

從領導與成員創造力人格觀點探討虛擬團隊的創造力績效

Exploring the Creativity Performance of Virtual Teams from the Perspectives of Leadership and Creative Personality

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摘要：虛擬團隊已成為新的任務單位，為提升團隊成員的創造力績效，企業必須同時從團隊的領導者與成員兩觀點進行探討。本研究採縱貫性研究方式，探討不同的領導激勵語言與成員創造力人格，對成員創造力績效的影響，採2×3實驗設計，將三校四個班級的180位大學生進行隨機指派分組，經四週的網路群體決策支援系統會議後，發現在創意構想量方面，領導者的同理心語言能明顯提升創新型與適應型人格成員的構想量，方向指引語言則能明顯提升中間型人格的構想量。在構想品質方面，創新型人格平均表現較佳，若成員在任務中傳達的構想量愈多，其構想品質也愈好。因此，建議虛擬團隊領導者在帶領成員執行任務時，應考量成員的人格差異，運用不同的激勵語言來鼓勵成員多發表意見與參考他人意見，並遴選創新型人格者來執行創意任務，此將有助於提升創造力績效。

關鍵字：虛擬團隊；領導；激勵語言；創造力人格；創造力

Abstract : The virtual team is a new type of work unit. In order to promote the creative performance of virtual team members, enterprises should explore relevant factors from the perspectives of both leadership and team members. The present study adopted a longitudinal approach to examine the effects of leaders' motivating language and members' creative personalities on the creative performance of virtual teams. This 2×3 experimental design project included 180 students from four classes at three universities who were randomly assigned to participate. After 4 weeks of on-line meetings on a web-based group decision support system, the following results were found: (1) the leader's empathetic language significantly improved the ideas of innovators or adaptors; (2) the leader's direction-giving language significantly improved the ideas of intermediates; and, (3) the innovators expressing more ideas showed superior quality in their creative performance. These results suggest that in order to promote members' creative performance, Leaders should consider members' creative personalities as well as choose appropriate motivating language to encourage members to express ideas. Meanwhile, leaders should select individuals with higher creative personality to deliver creative tasks.

Keywords : Virtual team; Leadership; Motivating language; Creative personality; Creativity

1. Introduction

In order to establish highly valuable and irreplaceable core competences for enterprises in the global market, the main challenge is to increase employees' creativity and formalize innovative environments (Shalley and Gilson, 2004). Consideration should be given to how to implement methods to increase employees' creativity at the individual, group, and organizational levels (Woodman, Sawyer and Griffin, 1993), as well as how to create synergy between individual characteristics and the organizational environment (Treffinger, Isaksen and Dorval, 2000). Creativity at the individual level is related to personality, motivation, and knowledge (Amabile, *et al.*, 1996). Creativity at the group or organizational level is correlated with training, job autonomy, supervisor and colleague support, leadership style, leaders' motivating language, rewards, and innovative climate (Amabile *et al.*, 1996; Isaksen *et al.*, 2000; Kahai, Sosik and Avolio, 2003; Mayfield and Mayfield, 2004). For example, Choi (2004a) discovered from his qualitative study of undergraduate students that dissimilar individual characteristics, motivations and abilities, and the social influences of peers and leaders in a group will produce differences in creative self-efficacy and degree of innovative motivation, resulting in an effect on individual creative behavior. Consequently, in order to increase members' creativity, organizations need to consider the possible influences of individual and organizational factors.

Ford's (1996) creative action theory addressed some of the main factors that affect creative performance, including motivation, personality, beliefs, emotions, knowledge and abilities. Furthermore, previous studies found that individual creative personality was highly related to creative performance (Kirton, 1976, 1988). Zhou and Oldham (2001) explored the relationship between creative personality and creative performance based on a sample of 68 undergraduate students who participated in a creative task (e.g. role playing). The result showed that people who tended to have creative personalities, indeed, did perform in a

more creative manner. Meneely and Portillo's (2005) study investigated the relationships among creative personality, cognitive style, and creative performance based on a sample of 39 undergraduate students, and found that a creative personality would significantly predict creative performance. Therefore, an individual's creative personality is a critical factor that influences creative performance.

However, prior studies focused primarily on the effects of members' creative performance at the individual level rather than the group level (Choi, 2004b). According to Woodman, Sawyer and Griffin's (1993) organizational creativity theory, individual creativity is influenced not only by individual factors, including personality traits, cognitive styles, knowledge and motivations, but also on group factors, including group composition (i.e., homogeneity versus heterogeneity), group characteristics (i.e., cohesiveness), group process (i.e., information processing), and the social influences generated from people's interactions with each other. Ocker (2005) recruited ten virtual teams from enterprises to participate in a qualitative study, and demonstrated that the collaborative climate in a virtual team and the constructive social influences among team members effectively increases their creative performance. Some enterprises have used testing tools to select appropriate employees who have creative personalities, such as the Kirton Adaptation Innovation Inventory (KAI) (Kirton, 1988) and the Torrance Tests of Creative Thinking (Torrance, 1974). After the selection process, employees presented similar or homogeneous personalities or creative thinking. Hence, the present study aimed to discover whether there was any difference in members' creative performance between a team made up of highly creative personalities and a team made up of less creative personalities. In other words, using the scenario of virtual teams that consisted of different levels of creative personalities, the present study explored the effects of virtual team members' creative personality levels on creative performance.

The person-environment fit theory illustrates that the higher the fit between the individual's characteristics or abilities and the organizational environment, the greater the member's creative performance (Choi, 2004b). That is to say, environmental factors play an important role in employees' creativity (Mumford

and Gustafson, 1988). Redmond, Mumford and Teach (1993) and Harborne and John (2001) agreed that leadership was the most important environmental factor that influences employees' creativity. Effective leadership can make employees engage more deeply in creative performance and achieve their challenging goals. Amabile *et al.* (1996) also found that employees' creativity and their creative performance were significantly influenced by the leaders' interaction with subordinates and their trusting and supportive relationship with subordinates.

Within the last decade, research has determined that leadership is vital for team effectiveness in a virtual environment. Evidence has shown that leadership behaviors within virtual teams had a significant impact on members' performance (Kayworth and Leidner, 2002). Specifically, some studies have classified leadership into transformational leadership and transactional leadership, as it relates to members' performance (Sosik, Avolio and Kahai, 1997, 1998; Kahai, Sosik and Avolio, 1997, 2003, 2004; Purvanova and Bono, 2009). Hambley, O'Neill and Kline (2007) concluded that past studies of leadership effectiveness in virtual teams had not yet identified the best leadership style. Based on the contingency leadership theory, effective leadership depends on various management contexts. For example, transactional leadership was a more efficient approach to facilitate teamwork than transformational leadership when team members knew each other's identities on the Internet. In contrast, transformational leadership was more efficient when the Internet behavior was anonymous. Furthermore, based on House's (1996) path-goal theory, effective leadership behavior emphasizes the fit between the environment and the employees. In summary, effective leadership relies on different situational factors. The present study applied the contingency leadership perspective to investigate which types of leadership behavior will increase creative performance when team leaders face various members' creative personalities.

The recent development of advanced information technology has changed the traditional face-to-face working conditions in organizations. Employees are able to utilize a network to discuss complex tasks and cooperate with others any time and anywhere. Due to the emergence of virtual teamwork, communication, leadership, and managerial models (Lipnack and Stamps, 1999; Cascio and

Shurygailo, 2003; Curseu, Schalk, and Wessel, 2008), the virtual team has been most typically defined as a group of members who have the same goals, working to accomplish their tasks with other members primarily via information and tele-communication technology (Hertel, Geister and Konradt, 2005). This new working style has become very popular with organizations (Hertel, Konradt and Orlikowski, 2004). However, virtual teamwork is more complicated than the traditional face-to-face work style. Leaders need to deliver and exchange information with members located in different places (DeSanctis, Wright and Jung, 2001). E-mail serves as a communication medium through both verbal and non-verbal language. Therefore, those verbal and nonverbal communications are the major elements of leadership in a virtual team. Sullivan (1988) developed a motivating language theory (MLT) that combines the concepts of leadership, motivation, and communication. Its goal was to transform the leader's traits into authentic communication with employees. Mayfield, Mayfield and Kopf (1995) used Sullivan's MLT as the basic linguistics of managerial communication, designated by three core speech approaches to stimulate employees' motivation to attain organizational goals. These three approaches include direction-giving, empathetic, and meaning-making. Virtual team leaders often use different speech approaches to motivate their team members. Therefore, the present study examined the effects of virtual team members' creative personalities on creative performance when leaders used different approaches to motivating language.

Many previous studies regarding virtual teams focused on developing the functions of communication information tools such as group decision support systems (Klein and Dologite, 2000; Dennis, Wixom and Vandenberg, 2001). Massetti (1996) demonstrated what types of technology tools can be effectively delivered for training programs, especially in creativity. Hambley, O'Neill, and Kline (2007) investigated the effects of different communication media on teamwork. Kahai, Sosik, and Avolio (1997, 2003) discussed the impact of leadership style, task structure, anonymity, and reward-sharing on the degree of team participation, efficiency, and task satisfaction. Unfortunately, prior studies of virtual teams did not consider individual trait differences before the members were randomly assigned to join the experimental study. In addition, few studies

have been done to determine what types of leadership behavior were suitable for virtual team members with different personalities, to increase their creative performance in virtual teamwork. As virtual teams are used more frequently in enterprises, research on the relationship between individual and environmental factors and creative performance becomes more important. Accordingly, the present study explored the effects of leaders' motivating language and creative personalities on members' creative performance, from the perspectives of both the leaders and the subordinates. The virtual team consisted of a group of people with similar creative personalities.

2. Literature Review

2.1. Creative Personality and Creative Performance

Individuals' professional abilities and personal characteristics are key influences on creative performance. Past research has addressed the effects of personal cognitive styles, personal characteristics and inner motivation on creative performance (Amabile, 1988; Woodman, Sawyer and Griffin, 1993; Oldham and Cummings, 1996). In terms of cognitive styles, Kirton (1976) discussed the relationship between creative personality and creative performance and concluded that an individual's creative personality was significantly and positively correlated with cognitive style, and both of them influenced creative performance.

Kirton (1976) developed an Adaption-Innovation (KAI) inventory to measure the creative personality by testing 532 participants in England with similar backgrounds. This inventory passed reliability and validity tests in some cross-cultural samples. Hence, the KAI was developed with 32 items divided into three dimensions: originality, efficiency, and rule/group conforming. The scores ranged from 32 to 160 and creative personality was classified into two types: innovator (those with higher scores) and adaptor (those with lower scores). Kirton (1976, 1989) demonstrated that innovators tend to be risk-seeking, unconventional thinkers, approaching tasks from unsuspected angles, bold in ideation, and creating dissonance. They are more suitable for innovative and

challenging jobs. In contrast, adaptors tend to follow the original rules, solve problems guided by the structure given, and expect to have jobs with more continuity, safety and stability.

There are numerous studies regarding the relationship between creative personality and individual performance. For example, Arunachalam, Sweeney and Kurtenbach (1997) used 149 undergraduate students to examine the relationship of KAI with task performance. The results showed that innovators performed better than adaptors on inorganic missions. Buttner, Gryskiewicz and Hidore (1999) selected 105 management staff members to assess their creative personality and performance; the results showed that staff members who tended to be innovators had better managerial ability. In addition, Gallivan (2003) used a sample of 220 software engineers and found that the creative personality had an impact on job attitudes and performance during the software development process. The results revealed that innovators had higher job satisfaction and better performance than adaptors. Moreover, Cheng *et al.* (2007) explored the effects of creative personality and different project problems on R&D work performance by testing 205 project managers. The results revealed that innovators performed better on assigned projects that had open-ended problems than adaptors did; however, adaptors performed better with assigned projects that had closed problems. Based on the research cited above, the conclusion is that innovators have better creative performance when it comes to creative tasks. However, a gap remains in the understanding of whether creative personality can effectively predict creative performance in a virtual team formed with a group of people who have similar creative personalities. Therefore, the research hypotheses are as follows:

H1a: Creative personality has a positive main effect on the creative performance (idea generation through on-line meetings) of a virtual team.

H1b: Creative personality has a positive main effect on the creative performance (quality of creative ideas generated through on-line meetings) of a virtual team.

2.2. Virtual Team Leadership

In the past, researchers have investigated leadership in virtual teams using the Input-Process-Outcome model. The leadership factor was set up as one of the input variables. The purpose was to compare the effects of transformational and transactional leadership, or participative and directive leadership, on teamwork processes and on work outcomes (e.g., Kahai, Sosik and Avolio, 2003, 2004).

Among the research on virtual team leadership, Sosik, Avolio and Kahai (1997) used a Group Decision Support System (GDSS) and the electronic brainstorming method with 96 undergraduate students assigned to 36 virtual groups, to examine the impact of different leadership types on group effectiveness. They found that during anonymous on-line meetings, group effectiveness was enhanced more by transformational leadership than by transactional leadership. Later, Sosik, Avolio and Kahai (1998) used Electronic Meeting Systems (EMS) and the electronic brainstorming method to conduct experimental research with 159 anonymous undergraduate students assigned to 36 virtual groups. The purpose was to discover how transformational and transactional leaderships affect group members' creativity. The results showed a positive correlation between the goal-setting behavior dimension of transactional leadership and the motivating behaviors of transformational leadership. However, there was a negative correlation between the direction-giving and empathetic dimensions of transformational leadership and group members' creativity. These results were interpreted to mean that the participants might be unfamiliar with use of the system, so that they misunderstood direction-giving and empathy as control mechanisms and were reluctant to perform creatively.

Kahai, Sosik and Avolio (2003) randomly assigned 118 undergraduate and 36 graduate students to 39 virtual teams to examine their leadership styles, reward methods, and Internet anonymity. The results showed that when participants' personal information could be identified on the Internet, the participants who accepted transactional leadership had higher group efficacy and task satisfaction than those who accepted transformational leadership. On the other hand, when personal information was hidden on the Internet, the results showed that the

participants who accepted transformational leadership had better group efficacy and task satisfaction. Kahai, Sosik and Avolio (2004) assigned undergraduate students to 24 groups to examine the differing influences of participative leadership and directive leadership on creative performance. The results showed that both types of leadership helped increase members' participation rate. Participative leadership helped to increase performance but led to lower task satisfaction. Furthermore, Wang, Chen and Fan (2006) randomly assigned 57 undergraduate students majoring in business management to 12 virtual teams. The authors invited graduate students to serve as team leaders. The purpose was to determine how different leadership styles and feedback influenced members' creative performance. The results demonstrated that transformational leadership had a significant positive effect on members' creative thinking. The members who did not receive feedback had better creative performance than those who received rewards. Purvanova and Bono (2009) compared the relationship between transformational leadership and team performance in a virtual team and in a face-to-face team. Each team consisted of three undergraduate students and one team leader. A total of 39 virtual teams were involved in this study. The results showed that transformational leadership was more positively correlated with team performance in the virtual environment than in under face-to-face conditions.

In summary, there are no consistent, generalizable conclusions about what leadership styles better promote members' creative performance. Under different team conditions, different leadership styles have different effects. Therefore, an effective virtual team leader needs to consider such factors as the mission's construction, reward system, and discussion methods, and then use the most effective leadership style (Kirkman *et al.*, 2002). Hence, the present study looked at different leaders' motivating language in a virtual team environment to examine the outcomes of different creative personalities.

2.3. Motivating Language, Creative Personality, and Creative Performance

Earlier behavioral approaches to leadership suggest that the effective leaders are those who engage in two basic activities: initiating structure and consideration.

Initiating structure refers to task-related activities, whereas consideration is related to the extent of care and concern for team members (Schriesheim, Cogliser and Neider, 1995). Based on this leader behavior theory and the concept of directive/supportive leadership in the Path-Goal Theory, Sullivan's (1988) Hierarchical Leadership Theory synthesized both Expectancy Theory and Goal-setting Theory. It transformed the traditional leader behavioral approach to verbal motivating language. Verbal communication is a strategic method for leaders to control, motivate and direct subordinates to reach an organization's vision, or to help subordinates reach their own goals. Leaders also use verbal communication to decrease mission uncertainty, motivate subordinates' personal development, transmit the company's rules, make members feel they are being treated considerately, and eventually improve their performance (Mayfield, Mayfield and Kopf, 1995; Mayfield, Mayfield and Kopf, 1998).

Effective communication between leaders and subordinates plays an important role in increasing organization innovation (Lievens, Moenert and S'Jegers, 1999). In the leader-subordinate verbal communication model, Mayfield, Mayfield, and Kopf (1995) applied Sullivan's (1988) Motivating Language (ML) theory to develop a scale to measure leaders' motivating language, which was divided into three categories: (1) Direction-giving: leaders use direction-giving language to clarify job duties, goals and responsibilities; (2) Empathetic: leaders show their consideration to subordinates and express their emotional understanding to them; and, (3) Meaning-Making: leaders transmit or explain the rules, cultural norms and expectations to subordinates. Motivating language has been verified as a critical communication skill, and is well established in support of modern leadership theories (Mayfield and Mayfield, 2004).

Mayfield, Mayfield, and Kopf (1995) collected a sample of 151 pairs of leaders and subordinates. The authors confirmed good reliability and validity, and also demonstrated that leaders' motivating language can positively improve subordinates' satisfaction with communication with leaders and with leaders' communication competence. Mayfield, Mayfield, and Kopf (1998) sent out 450 questionnaires to employees and 164 questionnaires were valid. The results showed that leaders' motivating language could significantly improve employees'

job performance and job satisfaction. Moreover, with every 10% increase in leaders' motivating language, there was a 7% increase in job satisfaction and a 2% increase in job performance. Mayfield and Mayfield (2004) used an experimental sample of 133 students to examine the impact of leaders' motivating language on creativity. The results showed a strong and significant link between leaders' motivating language and subordinates' creative performance. Furthermore, Sharbrough, Simmons, and Cantrill (2006) reviewed 134 questionnaires returned from 136 subordinates, and found that a leader's motivating language could improve leadership efficacy, satisfaction with communication with subordinates, job satisfaction, and communication competence. In conclusion, leaders' motivating language had significant, positive relationships with subordinates' communication satisfaction, job satisfaction, job performance, and creative performance.

To date, the self-reported questionnaire, rather than experimental design research, has been the main method used to examine leaders' motivating language in virtual teams. Previous literature reviews regarding leadership efficacy in virtual teams supports the conclusion that different leadership styles might have different leadership effects. Besides, from the perspective of Contingency Theory, leadership styles need to fit with context factors such as the organizational system, mission structure, leader-subordinate relationship, and subordinates' traits (Robbins, 1998). In summary, when virtual leaders use different motivating language or face different creative personalities, the effects and results might vary. The hypotheses were stated as follows:

H2a: There is a positive main effect of leaders' motivating language (Direction-Giving and Empathetic) on team members' creative performance (idea generation through on-line meetings) in a virtual team formed by a group of people with similar creative personalities.

H2b: There is a positive main effect of leaders' motivating language (Direction-Giving and Empathetic) on team members' creative performance (quality of creative ideas generated through on-line

meetings) in a virtual team formed by a group of people with similar creative personalities.

H3a: There is a significant interactive effect of creative personality and leaders' motivating language (Direction-Giving and Empathetic) on team members' creative performance (idea generation through on-line meetings) in a virtual team.

H3b: There is a significant interactive effect of creative personality and leaders' motivating language (Direction-Giving and Empathetic) on team members' creative performance (quality of creative ideas generated through on-line meetings) in a virtual team.

3. Method

To examine the influence of different creative personalities and motivating language on team members' creative performance, the present study was conducted with a 3×2 experimental design in a longitudinal approach.

3.1. Participants and Experimental Design

The present study included 188 students majoring in management to partially fulfill their course requirements. They were sophomore or junior students taking Human Resource Management courses in 4 classes of three universities located in central and southern Taiwan. To minimize threats to internal validity, students with similar ages and management backgrounds were selected. Before the experiment began, all students were required to take the Kirton Adaption-Innovation Inventory (KAI) in order to divide them into the appropriate groups. Simultaneously, a designated researcher delivered training on the use of the group decision support system (TeamSpirit software) to all 4 classes. The study excluded 8 students due to their absence from the KAI test or the training; so 180 students participated.

The participants were divided into 3 groups according to their KAI score rankings. The 3 groups were called the Innovators, the Adaptors and the

Intermediates, as defined by Kirton's definition of creative personality theory. Each group had 60 students, and they were randomly assigned to 20 teams. Half of the teams were given direction-giving motivating language, and half received empathic motivating language. Table 1 illustrates the experimental design. The 6 situations were categorized by the different creative personalities and by the 2 types of motivating language.

Table 1
Experiment Design

Motivating Language	KAI personality		
	Innovator	Intermediate	Adaptor
Direction-Giving	Treatment 1 (10 groups)	Treatment 2 (10 groups)	Treatment 3 (10 groups)
Empathetic	Treatment 4 (10 groups)	Treatment 5 (10 groups)	Treatment 6 (10 groups)

3.2. Variables and Measures

The independent variables in the present study were creative personalities and motivating language.

3.2.1. KAI

Kirton's KAI inventory (Kirton, 1988) was adopted to evaluate the students' creative personalities. The KAI inventory has been validated through expert evaluation of content validity, cross-cultural validity, criterion-related validity, reliability, and discriminant validity (Tullett and Kirton, 1995; Bagozzi and Foxall, 1995; Bobic and Davis, 1999), making it a very reliable and valid instrument to evaluate the creative personality. The KAI inventory has 32 items in three dimensions: 1) Originality, which refers to the personal attitude of developing and coping with creative ideas; 2) Efficiency, which refers to the degree that individuals pay attention to details and thoroughness; and, 3) Conformity, which refers to the degree to which a person agrees to the rules or group norms (Kirton, 1976). The total KAI score reflects the individual's creative personality. According to Kirton (1988), a person with a higher score can be categorized as an Innovator; on the other hand, a person with lower score is categorized as an

Adaptor. Therefore, participants' scores were ranked from high to low, and then divided them into three groups called the Innovators, the Intermediates, and the Adaptors. The Cronbach's alpha reliabilities of the three dimensions of creative personality were 0.82, 0.74 and 0.75, respectively, and the Cronbach's alpha reliability of the total KAI scale was 0.77. In addition, an analysis of variance (ANOVA) was performed and the result was significant ($F(2,177) = 311.14, p < .01$), indicating the three styles were distinguishable.

3.2.2. Instrumentation of the Motivating Language Scripts

We adopted the concepts of motivating language developed by Sullivan (1988) for this research. In the experimental design, only two approaches to the motivating language were manipulated, the direction-giving and empathetic approaches, with the meaning-making approach controlled since all subjects were asked to follow the same rules and use the same web-based group decision support system to finish the required task. In addition, communication was conducted through e-mail instead of face-to-face in the virtual team environment. Therefore, the researchers needed to design and develop motivating language scripts in order to manipulate the experimental conditions. The scripts were written with four direction-giving and four empathetic approaches in order to provide feedback to the members during the experiment. Since the script is a newly developed measurement, according to Schriesheim *et al.* (1993), the first step to demonstrate the validity of a newly developed instrument is to show the content adequacy of the instrument. Accordingly, in order to validate the motivating language scripts developed by the researchers, the following instrumentation procedures were implemented.

First, 213 EMBA students from 10 universities in central Taiwan were invited to test the scripts. Then, 11 students were excluded due to incomplete participation, leaving a valid sample of 202. The procedures recommended by Schriesheim *et al.* (1993) were followed to validate the content adequacy of the motivating language scripts. The researchers explained the definitions and examples of the three different motivating language types, and the EMBA students then read one motivating script, picked at random, and indicated what

kind of motivating language the script was by completing the motivating language scale developed by Mayfield, Mayfield, and Kopf (1998). The average accuracy rate reached 90% (Table 2). Furthermore, the content accuracy was assessed by examining the mean scores of two different scripts (direction-giving and empathetic). The results are shown in Table 3. For direction-giving scripts, the mean score for direction-giving was significantly higher than that for empathy. Similarly, for empathetic scripts, the average score for empathy was significantly higher than that for direction-giving. These results indicated that the participants could distinguish the different versions of the scripts.

In summary, the construct of the motivating language scripts was theoretically defined, and the scripts adequately represented the content domain of the underlying theoretical construct; therefore, the scripts the researchers developed had high content accuracy (Schriesheim *et al.*, 1993).

Table 2
The Content Accuracy of the Motivating Language Scripts

Feedback	Motivating Language (script)	Direction-Giving	Empathetic	Meaning-making	Accuracy (%)	Average Tenure (year)
1st	Direction-Giving	18	0	2	90.00	13.60
	Empathetic	1	23	0	95.83	17.38
2nd	Direction-Giving	22	0	1	95.65	14.52
	Empathetic	0	23	1	95.83	12.36
3rd	Direction-Giving	25	0	0	100.00	17.24
	Empathetic	1	23	0	95.83	11.18
4th	Direction-Giving	24	3	1	85.71	12.61
	Empathetic	1	31	2	91.18	12.00
Total	Direction-Giving	89	3	4	92.71	14.48
	Empathetic	3	100	3	94.34	13.17

3.3. Definitions and Measures of Dependent Variables

Both quantitative and qualitative aspects of a participant's creative performance were assessed in the current study. The quantitative aspect of creative performance was defined as the number of creative ideas being produced for a given decision task (Guilford, 1968; Saletta, 1978). Therefore, the quantity of creative performance in the present study was measured by the ideas generated

during the on-line meetings, each time and as a whole. Meanwhile, the qualitative aspect of creative performance was defined as the quality of the decisions made for a certain task. The 3 criteria of idea quality were novelty, feasibility, and thoroughness of the idea (Torrance, 1974; Massetti, 1996).

Table 3

The Differences in Mean Scores on Motivating Language Scripts

Feed back	Motivating Language (script)	n	Direction-Giving		Empathetic		df	Direction-Giving	Empathetic
			Mean	S.D.	Mean	S.D.		t	t
1st	Direction-Giving	20	3.72	0.49	2.68	0.71	42	4.83**	-4.44**
	Empathetic	24	2.77	0.78	3.65	0.73			
2nd	Direction-Giving	23	3.61	0.64	2.88	0.82	45	2.62*	-6.20**
	Empathetic	24	3.00	0.90	4.21	0.64			
3rd	Direction-Giving	25	3.69	0.30	3.14	0.69	47	5.65**	-5.67**
	Empathetic	24	2.67	0.84	4.13	0.50			
4th	Direction-Giving	28	3.62	0.38	3.56	0.74	60	2.90**	-3.90**
	Empathetic	34	3.21	0.71	4.21	0.49			
Total	Direction-Giving	96	3.66	0.45	3.10	0.80	200	7.74**	-9.37**
	Empathetic	106	2.94	0.82	4.06	0.62			

Note: + $p < .10$; * $p < .05$; ** $p < .01$

3.3.1. The Quantity of Creative Performance (On-line Idea Generation)

After each on-line meeting, the researchers reviewed and calculated the number of ideas generated during the meeting. Repetitive and similar ideas were excluded from the calculation. In addition, the procedures recommended by Massetti (1996); Kahai, Sosik, and Avolio (2003 and 2004) were followed to calculate the amount of ideas generated by each group.

3.3.2. The Quality of Creative Performance

A written proposal regarding the recruitment plan for an insurance company was the final assignment for the participants after the on-line meetings. A standard

report format was used to decrease potential experimental bias. The participants were requested to submit the following content in the proposal: the ideas generated in each brainstorming meeting, the best idea/solution generated in each brainstorming meeting, the reason the best idea/solution was selected, how the recruitment activity would be planned, the advantages/disadvantages of the solutions, and personal reflection on the planned activity. The proposal was required to be submitted within 1 week after the last on-line meeting. The researchers evaluated the proposals based on the following criteria: 1) novelty, the extent to which each proposal was rated as new and unique (scaled from 1 to 10); 2) feasibility, the extent to which each proposal was rated as realistic and sensible (scaled from 1 to 10); 3) thoroughness, the extent to which each proposal was rated as complete and detailed (scaled from 1 to 10); and, 4) overall score, a score generated by evaluating the whole proposal (scaled from 1 to 100).

3.4. The Group Decision Support System

The Group Decision Support System (GDSS) used in the present study, called "TeamSpirit", was developed by Wang and Chen (2006). The TeamSpirit system followed the Creativity Problem Solving (CPS) processes and included 3 procedures: problem identification, solution suggestions, and solution implementation. TeamSpirit allows members to generate, consolidate, and evaluate ideas in a virtual environment and support divergent and convergent thinking in the creative problem-solving process. There are facilitating tools in the system, such as an information-sharing platform, a discussion forum, and brainstorming. Members can hold on-line meetings without the limitations of time, space, and location.

3.5. Experimental Procedures

The experimental procedures took place over 3.5 months. Before the experiment started, the researchers designed, developed, and pre-tested the motivating language scripts. The targeted participants were also asked to fill out the KAI personality questionnaire in order to assign them to the appropriate groups.

3.5.1. Training

Before the experiment began, the researchers conducted training sessions for the 4 classes at the 3 participating universities. To avoid experimental bias, all training sessions were delivered by the same person. The training began with an introduction to the TeamSpirit system (5 minutes). The participants then began to create a log-in account and introduced themselves by 10 sentences starting with “I am...” The trainers then used activities to encourage the participants to use the information-sharing system and the brainstorming system, as well as the discussion forum system, in order to help them become familiar with the functions of TeamSpirit.

3.5.2 On-line Meetings

There were 4 on-line meetings during the 4-week experimental period. Each meeting lasted for 5 days. Before the first meeting began, the researchers e-mailed a task announcement and announced the beginning of the on-line meeting. Members began to introduce themselves and shared information regarding the task. This information-sharing session lasted for 4 weeks before the first brainstorming began. In the brainstorming sessions, members were encouraged to generate ideas and choose the best solution to deliver the tasks. After each brainstorming session, the researchers gathered all ideas generated and eliminated the ideas that were repetitive or similar. The researchers, who also served as the team leaders, used the designed motivating language scripts to provide feedback to their members. At the end of the on-line meetings, the participants received the standard proposal format and were asked to submit the proposal on-line in a week. Table 4 shows the detailed agendas of the online meetings.

4. Results

4.1. The Effects of KAI and ML on Creative Performance (Idea Generation)

This experiment had 4 on-line meetings (3 brainstorming sessions and 1

discussion forum). Since the content of the discussion forum was less structured, and less related to creative idea generation, only the ideas generated from the 3 brainstorming sessions were considered. The final experiments excluded 6 students because they did not complete the course, which left 174 students in the final sample.

Table 5 presents the impact of the KAI and motivating language on idea generation, and the interaction effect of KAI and motivating language. The results show that KAI and motivating language had no significant main effects on creative performance. The average number of ideas generated by the innovators was 6.26, while the intermediates generated 5.44, and the adaptors generated 7.47 ($F = 1.494, p > .05$). The average number of ideas generated after direction-giving language was 6.74, and 6.08 were generated after empathetic language ($F = .483, p > .05$), indicating that KAI and motivating language had different effects on individuals' creative performance.

However, the results indicated significant interaction effects of KAI and motivating language on idea generation ($F = 3.163 \sim 5.604, p < .05$). These results suggest that motivating language may have facilitated KAI in promoting creative performance by individuals under certain conditions. Table 6 shows a comparison of the mean values for idea generation with different KAI and motivating languages. The mean comparison results show that the innovators and adaptors who received empathetic motivating language had better idea generation results, compared with the intermediates. The intermediates who received direction-giving motivating language had better idea generation results, compared with the innovators and the adaptors. Specifically, the t-test results pointed out that the innovators who received empathetic motivating language had better idea generation results during the second brainstorming session ($t = -2.019, p < .05$) and on their total idea generation responses ($t = -1.679, p < .10$), compared with individuals who received direction-giving motivating language. The adaptors who received empathetic motivating language produced more ideas than the others ($t = -1.682 \sim -2.182, p < .10$) during the first and third brainstorming sessions and on the total idea generation responses. However, the intermediates who received direction-giving motivating language produced more ideas ($t = 2.035 \sim 2.590, p$

< .05) than those who received empathetic motivating language during the second and third brainstorming sessions, and on the total idea generation responses.

Table 4
Agendas of the On-line Meetings

Agenda	Meeting Objectives	Tool	Duration
	1 st meeting notice and task announcement on the campus recruitment activity.	e-mail	2 days
	Member introductions and information sharing about the task.	Information Sharing	4 weeks
Meeting 1	Idea generation on the task and choose a best approach for delivery of the task.	Brainstorming	5 days
	2 nd meeting notice and 1 st feedback from leader.	e-mail	2 days
Meeting 2	Members were asked to identify possible obstacles when delivering the task.	Brainstorming	5 days
	3 rd meeting notice and 2 nd feedback from leader.	e-mail	2 days
Meeting 3	Members were asked to seek out possible solutions to the obstacles identified in Meeting 2.	Brainstorming	5 days
	4 th meeting notice and 3 rd feedback from leader.	e-mail	2 days
Meeting 4	Members were asked to identify possible obstacles when delivering the solutions identified in Meeting 3.	Discussion Forum	5 days
	4 th feedback from leader, final report format, and report submission reminder were emailed out to all members.	e-mail	2 days
	Team members made final decision on the solution and submitted the final report.	Information Sharing	1 week

Table 5
Interaction Results of the KAI & ML on Creative Performance
(Idea Quantity)

On-line Meeting	Main Effect				Interaction	
	KAI		ML		KAI × ML	
	<i>F</i>	<i>df</i>	<i>F</i>	<i>df</i>	<i>F</i>	<i>df</i>
1 st Brainstorming	.392	2,135	1.235	1,135	3.163*	2,135
2 nd Brainstorming	.421	2,135	.139	1,135	4.891**	2,135
3 rd Brainstorming	.150	2,135	.425	1,135	5.604**	2,135
Total	1.494	2,168	.483	1,168	4.563*	2,168

Note. * $p < .05$; ** $p < .01$

It is interesting that within the direction-giving motivating language groups, the intermediates generated more ideas ($F = 3.114, p < .10$) than the other groups during the second brainstorming session, yet the intermediates generated fewer ideas than the other two during the third brainstorming session as well as for total idea generation responses ($F = 5.260, p < .01$; $F = 4.795, p < .05$, respectively). Figure 1 depicts the interaction effects of the different KAI and motivating language groups.

In summary, if the virtual team leader uses empathetic motivating language with individuals with higher- or lower-than-average creativity personalities, it will have a better effect on their creative performance. However, individuals with average creative personality will have better results if the leader uses direction-giving motivating language.

4.2. The Effects of KAI and ML on Creative Performance (Idea Quality)

The students' proposals, submitted online, were evaluated and scored according to their novelty, feasibility, thoroughness, and the total quality of their reports. A subset of the proposals ($n = 20$) were used to assess inter-rater reliability. Unfortunately, the ratings were not highly correlated among the raters; therefore, the ratings were transformed into standardized scores for further data analysis.

Table 6
Mean Comparisons of Idea Generation with different KAI and ML

On-line Meeting	ML	KAI			F	Post hoc
		1. Innovator (n = 57)	2. Intermediate (n = 57)	3. Adaptor (n = 60)		
1 st Brainstorming	Direction-Giving	1.600	2.500	1.654	1.997	
	Empathetic	2.304	1.652	3.000	1.671	
	<i>t</i>	-1.456	1.382	-1.792 ⁺		
2 nd Brainstorming	Direction-Giving	2.148	4.000	2.778	3.114 ⁺	2 > 1
	Empathetic	3.652	1.842	4.000	2.347	
	<i>t</i>	-2.019*	2.590*	-1.223		
3 rd Brainstorming	Direction-Giving	2.800	3.556	2.333	1.465	
	Empathetic	2.870	1.720	3.393	5.260**	3 > 2
	<i>t</i>	-1.06	2.173*	-2.128*		
Total	Direction-Giving	5.133	7.185	6.033	0.401	
	Empathetic	7.519	3.867	8.900	4.795*	3 > 2
	<i>t</i>	-1.679+	2.035*	-1.682+		1 > 2

Note: ⁺*p* < .10 ; **p* < .05

Figure 1
The Effect of Interaction of KAI & ML on the Quantity of Creative Performance (Idea Generation)

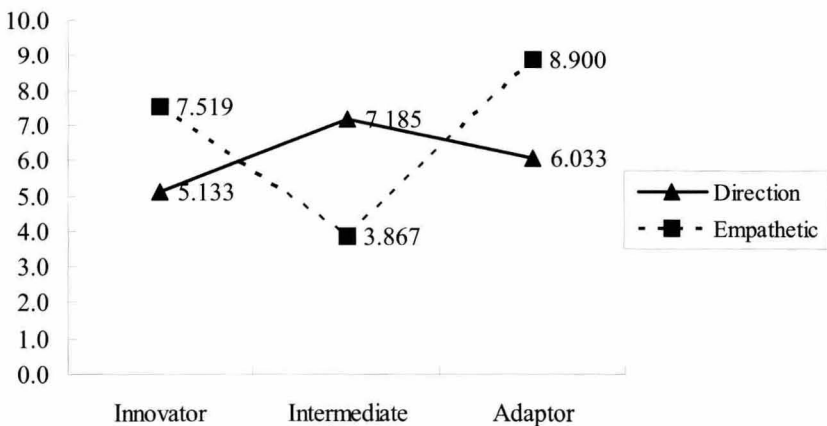


Table 7 presents the influence of the KAI and motivating language on the quality of creative ideas. The results indicate that the KAI scores had significant main effects on the quality of creative ideas, except on the criterion of thoroughness. However, the motivating language had neither significant main effects nor interaction effects on any of the evaluation criteria. In the *post hoc* analysis, the innovators' scores were higher than the intermediates' on novelty, feasibility, and total quality of the ideas, indicating that individuals with higher creative personality scores will perform better with respect to idea novelty, idea feasibility, and creative performance.

In addition, the researchers performed a correlation analysis on idea quantity and idea quality. The results suggest that on-line idea generation (idea quantity) is significantly and positively correlated with novelty ($r = .154, p < .05$), feasibility ($r = .159, p < .05$), thoroughness ($r = .210, p < .01$), and total quality ($r = .232, p < .01$). This finding suggests that the more ideas an individual produces on-line, the better the creative quality of the proposal.

Table 7
Interaction Results of the KAI & ML on Creative Performance
(Idea Quality)

Criteria	Main Effect					Interaction	
	KAI			ML		KAI × ML	
	<i>F</i>	<i>df</i>	Post hoc	<i>F</i>	<i>df</i>	<i>F</i>	<i>df</i>
Novelty	3.588*	2,166	Innovator > Intermediate	2.843	1,166	.847	2,166
Feasibility	3.065*	2,166	Innovator > Intermediate	.674	1,166	.399	2,166
Thoroughness	.242	2,166		.058	1,166	.328	2,166
Total	3.024*	2,166	Innovator > Intermediate	.306	1,166	.079	2,166

Note: * $p < .05$

5. Conclusion

5.1. Discussion

Virtual teams outperform the traditional face-to-face working environment. They allow members to communicate with each other anytime and anywhere, using technology tools such as web conferences, group decision support systems, and e-mail. In other words, virtual teams reduce the constraints of time and place. However, virtual teams might cause distinctive managerial contexts or problems. For example, it is difficult to build mutual trust among team members, due to misunderstanding, distortion, and incomplete expression during the communication process (Warkentin, Sayeed, and Hightower, 1997). Under such circumstances, team members need to obtain more feedback from leaders and suggestions that guide them to implement tasks or provide care to other members for the purpose of increasing the team's cooperation and effectiveness. Thus, the virtual team leader's communication behaviors are one of the main factors that affect members' performance.

Past studies were concerned with the effects of transformational leadership, transactional leadership (e.g., Sosik, Avolio, and Kahai, 1997; Purvanova and Bono, 2009), and participative and directional leadership (e.g., Kahai, Sosik and Avolio, 2004) on team performance. However, prior studies regarding the leadership of virtual teams rarely addressed the impact of the types of motivating language on members' creative performance, and did not consider the differences in members' personalities before samples were randomly assigned in the experimental design. The current study explored the effects of leaders' motivating language and members' creative personalities on creative performance, from the perspectives of both leaders' language and members' individual differences. The first findings from the study revealed that the effect of leaders' motivating language varied, depending on the members' creative personalities. It helped motivate more on-line idea generation. The second finding was that innovators had a higher quality of idea creativity. The final finding was that the more ideas the members generated, the better the quality of idea creativity, which is

consistent with the results of some prior studies (Torrance, 1974; Massetti, 1996; Wang and Horng, 2002).

First, the results of members' idea generation through on-line meetings revealed that neither leaders' motivating language received by members, nor creative personality, had a main effect on creative performance (Hypotheses 1a and Hypothesis 2a were rejected), but significant interaction did have a main effect on creative performance (Hypothesis 3a was accepted). For innovators and adaptors, there was more idea generation when empathic motivating language was used. This result can be interpreted to mean that when clear guidance was given to innovators, they were more reluctant to be bound by rules or to just follow (Kirton, 1989). If more encouragement and caring were provided to innovators by empathetic language, they were more willing to express their ideas and their creativity. On the other hand, if more encouragement and caring were provided by empathetic language to the adaptors, who were initially more likely to follow the rules and tasks, they had much higher motivation to express their ideas. In addition, intermediates had more idea generation when they received direction-giving language. It may be that intermediates feel reluctant to obey the rules and dislike standard guidance. Therefore, it would be helpful for intermediates to receive clear and specific directions or suggestions to increase their ideas or creativity. These results could be explained by face-to-face contingency leadership theory, such as Fieldler's contingency leadership model (1967) and path-goal theory (House, 1996). Both of these theories agreed that the style of leadership was determined by different employees' traits.

Second, the results showed that only creative personality achieved significantly positive main effects on the scores for innovation, feasibility and quality (Hypothesis 1b was accepted and Hypotheses 2b and Hypothesis 3b were rejected). Innovators achieved higher quality of creative performance and performed better than intermediates. Our interpretation of this result is that innovators preferred to receive new ideas and adopt creative thinking, and also were more likely to propose unique ideas. This result is consistent with prior studies regarding creativity (Kirton, 1976; Wang and Horng, 2002; Gallivan, 2003). Another result in the present study demonstrated that idea generation

through on-line meetings had a significantly positive association with the quality of creative ideas generated through on-line meetings. This result indicates that effective leadership can help motivate members to express their ideas for the purpose of increasing the quality of creative ideas and creative performance. This result was consistent with previous studies (Amabile *et al.*, 1996; Shin and Zhou, 2003).

5.2. Implications

Based on the results of the present study, enterprises can understand how to help virtual team members increase their creative performance. First, it is important for virtual leaders to select appropriate motivating language according to the individual's personality. A similar concept can be found in the traditional, face-to-face communication of contingency leadership theory. Shin and Zhou (2003) collected questionnaires from 333 employees and 77 supervisors and found that transformational leadership better motivated the conservation type of members' creativity. Moreover, Oldham and Cummings (1996) discovered from a survey of 171 employees in the manufacturing industry that supportive leadership increased the creative performance of employees with highly creative personalities. Second, enterprises are encouraged to use the KAI to identify and select innovators to form virtual teams, in order to improve the quality of idea creativity. Third, virtual team leaders need to encourage members to discuss and share information on-line in order to help them increase the quality of creative performance. This is true because the opinions are recorded on the meeting system, and may inspire brainstorming between members in order to produce more creative ideas (Osborn, 1963).

5.3. Limitations and Recommendations for Future Study

As with prior studies concerning leadership in virtual teams (e.g., Sosik, Avolio, and Kahai, 1997; Kahai, Sosik, and Avolio, 2003, 2004; Purvanova and Bono, 2009), the cause-effect relationship among variables can be examined in this experimental research, but only targeted students were used in the experimental sample. Therefore, external validity is still a concern, and was

difficult to avoid in the present study. Selecting practitioners to join the virtual teams as the experimental samples for future studies is encouraged. This could increase the reliability and the range corollary of the study results. Moreover, because the sample in the present study consisted of university students majoring in the management field, the experiment could develop more management-related tasks for students. The results from the students assigned management tasks might be distinct from real business operations. Hence, the selection of different kinds of team tasks could be included in future studies. In addition, there was a limitation in the present study, in that the virtual teams were homogeneous, composed of groups who shared similar creative personalities. The results from the homogeneous teams in the present study were different from the results from heterogeneous teams randomly formed by different creative personalities in business enterprises. If heterogeneous teams can be designed for study, more participants would be needed for this experimental design. Therefore, future studies can examine the different effects of leadership on members' creativity between homogeneous teams and heterogeneous teams. The final limitation was the difficulty in avoiding the possibility that team members within the same group communicated via face-to-face discussion, although the sample students were randomly selected across three universities. Virtual teams working across countries or regions, and across samples such as Taiwanese students and American students, or even global cooperation from different areas, is strongly encouraged.

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