PERSONALITY TYPES AND LEARNERS' INTERACTION IN WEB-BASED THREADED DISCUSSION

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This study examined the effects of group composition based on the learners' personality types as measured by the Myers-Briggs type indicator as they interacted in threaded discussions. Three groups comprised introverts, extroverts, and mixed introvert-extrovert classifications. Ninety-six participants were divided into 24 groups of 4 participants each: 8 introverted, 8 extroverted, and 8 mixed. Dependent measures included number of posted messages, social, interactive, cognitive, and metacognitive interaction as measured by Henri's (1992) scheme for coding the type of interaction. Participants in the mixed and extroverted groups posted more messages than those in the introverted group. The extroverted and mixed groups' learners showed more social, interactive, and cognitive interaction than those of the introverted group. However, the mixed group showed more metacognitive interaction than that of the extroverted group.

INTRODUCTION

Recent advances in communication and technology have impacted Web-based learning environments that support learners' active participation (Fisher, & Churach, 2001; Gay, Pena-Shaff, & Martin, 2001), authentic learning (Murphy, Drabier, & Epps, 1998), learning through reflective thinking (Kenny, Andrews, Vignola, Schilz, & Covert, 1999), and collaborative learning (Fisher, & Churach, 2001; Murphy, Drabier, & Epps, 1998). Web-based learning environments also allow learners to access a variety of educational resources at any time and place; to communicate with each other via e-mail, chatting, and instant messenging (Danchak & Kenyon, 2002) and, finally, to improve their knowledge and skills with synchronous and asynchronous discussion (McKenzie & Murphy, 2000). However, the Web-based environments, in and of themselves, may not produce quality in learning

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processes and outcomes unless interaction is considered in their design (Gao & Lehman; 2003; Lawless & Mills, 2004).

Interaction, defined as interplay and exchange in which individuals and groups influence each other, has been highlighted because previous studies (e.g. Wagner, 1994, 1997) showed that interaction has close relations with the quality of learning processes and outcomes (Cavanaugh, 2001; Gao & Lehman, 2003; Kawachi, 2003; Lawless & Mills, 2004). In addition, interaction also has played a role as the facilitator of higher order thinking skills such as critical thinking (Garrison, Anderson, & Archer, 2001). Many researchers have attempted to design effective strategy to foster interaction to improved high quality in learning processes and products.

Hirumi (2002) and van Es and Sherin (2002) sought to find effective instructional strategies to facilitate the interaction. Various studies have shown that online interaction helps learner construct new ideas actively and communicate valuable perspectives across different learners and groups. In addition, learners can achieve a group consensus of knowledge through active interaction in Web-based learning environment (Wilson & Stacey, 2004). Active interaction also have yielded information regarding how learners view each other, how they agree the decision without conflict, and how they collaborate interpersonally in online learning environments (Fahy, 2002).

Group composition, the homogenous or heterogeneous mix of individual learners, has been studied. The ways each learner is classified based on their personal characteristics can facilitate interaction among the learners through Web-based discussion (see Buboltz, Young, & Wilkinson, 2003; Chen & Caropreso, 2004; Childress & Overbaugh, 2001; Daughenbaugh, 2002; Freeman & McFrazier, 2002; Kato & Akahori, 2004). Ahn and Ahn (2000) found that there was a strong relationship between personality types and group collaboration. Chen and Caropeso (2003) also showed that personality has great impact on the quantity and quality of online discussion and group interactions.

Many researchers (e.g. Downs, & Jenkins, 2002; Schrum, 2004) have pointed out that group composition by learners' characteristics has increased interaction because learners take part in the interaction with different goals, attitudes and characteristics (Harasim, 1990). Whether the learners are composed homogenously or heterogeneously based on their characteristics seems to be one of key variables in achieving high interaction in the end. It is possible to compose groups by the following variables: learners' prior knowledge on a specific topic (Hmelo, Nagarajan, & Day, 2000); learning ability (Brush, 1997); gender (Busch, 1996) and levels of efficacy (Strijbos, Martens, Jochems, & Broers, 2004). We chose learners' personality types, as classified by the MBTI into introverted and extroverted, because these types have been demonstrated to affect learners' achievement in Web-based discussion (see Carolyn & Leslie, 2001; Dewar & Whittington, 2000; Huber, Shipley, Johnson, & Hashemi, 2003; Russell, 2002).

Previous research suggests that introverted learners tend to be reflective thinkers and prefer connecting and integrating information in the assumption that knowledge is the interaction of information through the world (Dewar & Whittington, 2000; Nussbaum, 2002). Introverted learners tend to keep quiet, be passive, thoughtful, and reflective, avoid interference, and concentrate on the topic longer (Anderson & Simpson, 2004; Carabajal, LaPointe, & Gunawardena, 2003). Thus, they may actively participate in asynchronous environments such as Web-based threaded discussion because they have enough time to think. Introverted learners can benefit from Web-based threaded discussion because they may be able to express their ideas in an anonymous and depersonalized manner (Taylor, 1998).

On the other hand, extroverted learners actively express their thoughts verbally, like learning together with groups, and enjoy cooperative problem-solving processes (Dewar & Whittington, 2000; Nussbaum, 2002). They

tend to involve themselves more in group activities because they are social, prefer verbal communication, act spontaneously, and are not influenced by others' interference (Anderson & Simpson, 2004; Carabajal, LaPointe, & Gunawardena, 2003; Connor, 1997; Lawrence, 1984). In Web-based threaded discussion, extroverted learners can learn by actively posting their opinions when they want to, and introverted learners can think and reflect more when they do not participate in the real-time discussions. In the case of a mixed group that consists of extroverted and introverted learners, it could be argued that introverted learners and extroverted learners will interactively complement the each other's personality styles (Carabajal, LaPointe, & Gunawardena, 2003; Nussbaum, 2002). In other words, extroverted learners are motivated by introverted learners' analytical and thoughtful discussions, while, conversely, introverted learners are inspired by extroverted learners' spontaneous feedbacks and new ideas.

We found few studies that examined how group composition by personality type affects interaction, although previous studies have used achievement or recognition as a dependent measure (e.g., Gao & Lehman, 2003; Kawachi, 2003; Lawless & Mills, 2004). In addition, current research and discussion regarding the impact of group composition by personality type have not precisely specified how a group composed by this type may relate to the interaction, nor has it examined the number of messages and types of the interaction (Ellis, 2003). The purpose of the present study is to investigate the effect of the group composition in terms of learners' personality type on interaction in Web-based threaded discussion.

Specifically, the study examined the effects of learners' personality type from three different group compositions: (a) a group consisting of introverted learners; (b) a group consisting of extroverted learners; and (c) a group consisting of mixed (introverted and extroverted) learners. We used two dependent measures: (a) the number of messages posted by each by the group and (b) the types of interaction based on the posted messages. The study sought to clarify the following questions: (a) whether group composition based on the learners' MBTI personality types affects the number of posted messages and (b) whether group composition affects the types of interaction.

METHOD

Participants

Ninety-six participants were recruited from undergraduates registered in "Instructional Media and Technology" required course at a large university in Korea in spring 2004. The participants were selected to include as large a number of participants and variety of backgrounds. Their age ranged from 21 to 24 years. They had taken at least two courses using the E-campus system that is similar to the Blackboard^{TM} system. The volunteers were assured of the confidentiality of their responses through the use of an informed consent form.

Material

The Myers Briggs Type Indicator, Form G (MBTI) was used to profile the personalities of the participants (Chapman, 2003). The MBTI instrument consists of 94 items and the forced choice and self-reported responses that are dichotomous. The MBTI divides the participants into four dichotomous categories: (1) extroverted and introverted; (2) sensing and intuitive; (3) thinking and feeling, and (4) judging and perceiving. Of those categories, the extroverted and introverted dimension was selected because it has been widely used to measure interpersonal style and is related to learning style (see www.MBTI.com).

Independent Variable

Group composition was the independent variable, comprising an extroverted group, an introverted group, and a mixed group. The extroverted group showed they learned more

through contacts with the external world. The introverted group showed they better learned ideas and concepts alone. The mixed group combined equivalent numbers of extroverted participants and introverted participants. Based on the MBTI indicators, the participants were divided into three groups that were formed for analysis: the extroverted group, the introverted group, and the mixed group. That is, the participants who presented the extroverted personality type were assigned to the extroverted group. The participants who showed the introverted personality type were assigned to the introverted group. Finally, equal numbers of participants showing introverted and extroverted personality types were allocated to the mixed group.

Dependent Measures

Dependent measures comprised the number of messages and interaction type. Each week, we counted the number of messages posted on the Web-based threaded discussions. We used Henri's (1992) scheme for coding the type of interaction. The coding scheme addressed the four types of interaction: (1) social interaction, in which the relation between messages is not closely related to current discussion topics; (2) interactive interaction: the relation between messages connects to other posted messages; (3) cognitive interaction: the relation between messages exhibits the contents related to learning processes such as inference and judgment; and (4) metacognitive interaction: the relation between messages shows metacognitive knowledge and skills.

Procedure

At the beginning of the semester, the participants were provided an in-class workshop. The participants were provided an informed consent form to grant voluntary inclusion of their data in the study. The informed consent form told the participants the purpose of study, the procedures that they should follow, and time that they could spend during the study. The researchers explained the general guidelines and schedule of the study to the participants who were willing to sign the consent forms. The MBTI, administered in Korean, was distributed to obtain all the volunteer participants' personality type. Twenty-four groups (eight extroverted groups, eight introverted groups, and eight mixed groups) were formed based on the result of the MBTI. Each group included four individual participants. The names of the groups to which the participants belonged were posted on the announcement page in the E-campus system as well as distributed through an e-mail listserv.

Each week, the researchers selected and posted a topic dealing with challenges and changes in education. For example, one of the topics was "More than 100,000 learners fall victim to crimes at school. Half of them have experience with school violence. As a teacher, how can you decrease the rate of school violence?" They were asked to post a specific idea for the topic and subsequent responses to other participants' questions and comments on the discussion boards bi-weekly. These repetitive discussions without transforming the format of the groups and participants continued until the end of the semester.

Data Analysis

A multivariate analysis of variance (MANOVA) was used, treating four types of group interactions (social, interactive, cognitive, and metacognitive interaction) as dependent variables. Follow-up univariate analysis of variance (ANOVA) was conducted to compare the number of interaction types among the groups. The Scheffe test was used to identify where differences lay among the groups for each dependent variable. In addition, the number of messages was analyzed by a univariate analysis of variance (ANOVA). The Scheffe test was also used to determine the differences among the groups.

RESULTS

Descriptive Data

Descriptive statistics for the means and standard score of each dependent variable across each group are presented in Table 1. There were no missing data. The resulting sample sizes were: the extroverted group $n = 8$, the introverted group $n = 8$; and the mixed group $n = 8$. An initial screening of the data did not show any outliers, so all of the data were retained.

Kolmogorov-Smirnov's test of the normality setting with alpha level at .05 for the number of messages ($z = .129$, $p > .05$) and each type of interaction: social interaction ($z = .099$, $p > .05$), interactive interaction ($z = .102$, $p > .05$), cognitive interaction ($z = .133$, $p > .05$), and metacognitive interaction ($z = .165$, $p > .05$) indicated that the scores of the dependent variables were normally distributed.

In addition, skewness and the standard deviation for each dependent variable are between −2 and +2. Therefore, the data are normal based on skewness. Kurtosis and its standard deviation for each dependent variable are between −2 and +2. Therefore, the data are also normal based on Kurtosis.

The Number of Message by the Groups

A univariate ANOVA indicated a significant difference for the number of posted messages among all groups ($F[2, 21] = 12.20$, $MSE = 24.40$, $p \leq .01$, $\eta^2 = .537$). A subsequent Tukey HSD showed that the mixed group versus introverted group contrast as well as extroverted and introverted group contrast were statistically significant at .05 alpha level. That is, the participants in the mixed group and extroverted group posted more messages than those in the introverted group, though there was no significant difference in the number of posted messages between the mixed group and extroverted group.

Group Difference by the Types of Interaction

The assumptions of MANOVA analysis show that the data in each group were independently sampled from a multivariate normal distribution with equal covariance matrices over the groups. None of the data suggested concern about possible violation of the independence assumption. The Levene's test of the homogeneity of variance setting with alpha level .05 for the number of messages ($F = 1.26$, $p > .05$) and the types of interaction social interaction ($F = .896$, $p > .05$), interactive interaction ($F = 2.237$, $p > .05$), cognitive interaction ($F = 1.167$, $p > .05$), and metacognitive interaction ($F = 3.147$, $p > .05$) provided no evidence to reject the assumption of homogeneity of variances across the dependent variables.

TABLE 1
Descriptive Statistics for the Number of Posted Messages

	Group Composition					
	Extroverted Group (n = 8)		*Introverted Group (n =8)*		*Mixed Group (n = 8)*	
Dependent Variables	*M*	*SD*	*M*	*SD*	*M*	*SD*
Social interaction	22.75	6.50	v7.13	4.19	17.38	4.47
Interactive interaction	32.38	11.35	19.88	6.85	35.88	6.18
Cognitive interaction	38.50	14.92	25.00	6.37	37.50	4.66
Metacognitive interaction	23.50	9.91	13.63	2.83	34.13	7.81
Total	937		525		999	

Note: Table contains means and standard deviation.

The test of the assumption of homogeneity of covariance matrices in the three groups resulted in a reject decision (Box's M = 105.65, $F[2, 21] = 8.253$, $p = .068$), indicating no violation of the assumption. To identify the result, the assumptions of linear relationship between dependent measures in MANOVA, Pearson's r parameter test and Spearman's non-parametric test, which measured the correlation between the two dependent variables, were conducted at the .05 alpha level with two tailed-distribution. The result satisfied the linear relationship assumption ($r = .281$, $p < .05$; $= .293$, $p < .5$).

The multivariate null hypothesis of equality of the means over all three groups for all dependent variables was rejected at the 0.01 level (Wilk's Lamda = .049, $F[2, 21] = 12.021$, $p < 0.05$; Phillai's Trace statistic = 1.503, $F[2, 21] = 10.892$, $p < 0.05$; Hotelling's Trace statistic = 8.220, $F[2, 21] = 13.153$, $p < 0.05$; and Roy's Largest Root statistics = 6.464, $F[2, 21] = 23.272$, $p < 0.05$). To identify the dependent variables that contributed to the rejection of the multivariate null hypothesis, a follow-up univariate ANOVA was conducted for each of the dependent variables.

Social Interaction

The computed value of $F(2, 21)$ was 18.964 for social interaction dependent variable ($p < .05$). The value of strength of association (η^2) for the same variable was 0.644. The result of ANOVA supported a follow-up pairwise comparison test for the dependent variable. The point estimates, test results, and 95% confidence intervals for the comparisons are given in Table 2. The Tukey HSD procedure was used for the dependent variable to provide additional family-wise protection. Of all comparisons, the extroverted group and the introverted group contrast as well as the mixed group and the introverted group contrast was statistically significant. The extroverted group and the mixed group showed more social interaction than the introverted group, while there was no significant difference in social interaction between the extroverted group and the mixed group.

Interactive Interaction

The computed value of $F(2, 21)$ was 7.937 for interactive interaction dependent variable ($p < .05$). The value of strength of association (η^2) for the same variable was .430. The result of ANOVA supported a follow-up pairwise comparison test for the dependent variable. The point estimates, test results, and 95% confidence intervals for the comparisons are given in Table 2. The Tukey HSD procedure was used for the dependent variable to provide additional family-wise protection. Of all comparisons, the extroverted group and the introverted group contrast as well as the mixed group and the introverted group contrast was statistically significant. The extroverted group and the mixed group showed more interactive interaction than the introverted group, while there was no significant difference in interactive interaction between the extroverted group and the mixed group.

Cognitive Interaction

The computed value of $F(2,21)$ was 4.767 for cognitive interaction dependent variable ($p<.05$). The value of strength of association (η^2) for the same variable was .312. The result of ANOVA supported a follow-up pairwise comparison test for the dependent variable. The point estimates, test results, and 95% confidence intervals for the comparisons are given in Table 2. The Tukey HSD procedure was used for the dependent variable to provide additional family-wise protection. Of all comparisons, the extroverted group and the introverted group contrast as well as the mixed group and the introverted group contrast was statistically significant. The extroverted group and the mixed group showed more cognitive interaction than the introverted group, while there was no significant difference in cognitive interaction between the extroverted group and the mixed group.

TABLE 2
Group Contrast

Contrast	*Estimate (Mean difference)*	*95% Interval*
Social Interaction		
Extroverted vs. introverted	15.63*	8.84, 22.41
Introverted vs. mixed	−10.25*	−17.04, −3.46
Mixed vs. extroverted	−5.38	−12.16, 1.41
Interactive Interaction		
Extroverted vs. introverted	12.50*	1.86, 23.14
Introverted vs. mixed	−12.50*	−26.64, −5.36
Mixed vs. extroverted	3.50	−7.14, 14.14
Cognitive Interaction		
Extroverted vs. introverted	13.50*	1.22, 25.78
Introverted vs. mixed	−12.50*	−24.78, −.22
Mixed vs. extroverted	−1.00	−13.28, 11.28
Metacognitive Interaction		
Extroverted vs. introverted	9.88*	.46, 19.29
Introverted vs. mixed	−20.50*	−29.91, −11.09
Mixed vs. extroverted	10.62*	1.21, 20.04

Note: * Significant at the 0.05 level with Tukey's procedure

Metacognitive Interaction

The computed value of $F(2, 21)$ was 15.083 for social interaction dependent variable ($p < .05$). The value of strength of association (η^2) for the same variable was .590. The result of ANOVA supported follow-up pairwise comparison test for the dependent variable. The point estimates, test results, and 95% confidence intervals for the comparisons are given in Table 2. The Tukey HSD procedure was used for the dependent variable to provide additional family-wise protection. All the contrast among the groups was statistically different. The mixed group showed more metacognitive interaction than the others, while the extroverted group showed more metacognitive interaction than the introverted group.

DISCUSSION

Message differences by groups

The extrovert groups posted more messages than the introvert groups. These findings are consistent with those of Dewar and Whittington (2000) and Nussbaum (2002) who concluded that since extroverted learners are task-oriented and sensitive to external stimulants such as others' opinion, and the extroverted learners evaluated and reacted based on others' opinions, comments, and responses. We conclude that active participations in terms of the number of messages posted by other learners motivated these groups to post more messages (e.g. "the other group posted up more messages. Let's do better"). Lawrence (1997) claims that it is an effective method to teach extroverted learners to observe others' doing in Web-based discussion.

On the other hand, the number of posted message seemed to support the claim introverted learners posted messages once they had enough time to reflect and organize their thoughts. They had a tendency to connect and integrate information, and not to perceive pieces of information as knowledge. They tried to elaborate their own ideas in depth (e.g. "Um … don't understand why they [extroverted group] would post up so many messages. Let's beat them in terms of quality"). Thus, it seemed to be difficult for them to post

as many messages as they could within the restricted time period, which was a week. Lawrence (1997) argued that it was a good method to give introverted learners sufficient time to elaborate on their work during discussion.

In addition, the mixed group posted more messages than did the introverted group. One of the main reasons can be explained by the dynamic interaction between the extroverted participants and the introverted participants in the mixed group (Anderson & Simpson, 2004; Carabajal et al., 2003). The extroverted learners generated messages that demonstrated their interests in discussion topics initially, and then the introverted learners provided feedback and in-depth argument with reaction to prior messages. For example, extroverted learners raised new issues, while introverted learners commented on the opinions of the extroverted learners.

Since introverted learners tend to react to others' opinions instead of taking the initiative to express themselves, they are more likely to convey their opinion when they are in discussion sessions with extroverted learners who actively convey their opinions (Carabajal et al., 2003; Connor, 1997; Lawrence, 1984). Therefore, it can be implied that the initiatives of extroverted participants led introverted groups to respond to their messages so that the number of posted messages in the mixed group was more than that of the introverted learners. The result of the study aligns with some studies (e.g. Jackson, 1992) that have claimed heterogeneous group compositions tend to facilitate group interaction more so than the homogenous group composition.

Analysis of the Types of Interaction

Social Interaction

There was significant difference in the number of social interaction between the extroverted groups and the introverted groups as well as the introverted groups and the mixed groups regarding the social interaction dimension in the result. As addressed earlier, the introverted learners have the tendency to more slowly respond the interaction and need more time in discussing a topic. The extroverted and the mixed groups posted more messages on discussion boards (Dewar & Whittington, 2000; Nussbaum, 2002). However, it should be also considered that the number of social interaction was smaller than the other types of messages across all the groups. One of the possible reasons for that is the learners of all the groups were more focused on discussing the topics provided rather than conversing the issues that had not related with the topic.

Moreover, it was found that the extroverted groups and mixed extroverted/introverted groups began with active interaction at the social dimension aspect while introverted groups delved right into argument on the discussion topic without self-introduction or salutation. Moreover, even during the discussion, extroverted learners of the mixed extroverted/introverted groups and extroverted groups tended to talk about personal matters and post encouraging messages. This can be perceived as reflecting the characteristics of extroverted learners, who bring up personal information easily and who tend to communicate their experiences, with the characteristics of the introverted learners, who tend to reflect their experiences internally before bringing up their experiences and who are hesitant about sharing their personal information.

Interactive Interaction

Interactive interaction consisting of explicit, implicit, and direct statements can be influenced by the amount of other interactions among each group. In other words, the more the participants in each group posts messages, the more the amount of interactive interaction increases. This may have been because the extroverted participants who would like to express various ideas and opinions participated interactively more often than did the introverted participants (Ahn & Ahn, 2000; Buboltz, Young, & Wilkinson, 2003; Chen &

Caropreso, 2004). In addition, it can be inferred that the extroverted participants of the mixed groups may ask the introverted participants in the group to respond and comment on their ideas. Sometimes, extroverted participants immediately respond to the messages posted by an introverted participant and will request more and more direct responses than the introverted. In short, the amount of interactive interaction has close relationships with other types of interaction.

Cognitive Interaction

The extroverted group showed more cognitive interactions than did the introverted groups. One possible reason for this result is discussion topics that would inspire learners' debate motivated the extroverted learners (Huber, Shipley, Johnson, & Hashemi, 2003; Russell, 2002). These topics encouraged the extroverted groups to clarify the nature of discussion topics, search for evidence of inductive and deductive reasoning and, finally, to make a judgment for the agreement among the participants, whereas the learners in the introverted groups tended to think individually and hesitated to express their own ideas in their minds. However, we should be cautious in interpreting the result the way that the differences between two groups in the amount of cognitive interaction solely depended on the attributes of the topics. Obviously, the result was interpreted based on the expressed messages so that the cognitive processes of each group might not appear with the external text. The learners in the introverted groups may give more consideration to internal cognitive and learning processes without provoking discussions for the reason that the amount of cognitive interaction was much higher than those of other types of interactions in the introverted groups. In the case of mixed groups, task-oriented extroverted learners participated actively, and it is possible to assume that the introverted learners participated actively in the discussion topics, based on the instantaneous feedback and new ideas of extroverted learners (Buboltz, Young, & Wilkinson, 2003). Although the difference in the amount of interaction between the extroverted groups and the mixed groups was not significant, as was previously mentioned, the cause of the difference may not be same: the interaction of the extroverted groups was affected by the attributes of the topics while the interaction mixed groups was affected by the interaction activities among the participants.

Metacognitive Dimension

In the mixed group, the extroverted learners who plan out work by interacting with people tended to reach conclusions by planning and regulating their opinion with other extroverted and introverted learners. In conjunction with the dynamic interaction among the participants in the mixed group, the introverted learners who reflect on themselves, raise questions, and evaluate the discussion process continuously assessed their cognitive processes while they interacted. That is, the mixed groups were well-organized places in which the metacognitive knowledge and skills were processed by the participants in the group. The extroverted group was more focused on the metacognitive knowledge parts, which were composed of declarative knowledge about the involved people, tasks that should be done, and strategies that were needed to complete the discussion.

On the other hand, the introverted group was more focused on metacognitive skills that reflect the assessment of other learners' knowledge and skills as well as the supervision of one's cognitive processes and regulation of them (Thomas, 2002, 2003). It seemed that the heterogeneous group composition led to more in-depth, reflective, critical, and meaningful cognitive processes. In addition, the mean differences in the types of metacognition between the extroverted groups and the introverted groups depended on, in part, whether the ideas and opinion were expressed or not. Therefore, we may not conclude that the cognitive processes of the extroverted groups were more prevalent than those of the introverted group

because the participants of the introverted groups need much time to express their ideas as well as wait until their ideas were clarified.

FINAL REMARKS

Extroverted learners are likely to participate in Web-based discussion actively, since they are task-oriented (e.g. Buboltz, Young, & Wilkinson, 2003; Chen & Caropreso, 2004; Childress & Overbaugh, 2001; Daughenbaugh, 2002). They tend to enjoy learning with cooperation and going through the cooperative problem-solving process. This Web-based threaded discussion may not be appropriate for introverted learners, since they could be more passive during the discussions. Based on the result, it is suggested that groups comprise a mix of extroverted and introverted learners. Although extroverted learners have a tendency to participate, in the study, metacognitive interaction level is lower than those of mixed groups (Ahn & Ahn, 2000; Buboltz, Young, & Wilkinson, 2003). In addition, if a group is formed with introverted learners alone, the level of participation will be low, due to the nature of introverted learners, who respond to questions instead of raising them, as shown on the results of the study. Introverted learners may be stimulated to participate in the discussion by the instant feedback and new ideas raised by extroverted learners, while extroverted learners can benefit from in-depth discussion, due to the logical and in-depth arguments made by introverted learners. Moreover, mixed extroverted/introverted group composition can increase metacognitive instruction. In conclusion, mixed group composition can be considered and taken as an effective strategy to foster various interactions in Web-based threaded discussion.

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