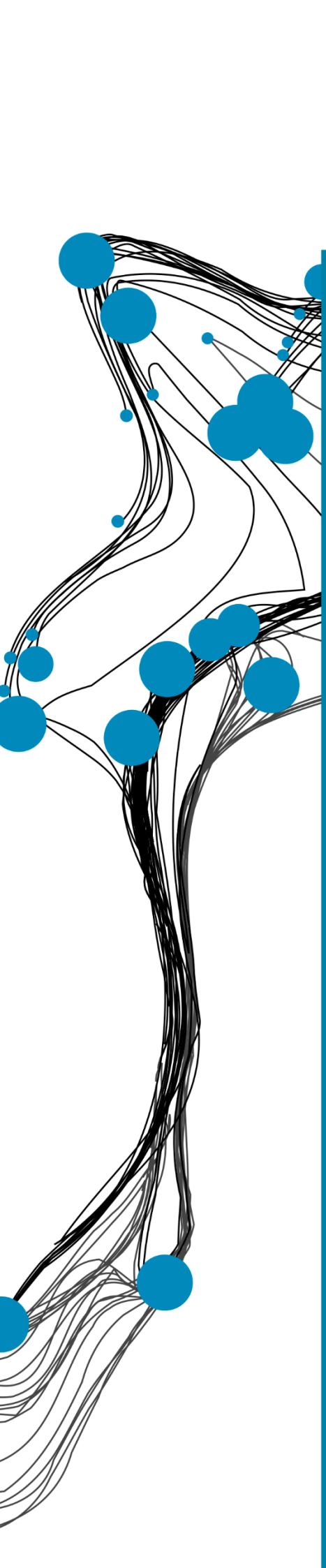

Introverts and Extraverts Collaborating: The Influence on Participation, Transactivity and Group Work Perceptions during an Online Discussion

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Abstract

In order for collaborative learning to be effective, it is important every student is involved equally and experience the group work positively. However, when introverted and extraverted students work together, differences in their participation level and perceptions towards group work might occur. This explorative research investigated the effects of introverted and extraverted university students (n = 32) working together in introvert-extravert dyads on their participation level, transactivity and perceptions on group work during a scripted online discussion, using video conferencing technology. Results showed that the extraverts significantly participated more in the discussions based on their word count. No significant differences between introverts and extraverts on their transactive behaviour or perceptions on group work were found. Additional analysis on transactive behaviour between the different dyads did show a significant correlation: the greater the difference within the dyads on their score for extraversion, the lower the proportional amount of total transactive talk. This finding can be a good starting point for future research on transactivity and personality, next to focussing on the effects of scripting when introverts and extraverts work together, to get more insight in how to optimally support this collaboration. Finally, the effect of other personality aspects on participation, transactivity and group work perceptions could be further investigated.

Keywords: introversion, extraversion, collaborative learning, participation, transactivity, group work perceptions

Introduction

The Dutch system for higher education can be described as a system that focuses a lot on teamwork in which students collaborate in groups during large parts of their studies, where students are expected to develop and express their own opinion (Studyinholland, 2019). Research on collaborative learning has demonstrated the positive relationship between collaborative learning and student achievement, effort, motivation and more positive attitudes towards learning in general (Johnson & Johnson, 2005; Scager, Boonstra, Peeters, Vulperhorst & Wiegant, 2016). However, collaborative learning has also been criticised for being too broadly applied to all learning situations and all learner types (Hopper, 2003).

Differences between learning partners can have a negative impact on the collaboration, with more quiet students feeling elevated levels of stress and experiencing considerable tensions between speaking and silence when interacting with group members (Medaille & Usinger, 2018). This results in complaints and negative experiences with group assignments (Walker, 2007). The personality trait that is most likely to have an impact on group interaction is extraversion-introversion, with extraverts rating group work as more enjoyable than introverts do (Walker, 2007). However, Walker (2007) showed that introverts and extraverts did not significantly differ in their assessment marks. Research on introverted and extraverted students working together has shown that more introverted students like to be more independent and on their own (Nussbaum, 2002; Strom, 2018), while more extraverted students crave more interpersonal interaction and therefore generally learn better in groups (Furnham & Chamorro-Premuzic, 2005; Nussbaum, 200). This results in more positive responds from extraverts to environments with high participative learning (Pawlowska, Westerman, Bergman & Huelsman, 2014).

Besides that introverts and extraverts experience collaborative learning differently, there might also be a danger that they do not participate equally during group work. Small group discussions and the construction of arguments are positively correlated with achievement (Cohen, 1994; Webb, Troper & Fall, 1995), but this can only be reached if every student is involved equally (Nussbaum, 2002). However, there might be a danger that more extraverted students will dominate group discussions (Hennesy & Evans, 2006; Nussbaum, 2002). As a result, it could be difficult to ensure equal participation within heterogeneous introvert-extravert groups.

The personality trait of extraversion-introversion seems to be especially relevant to online behaviour (Amichai-Hamburger, 2007; Blau & Barak, 2012). The protected internet environment may help introverts in expressing themselves more freely, while extraverts feel

comfortable both online and offline (Amichai-Hamburger, Wainapel & Fox, 2002). On the other hand, another study revealed that extraverts would rather take part in a face-to-face classroom environment (Pavalache-Ile & Cocorada, 2014). Moreover, Pavalache-Ilie and Cocorada (2014) found that introverts disapprove of online collaborative learning because they miss face-to-face feedback from the teacher. Teachers are therefore advised to implement proper rules for the communication between students working together online (Pavalache-Ilie & Cocorada, 2014). Little research has been done on the collaboration between introverts and extraverts in an online environment in a heterogeneous group setting. To explore whether this type of learning environment leads to equal contribution and more positive perceptions towards collaborative learning between introverts and extraverts, the purpose of this study is to explore how introverts and extraverts behave and feel during an online collaborative learning activity.

Theoretical Framework

Introversion vs. Extraversion

Personality seems to be stable over time in its influence on behaviour (Chen, Davis, Hauff & Houben, 2016). The distinction between introversion and extraversion is well-known when talking about personality. Two common personality measures show a definition for extraversion: The Myers-Briggs Type Indicator (MBTI, Myers & Myers, 1995), most popular in the consultancy and training world and the Big Five Personality Factors (Goldberg, 1992), more common in the academic research area on personality (Furnham, 1996). Myers and Myers (1995) made a distinction between introversion and extraversion in which introversion is defined as a type whose main interest lies within their inner world, ideas and concepts. On the other hand, extraverts are more involved with the world of people and things surrounding them (Myers & Myers, 1995). The basic difference lays in the way people prefer to use their minds. For example, introverts can deal with the world around them as extraverts do, but they prefer to reflect and work more inside their heads, so the natural preference always remains. Both types are complementary to each other, which means that a person is not a hundred percent introvert or extravert, it is about which type is more dominant (Myers & Myers, 1995).

According to The Big Five (Goldberg, 1992), extraversion is defined as the degree to which people are talkative, social, spontaneous, boisterous, energetic, and like to seek adventure (Shiota & Kalat, 2018). A study on the relationship between MBTI and the Big five showed a strong correlation between the Big Five extraversion and the MBTI extraversion-

introversion dimensions (Furnham, 1996). Since the Big Five is more commonly used in personality research and is closely correlated with the MBTI, this study will only focus on the extraversion definition of the Big Five Factor model.

Collaboration between introverts and extraverts

Collaborative learning is defined as a teaching method in which students have to collaborate in order to help each other learn (Slavin, 2014). Students that work in group settings achieve better with respect to conceptual understanding compared to learning individually (Linton, Farmer & Peterson, 2014). A crucial component for effective collaboration is social interaction (Volet, Summers & Thurman, 2009). During collaborative learning, students are challenged bot socially and emotionally as they are required to articulate and defend their ideas, next to listening to different perspectives (Laal & Laal, 2012). Moreover, collaborative learning provides social skills needed for future professional work (Scager et al., 2016).

In order to benefit from the full knowledge of all the group members, it is important that every group member participates equally and that they communicate well with each other (Nussbaum, 2002; Woolley, Aggerwal & Malone, 2015). However, there might be a danger that more extraverted students dominate group discussions (Blau & Barak, 2012; Hennesy & Evans, 2006), resulting in unbalanced participation between introverts and extraverts.

In addition to equal participation, the quality of group discussions is also of great importance for effective collaboration. The quality of student discussions has been found to influence the learning outcomes of collaborative learning (Scager et al., 2016; Teasley, 1997). In order to learn from each other, students should be able to reflect and act upon their partner's reasoning, which is positively related to individual knowledge acquisition (Teasley, 1997; Weinberger & Fischer, 2006). Operating on the reasoning from a learning partner could be described in terms of transactivity: the process by which learners work together, how they construct arguments and how they build on the contributions of their learning partners (Joshi & Rosé, 2007; Teasley, 1997).

Weinberger and Fischer (2006) distinguished five social modes of co-construction, namely: 1) externalization: articulating thoughts to group 2) elicitation: questioning the learning partner 3) quick consensus building: accepting the contributions of the learning partner 4) integrating-oriented consensus building: taking over, integrating and applying the perspectives of the learning partners and 5) conflict-oriented consensus building: disagreeing, modifying or replacing the perspectives of the learning partners. These five social modes of co-construction represent different degrees of transactivity, where externalization is regarded as

the least transactive social mode and conflict-oriented consensus building as the most transactive mode (Teasley, 1997; Weinberger & Fischer, 2006).

When introverts and extraverts work together, they seem to approach collaborative learning activities in different ways (Myers & Myers, 1995). For example, the willingness to share one's knowledge seems to be influenced by extraversion. Extraversion is important for the team communication process and helps to establish common ground (Carbonell, Rienties & Van den Bossche, 2011). Moreover, extraverts would be more willing to directly contact teachers and/or peers to capture knowledge while introverts prefer to be more self-reliant (Soles & Moller, 2001). These differences in willingness to communicate between introverts and extraverts might cause problems for successful collaboration. More introverted students could have difficulties in contributing transactive statements when working together with a more extraverted learning partner (Jurkowski & Hanze, 2015; Webb, 2010). Because extraverts are generally better at communication, they probably also have a natural tendency to explain their thoughts and debate (Van Boxtel, Van der Linden, Roelofs & Erkens, 2002). On the other hand, introverts seem to understand complex knowledge more thoroughly and are better in recognizing underlying principles than extraverts (Myers & Myers, 1995; Soles & Moller, 2001), but they usually need more time to think and reflect (Cain, 2013).

These differences in behaviour could be explained by the way someone feels towards working with others in general (Walker, 2007). When extraverts are expected by their introverted groupmates to be someone who makes a major contribution to the group output, this might reinforce the extraverts' natural preference of socializing, which in turn makes their group work experience more enjoyable (Walker, 2007).

Although extraverts seem to be more willing to do collaborative activities, Flanagan and Addy (2019) did not find a difference in learning outcomes between introverts and extraverts who worked together in heterogeneous groups. The results showed no disadvantage for introverts on final grades nor received peer evaluation whilst having reported similar affective attitudes towards the courses. However, several studies suggest that big differences between introverts and extraverts on their attitudes towards collaborative learning remain, with introverts finding group work less enjoyable (Al-Dujaily & Ryu, 2007; Hennessy & Evans, 2006; Persky, Henry & Campbell, 2015; Walker, 2007). This could be related to extraversion being correlated to the frequency and intensity of positive emotion. People with a higher level of extraversion on average are happier and they respond with a greater increase in positive emotions to specific positive stimuli compared to those who are more introverted (Gross, Sutton, & Ketelaar, 1998).

Online collaboration between introverts and extraverts

A learning environment that might be beneficial for extraverts and introverts working together is online collaborative learning. Especially for introverts, the protected internet environment may be helpful to express themselves more freely (Amichai-Hamburger et al., 2002). On the other hand, Pavalache-Ilie and Cocorada (2014) found that extraverts prefer a face-to-face classroom environment, but another study showed that extraverts feel comfortable both online and offline (Amichai-Hamburger et al., 2002). Moreover, extraverted students who are inclined to intellectual and/or imaginative talk with others, seem to be better able to meet the goals of collaborative online interaction (Chen et al., 2016). When working together online, introverts also seem to prefer textual group discussion using a discussion forum (Blau & Barak, 2012; Blau et al., 2017).

Despite that introverts prefer working together online in an asynchronous setting, using text messages, this also leads to less learning effectiveness, due to the increased cognitive load, lower psychological arousal and higher ambiguity of messages (Kock, 2005). Therefore, according to the Medium Naturalness Theory (Kock, 2005), it is advised that when working together online, to use a medium that is as close to a face-to-face setting as possible (Weiser, Blau & Eshet-Alkalai, 2018). A synchronous online medium like video conferencing technology allows the students to speak to each other spontaneously, both visual and verbal in a face-to-face setting (Weiser, Blau & Eshet- Alkalai, 2018). The collaborative learning still takes place a protected internet environment which can give introverts the opportunity to express themselves more freely (Amichai-Hamburger et al., 2002), in addition to respecting the preference of extraverts to work together in a face-to-face setting (Pavalache-Ilie & Cocorada, 2014).

Blau and Barak (2012) did an experiment on the readiness to participate, the degree of actual participation, and the quality of contribution to synchronous online group discussions between introverts and extraverts. They found that extraverts were more inclined to participate in discussions, engaged more actively in discussions and showed a greater quality of contribution compared to introverts. These differences in participation and quality of contribution could be explained by the finding of Pavalache-Ilie and Cocorada (2014), who showed that introverts miss feedback and support from the teacher in an online learning environment. Implementing proper rules for the online communication between introverted and extraverted students might therefore be beneficial. Especially introverts can benefit from well structured collaborative learning as this creates a more productive environment (Jacobs, 2014).

Supporting online collaboration

Support could be given by the teacher with a clearly structured task. This structure could be in the form of annotated examples of completed tasks and pre-teaching of important concepts (Jacobs, 2014). Another way to support collaboration is to give students time to think first, this can be done by dividing roles to the group members, so they all have an equal opportunity to participate (Jacobs, 2014). This could be especially beneficial for introverts, since they prefer to think and reflect (Cain, 2013), without giving extraverts the opportunity to directly dominate the discussion (Nussbaum, 2002).

A possible way to divide roles is by using a collaboration script. Collaboration scripts are instructions, which specify and sequence learning activities (Weinberger, Stegmann, Fischer & Mandl, 2007). In this way, learners can be more encouraged to share their ideas with their partners and to reflect on differences (Weinberger et al., 2002). According to King (2007), scripting can be an effective approach in promoting learning in collaborative contexts. Weinberger et al. (2002) concluded that learners can greatly benefit from scripts by reducing process losses and specifying activities and roles during collaboration. Next to that, scripts can structure interaction by committing learners to specific forms of interaction, like questioning and argumentation (Dillenbourg, 2002; King, 2007), which could possibly encourage transactive talk.

When supporting collaborative learning, Bakhtiar, Webster and Hadwin (2017) found that group members who received high-level scripting for individual planning were better prepared for the collaboration. Since difficulties with planning, such as task understandings and goals, can have a profound effect on performance when students collaborate, a script to help planning the task by letting the students prepare individually could be beneficial (Hadwin, Bakhtiar & Miller, 2018). Moreover, Van Dijk, Gijlers and Weinberger (2014) showed positive effects of scripting on learning processes and outcomes, despite intentional grouping based on differences between learning partners. Therefore, using a collaboration script when introverted and extraverted students work together online could potentially be helpful to reach more equal participation, more transactivity and more positive perceptions towards group work.

Present study

Previous research has shown differences between introverts and extraverts working together concerning their level of participation, transactivity and perceptions towards group work. Extraverts seem to show a higher level of participation than introverts during collaborative learning activities (Blau & Barak, 2012; Hennesy & Evans, 2006). However, in order to

reach the positive effects of small group discussions and the construction of arguments on achievement, it is important that every student is involved equally in the discussion (Nussbaum, 2002). Introverts could also experience more difficulties in contributing to transactive talk when working together with extraverts (Jurkowski & Hanze, 2015; Webb, 2010). These differences could also lead to differences in perceptions towards group work between introverts and extraverts. However, introverts and extraverts are still expected to work together in their later careers (Flanagan & Addy, 2019; Scager et al., 2016). Therefore, this study will focus on introverts and extraverts working together in a heterogeneous group setting. Since working together in a scripted synchronous online environment could potentially lead to equal participation, more transactive behaviour and more positive perceptions towards group work for introverts and extraverts working together, the following research question will be investigated: To what extent does the collaboration between introverted and extraverted students influence their participation and perceptions during an online scripted discussion, using video conferencing? In order to answer this question, three different sub-questions will be examined in this study:

R1: To what extent does the collaboration between introverted and extraverted students influence their participation level during an online scripted discussion, using video conferencing?
H1: Previous research has shown that extraverts significantly participated more actively in discussions than introverts (Blau & Barak, 2012). Next to that, more extraverted students are generally more talkative and spontaneous (Shiota & Kalat, 2018) and have better communication skills like explaining their thoughts (Van Boxtel et al., 2002). Therefore, it is hypothesized that the level of participation will be higher for more extraverted students.

R2: To what extent does the collaboration between introverted and extraverted students influence their transactive behaviour during an online scripted discussion, using video conferencing?
H2: Students with different personalities approach collaborative learning differently. Introverts are generally better at the analysis phase of group work and are more skilled in recognizing underlying principles (Myers & Myers, 1995). However, they do need more time to think and reflect (Cain, 2013) than extraverts do. Blau and Barak (2012) found that extraverts had a higher quality of contribution, but they did not include a scripting element in their study. Since this study does give the students time to prepare themselves, this could be beneficial for the more introverted students to express themselves and reflect upon their partners ideas.

Therefore, it is hypothesized that introverted and extraverted students will engage equally in transactive behaviour.

R3: To what extent does the collaboration between introverted and extraverted students influence their group work experience during an online scripted discussion, using video conferencing?

H3: More extraverted students mostly experience collaborative learning more positively, since they generally feel more positive towards working with others (Walker, 2007), are more willing to do collaborative activities (Soles & Moller, 2001), and show higher frequencies and intensity of positive emotions, which they get from socializing (Gross, Sutton, & Ketelaar, 1998). However, these studies did not include a scripting element in which the students got time to prepare themselves. Since the script used in this study could be an effective approach in promoting learning in collaborative contexts (King, 2007), it is hypothesized that also introverts will enjoy the collaborative learning activity and therefore do not report different perceptions towards the group work compared to the extraverts.

Method

Participants

In total, 32 (28 female, 4 male) Dutch University students participated in this study. The participants' age range was 20 to 25 (M=22.81, SD=.965). All participants were enrolled in, or recently finished, a Bachelor (25%) or Master (75%) program at a Dutch University. All the students participated voluntarily; they were not given any reward, and all the participants gave active consent to use the gathered data for this study. Participants were grouped into introvert-extravert dyads, resulting in a total of 16 heterogeneous introvert-extravert dyads. In both the introverted and the extraverted group there were 14 females and 2 males.

Discussion topic

The participants were asked to discuss their opinion about the following question: "Should pupils and/or students be given the opportunity to assess their teacher?" ("Moeten leerlingen en/of studenten de mogelijkheid krijgen om hun docent te beoordelen?"). This statement was retrieved from an article on 'The Learning Network' website of the New York Times (Conchar, 2014), in which students were asked this question on a discussion forum, which showed that many different perspectives were possible.

If early consensus was reached (before discussing for 20 minutes), one or two follow-up questions were being asked to the students. The first follow-up question was: "Should

pupils and/or students also be involved in application procedures or discussions for a teacher's contract extension?" ("Moeten leerlingen en/of studenten ook betrokken worden bij sollicitatieprocedures of besprekingen voor een contractverlenging van een docent?"). The second follow-up question was: "Should only the 'best' pupils and/or students be allowed to judge their teachers?" ("Zouden allleen de 'beste' leerlingen en/of studenten hun docenten mogen beoordelen?"). These follow-up questions arose from the proposal made by LAKS (The national action committee for pupils) to the House of Representatives in The Netherlands in 2015, in which they wanted students to be able to assess their teacher and have them participate in job interviews for new teachers.

Instruments

Personality questionnaire. The participants individually filled out a personality questionnaire in order to identify whether they could be considered introverts or extraverts. A 20-item questionnaire (DeYoung, Quilty and Peterson (2007), based on the Big Five Factors (Goldberg, 1992) was used. Extraversion could be divided into two subcategories, namely enthusiasm and assertiveness. Each of those categories consisted of ten items which were all included in the International Personality Item Pool (IPIP). For example, enthusiasm was measured by statements like "I make friends easily" and assertiveness by statements like "I see myself as a good leader". All questions were translated to Dutch and answered on a five-point Likert scale (ranging from strongly disagree to strongly agree) as suggested by DeYoung and colleagues (2007)(See Appendix A). As suggested and done by Blau and Barak (2012), participants were identified as introvert or extravert by using the median scale score of this questionnaire (*Median*=75). As exactly two of the participants had a score of 75, for this study, one of them was classified as an introvert and one of them as an extravert. The reliability analysis of the items resulted in a Cronbach's alpha coefficient of .81.

Group work experience questionnaire. In order to measure the students' perceptions of a collaborative learning activity, the 15 items of the Perceptions of a Cooperative Learning Activity Questionnaire (PCLA-Q), developed and validated by Mouw, Saab, Pat-El and Van den Broek (2019), were used. The items in this questionnaire differentiate between a Group Processes scale and an Attitude/Utility scale. Group Processes measure students' perceptions of the quality of the group work with items like "We first discussed how we would approach this task". Attitude/Utility measures students' attitudes towards and perceived utility value of a specific collaborative learning activity with items like "I enjoyed taking part in this discussion".

For this study, the scale has been translated to Dutch and adjusted to a group size of two who took part in a discussion (e.g.: “Ik vind dat ik goede argumenten gegeven heb”)(see Appendix B). The original scale was developed for primary school students, who answered the questions on a three-point Likert scale. Since the target group of this study are older students, the questions were answered on a five-point Likert scale (ranging from strongly disagree to strongly agree) as suggested by DeYoung and colleagues (2007). The reliability analysis of the items resulted in a poor Cronbach’s alpha coefficient of .49. The Cronbach’s alpha could be increased to .63 if two items were deleted. Therefore item 8 (“During the discussion we made eye-contact”) and item 13 (“We first discussed how we would approach this task”) were deleted from the analysis. This might be explained by the fact that the original questionnaire was used for assessing group work experience in a face-to-face, instead of an online setting, resulting in different opinions in whether or not someone made eye-contact. According the item on the task approach, the collaboration was scripted, so the students did not necessarily have to discuss how to approach the task, possibly resulting in varying answers regarding this question.

Calculation of Cronbach’s alpha for the introverts and extraverts separately did show a difference in reliability, with an alpha of .60 for the introverts and .67 for the extraverts (after deleting Item 8 and 13). This indicates that this questionnaire was more reliable for the students classified as extravert. However, the sample size of this study was very small and the participants were identified as introvert or extraverts based on their score on the personality questionnaire, based on the mean score of this specific sample. When using a bigger sample size, it is possible that a student that was classified as extravert for this study, could be classified as introvert in another study. Therefore, further research is needed in order to say if this questionnaire is more reliably for extraverts.

Script. The scripting element of this study consisted of the students being given preparation time and the follow-up questions that were being asked by the researcher. The students were given five minutes to formulate their opinion about the given discussion topic. Moreover, a maximum duration of 20 minutes for the discussion was set in advance.

Procedure

The data collection of this study was fully conducted online. Beforehand, all the participants filled out the personality questionnaire. Based on this questionnaire, introvert-extravert dyads were formed by the researcher. Next, the dyads were scheduled for a video conference session via Skype on a day and time that was convenient for both participants and the researcher. The video meeting lasted for 30 minutes and was recorded. At the start of the

session, the participants were welcomed and shortly introduced to each other. Next, the researcher explained the task and gave them the statement they had to discuss. The participants were given five minutes to write down their thoughts and opinions about the statement. During this time, the participants, as well as the researcher, stayed online. After preparing individually, the researcher let the dyads discuss their ideas on the statement for around 20 minutes. If early consensus was reached, the researcher asked one or two follow-up questions to keep the discussion going. When the discussion was finished, the researcher thanked the participants and asked them to individually fill out the group work perceptions questionnaire immediately after the session had ended.

Data analysis

In order to investigate how introverts and extraverts behave and feel during a scripted online discussion using videoconferencing, the level of participation, transactivity and perceptions on group work will be analysed. For all dependent variables, both individual and dyadic scores were compared.

Personality questionnaire analysis. For the personality questionnaire, nine items were negatively formulated (e.g.: "*I am hard to get to know")* and were recoded for analysis in order to calculate each participants' total score for extraversion, with a minimum of 20 (least extravert) and a maximum of 100 (most extravert). Partners within a dyad differed at least eleven points (*Range*=11-17) on their score on the extraversion scale.

Participation level analysis. To measure the effect of introverts and extraverts working together on the actual participation of the participants, the recorded discussions were transcribed, where after the total amount of words spoken by each participant was counted. Next, this number was expressed as a percentage of the total number of words spoken by the duo overall. In this way, the level of participation between the introverts and the extraverts could be compared.

Next to comparing the participation level between the introverts and the extraverts, the total amount of spoken words by the dyads were also compared to each other. Within the dyads, both participants had different scores on their level of extraversion, varying at least eleven points on extraversion. This resulted in varying difference scores for each of the dyads. The effect of this difference score on the total amount of spoken words was also measured, to explore if this might have had any influence on their overall participation.

Transactivity analysis. To assess the degree of transactivity during the discussion, a coding scheme was developed (see Table 1). This coding scheme was based on the work of Weinberger and Fischer (2006), who divided the degree of transactivity into five categories:

1) externalization 2) elicitation 3) quick consensus building 4) integrating-oriented consensus building 5) conflict-oriented consensus building. These five social modes of co-construction represent different degrees of transactivity, where externalization is regarded as the least transactive social mode and conflict-oriented consensus building as the most transactive mode (Teasley, 1997; Weinberger & Fischer, 2006).

Table 1

Overview of transactive coding

Categories	Description	Examples
Information sharing		
Externalization	Externalizing content to collaborative partner	"One student will find it very important that they have a good connection and the other would attach more value to if something can be properly explained".
Elicitation	Requesting information from collaborative partner	"But do you think that these surveys should be anonymous or not?
Quick consensus		
Agreeing	Quick consensus building; agreeing with partner	“Yes”
Disagreeing	Disagreeing without showing comprehension	“No”
Transactivity		
Integrating	Evidence that the speaker learned from partner	"Yes, I think I am on the same page as you in that respect".
Critiquing	Critiquing or correcting input from partner	“Yes, only the question is whether you will get representative data.”

Regarding to the coding process, for each speaking turn it was first decided whether it was a separate externalization or a response to the other speaker. If it was a response, it was first decided if this was an agreeing or disagreeing response. When agreeing, the talk was either coded as agreeing (A) or integrating (Int). When disagreeing, the talk was either coded as disagreeing (D) or critiquing (Cri). If the talk was a separate externalization, it was either coded as externalization (Ex) or elicitation (El).

After coding the transcripts, within each code, the total utterances were calculated. Next, a percentagewise score for each of the categories of transactivity were calculated, by dividing the number of utterances in each code by the total number of utterances provided by each student. Next to individual comparisons, also the proportional amount of transactive talk for each dyad was calculated, in order to compare those to their difference scores on extraversion.

Group work perceptions analysis. To measure the influence of introverts and extraverts working together on the group work perceptions of the participants, a total score for this questionnaire was calculated. The answers to each of the questions were summed, resulting in a minimum of 13 and a maximum of 65 points. A higher score on the group work questionnaire stood for more positive perceptions towards this specific collaboration task. Next to individual differences, the mean scores of the dyads were also compared based on their difference score on the personality questionnaire.

Results

In order to examine differences between extraverted and introverted students on their participation level, transactivity and group work perceptions, a series of independent samples *t* tests are reported. Next, results on the correlational analysis of the difference scores for extraversion on the three dependent variables between the different dyads are reported, to explore if the difference score on extraversion within the dyads could potentially have influenced the results.

Differences on participation level, transactivity and group work perceptions between introverts and extraverts

In this sub-section, results on the analysis between introverts and extraverts on participation level, transactivity and group work perceptions are reported. Table 2 shows an overview of the descriptive statistics for each of the dependent variables.

Introversion vs. extraversion: influence on participation level. An independent samples *t* test was used to compare the level of participation (average percentage of spoken

words) of the participants classified as ‘introvert’ (n = 16) to the participants classified as ‘extravert’ (n = 16). The t test was statistically significant, with the extraverts (M = 53.35, SD = 9.34) using on average 7.95% more words than the introverts (M = 45.40, SD = 10.29), $t(30) = -2.29$, $p = .029$, $d = .81$.

Table 2

Means and Standard Deviations for the Scores on Participation Level, Transactivity and Group Work Perceptions for the Extraverts and the Introverts

	Extraverts		Introverts	
	M	*SD*	*M*	*SD*
Participation level (% words)	53.35	9.34	45.40	10.29
Transactivity				
Information sharing total	46.09	10.22	47.17	14.03
Externalization	37.67	13.48	37.44	13.02
Elicitation	8.42	6.97	9.73	8.10
Quick consensus building total	20.65	12.29	15.86	11.64
Agreeing	20.65	12.29	15.86	11.64
Disagreeing	--[a]	--	--	--
Transactivity total	33.33	10.26	36.98	17.89
Integrating	28.54	9.15	32.89	17.38
Critiquing	4.73	4.55	4.09	3.26
Group work perceptions	55.13	3.93	55.31	3.70

Note. n = 16 for each cell.

[a] None of the participants disagreed with their partner without further explanation.

Introversion vs. extraversion: influences on transactivity. After coding the transcripts for transactive talk, it appeared that the talks of all the dyads were constantly about the discussion topic. Of all the utterances, 48% was coded as ‘information sharing’ (externalisation or elicitation), 21% as ‘quick consensus building’ (agreeing or disagreeing), and 31 % as ‘transactive’ (integrating or critiquing). To determine how introversion versus extraversion affected the students’ discourse, students’ percentagewise sub-categorical scores for the different subcategories were calculated, showing proportional amount of talk and

distribution of participation within these categories. Percentagewise scores were used to rule out any effects of the difference between the introverts and extraverts in amount of utterances.

A series of independent samples *t* tests was used to compare the average percentage of the total scores for the three main categories: information sharing, quick consensus building and transactivity of the participants classified as 'introvert' (n = 16) to the average percentage of the participants classified as 'extravert' (n = 16). None of the *t* tests were significant, with $t(27.42) = .25$, $p = .805$, $d = -0.09$ for total information sharing, $t(29.91) = -1.13$, $p = .266$, $d = -0.25$ for total quick consensus building and $t(23.75) = .72$, $p = .477$, $d = -2.10$ for total transactivity.

Introversion vs. extraversion: influence on group work perceptions. An independent samples *t* test was used to compare the mean scores on the group work perceptions questionnaire of the participants classified as 'introvert' (n = 16) to the mean scores of the participants classified as 'extravert' (n = 16). The *t* test was non-significant, $t(30) = .139$, $p = .890$, $d = -.05$.

Differences on participation level, transactivity and group work perceptions between dyads

To examine whether there are any differences in the mean level of participation, transactivity and group work perceptions between the different dyads, this sub-section shows results on the correlational analysis between the dyads' difference score, meaning the amount of points the introvert and extravert within each dyad differed from each other on the personality questionnaire. Table 3 shows an overview of the descriptive statistics for the mean participation level, transactivity and group work perceptions between the dyads. After checking the assumption for calculating a Pearson's product-moment correlation coefficient, it appeared that the assumption of normality was violated. Therefore, Spearman's rho was calculated for all the correlational analyses.

Correlation between difference score and participation level. The linear relationship between the dyad's difference score and the distribution of percentagewise amount of spoken words by the extravert within thy dyads was non-significant. Spearman's rho did not indicate a significant correlation, $r_s = .12$, $p = .670$, two-tailed, $N = 16$.

Correlation between difference score and transactivity. The linear relationship between the dyad's difference score and the total mean percentage of transactive talk for each dyad did show a significant result. Spearman's rho indicated the presence of a negative correlation between the difference score and transactivity, $r_s = -.76$, $p = .001$, two-tailed, $N =$

16. The greater the difference within the dyads on the score for extraversion, the lower the proportional amount of total transactive talk.

Correlation between difference score and group work perceptions. The linear relationship between the dyad's difference score and the mean score for each dyad on group work perceptions was non-significant. Spearman's rho did not indicate a significant correlation, r_s = -.04, p = .874, two-tailed, N = 16.

Table 3

Descriptive Statistics for the Dyadic Means on Participation Level, Transactivity and Group Work Perceptions

	M	*SD*
Participation Level	53.34	9.33
Transactivity		
Information sharing total	46.65	7.18
Externalization	37.48	4.97
Elicitation	9.17	5.06
Quick consensus building total	18.23	9.91
Agreeing	18.23	9.91
Disagreeing	--[a]	--
Transactivity total	35.13	12.89
Integrating	30.68	11.75
Critiquing	4.47	2.86
Group work Perceptions	55.22	2.96

Note. n = 16 for each cell. Participation level = mean percentage of words spoken by the extravert.

[a] None of the participants disagreed with their partner without further explanation.

Discussion

Theoretical implications

The aim of this study was to explore how introverts and extraverts behave and feel during a scripted online collaborative learning activity by looking at their level of participation, transactive behaviour and perceptions on group work during a scripted online discussion,

using video conferencing. As expected, the results of this study showed a significant difference between the average level of participation between the introverts and the extraverts, with the extraverts participating more in the discussion based on their word count. Earlier research already showed that extraverts, in general, are more talkative (Shiota & Kalat, 2018), more willing to do collaborative activities (Soles & Moller, 2001) and have better communication skills (Van Boxtel et al., 2002). Weiser et al. (2018) also showed that introverts had lower participation levels than extraverts in several different learning settings. Therefore, this finding confirms the same effect during a synchronous online collaborative setting, using video conferencing. Although extraverts significantly participated more in terms of their word count, all the discussions were constantly on task. This can possibly be explained by the discussion topic. This study followed the recommendation by Blau and Barak (2012) to use a sensitive, intriguing, and challenging discussion topic to increase the involvement of group discussions for every individual. However, the extraverts still dominated the discussions, so there might still be a danger that the introverts felt left out (Hennesy & Evans, 2006).

Results on the degree of transactivity between introverts and extraverts did not show any significant differences. It was hypothesized that introverts and extraverts would show an equal amount of transactive behaviour. Since no significant differences were found, this hypothesis can be confirmed. Introverted students could have difficulties in contributing transactive statements when working together with a more extraverted learning partner (Jurkowski & Hanze, 2015; Webb, 2010). However, by using a script, which gave the students time to prepare themselves, the students should have been more encouraged to share their ideas with their partners and to reflect on differences (Weinberger et al., 2002). Moreover, by committing learners to specific forms of interaction, like questioning and argumentation (Dillenbourg, 2002; King, 2007), transactive talk should have been encouraged, possibly explaining why no differences were found on transactivity for the introverts and extraverts.

Although no significant differences between the introverts and the extraverts were found, when looking at the mean scores for the different subcategories, a few differences could be noted. The data indicated that extraverts on average were more involved in quick consensus building, while introverts scored slightly higher on transactive talk. However, these mean differences were not significant but could be interesting to investigate in future research. Because this was an explorative research, follow up research is needed to investigate whether scripting could potentially have an effect on the transactive behaviour of introverts and extraverts, by for example using different conditions with varying preparation time

Results regarding the group work perceptions between introverts and extraverts did not show any significant differences in how they perceived the collaborative learning activity. It was hypothesized that introverts and extraverts would enjoy the collaboration equally as much, so this hypothesis can be confirmed. Extraverts generally feel more positive towards working with others (Walker, 2007) and are more willing to do collaborative activities (Gross, Sutton, & Ketelaar, 1998; Soles & Moller, 2001). However, the used collaboration script gave the students time to prepare. This might have had a positive influence on the perceptions on the group work of both the introverts and the extraverts. Moreover, previous research showed that introverts have a preference for online learning (Amichai-Hamburger et al., 2002), while extraverts seem to prefer a face-to-face context (Pavalache-Ile & Cocorada, 2014). This study made use of video conferencing technology, which is online, but as close to a face-to-face setting possible. This may have made the introverts and the extraverts perceive this collaborative learning activity as equally enjoyable.

Additional correlational analyses of the dyadic scores was performed to explore whether varying difference scores on extraversion between the dyads had any effects. Dyads were made based on every participant's score on their level of extraversion. This difference score on extraversion between the students was not the same within each dyad. No significant differences were found on the distribution of time talked by the extraverts. Also, no significant difference was found on the average group work perceptions between the dyads. For transactivity, however, a significant negative correlation was found between dyads with varying difference scores on their level of extraversion. The total proportion of transactive talk between the dyads correlated negatively. The greater the difference within the dyads on their score for extraversion, the lower the proportion of total transactive talk. This effect might be partly due to how comfortable the student's felt to integrate with or critique on their partner's opinions. Since extraverts are more likely to dominate decision making and group discussions, where introverts can or feel to be left out (Hennesy & Evans, 2006), a greater difference in extraversion score could possibly increase this effect. This is an interesting finding to investigate in future research, since most studies focus on introversion and extraversion as two separate constructs, but little research has been done using extraversion as a continues scale.

Practical implications

This study also has a couple of practical implications. As mentioned earlier, extraverts significantly participated more in the discussions, but this does not mean that the introverts did not actively participated. The conversations of the students were constantly on the given

discussion topic, which confirms that the discussion topic was indeed challenging and intriguing (Blau & Barak, 2012), resulting in greater involvement of the participants. However, it has to be taken into account that during the online discussion, the researcher was also online during the video call. The presence of a teacher during collaborative learning is positively associated with student motivation in face-to-face (Allen, With & Wheeless, 2006) and online contexts (Baker, 2010; Savvidou, 2013). The researcher's presence during the discussion could have the same effect as a teacher would have in an online face-to-face setting, resulting in some sort of control mechanism for the participants to keep their attention to the task and stay motivated.

Moreover, most of the previous studies were performed in a face-to-face setting with a larger group size. For this study, an online setting with groups of two was used. Heterogeneous groups of two would have the smallest chance of large differences in group work experience between introverts and extraverts (Al-Dijaily & Ryu, 2007; Jacobs, 2014), possibly explaining why extraverts and introverts did not show different results on group work experience. Therefore, it is recommended for a teacher who wants to adapt to learners with different personalities in an online environment, to let the students work together in heterogeneous dyads.

Limitations and Future Research

The results of the current study showed that extraverts participated more in the discussion, but there was no evidence that they also enjoyed the discussion more or less compared to the introverts. However, it has to be noted that the questionnaire used to measure the participants' group work perceptions, did not result in a very high Cronbach's alpha. Even after two items were deleted, the reliability of the questionnaire was still questionable. A possible explanation could be that the questionnaire used was translated to Dutch. Moreover, the items were adapted to a different target group and also to a different collaborative task. This might have caused problems for the reliability of the questionnaire for the method used in this study. Therefore, future research could focus on using a different, or developing a new questionnaire that is more suitable for this target group and task, with questions about engaging in a discussion in pairs, in order to make statements about how the collaboration was perceived. Moreover, to know whether introverts and extraverts had different group work perceptions, adding more qualitative data by interviewing the participants could also give more insight as this will give them the chance to explain and reflect on the collaboration. It has to be taken into account that a synchronous online setting was used for this study, but that this might not always be possible in education. Other research did find differences in attitudes

towards group work between introvert and extraverts in a face-to-face setting, with introverts generally finding group work less enjoyable (Walker, 2007). Future investigation on group work perceptions during a synchronous online setting is recommended, since online collaborative learning is becoming more and more common in higher education (Weiser et al., 2018). Therefore, finding ways to collaborate effectively in this setting is needed.

As mentioned earlier, follow up research on the effects of scripting on the transactive behaviour of introverts and extraverts is needed. The script used in this study could potentially have helped introverts to think and reflect (Cain, 2013). The data also indicated slightly more transactive behaviour from the introverts. In order to know whether it was indeed the script that made this happen, future studies investigating different scripting methods, with for example more or less structured scripts or with different preparation times could give insight if scripting can be beneficial for introverts and extraverts working together. The correlational analysis on transactivity for dyads with varying difference scores on extraversion already indicated that the greater the difference within the duos on the score for extraversion, the lower the proportional amount of total transactive talk was. This might also be a good starting point for a follow up study, focussing on introvert-extravert dyads which differ more or less from each other in terms of extraversion and the relationship toward transactive behaviour.

Finally, this study only focused on one of the five big factors of personality, namely extraversion (Goldberg, 1992). Since the other factors, were not taken into account in this study, they could still have affected the participants' behaviour. Moreover, a relatively small sample was used, due to limited time and resources. Next to that, the male/female distribution of participants in this study was not heterogeneous, with only four men participating. To increase the reliability and generalizability of this study, as well as examining possible differences between genders follow-up research is recommended. It might be interesting to further investigate whether students' level of participation, group work experiences and transactivity differs with a larger, heterogeneous sample size, with taking all aspects of personality into account.

Conclusion

The present study tried to explore how introverted and extraverted students behave and feel during a scripted online collaborative learning activity, by looking at their participation level, transactive behaviour and group work perceptions during a scripted online discussion, using video conferencing. It can be concluded that extraverts participated significantly more in the discussions, but they did not enjoy the group work more or less than extraverts did.

Next to that, no differences on transactive behaviour between introverts and extraverts were found, but additional correlational analysis did show significant differences between the dyads' overall amount off transactive talk. With these findings, this explorative research contributes to previous research on collaboration between introverts and extraverts. Future research could focus on the effects of scripting when introverts and extraverts work together, to get more insight in how to optimally support this collaboration. In addition, by looking more closely at the difference in transactive behaviour between students with different personalities, collaboration can be better supported in the future. Finally, effect of other aspects of personality on participation, transactivity and group work perceptions could be investigated in the future.

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Appendices

Appendix A

Personality Questionnaire.

The following items, translated to Dutch from the questionnaire of DeYoung, Quilty and Peterson (2007), were answered on a five-point Likert scale, ranging from strongly disagree to strongly agree.

1. Ik maak gemakkelijk vrienden
2. Ik voel mij snel op mijn gemak bij anderen
3. Ik laat het zien wanneer ik vrolijk ben
4. Ik heb veel plezier
5. Ik lach veel
6. Ik ben moeilijk om te leren kennen
7. Ik houd anderen op afstand
8. Ik laat weinig over mijzelf los
9. Ik raak zelden bevangen door enthousiasme
10. Ik ben niet een erg enthousiast persoon
11. Ik neem de leiding
12. Ik heb een sterke persoonlijkheid
13. Ik weet mensen te boeien
14. Ik zie mijzelf als een goede leider
15. Ik kan anderen makkelijk overhalen iets te doen
16. Ik ben de eerste die handelt
17. Ik heb geen assertieve persoonlijkheid
18. Ik ben niet goed in het beïnvloeden van anderen
19. Ik wacht tot anderen het voortouw nemen
20. Ik houd mijn mening voor me

Appendix B

Group Work Experience Questionnaire.

The following items, which were translated to Dutch and adjusted to the task and a group size of two, were answered on a five-point Likert scale, ranging from strongly disagree to strongly agree. The questionnaire is based on the questionnaire of Mouw, Saab, Pat-El and Van den Broek (2019).

1. We luisterden naar elkaar
2. We hebben allebei actief deelgenomen aan het gesprek
3. We waren het snel eens over hoe de stelling aangepakt moest worden
4. Ik vond het leuk om deze discussie te voeren
5. Door samen te discussiëren heb ik meer geleerd over het onderwerp dan wanneer ik het alleen had gedaan
6. Ik vind dat ik goede argumenten heb gegeven
7. Ik heb veel ideeën en argumenten naar voren gebracht
8. Tijdens de discussie keken we elkaar aan
9. We hebben elkaar niet onderbroken en lieten elkaar onze zinnen afmaken
10. Ik heb veel geleerd van deze discussie
11. We gaven elkaar regelmatig complimenten
12. We hebben ideeën van ons allebei overwogen
13. We hebben eerst besproken hoe we de taak aan gingen pakken
14. Ik was bang om de ander om hulp te vragen
15. Ik heb mijn best gedaan om te begrijpen wat de ander bedoelde