistency of these three items ($n = 123$) was good ($\alpha = .88$). Each of the three items was compatible with the Outcomes of Collaboration scale (see Table 4.9). A factor analysis revealed that all items loaded on a single construct (see Table 4.10).

Table 4.9

Internal Consistency of Outcomes of Collaboration Items

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Pearson's r | R^2 | Cronbach's α if Item Deleted |
|--------------------|----------------------------------|--------------------------------------|---------------|-------|---|
| Learned more | 6.76 | 4.61 | .72 | .52 | .88 |
| Helped reach goals | 6.80 | 4.44 | .80 | .66 | .81 |
| Enjoyed | 6.80 | 4.04 | .80 | .66 | .81 |

Note. Alpha = .88.

Table 4.10

Factor Loading of the Outcomes of Collaboration Scale

| | Component 1 |
|--------------------|-------------|
| Learned more | .87 |
| Helped reach goals | .92 |
| Enjoyed | .92 |

Note. Extraction method: Principal Component.

4.5.3 Perceptions of Collaboration

The reliability of the combined Quality and Outcomes of Collaboration scales was examined to determine if these combined items could be used to measure students' general perceptions of the collaborative learning experience ($n = 157$) (see Table 4.11).

Table 4.11

Internal Consistency of Combined Quality of Collaboration, Outcomes of Collaboration, and Frequency of Collaboration

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Pearson's <i>r</i> | R ² | Cronbach's α if Item Deleted |
|--------------------|----------------------------------|--------------------------------------|--------------------|----------------|---|
| Frequency | 22.45 | 24.48 | .32 | .12 | .88 |
| Respect | 21.44 | 21.49 | .68 | .64 | .84 |
| Diversity | 21.43 | 22.72 | .52 | .52 | .86 |
| Valued important | 21.67 | 20.45 | .73 | .57 | .83 |
| Learned more | 22.18 | 19.85 | .71 | .56 | .83 |
| Helped reach goals | 22.22 | 20.03 | .71 | .68 | .83 |
| Enjoyed | 22.23 | 18.67 | .78 | .70 | .82 |

Note. Alpha = .88.

There was a high level of internal consistency for these combined items ($\alpha = .88$) (DeVellis, 2012; Kline, 2005). When the frequency of collaboration was included, the internal consistency level was slightly lower, but still good ($\alpha = .86$). However, the Pearson's correlation coefficient was still rather low ($r = .32$). Likewise, the R² value was low (R² = .12). Therefore, frequency was deemed ill-fitted to measure the Quality of Collaboration scale as well as the combined Quality and Outcomes of Collaboration which is hereafter referred to as Perceptions of Collaboration. Frequency was left off the Perceptions of Collaboration scale.

A rotated component analysis revealed that the combined Quality of Collaboration and Outcomes of Collaboration items fell into their respective components (see Table 4.12).

Specifically, “learned more”, “helped reach goals”, and “enjoyed” fell within the first construct while “respect”, “diversity”, and “valued important” fell within the second construct. These outcomes demonstrated that these two distinct constructs do indeed exist within the Perceptions of Collaboration scale.

Table 4.12

Rotated Component Matrix of the Frequency, Outcomes, and Quality of Collaboration

| | Component 1 | Component 2 |
|--------------------|-------------|-------------|
| Frequency | .59 | -.03 |
| Respect | .25 | .87 |
| Diversity | .04 | .90 |
| Valued important | .49 | .69 |
| Learned more | .76 | .37 |
| Helped reach goals | .86 | .25 |
| Enjoyed | .77 | .44 |

Note. Extraction method: Principal Component. Rotation method: Varimax with Kaiser Normalization. Factor loadings in bold.

4.5.4 Cognitive Style Indicator

The entire 18-item Cognitive Style Indicator ($n = 157$) had an excellent level of internal consistency ($\alpha = .87$) (DeVellis, 2012; Kline, 2005). Looking at the separate constructs of the CoSI, the 4-item Knowing scale within the CoSI had a high level of internal consistency ($\alpha = .86$)

(DeVellis, 2012; Kline, 2005). Likewise, the 7-item Planning scale had high internal consistency ($\alpha = .81$) (DeVellis, 2012; Kline, 2005).

The 7-item Creating scale had adequate reliability ($\alpha = .76$) (DeVellis, 2012; Kline, 2005). The “avoid routine” item was the primary contribution to the low Cronbach’s Alpha value. With the “avoid routine” item deleted, the internal consistency increased substantially ($\alpha = .78$). Pearson’s correlation coefficient for the “avoid routine” item ($r = .31$) as well as the low R^2 value ($R^2 = .19$) suggested that, among the Creating items, the “avoid routine” item was the least well aligned to the scale (see Table 4.13). Due to the adequate Cronbach’s alpha values measuring the internal consistency of the scales along with previous reliability results on the scale (Cools & Van den Broeck, 2007), the “avoid routine” item was kept in the Creating scale in this study.

Table 4.13

Internal Consistency of the Creating Scale from the CoSI

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Pearson’s r | R^2 | Cronbach’s α if Item Deleted |
|----------------------|----------------------------------|--------------------------------------|---------------|-------|---|
| Innovative solutions | 22.29 | 12.64 | .48 | .41 | .74 |
| Creating solutions | 22.35 | 11.97 | .53 | .39 | .72 |
| Ongoing innovation | 22.39 | 11.82 | .56 | .42 | .72 |
| Variety | 22.29 | 12.72 | .42 | .23 | .75 |
| New ideas | 22.50 | 12.10 | .53 | .33 | .73 |
| Extend boundaries | 22.66 | 11.32 | .58 | .37 | .71 |
| Avoid routine | 23.50 | 12.50 | .31 | .19 | .78 |

Note. Alpha = .76.

4.6 Research Question 1

RQ1: Is there an association between the perceived quality of collaborative learning and the perceived outcomes of collaborative learning?

H_0 : There is no association between the perceived quality of collaborative learning and the perceived outcomes of collaborative learning.

H_A : There is an association between the perceived quality of collaborative learning and the perceived outcomes of collaborative learning.

A Spearman's rank-order correlation was conducted to assess the relationship between the Quality of Collaboration and the Outcomes of Collaboration. The assumptions of a Spearman's rank-order correlation require a monotonic relationship between the two variables. A monotonic relationship was found as determined by a visual inspection of a bubble plot (see Figure 4.11).

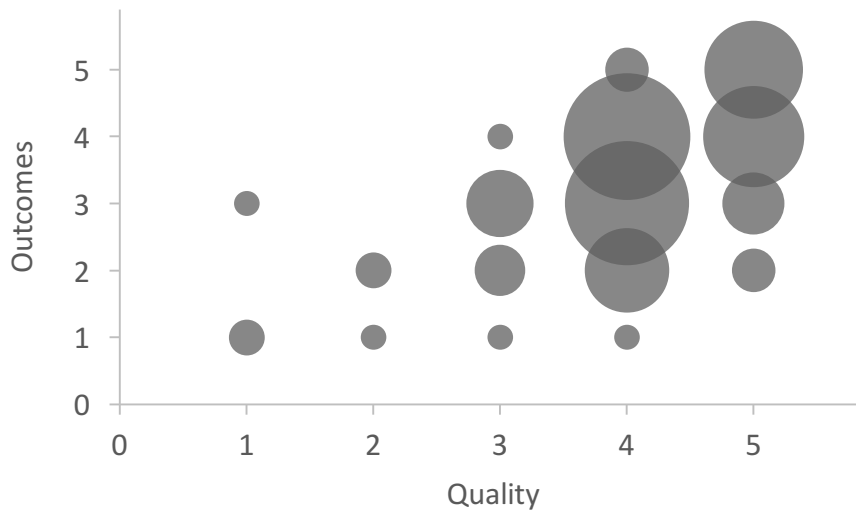


Figure 4.11. Monotonic relationship between Quality of Collaboration and Outcomes of Collaboration scales.

There is a significant positive correlation between the Quality of Collaboration and the Outcomes of Collaboration, $r_s(121) = .61$, 95% CI [.49, .71], $p < .001$. The null hypothesis was rejected and the alternative hypothesis accepted. The Spearman correlation is an estimate of the effect size (Field, 2013). In the proportion variance in the ranks that the two variables share $r_s = .61$ which is interpreted as a large effect size (Cohen, 1988). A large effect size like this explains 25% of the variance (Field, 2013). This means that students who believed the quality of the collaborative learning was high also tended to believe that the outcomes of collaborative learning were high.

4.7 Research Questions 2 & 3

RQ2: Is there an association between cognitive style and the perceived quality of collaboration?

RQ3: Is there an association between cognitive style and the perceived outcomes of collaboration?

4.7.1 Monotonic Relationships

Research Questions 2 and 3 were both examined using a Spearman's rank-order correlation calculation. This calculation is appropriate for ordinal data such as the data in this study which was derived from Likert scales (Laerd Statistics, 2015). Spearman's correlation assumes a monotonic relationship between variables, so the monotonic relationship was visually inspected for each of the paired variables from RQ2 and RQ3 (see Figure 4.12 to Figure 4.17).

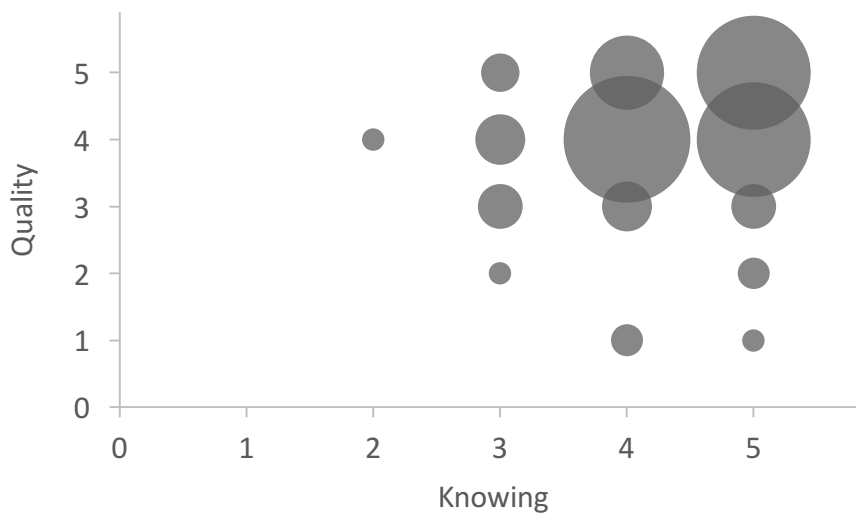


Figure 4.12. Monotonic relationship between the Knowing cognitive style scale and the Quality of Collaboration scale.

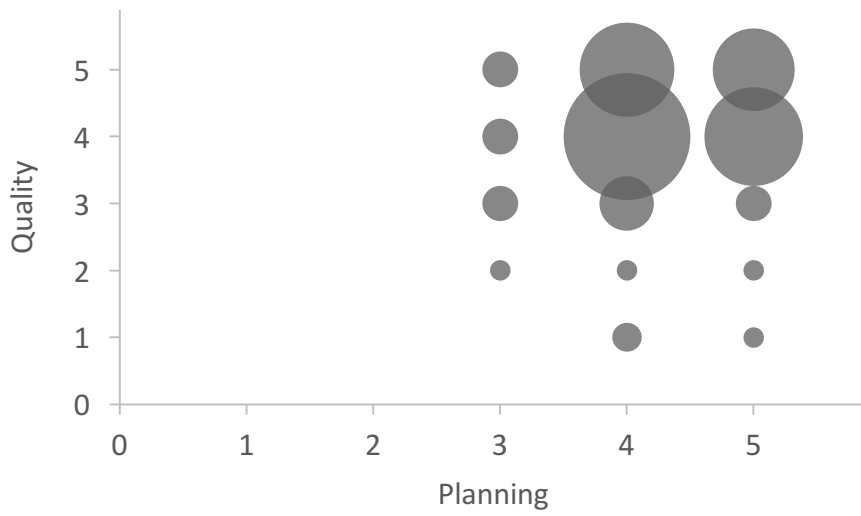


Figure 4.13. Monotonic relationship between the Planning cognitive style scale and the Quality of Collaboration scale.

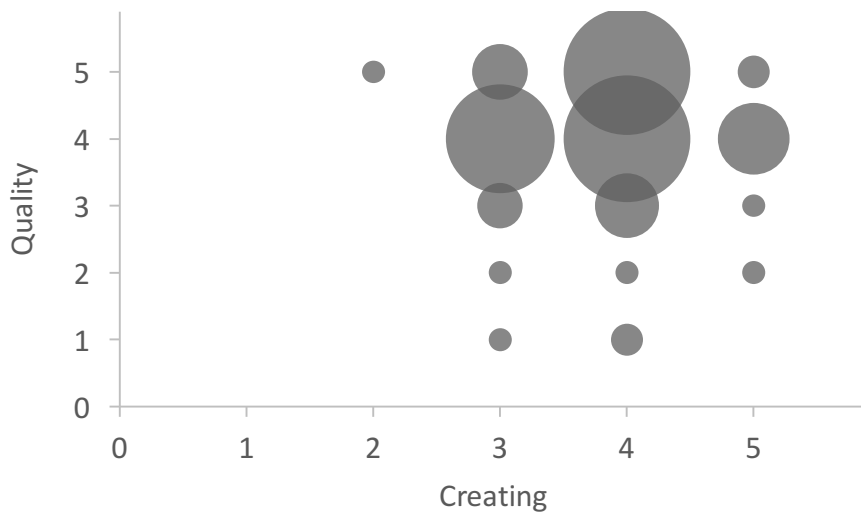


Figure 4.14. Monotonic relationship between the Creating cognitive style scale and the Quality of Collaboration scale.

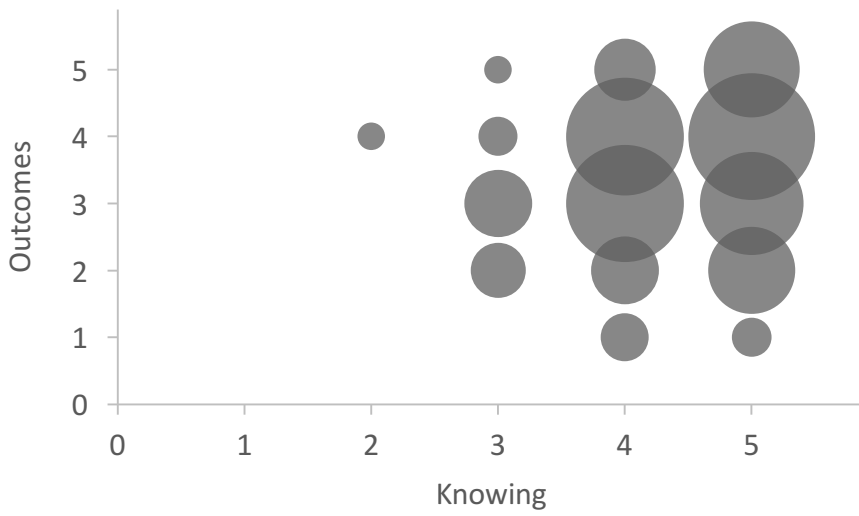


Figure 4.15. Monotonic relationship between the Knowing cognitive style scale and the Outcomes of Collaboration scale.

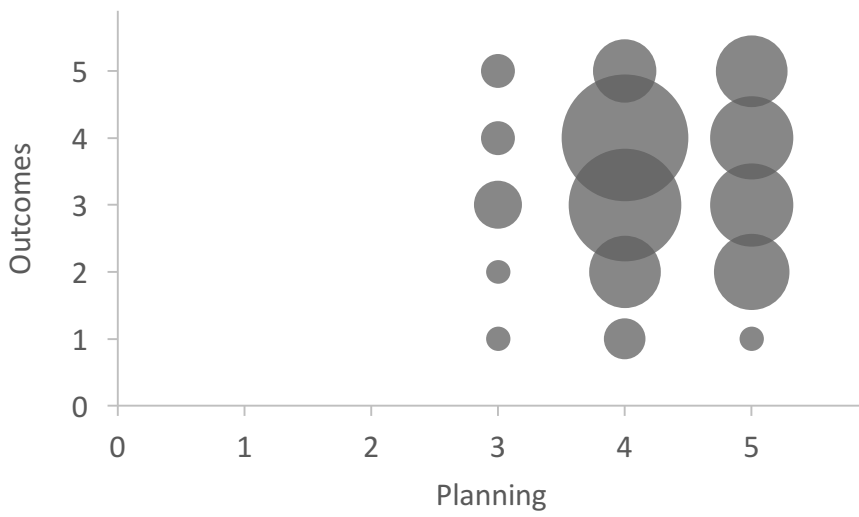


Figure 4.16. Monotonic relationship between the Planning cognitive style scale and the Outcomes of Collaboration scale.

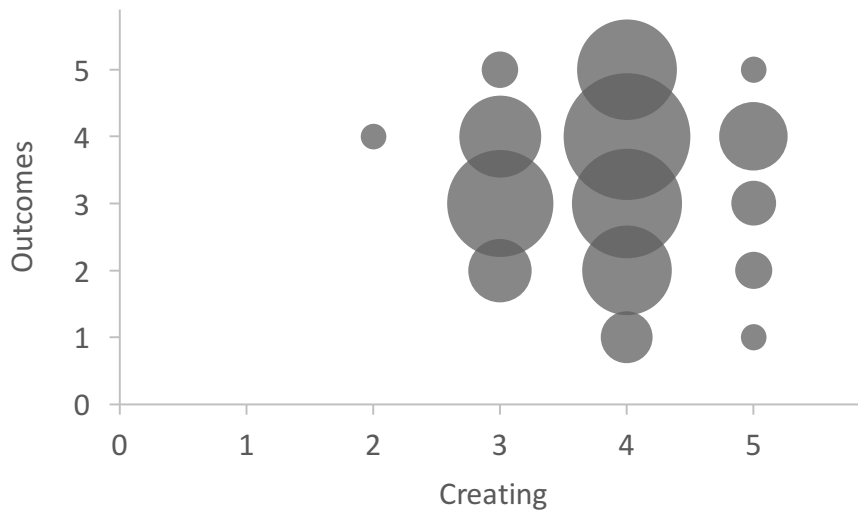


Figure 4.17. Monotonic relationship between the Creating cognitive style scale and the Outcomes of Collaboration scale.

4.7.2 Spearman's Correlations

RQ2: Is there an association between cognitive style and the perceived quality of collaboration?

H_0 : For online community college students, there is no association between students' cognitive styles and student's perceptions of the quality of collaboration.

H_A : For online community college students, there is an association between students' cognitive styles and student's perceptions of the quality of collaboration.

The Spearman's correlation failed to reveal any significant correlations between the Quality of Collaboration and the cognitive styles (see Table 4.14). However, there was a non-significant trend that those with a high Knowing style tended to rate the Quality of

Collaboration high ($r_s(121) = .15, p = .10$). This correlation was interpreted as having a small effect size (Cohen, 1988).

Table 4.14

Correlations (r_s) Between Perceived Frequency, Quality, and Outcomes of Collaborative Learning and Cognitive Styles

| Measure | 1 | 2 | 3 | 4 | 5 | 6 | <i>M</i> | <i>SD</i> | <i>n</i> |
|--------------|-------|-------|-----|-------|-------|---|----------|-----------|----------|
| 1. Frequency | — | | | | | | 2.69 | 1.19 | 157 |
| 2. Quality | .28** | — | | | | | 4.09 | .82 | 123 |
| 3. Outcomes | .37** | .61** | — | | | | 3.39 | 1.01 | 123 |
| 4. Knowing | -.01 | .15 | .08 | — | | | 4.24 | .68 | 157 |
| 5. Planning | -.02 | .10 | .04 | .66** | — | | 4.21 | .51 | 157 |
| 6. Creating | .11 | .11 | .13 | .49** | .30** | — | 3.76 | .57 | 157 |

Note. Measures 4, 5, and 6 are each cognitive styles measured by the CoSI.

* $p < 0.05$. ** $p < 0.01$.

Due to the lack of statistically significant correlations between the cognitive styles and the quality of collaboration, the null hypothesis was not rejected.

RQ3: Is there an association between cognitive style and the perceived outcomes of collaboration?

H_0 : For online community college students, there is no association between students' cognitive styles and students' perceptions of the outcomes of collaboration.

H_A: For online community college students, there is an association between students' cognitive styles and students' perceptions of the outcomes of collaboration.

None of the cognitive styles were significantly associated with the Outcomes of Collaboration, meaning, that students with certain styles did not perceive greater learning outcomes from collaborative learning than others (see Table 4.14). Although not significant, the Creating style was slightly positively correlated the Outcomes of Collaboration ($r_s(121) = .13, p = .15$) with a small effect size (Cohen, 1988).

For RQ3, there was not sufficient evidence to reject the null hypothesis: there were no significant correlations between the Outcomes of Collaboration and students' individual cognitive styles.

4.8 Research Questions 4 & 5

RQ4: Is there an association between personality and the perceived quality of collaboration?

RQ5: Is there an association between personality and the perceived outcomes of collaboration?

4.8.1 Monotonic Relationships

The relationships between the variables for RQ4 and RQ5 were reviewed. Monotonic relationships were identified based on visual inspection (see Figure 4.18 to Figure 4.27).

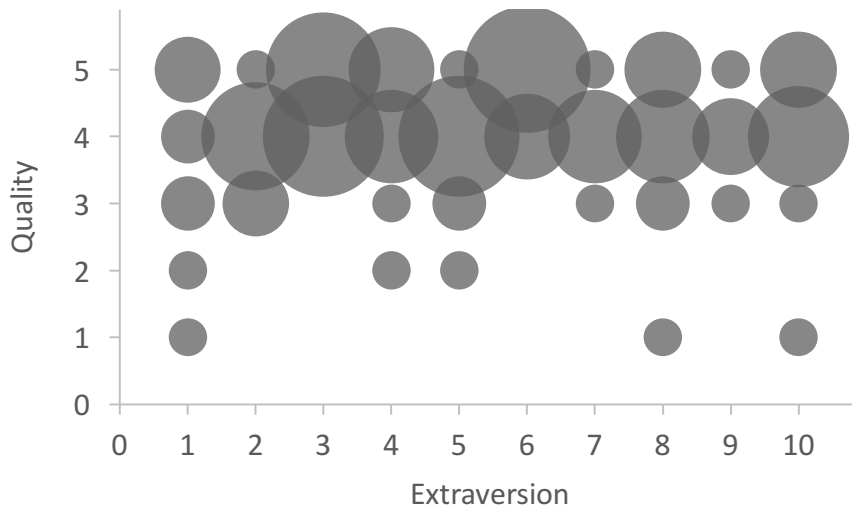


Figure 4.18. Monotonic relationship between the Extraversion personality style and the Quality of Collaboration scale.

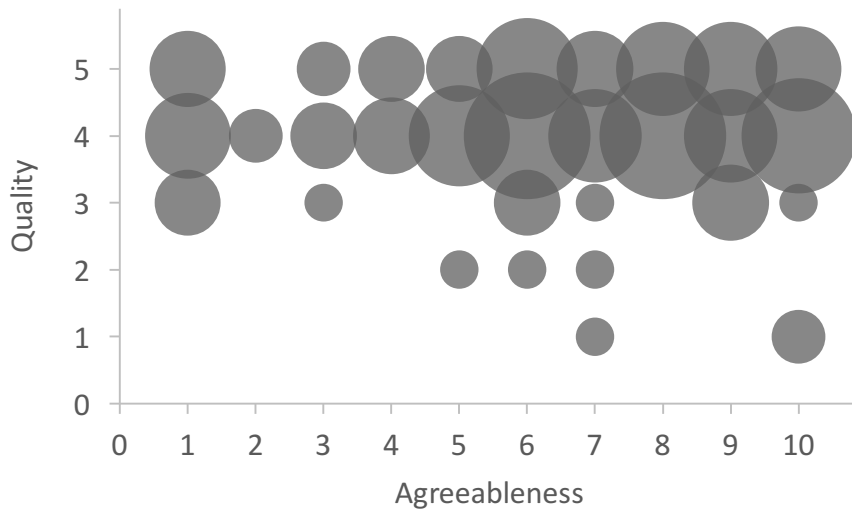


Figure 4.19. Monotonic relationship between the Agreeableness personality style and the Quality of Collaboration scale.

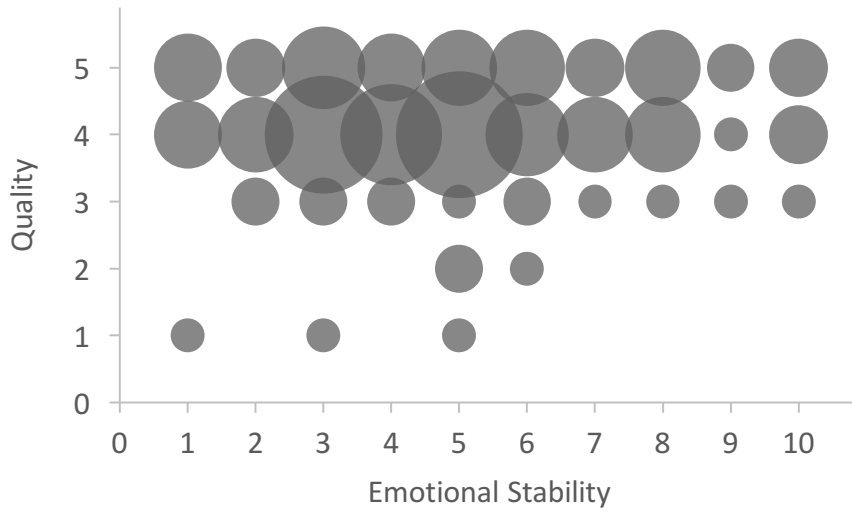


Figure 4.20. Monotonic relationship between the Emotional Stability personality style and the Quality of Collaboration scale.

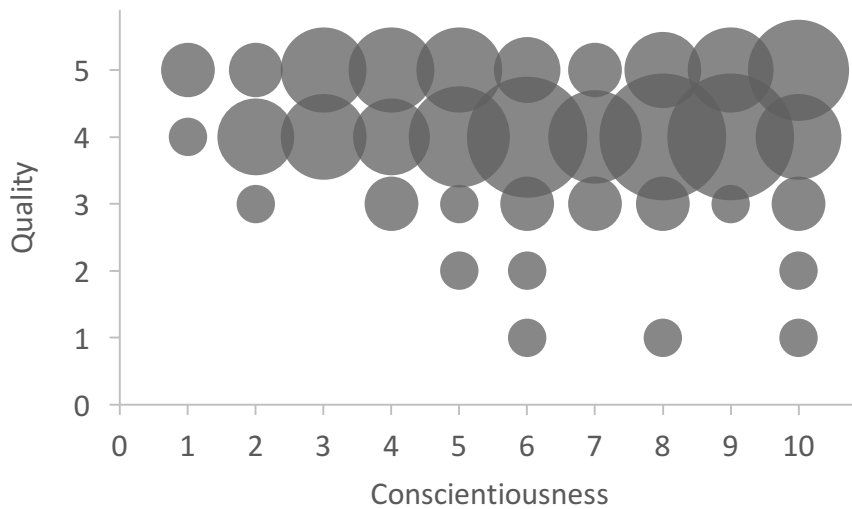


Figure 4.21. Monotonic relationship between the Conscientiousness personality style and the Quality of Collaboration scale.

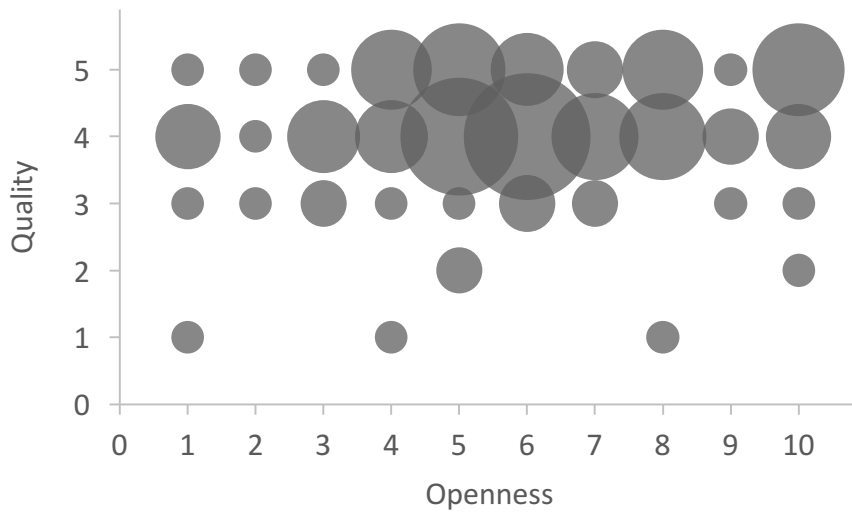


Figure 4.22. Monotonic relationship between the Openness personality style and the Quality of Collaboration scale.

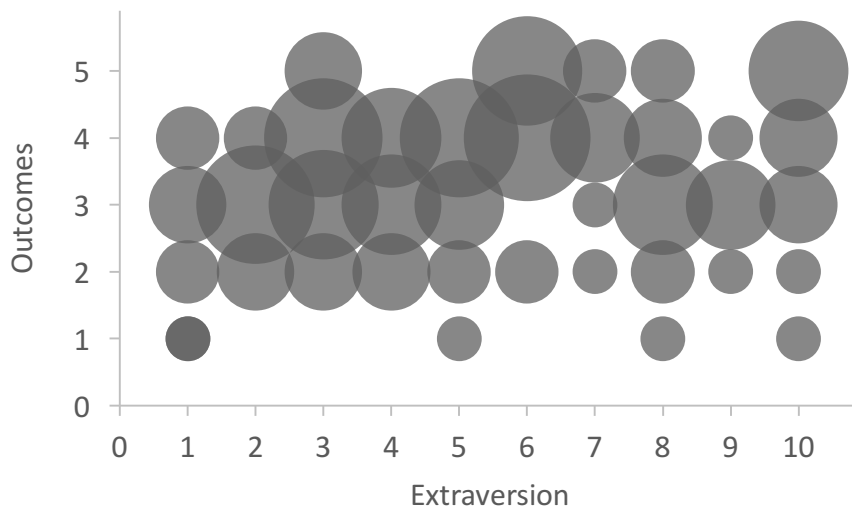


Figure 4.23. Monotonic relationship between the Extraversion personality style and the Outcomes of Collaboration scale.

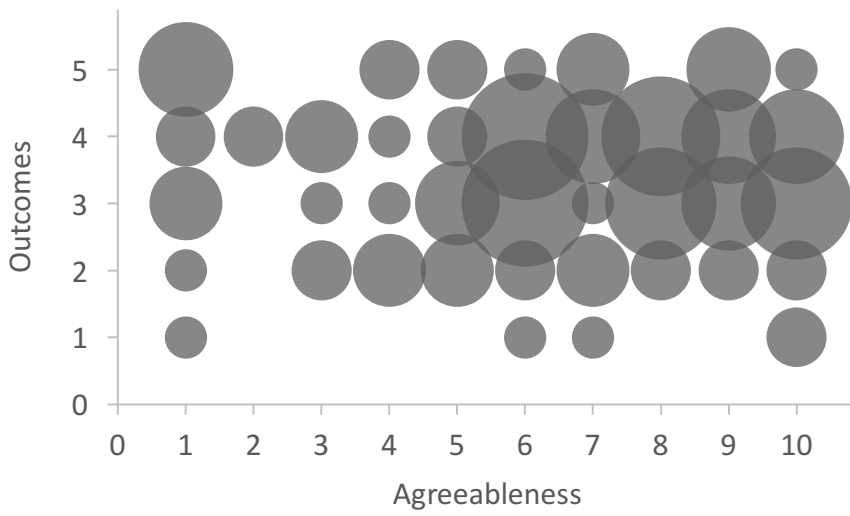


Figure 4.24. Monotonic relationship between the Agreeableness personality style and the Outcomes of Collaboration scale.



Figure 4.25. Monotonic relationship between the Emotional Stability personality style and the Outcomes of Collaboration scale.

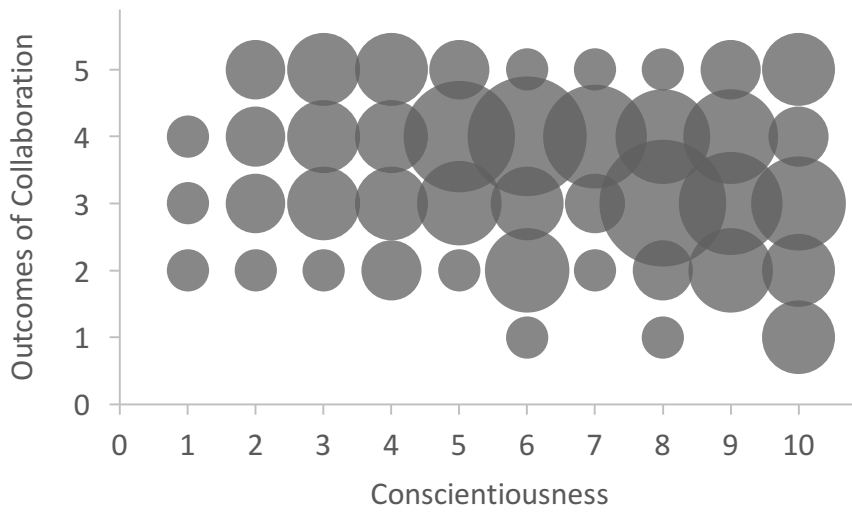


Figure 4.26. Monotonic relationship between the Conscientiousness personality style and the Outcomes of Collaboration scale.

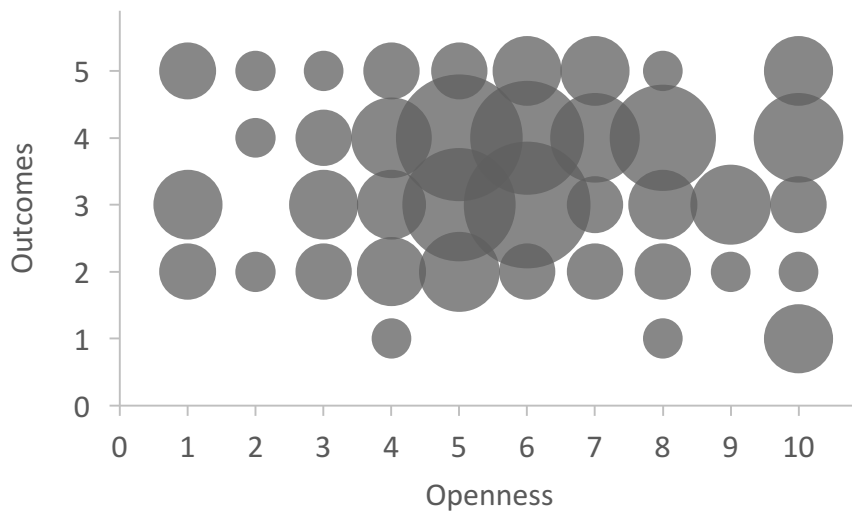


Figure 4.27. Monotonic relationship between the Openness personality style and the Outcomes of Collaboration scale.

4.8.2 Spearman's Correlation

RQ 4: Is there an association between personality and the perceived quality of collaboration?

H_0 : For online community college students, there is no association between students' personality type and students' perceptions of the quality of collaboration.

H_A : For online community college students, there is an association between students' personality type and students' perceptions of the quality of collaboration.

There were no statistically significant associations between the personalities and the Quality of Collaboration (see Table 4.15). However, Conscientiousness is slightly negatively correlated with Quality of Collaboration, $r_s(121) = -.15, p = .09$. The effect size was interpreted as small (Cohen, 1988). This means that those who were more open tended to rate the quality of the collaborative experiences slightly higher than others. The Openness personality type was also non-significantly positively associated with the Quality of Collaboration ($r_s = .13, p = .16$). Due to the lack of significant correlations, there was not sufficient evidence to reject the null hypothesis.

Table 4.15

Correlations (r_s) Between Perceived Frequency, Quality, and Outcomes of Collaborative and Personalities

| Measure | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <i>M</i> | <i>SD</i> | <i>n</i> |
|------------------------|-------|-------|------|------|------|-------|------|---|----------|-----------|----------|
| 1. Frequency | — | | | | | | | | 2.69 | 1.19 | 157 |
| 2. Quality | .28** | — | | | | | | | 4.09 | .82 | 123 |
| 3. Outcomes | .37** | .61** | — | | | | | | 3.39 | 1.01 | 123 |
| 4. Extraversion | -.02 | .09 | .22* | — | | | | | 5.43 | 2.78 | 157 |
| 5. Agreeableness | .02 | -.03 | -.06 | .00 | — | | | | 6.42 | 2.63 | 157 |
| 6. Emotional Stability | -.01 | .04 | -.06 | -.12 | .15 | — | | | 4.99 | 2.58 | 157 |
| 7. Conscientiousness | -.07 | -.15 | -.18 | .08 | .16 | .04 | — | | 6.49 | 2.52 | 157 |
| 8. Openness | -.06 | .13 | .05 | -.11 | .20* | .27** | -.02 | — | 6.02 | 2.42 | 157 |

Note. Measures 4, 5, 6, 7, and 8 are each personality types measured by the SIMP.

* $p < 0.05$. ** $p < 0.01$.

RQ5: Is there an association between personality and the perceived outcomes of collaboration?

H_0 RQ5: For online community college students, there is no association between students' personality type and students' perceptions of the outcomes of collaboration.

H_A RQ5: For online community college students, there is an association between students' personality type and students' perceptions of the outcomes of collaboration.

There was a statistically significant association between one of the personality types and the Outcomes of Collaboration (see Table 4.15). Students who scored higher on the

extraversion scale tended to rate the Outcomes of Collaboration higher than other students, $r_s(121) = .22$, 95% CI [.04, .43], $p = .01$. The effect size had a medium magnitude (Cohen, 1988).

Additionally, the Conscientiousness personality type had a negative correlation with the Outcomes of Collaboration, $r_s(121) = -.18$, $p = .05$. This significance level is nearly less than .05, so this correlation is considered of practical significance. The effect size was considered small (Cohen, 1988) where the effect accounted for approximately 9% of the variance (Field, 2013). This means that extraverted students tended to perceive slightly better outcomes from collaborative learning than non-extraverted students. Conversely, conscientious students perceived the outcomes of collaborative learning as slightly lower than other students.

Since significant correlations were found, the null hypothesis was rejected and the alternative hypothesis was accepted.

4.9 Research Question 6

RQ6: To what degree can cognitive style and personality together explain the perceptions of collaboration (i.e., the combined perceived outcomes and quality of collaboration)?

H₀ RQ6: Community college students' personalities and cognitive styles cannot be used together to explain the perceptions of collaboration (i.e., the combined perceived outcomes and quality of collaboration).

H_A RQ6: Community college students' personalities and cognitive styles can be used together to explain the perceptions of collaboration (i.e., the combined perceived outcomes and quality of collaboration).

4.9.1 Linear Regression

A linear regression analysis was conducted to determine if there was a significant linear relationship between the combined Quality and Outcomes of Collaboration (i.e., Perceptions of Collaboration) and the personal characteristics (i.e., personality types and cognitive styles) (see Table 4.16).

Table 4.16

Regression Analysis Summary for Personal Characteristics Predicting the Combined Quality and Outcomes of Collaboration

| Variable | <i>B</i> | <i>SE B</i> | β | <i>t</i> | <i>p</i> |
|---------------------|----------|-------------|---------|----------|----------|
| Knowing | .21 | 0.15 | .16 | 1.34 | .18 |
| Planning | .02 | 0.20 | .01 | 0.10 | .92 |
| Creating | .00 | 0.15 | .00 | 0.02 | .99 |
| Extraversion | .06 | 0.03 | .21 | 2.23 | .03 |
| Agreeableness | -.01 | 0.03 | -.05 | -0.48 | .64 |
| Emotional Stability | .00 | 0.03 | .00 | -0.02 | .99 |
| Conscientiousness | -.07 | 0.03 | -.22 | -2.41 | .02 |
| Openness | .03 | 0.03 | .09 | 0.92 | .36 |

Note. $R^2 = .108$ ($N = 123$). ANOVA Regression significance $p = .101$

The results of the linear regression analysis indicated that 11% of the variance in Quality of Collaboration could be predicted by the personality characteristics with an adjusted $R^2 = .037$. This R^2 value represents a medium effect size. While there were no significant predictors of the

Quality of Collaboration, Extraversion and Conscientiousness were independently significant predictors of the combined Quality and Outcomes of Collaboration ($p = .03, .02$, respectively).

4.10 Summary of Chapter 4

There was a significant positive correlation between the Quality of Collaboration and Outcomes of Collaboration ($r_s = .61, p < .001$). This was the strongest correlation in the study. Additionally, there were two significant associations found between the Outcomes of Collaboration and the personalities (SIMP). These associations and other associations with possible practical significance are summarized in Table 4.17. The relative directions of these associations are depicted in Figure 4.28 to Figure 4.31. Based on the findings of this study, the following two null hypotheses were rejected (see Table 4.18):

- H_0 RQ1: There is no association between the perceived quality of collaborative learning and the perceived outcomes of collaborative learning.
- H_0 RQ5: For online community college students, there is no association between students' personality type and students' perceptions of the outcomes of collaboration.

Table 4.17

Associations Between Quality and Outcomes of Collaboration and Characteristics (n = 123)

| | Quality of Collaboration | Outcomes of Collaboration |
|----------------------------|--------------------------|---------------------------|
| Knowing style (CoSI) | + | |
| Planning style (CoSI) | | |
| Creating style (CoSI) | | + |
| Extraversion (SIMP) | | + * |
| Agreeableness (SIMP) | | |
| Emotional Stability (SIMP) | | |
| Conscientiousness (SIMP) | - | - * |
| Openness (SIMP) | + | |

Note. "+" = positive correlation, "-" = negative correlation. * = $p \leq .05$.

Table 4.18

Research Questions and Rejection of Null Hypotheses

| Research Question | H ₀ Not rejected | H ₀ Rejected |
|---|-----------------------------------|----------------------------|
| 1: Is there an association between the perceived quality of collaborative learning and the perceived outcomes of collaborative learning? | | X |
| 2: Is there an association between cognitive style and the perceived quality of collaboration | X | |
| 3: Is there an association between cognitive style and the perceived outcomes of collaboration? | X | |
| 4: Is there an association between personality and the perceived quality of collaboration? | X | |
| 5: Is there an association between personality and the perceived outcomes of collaboration? | | X |
| 6: To what degree can cognitive style and personality together explain the Perceptions of Collaboration (i.e., the combined perceived outcomes and quality of collaboration)? | X | |

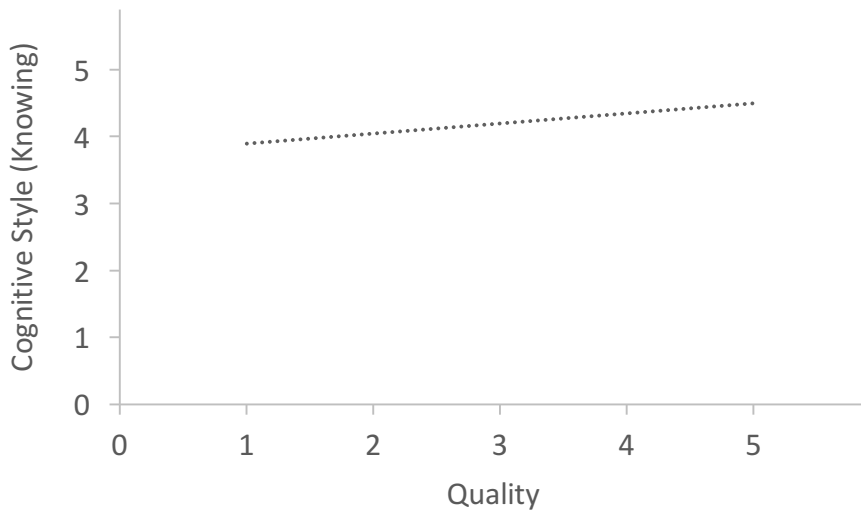


Figure 4.28. Associations between Knowing style (CoSI) (Cools & Van den Broeck, 2007) and the Quality of Collaboration.

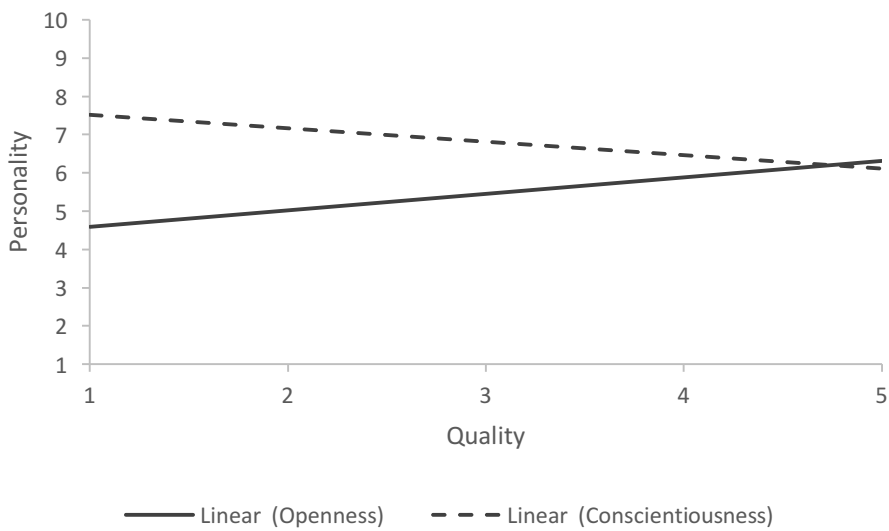


Figure 4.29. Associations between the Openness and Conscientiousness personality types (SIMP) (Woods & Hampson, 2005) and the Quality of Collaboration.

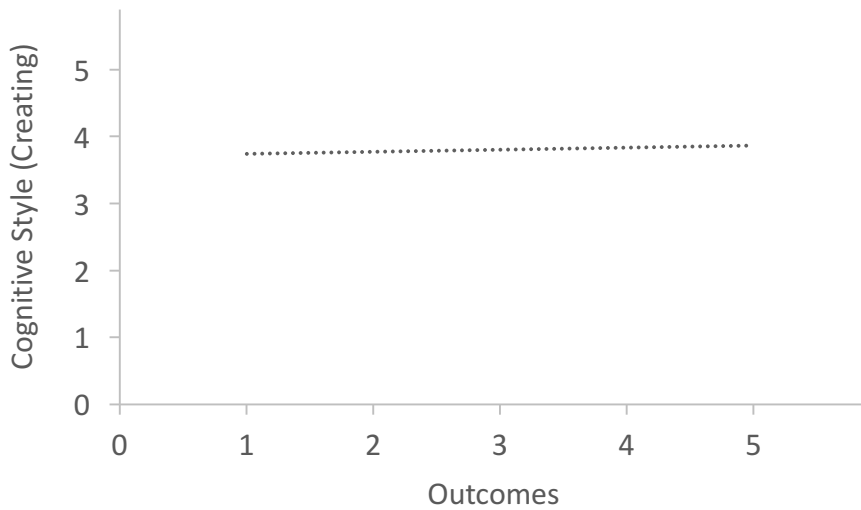


Figure 4.30. Associations between the Creating cognitive styles (CoSI) (Cools & Van den Broeck, 2007) and the Outcomes of Collaboration.

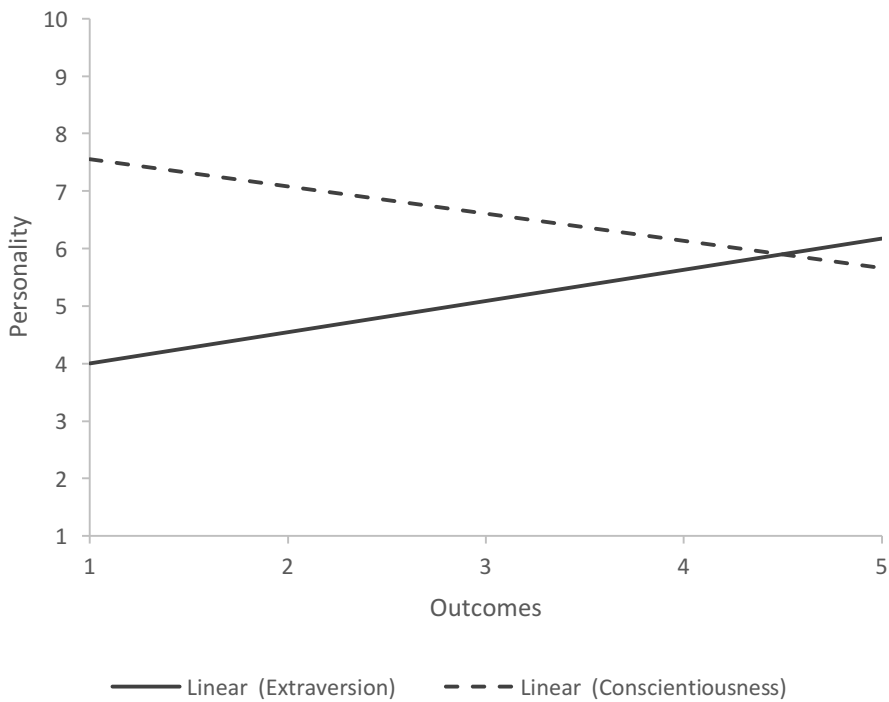


Figure 4.31. Associations between the Extraversion and Conscientiousness personality types (SIMP) (Woods & Hampson, 2005) and the Outcomes of Collaboration.

Although not statistically significant, the linear regression analysis suggested that Perceptions of Collaboration, as measured by the Outcomes of Collaboration and the Quality of Collaboration, could be partially explained by the personal characteristics with a medium effect size. Personal characteristics could predict 11% of the variation in Perceptions of Collaboration ($p = .10$).

CHAPTER 5

CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

It is generally believed that collaborative learning is beneficial, but the current literature does not paint a complete picture to account for the lack of enthusiasm for collaborative learning among online learners. Different personalities were found to be associated with academic achievement (Beaujean et al., 2011; Rimfeld, Kovas, Dale, & Plomin, 2016). The findings of this study add to that picture by contributing evidence that students with different personalities have different perceptions about the outcomes of collaborative learning in an online classroom.

These findings are important for two reasons. First, they may be of use to course designers who are determining the extent of collaboration to include in their online courses and whether such collaboration is mandatory or optional. Second, these findings may be interesting to educators in helping students to cultivate personality traits that can help them succeed in their online education. Such personality changes can and do occur and were found to correlate with life satisfaction (Boyce et al., 2013). Although beyond the scope of this study, it seems plausible that changes in personalities could potentially predict online students' academic success.

Two main significant findings were uncovered in this investigation. Two personality styles were significantly associated with the Outcomes of Collaboration. Extraversion was positively associated with the Outcomes of Collaboration ($p < .05$) while Conscientiousness was negatively associated ($p = .05$). There were no statistically significant association between the Quality of Collaboration and neither the personality traits nor the cognitive styles. There were

also no significant associations between the Outcomes of Collaboration and the cognitive styles. The personal characteristics did not significantly explain the Perceptions of Collaboration. The results as well as some noteworthy non-significant associations are discussed below.

5.1 Perceptions of Collaboration

RQ1. Is there an association between the perceived quality of collaborative learning and the perceived outcomes of collaborative learning?

There was a statistically significant positive correlation between the Quality of Collaboration and the Outcomes of Collaboration ($r_s = .61, p < .01$). This correlation was anticipated because the quality of the collaborative environment was expected to play a role in the outcomes of the collaborative learning experience (Allison & Hayes, 1998; Mattessich & Monsey, 1992). Based on the findings of this study, however, no conclusion can be made regarding the causal nature of this association. This was the strongest correlation in the study and stands as a benchmark or reference point for the other correlational findings. Approximately 36% of the perceived Outcomes of Collaboration can be explained by knowing the perceived Quality of Collaboration. This is regarded as a strong association according to the guidelines provided by Cohen (1988).

5.1.1 Frequency of Collaboration

Despite suggestions from the literature that frequency of collaboration contributed to the quality of collaboration (Mattessich & Monsey, 1992), frequency item did not strongly correlate with the Quality of Collaboration scale. It was therefore not included in the Quality of

Collaboration scale for this study. The frequency item also did not seem to belong with the overall experiences of collaborative online learning (i.e., items from Outcomes of Collaboration and Quality of Collaboration combined). Therefore, it was not included with the Perceptions of Collaboration scale.

Despite not fitting well into the collaboration sales, the frequency was significantly positively associated with the Perceptions of Collaboration ($r_s(121) = .37$, 95% CI [.19, .53], $p < .001$). Frequency was more closely related to the Outcomes of Collaboration ($r_s(121) = .37$, 95% CI [.21, .51], $p < .001$) than the Quality of Collaboration ($r_s(121) = .29$, 95% CI [.09, .43], $p < .001$). Upon closer investigation, a linear regression analysis showed that the perceived frequency was able to significantly predict 11% the Outcomes of Collaboration (see Table 5.1) with a large effect size (Cohen, 1988).

Table 5.1

Regression Analysis Frequency of Collaboration Predicting the Outcomes of Collaboration

| Variable | <i>B</i> | <i>SE B</i> | β | <i>t</i> | <i>p</i> |
|-----------|----------|-------------|---------|----------|----------|
| Frequency | .37 | 0.10 | .33 | 3.83 | .000 |

Note. $R^2 = .108$ ($N = 123$). ANOVA Regression significance $p < .001$

A factor analysis of the Perceptions of Collaboration scale, shows that the frequency loads more heavily with the Outcomes of Collaboration items (see Table 5.2). However, the reliability analysis comparing the frequency with the Quality and Outcomes of Collaboration revealed that the Regression coefficient ($R^2 = .12$) and Pearson's r ($r = .32$) were both relatively

low (Laerd Statistics, 2015). The relatively low factor loading and the lack of alignment with the scale suggest the possibility that frequency belongs to a separate construct.

Table 5.2

Rotated Component Matrix of the Outcomes and Quality of Collaboration

| | Component 1 | Component 2 |
|--------------------|-------------|-------------|
| Frequency | .59 | -.03 |
| Respect | .25 | .87 |
| Diversity | .04 | .90 |
| Valued important | .49 | .69 |
| Learned more | .76 | .37 |
| Helped reach goals | .86 | .25 |
| Enjoyed | .77 | .44 |

Note. Extraction method: Principal Component. Rotation method: Varimax with Kaiser Normalization. Factor loadings in bold.

Future research should examine the relationship between the frequency of collaboration and the outcomes of collaboration in order to identify potential causality and to prescribe recommendations for online educators. Frequent collaboration can be challenging in an online class because of the difficulty managing the logistics of synchronous meetings and asynchronous information sharing (Smith et al., 2011). Increasing the expectation for the frequency of collaboration may have some adverse side effects because of this added logistical stress. These considerations should be carefully weighed with the potential benefits of frequent collaboration.

5.2 Cognitive Styles and Collaboration

RQ2. Is there an association between cognitive style and the perceived quality of collaboration?

There were no statistically significant correlations between the cognitive styles and the Quality of Collaboration. Therefore, there is not sufficient evidence to support the alternative hypothesis for research question 2. However, for this sample population, there was one slight positive correlation between the Knowing cognitive style and the Quality of Collaboration. Upon further examination of this trend, a significant positive relationship was discovered between the Knowing style and the item stating, “The members in my collaborative group(s) showed **mutual respect** for one another” ($r_s(121) = .18$, 95% CI [-.02, .35], $p = .049$) (see Table 5.3).

According to the questions in the CoSI survey (Cools & Van den Broeck, 2007), those with a Knowing style tend to desire to understand all problems related to an area of study. As they study those problems, they seek to understand the underlying logic. Students with a high Knowing style enjoy analyzing the problems through detailed analyses. Perhaps those with a strong Knowing style are more likely to appreciate the subtleties of the collaborative setting like mutual respect among group members.

RQ3. Is there an association between cognitive style and the perceived outcomes of collaboration?

There were no statistically significant correlations between the cognitive styles and the Outcomes of Collaboration. There was insufficient evidence to reject the null hypothesis. There was, however, a slight positive trend between the Creating cognitive style and the Outcomes of

Collaboration scale. Specifically, there was a trend between those with strong a Creating style and reported enjoyment of the collaborative experience (see Table 5.3).

Table 5.3

Correlations (r_s) Between Items Measuring Perceptions of Collaboration and Cognitive Styles

| | Knowing | Planning | Creating |
|--|---------|----------|----------|
| The members in my collaborative group(s) showed mutual respect for one another. ^a | .18* | .11 | .11 |
| The members of my collaborative group(s) came from a variety of backgrounds and/or had differing perspectives . ^a | .15 | .06 | .13 |
| Each group member had a valued and important role in the collaborative group(s). ^a | .07 | .11 | .03 |
| I learned more from participating in the collaborative group experience than I would have on my own. ^b | .14 | .14 | .12 |
| The collaborative experiences helped me reach my goals for the course. ^b | .06 | .03 | .07 |
| I enjoyed the collaborative group experience. ^b | .07 | -.01 | .15 |

Note. ^a = Quality of Collaboration items, ^b = Outcomes of Collaboration items.

* $p < 0.05$. ** $p < 0.01$.

Others have suggested that cognitive style may be a fundamental factor in determining individual behavior (Armstrong et al., 2012) and may influence students' desire to participate in groupwork (Du et al., 2013). So this slight correlation may be of practical significance.

The CoSI questions described someone with a Creating cognitive style as liking innovation and creative solutions (Cools & Van den Broeck, 2007). Those with a creative style prefer variety, extending boundaries, and avoiding routine. It is possible that those with a

creating style tended to recognize and appreciate the creative solutions that arose from collaboration. This type of student seems to enjoy and may benefit from the innovative nature of collaboration.

I had a degree of concern regarding the data that was collected by the CoSI segment of the instrument. The respondents tended to provide more repeated answers through this portion of the survey. This potentially compromised data may be reflected in the CoSI related data analyses. A discussion of this concern can be found in APPENDIX B.

5.3 Personalities and Collaboration

RQ4. Is there an association between personality and the perceived quality of collaboration?

No statistically significant correlations between the personality styles and the Quality of Collaboration were found. Two non-significant correlations were noted. There was a slight negative correlation between the Conscientiousness personality type and the Quality of Collaboration. A closer look revealed a significant negative correlation between Conscientious students and the Diversity item: “The members of my collaborative group(s) came from a variety of **backgrounds** and/or had differing **perspectives**” ($r_s (121) = -.19, 95\% \text{ CI } [-.36, .01], p = .03$) (see Table 5.4).

A conscientious person was described in the instrument as “someone who likes to plan things, likes to tidy up, pays attention to details, but can be rigid or inflexible” (Woods & Hampson, 2005, p. 388). It could be argued that the messy, chaotic realities of working with other people affected conscientious students’ perceptions of the quality of the collaborative learning experience.

There was also a slight positive correlation between the Openness personality type and the Quality of Collaboration. Someone with a high degree of Openness was described in the survey as “someone who spends time reflecting on things, has an active imagination, and likes to think up new ways of doing things, but may lack pragmatism” (Woods & Hampson, 2005, p. 388). As with the Creating students, and unlike the Conscientious students, perhaps those with an open personality type were more appreciative of the innovative and imaginative ideas exchanged in the collaborative group. They may also have been less susceptible to the chaos and mess.

RQ5. Is there an association between personality and the perceived outcomes of collaboration?

Some students perceive that certain personalities are better fitted for groupwork (Winter & Neal, 1995). Personalities were found to be an even stronger predictor of lifetime satisfaction than other common indicator variables such as income or marriage status (Boyce et al., 2013). In this study, there was a significant association ($p \leq .05$) between two of the individual personalities and the Outcomes of Collaboration. The null hypothesis was rejected and the alternative hypothesis accepted. These significant associations are described below.

5.3.1 Extraversion and Outcomes of Collaboration

The Extraversion personality type was significantly positively associated with the Outcomes of Collaboration. An extravert was described in the survey as “someone who is talkative, outgoing, is comfortable around people, but could be noisy and attention seeking” (Woods & Hampson, 2005, p. 388). Such individuals would be expected to thrive in a

collaborative environment because of their social tendencies. It is not surprising, therefore, that they perceive greater benefits as an outcome of collaborative learning. One factor of successful collaborative groups that was not addressed in this study was the lack of dominating individuals (Moore & Kearsley, 2012). As extraverted students are described as talkative and possibly noise and attention seeking, these individuals may be at risk of dominating the group time. If they do, they may impact the quality and outcomes of the collaborative learning experience. This is a topic for future research to explore.

Considering that, by nature, online courses tend to be more isolated than face to face courses, extraverted students may be more inclined to take face to face courses rather than online courses. The personality make-up of students in online courses versus face to face courses is a topic for future research. Such a study could examine whether students with polar extremes in personality like Extraversion and Conscientiousness tend to enroll more or less in online courses.

Since extraverted students thrive on social interactions, it is possible that extraverts establish a stronger sense of social presence in the classroom or collaborative group. Social presence was shown to have a strong impact on students' perceptions, particularly students' satisfaction (Gunawardena & Zittle, 1997). Extraverted students may engage more in the social knowledge construction that occurs during collaborative learning. Their social knowledge sharing may help extraverts' mental models to evolve. Social presence and socially constructing knowledge by extraverted students may both contribute to these students' perceptions of greater outcomes of collaboration. Training introverted students to engage in collaborative settings and develop the skills of social knowledge construction as well as helping introverts in

establishing their social presence within the collaborative group may boost students' perceptions of the benefits of collaboration.

Extraverts tended to perceive higher outcomes from the collaborative experience, yet, based on their responses to the item, “I **enjoyed** the collaborative group experience” they didn't seem to enjoy the experience significantly more than less extraverted students (see Table 5.4). It is possible that these outcomes were just more evident to the extraverts. While online students may not prefer or have positive perceptions toward working in groups (Nummenmaa & Nummenmaa, 2008; Smith et al., 2011), at least in some instances, student enjoyment of groupwork was not correlated with outcomes like grades (Winter & Neal, 1995). This finding aligned with the research and suggests that enjoyment of collaborative learning is not necessarily a good judge of educational gains.

A look at the individual questions measuring the Outcomes of Collaboration showed that extravert students tended to agree more with the Outcomes of Collaboration item “I **learned more** from participating in the collaborative group experience than I would have on my own” than other students (see Table 4.18). The Learned More and Extraversion correlation was particularly strong, $r_s(121) = .25$, 95% CI [.06, .42], $p = .005$, and the effect size was medium (Cohen, 1988). Students who scored high on Extraversion also tended to agree more strongly with the Outcomes of Collaboration item “The collaborative experiences helped me **reach my goals** for the course,” $r_s(121) = .23$, 95% CI [.08, .42], $p = .02$. The effect size of this correlation was also medium (Cohen, 1988).

5.3.2 Conscientiousness and Outcomes of Collaboration

The Conscientiousness personality type was significantly negatively related ($p = .05$) to the Outcomes of Collaboration. In the words of the survey, a conscientious person is “someone who likes to plan things, likes to tidy up, pays attention to details, but can be rigid or inflexible” (Woods & Hampson, 2005, p. 388). Alternately, someone with low Conscientiousness could be described as, “someone who doesn’t necessarily work to a schedule, tends to be flexible, but disorganized, and often forgets to put things back in their proper place” (Woods & Hampson, 2005, p. 388). Like Extraversion, Conscientiousness was significantly associated with the Helped Reach Goals item, but this time, the association was negative ($r_s(121) = -.22$, 95% CI [-.39, -.03], $p = .01$) (see Table 5.4).

Table 5.4

Correlations (r_s) Between Items Measuring Quality and Outcomes of Collaboration and Personality Types

| | Extra | Agree | Emot Stab | Consc | Open |
|--|-------|-------|--------------|-------|------|
| The members in my collaborative group(s) showed mutual respect for one another. ^a | .08 | .00 | .12 | -.06 | .15 |
| The members of my collaborative group(s) came from a variety of backgrounds and/or had differing perspectives . ^a | .09 | -.08 | .07 | -.19* | .15 |
| Each group member had a valued and important role in the collaborative group(s). ^a | .08 | .01 | -.03 | -.16 | .07 |
| I learned more from participating in the collaborative group experience than I would have on my own. ^b | .25** | -.06 | -.10 | -.10 | .03 |
| The collaborative experiences helped me reach my goals for the course. ^b | .23** | -.08 | -.14 | -.22* | .01 |
| I enjoyed the collaborative group experience. ^b | .17 | -.05 | .03 | -.15 | .04 |

Note. ^a = Quality of Collaboration items, ^b = Outcomes of Collaboration items.

* $p < 0.05$. ** $p < 0.01$.

Of all the personality styles, Conscientiousness was most associated with academic achievement (Digman & Takemoto-Chock, 1981; Noftle & Robins, 2007), so the finding from this study that conscientious students don't perceive better outcomes from collaboration was somewhat unexpected. It seems reasonable to believe that conscientious students may find it difficult to work with those who are not conscientious. Those who feel collaboration is inefficient might be the students who contribute the most. Conscientious students may pick up the work that the slackers neglect to do. This hypothesis is supported by previous research which found that the presence of a slacker in the group detracted from peers' perceptions of

and satisfaction with collaboration (Payne & Monk-Turner, 2006). The conscientious students may feel like they have to pick up the pieces of the task. As detail oriented people, they may become frustrated when the details of the assignment slip through the cracks in a collaborative environment.

In addition, the ability to compromise was one of the factors of successful groups (Mattessich & Monsey, 1992). The SIMP describes someone with high conscientiousness, in part, as "... rigid or inflexible" (Woods & Hampson, 2005). Those with high conscientiousness (and therefore, propensities for rigidity and inflexibility) tended to rate the Outcomes of Collaboration low. Perhaps their lack of flexibility was incongruent with the task of working with others who have diverse perspectives, information processing patterns, and work habits.

One way to approach the problems of collaborative work distribution and inflexibility problem would be to support less conscientious students in the development of higher levels of conscientious and to support conscientious students in developing a degree of flexibility. The practice of changing personalities as is proposed here was described in recent literature (Boyce et al., 2013). As others have noted, conscientiousness shares commonalities with self-regulation and academic motivation (Eisenberg, Duckworth, Spinrad, & Valiente, 2014) which are skills that would help collaborative group members distribute the work more fairly. Flexibility is an important skill for successful collaborative learning (Mattessich & Monsey, 1992).

To examine these relationships between personal characteristics and Outcomes of Collaboration further, regression analysis was applied the individual items of the Outcomes of Collaboration scale. The item personality traits were significant predictors of students' responses to the statement, "The collaborative experiences helped me **reach my goals** for the

course” ($p = .02$) (see Table 5.5). This predictive value had an adjusted R^2 value of .087 and a large effect size. Individually, the items Extraversion and Conscientiousness were significant predictors of responses to the “reach goals” item.

Table 5.5

Regression Analysis Summary for Personality Type Predicting Responses to the “Reached Goals” Item

| Variable | <i>B</i> | <i>SE B</i> | β | <i>t</i> | <i>p</i> |
|---------------------|----------|-------------|---------|----------|----------|
| Extraversion | .09 | 0.04 | .21 | 2.39 | .02 |
| Agreeableness | .00 | 0.04 | .00 | -0.02 | .99 |
| Emotional Stability | -.07 | 0.04 | -.16 | -1.72 | .09 |
| Conscientiousness | -.11 | 0.04 | -.27 | -2.98 | .00 |
| Openness | .02 | 0.04 | .04 | 0.45 | .65 |

Note. $R^2 = .147$ ($N = 123$). ANOVA Regression significance $p = .017$.

5.4 Personal Characteristics Explaining Perceptions of Collaboration

RQ6. To what degree can cognitive style and personality together explain the perceptions of collaboration (i.e., the combined perceived outcomes and quality of collaboration)?

In this study, the personal characteristics helped to explain 11% of the Perceptions of Collaboration. The ANOVA was not significant, but the high R^2 value suggests that some of the individual factors were associated with Perceptions of Collaboration.

Thus, personal characteristics, in particular Extraversion and Conscientiousness, may be able to account for the some of the different perceptions reported in the literature that online

students have toward collaborative learning (Payne et al., 2006; Payne & Monk-Turner, 2006; Winter & Neal, 1995).

These findings also suggest that while personal characteristics are associated with how students perceive the collaborative experience, other variables are also likely correlated with the Perceptions of Collaboration. This study dealt with the quality and the outcomes of collaboration. Other variables may include the level of social presence among individual group members (Gunawardena & Zittle, 1997), the features of the collaborative tasks, or the nature of the digital technology for collaboration, and the presence or lack of individual and group accountability.

The linear regression analysis showed that Quality of Collaboration, Extraversion and Conscientiousness were significant predictors of the Perceptions of Collaboration (see Table 4.16). When all other personality styles were held constant, the Extraversion personality style and the Conscientiousness personality style were individual item predictors of the combined Perceptions of Collaboration ($p = .03$, $p = .02$, respectively). High levels of Extraversion predicted high Perceptions of Collaboration while high levels of Conscientiousness predicted low Perceptions of Collaboration.

5.5 Wish to Collaborate

The Wish to Collaborate item was included in the survey instrument to obtain data from those who did not collaborate in their online course. Those who reported collaborating were not asked “Did you wish to collaborate?” because the responses may have been influenced by the collaboration they experienced in their course. There were significant correlations between

the responses to Wish to Collaborate and cognitive styles. The Wish to Collaborate question was significantly negatively correlated with both the Knowing style ($r_s(33) = -.42, p = .01$) and the Planning style ($r_s(33) = -.40, p = .02$). It was negatively correlated with the Creating style, $r_s(33) = -.24, p = .17$. This negative direction means that the higher the student's score on the cognitive style, the less likely they were to indicate that they wished to collaborate. There were no significant correlations between the Wish to Collaborate and the personality types, but the Openness type was non-significantly negatively correlated with the Wish to Collaborate item, $r_s(33) = -.30, p = .09$. The more open a student was, the less likely they were to wish for collaboration.

The majority of students who did not collaborate (65%) reported that they did not wish to collaborate. This may have included students who were given the opportunity to collaborate, but chose to work independently. It should be noted, however, that the distribution of personality types and cognitive styles from the group that did not collaborate was similar to the distribution of personality types and cognitive styles of those who did collaborate. Thus, if participation in collaborative learning was optional, there was not a clear type of student who chose not to join in.

5.6 Recommendations for Online Course Design

Course designers should be aware of some of the limitations of collaboration. For example, course designers may inadvertently support extraverted students over other personality types when they incorporate high amounts of collaborative work into the course structures. In such courses, the morale and motivation of conscientious students may suffer. A

balanced amount of collaborative and individual work should be sought. Course instructors may want to be mindful and supportive of conscientious students during collaborative work due to these students' tendency to believe they would benefit more from working individually.

If the students' perceptions collected in this study were accurate, and conscientious students do indeed benefit less from collaborative experience than others while extraverted students benefit more, then some teachers might be tempted to design courses which allow students to choose whether they collaborate or not. This may ease some students' concerns about the messy nature of collaboration or concerns about having to do more than one's share of the work. Yet it is not wholly advised. Many "soft skills" can be learned through collaboration. These skills can benefit students in their future careers and relationships. Instead, course designers and instructors are encouraged to offer a balance of individual and collaborative work and to eliminate unnecessary stress from the collaborative experience.

Stress arising from technical complications should be eliminated when possible. Students can be given opportunities to choose their groupmates and thus potentially overcome scheduling difficulties.

To improve the collaborative experience for all, educators may also consider finding ways to enhance students' social presence and social knowledge construction skills such as negotiation, conflict resolution, and plasticity of mental models, especially for students with low levels of Extraversion. For students with low levels of Conscientiousness, educators can support the development of self-regulation and academic motivation. For students with high Conscientiousness, the focus can be on supporting the development of moderate levels of flexibility in order to better succeed in collaborative environments.

5.7 Future Research

With the current interest in collaboration, there is a need to look more closely at the associations between collaboration and academic achievement. The presence or absence of such a link could help inform instructors and course designers as they consider incorporating collaborative experiences into their courses.

Future research should explore the benefits and limitations of collaborative learning for different types of people. The findings of this study indicate that, despite some of the current literature supporting collaborative learning, collaboration may not be the best way for all students to learn. In-depth studies including interviews with students may help shed light on the reasons for variations in perceptions about the quality and outcomes of collaboration. Such studies should also examine the context of students' collaborative experiences looking particularly at both positive and negative experiences.

Additionally, there is likely a degree of overlap between the personalities and cognitive styles. Some students may be strong in multiple types or styles. researchers should examine associations between composite personalities as well as composite cognitive styles and students' perceptions of collaborative learning.

This study examined a limited number of variables. The researcher recognizes that other variables likely influence the associations between quality and outcomes of collaboration. Other variables of collaboration should be investigated including the types of collaboration (e.g., collaboration, cooperation, coordination), the nature of the collaborative task, the digital medium of collaboration, workload balance, and grading or rewarding of collaborative work. Due to the significant correlation between the frequency of collaboration and the outcomes of

collaboration, frequency of collaboration should be examined to identify whether causation exists and to determine the optimal frequency of collaborative meetings. Care should be given with frequency recommendations for online students: researchers should consider the added stress of working together over a distance and across multiple time zones.

A recommendation given by Mattessich and Monsey (1992) is echoed here: the factors of successful collaboration should be confirmed and compiled. The Perceptions of Collaboration presented in this paper along may be merged with recommendations from other research and tested as an instrument for measuring the success of a collaborative learning experience.

5.8 Summary of Chapter 5

It is generally believed that collaborative learning has great merit. The results of this study revealed that the value of collaborative learning should be examined in light of who benefits and who suffers. This study indicated that, within this sample population, extraverted and unconscientious students felt they benefit while conscientious and introverted students did not feel they benefitted quite as much. While not generalizable, these results can help to inform future studies. This study is expected to contribute to the literature regarding students' experiences with collaborative learning and associations with personality and cognitive style.

One surprising result of this study was the finding that, for this population, conscientious students felt the outcomes of collaboration were lower than other students. This result was surprising because Conscientiousness has historically been a predictor of academic achievement (Digman & Takemoto-Chock, 1981; Nofle & Robins, 2007). It is suspected that

conscientious students are negatively affected by their less conscientious peers in the collaborative environment. Additionally, some conscientious students may lack sufficient flexibility to work well in a collaborative group.

The possibility of extending the benefits of collaboration to all students is suggested in this study. Students with less extraverted personalities may benefit from training in social sharing while those with conscientious personalities may profit from improved flexibility skills. Those with low conscientiousness may help the entire group's learning outcome by enhancing their self-regulation skills and motivation to learn.

APPENDIX A
INSTRUMENT

Questionnaire

1. What is your current college GPA? (0.0-0.9/1.0-1.9/2.0-2.9/3.0-4.0/Prefer not to answer)
2. Before this semester, how many online college courses have you taken?
(0/1/2/3/4/5+)
3. About what percent of your college courses in the past 2 years were online? (0%, 10%, 25%, 50%, 75%, 100%)
4. Name one recent online college course you have taken in which you collaborated with your classmates (Ex. Bio 101 or Intro to Biology).
 - a. *(For this survey, collaborating means working together with others. This includes studying together and working on projects or tasks assigned by your teacher.)*
 - b. If you haven't collaborated with classmates in any of your recent online courses, just name a recent course you have taken.
5. Did you complete the course? (Yes/No/I'm taking the course now)
6. What grade did you receive? (A/B/C/D/F/The course isn't finished/Prefer not to answer)
7. How often did you collaborate (work together) with your classmates on class-related activities throughout the course? (never/rarely/sometimes/often/always)

How well do you agree that the statements below?

(strongly disagree/disagree/undecided/agree/strongly agree)

8. The members in my collaborative group(s) showed **mutual respect** for one another.
9. The members of my collaborative group(s) came from a variety of **backgrounds** and/or had differing **perspectives**.
10. Each group member had a **valued and important** role in the collaborative group(s).
11. I **learned more** from participating in the collaborative group experience than I would have on my own.
12. The collaborative experiences helped me **reach my goals** for the course.
13. I **enjoyed** the collaborative group experience.

Cognitive Styles Indicator (CoSI)(Cools & Van den Broeck, 2007)

18-Items, 5-point Likert Scale (1=totally disagree, 5=totally agree)

Single Item Measures of Personality (SIMP) (Woods & Hampson, 2005)

5-Item polar response scale

Demographic Questions

How old are you? (18-24/25-34/35-44/45-54/55-64/65+, Prefer not to answer)

What is your gender? (Male/Female/Prefer not to answer)

With which ethnic background do you most identify? (African American/Asian/Hispanic/Native American/White/Other (specify)/ Prefer not to answer)

APPENDIX B
DATA SELECTION

Data Selection

The data was originally reduced to 200 responses. The fastest 23% (those completed under 3 minutes and 35 seconds) and those with 15 consecutive repeated answers were eliminated. Upon review of the data, it was noted that there was a high degree of correlation among the cognitive styles (see Table B.1). This suggested that many individuals had responded similarly for all the cognitive style questions. This section of questions was also recognized as the most tedious: it involved 18 Likert-style questions arranged out in a matrix. Matrices can be troublesome because respondents may be tempted to draw pictures out of the answer sections or to quickly select the same answers without reading the questions. It is suspected that some respondents stopped reading the questions in this section and clicked on the same answer for most of the cognitive style questions.

Table B.1

Correlations (r_s) Among Cognitive Styles

| Measure | 1 | 2 | 3 | <i>M</i> | <i>SD</i> |
|-------------|-------|-------|---|----------|-----------|
| 1. Knowing | — | | | 2.74 | 1.16 |
| 2. Planning | .73** | — | | 4.13 | .81 |
| 3. Creating | .50** | .38** | — | 3.41 | .98 |

Note. $n = 200$. Measures 1, 2, and 3 are cognitive styles measured by the Cognitive Style Indicator (CoSI) (Cools & Van den Broeck, 2007).

* $p < 0.05$. ** $p < 0.01$.

To test this hypothesis, responses which had 11 or more answers were identified. The average time it took respondents to complete the survey was analyzed. Including those with 11+ consecutively repeated answers, but excluding outliers (i.e., those who completed the survey in 20+ minutes) the average time to complete the survey was 5:37 (SD = 2:57) ($n = 185$). The average completion time for those with 11+ consecutive repeated answers (excluding outliers) ($n = 39$), the average completion time was 4:41 (SD = 1:38). This hypothesis was supported by the shorter average survey completion time. Thus, the data presented in this paper were selected based on these parameters: responses completed in over 3 minutes and 35 seconds and containing fewer than 11 consecutively repeated answers.

A comparison between the results of the initial larger sample and the final smaller sample indicated that the more aggressive thinning of the data reduced some of the noise among the correlational findings (see Table B.2). For example, the Conscientiousness and Quality of Collaboration correlation became stronger after weeding out junk responses. The Extraversion and Conscientiousness personalities were more strongly correlated with the Outcomes of Collaboration in the final smaller sample. Below are the results initial data analysis containing ($n = 163$) compared with the results of the final sample ($n = 123$). Additionally, the effect size of each of the linear regression analyses was small for the initial sample, but medium for the final sample (see Table B.3).

Table B.2

Associations Between Quality and Outcomes of Collaboration and Personality/Cognitive Style of the Student: A Comparison Between Initial and Final Samples

| | Initial Sample | | | | Final Sample | | | |
|----------------------------|--------------------------|-----|---------------------------|-----|--------------------------|-----|---------------------------|-----|
| | Quality of Collaboration | | Outcomes of Collaboration | | Quality of Collaboration | | Outcomes of Collaboration | |
| | r_s | p | r_s | p | r_s | p | r_s | p |
| Knowing style (CoSI) | .17* | .03 | — | — | .15 | .10 | — | — |
| Planning style (CoSI) | .19* | .02 | — | — | .10 | .28 | — | — |
| Creating style (CoSI) | .12 | .16 | .12 | .13 | .11 | .20 | .13 | .15 |
| Extraversion (SIMP) | — | — | .18* | .02 | — | — | .22* | .01 |
| Agreeableness (SIMP) | — | — | — | — | — | — | — | — |
| Emotional Stability (SIMP) | — | — | — | — | — | — | — | — |
| Conscientiousness (SIMP) | -.07 | .35 | -.14 | .08 | -.15 | .09 | -.18* | .05 |
| Openness (SIMP) | .13 | .11 | — | — | .13 | .16 | — | — |

Note. * = $p < .05$. — = considered to have no correlation ($p > .30$)

Table B.3

Regression Analysis Summary for Personal Characteristics Predicting the Combined Quality and Outcomes of Collaboration: A Comparison Between Initial and Final Samples

| | Initial Sample | Final Sample |
|------------------------------|--------------------------|--------------|
| | Personal Characteristics | |
| Quality of Collaboration | $R^2 = .068$ | $R^2 = .100$ |
| Outcomes of Collaboration | $R^2 = .072$ | $R^2 = .109$ |
| Perceptions of Collaboration | $R^2 = .064$ | $R^2 = .108$ |

APPENDIX C

ASSOCIATIONS BETWEEN COGNITIVE STYLES AND PERSONALITY TYPES

Associations Between Cognitive Styles and Personality Types

Relationships were examined between the personality styles (SIMP) and the cognitive styles (CoSI) (see Table C.1). A significant negative correlation was found between the Creating cognitive style and the Agreeableness personality trait, $r_s(155) = -.17$, 95% CI [-.33, .00], $p = .03$. The effect size was small (Cohen, 1988). Also, a significant positive correlation appeared between the Creating cognitive style and the Openness personality trait, $r_s(155) = .23$, 95% CI [.09, .41], $p = .004$. Although not significant, the effect size was considered medium (Cohen, 1988). There was a significant positive correlation with a small effect size between Openness and Knowing, $r_s(155) = .15$, 95% CI [-.03, .30], $p = .06$.

Table C.1

Correlations (r_s) Between Cognitive Styles and Personality Types

| Measure | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <i>M</i> | <i>SD</i> |
|----------------------|-------|-------|-------|------|------|-------|------|---|----------|-----------|
| 1. Knowing | — | | | | | | | | 4.24 | .68 |
| 2. Planning | .66** | — | | | | | | | 4.21 | .51 |
| 3. Creating | .49** | .30** | — | | | | | | 3.76 | .57 |
| 4. Extraversion | -.08 | -.05 | -.02 | — | | | | | 5.42 | 2.78 |
| 5. Agreeableness | -.11 | -.07 | -.17* | .00 | — | | | | 6.42 | 2.63 |
| 6. Emotion Stab | .10 | -.02 | .08 | -.12 | .15 | — | | | 4.99 | 2.58 |
| 7. Conscientiousness | .12 | .12 | .00 | .08 | .16 | .04 | — | | 6.49 | 2.52 |
| 8. Openness | .15 | .02 | .23** | -.11 | .20* | .27** | -.02 | — | 6.02 | 2.42 |

Note. $n = 200$. Measures 1, 2, and 3 are cognitive styles measured by the Cognitive Style Indicator (CoSI) (Cools & Van den Broeck, 2007). Measures 4, 5, 6, 7, and 8 are personality types measured by the Single Item Measures of Personality (SIMP) (Woods & Hampson, 2005). * $p < 0.05$. ** $p < 0.01$.

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