

# Exploring the Role of Self-Confidence, Need-for-Cognition, and the Degree of IT Support on Individual Creativity: Multilevel Analysis Approach

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**Abstract** In today's creative economy, individuals generally have not been regarded as reservoirs of creativity who yield sustainable growth in hypercompetitive markets. Individuals rely on IT support to reduce clerical loads and enhance the effectiveness and efficiency of their work as well. When they work in teams, they also require self-confidence and the need for cognition to promote their individual creativity. Data were derived from the members of a large system integration company in South Korea ( $N = 256$ , 50 teams). As the study considered variables at both the team and individual levels, we adopted a multilevel analysis approach. We found that individual self-confidence, which indicates the degree of perceived possibility of success at a task, and the need for cognition, the intrinsic motivation to engage in and enjoy thinking, affected individual creativity significantly. Further, the degree of IT support, the team-level variable, had a significant effect on individual creativity. The degree of IT support did not have a significant effect on the relationship between self-confidence and individual creativity, but did have a moderating effect that weakened the relationship between the need for cognition and individual creativity. These findings have implications for theories of members' creativity in organizations.

**Keywords** Creativity · Self-confidence · Need for cognition · Degree of IT support · Multilevel analysis

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In today's society, an overall paradigm shift has taken place due to the development of information technology (IT) and digitalization. The traditional factors related to competitive advantage are disappearing rapidly, while the competitive power of knowledge and creative thinking have emerged as important factors. Particularly in mass production, philosophy-driven assertions and assumptions have lost their attractiveness due to the emergence of a knowledge-intensive and creative economy. In the case of knowledge-intensive goods and services, for which marginal production costs are nearly zero, the concept of manufacturing cost and productivity may not apply. In today's business environment especially, where the first to enter the market is likely to assume control of the entire market, the ability to create something new is becoming the primary focus.

From this perspective, the essence of modern business competitiveness is creativity, and its ultimate agent is the individual. Evidence suggests that employees' creativity contributes to an organization's innovation, and accordingly, to its survival (Amabile 1996; Nonaka 2008). Thus, when individuals exhibit creativity in their work, they provide novel and potentially useful ideas related to goods, services and processes (Shalley and Gilson 2004). Creativity is a concept that differs from innovation. Innovation does not take place when an individual shares novel and potentially useful ideas with other people, but occurs only when an individual's ideas are implemented successfully in a team or organization (Amabile 1996; Mumford and Gustafson 1988). Traditionally, studies of creativity that have been conducted within the field of psychology have tried to understand individual creativity by focusing on individual cognition and personality.

Creativity, which plays an important role in an organization's performance, may be affected by the personalities and cognitive characteristics of its members. Further, with respect to the environment, it may be affected as well by the degree of

Information Technology support (here, IT refers to the technology related to the information systems used to carry out daily organizational tasks). In this study, we approached the effect of the degree of IT support on individual creativity production from the perspective of an organization's members' self-confidence and need for cognition (NFC). Specifically, we used a multilevel analysis to ensure accurate analysis of the effect of the degree of IT support, the team-level variable, on individual-level variables.

The objectives of this study were as follows. The first was to determine the relationship between the degree of IT support of teams and the individual creativity of their members. The second was to examine how the degree of IT support affects self-confidence with respect to personality and NFC. Third, based on the results derived from the first two, we attempted to provide an effective strategy to maximize individual creativity according to individual and team level characteristics.

## Theoretical Backgrounds and Hypotheses

### Individual Creativity

Creativity has been studied from different perspectives depending on the theoretical backgrounds of the researchers. For example, studies have been conducted separately on the creative process, creative environment, and creative product using similar theories and approaches. An integrative approach that regards creativity as the aggregation of creative process, environment, and product, is accepted increasingly among researchers (Sternberg and Lubart 1991). Creativity is seen as the ability to make something novel and useful, and it is affected largely by personality characteristics, cognitive abilities, and interactions with the social environment (Amabile 1983).

Over the past several decades, many studies have defined creativity as the production of novel and potentially useful ideas related to products, services, processes, and procedures (Amabile 1996; Zhou and Shalley 2003). An idea is considered to be novel when it is unique compared to the existing ideas used in an organization. If the idea has the potential to provide either short- or long-term direct or indirect value to the organization, it is considered useful (Shalley et al. 2004). Many existing studies of creativity have examined the possibility that various individual characteristics affect creativity (Rodan and Galunic 2004; Tierney and Farmer 2002). Among these, early researchers postulated that individual cognitive styles could affect creativity directly (Amabile 1996; Woodman et al. 1993). However, too few studies to date have examined how individuals' views of themselves affect creativity.

This study sought to investigate the relationship between individual perspectives and creativity by considering

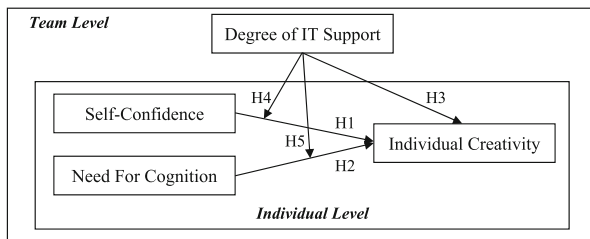
constructs such as self-confidence. Specifically, we studied creativity as a function of the interaction among personality characteristics, workplace characteristics, and other environmental characteristics. In the study, the personality characteristics considered were self-confidence and NFC as a cognitive style, which has received much attention in studies of creativity. Such characteristics are expected in particular to affect various strategies of individual creativity. For example, people with certain personality characteristics may be very effective in recognizing problems and integrating new information and therefore, tend to work more creatively. This study also examined the effects of self-confidence and NFC as personal characteristics on individual creativity. In addition, we developed the research model shown in Fig. 1 to determine the effect of the degree of IT support as an external environmental characteristic on individual creativity.

The model for this study includes individual- and team-level constructs. The individual-level constructs are self-confidence, NFC, and individual creativity, and the team-level construct is the degree of IT support. The ways in which individuals work in a team, including the degree of self-confidence they possess, has a significant influence on creativity. In addition to self-confidence, the NFC, which indicates the degree of intrinsic motivation they have to resolve given tasks and problems may have a positive effect on the degree and quality of individual creativity (H1, H2). Moreover, modern work environments assume that individuals always work in the context of IT support. Therefore, the degree of IT support also influences individual creativity (H3), and has certain moderating effects on the relationships between it and self-confidence, and NFC and individuals as well (H4, H5). The survey was conducted on 256 people who were members of 50 teams.

### Self-Confidence and Creativity

Self-concept is a global construct that consists of self-efficacy and other aspects of self (Schunk 1991). The term is multidimensional, as it consists of self-esteem, self-confidence, stability, and self-crystallization (Rosenberg and Kaplan 1982). Self-esteem is an individual's perceived sense of self-worth (Schunk 1991), while self-confidence is the degree of perceived probability of successful completion of a task (McClelland 1987). Although self-confidence and self-esteem appear to be similar, they are fundamentally different. Self-esteem is one's judgment of self-worth, while self-confidence is the judgment of one's abilities (Hollenbeck and Hall 2004).

Among theories related to self-confidence, Bandura's theory of perceived self-efficacy is the most popular. The terms self-efficacy and self-confidence have been used interchangeably to represent people's perceived abilities to achieve a certain level of performance (Hollenbeck and Hall 2004; Kickul



**Fig. 1** Research Model

et al. 2008; Wilson et al. 2007). Self-efficacy refers to self-confidence in specific tasks and situations (Boyd and Vozikis 1994), while self-confidence is defined as an individual's cognition of the probability of success in a task (McClelland 1987).

From the viewpoint of creativity, self-confidence has been used primarily as an index to measure the characteristics and individual creativity of creative people. For example, self-confidence has been regarded as one of the characteristics of creative people (Martindale 1989). Davis (1986) listed the common personality traits of creative people. Among them, recognizing oneself as creative and trusting oneself may be regarded as indicators of self-confidence. Further, self-confidence also has been measured with six scales related to the self-realization of creativity (Khatena and Torrance 1976). Based on these previous studies, we proposed the following hypothesis.

H1. Self-confidence will contribute positively to individual creativity.

### Need for Cognition and Creativity

With respect to cognition, several models have been proposed to understand creativity (O'Hara and Sternberg 2001; Runco and Chand 1995). Novel thinking or the novel integration of old ideas is the core of all definitions of creativity (Mumford and Gustafson 1988). Therefore, creativity researchers have shown much interest in the cognitive approach. In motivating individual creativity, individuals' intrinsic motivation to resolve given tasks and problems is crucial. In this sense, NFC is defined as the fundamental motivation to engage in and enjoy the thinking required for problem-solving (Cacioppo and Petty 1982; Cacioppo et al. 1996). NFC includes various types of individuals, from cognitive "misers" to people who carry out effortful thinking and problem solving actively (Cacioppo and Petty 1982; Cacioppo et al. 1996). In general, people with high NFC are better able to solve problems and show a positive attitude when approaching a task. They also try to gain experience from other resources in order to obtain additional information relevant to a problem (Henning and Vorderer 2001; Tuten and Bosnjak 2001).

NFC may be an indicator of individual tendencies to be motivated intrinsically to engage in effortful cognitive activity (Cacioppo and Petty 1982). Thus, NFC is referred to as intrinsic motivation related to problem solving. The information-processing capability of individuals given the same information can be demonstrated in different ways depending on personal characteristics and the environmental context. NFC in particular facilitates an individual's intrinsic motivation to process information. Therefore, individuals with high NFC invest much effort in understanding the relationships between stimuli and events, while those with low NFC minimize their cognitive efforts by relying on peripheral cues to process information. Therefore, as Amabile (1996) indicated, NFC is related closely to creativity. Based on these previous studies, we proposed an hypothesis about the relationship between NFC and individual creativity, as follows:

- H2. NFC has a positive effect on individual creativity.

### The Degree of IT Support and Creativity

IT refers to a number of techniques that support users with data or information storage, processing, and communication for their administrative, strategic decision making (Bakos and Treacy 1986). Therefore, IT plays important roles in enhancing work performance and competitiveness by taking advantage of both Information and Communications Technologies (ICT) and Information Systems (IS), and providing interpersonal and departmental communications that include necessary information on a timely basis. Shneiderman (2009) studied the ways in which the use of software stimulates individual creativity, and Wierenga and Bruggen (1998) studied how a creativity support system affects the quantitative and qualitative aspects of creative output. Use of visualization-related IT tools can provide many more alternatives and stimulates creative cooperation (Terry et al. 2004).

Because the technology available to the organization can only have an effect through people's activities, IT itself does not guarantee that an organization will be competitive. However, in an environment that employs user-centric information, the level of IT service and degree of IT support can be important factors in determining the success of an information system (Doll and Torkzadeh 1988), and they are expected to play important roles in carrying out creative tasks. Based on the research related with the IT utilization of Ein-Dor and Segev (1982), the degree of IT support is defined as how support and cooperation are progressed smoothly and effectively.

Since user's feeling about service and support level is one of the most important factors to determine the success of information system (Doll and Torkzadeh 1988), the reliance on IT of individual is growing. Moreover, it is considered that IT

stimulates cognitive aspects of the individual and this can be inferred from the research of Gallupe et al. (1991) which shows the positive relationship between the use of computer supporting system and producing more ideas.

We may presume that IT support is likely to suppress the NFC and related cognitive efforts among people with high NFC because of its convenience, and lead to significant dependence on information, functions, and services it provides. Therefore, if the IT support provided to a team is too convenient, it may weaken the NFC and its positive effect on individual creativity. Accordingly, we proposed the following hypotheses, which postulate that the degree of IT support will affect individual creativity, and will have a moderating effect not only on the relationship between individual creativity and self-confidence, but also on the relationship between individual creativity and NFC.

- H3. The degree of IT support will have a positive effect on individual creativity.
- H4. The degree of IT support will strengthen the relationship between self-confidence and individual creativity.
- H5. A greater degree of IT support will weaken the relationship between NFC and individual creativity.

**Method**

**Participants**

To analyze the effects of the degree of IT support on team members’ creativity, we conducted a survey of members of a system development team and system operation team in a large system integration (SI) company in South Korea. In total, we surveyed 50 teams that included 256 people. Table 1 shows the characteristics of the respondents.

169 (66 %) of the respondents were male and 87 (34 %) were female. 18 % were in their 20s, 20 % were in their 40s, and the remainder were in their 30s. Most held college degrees. 32.5 % of the respondents had less than 5 years of work experience, and 43.4 % of them had more than 10 years of work experience. Therefore, it seems reasonable to conclude that the respondents were highly skilled and had a good understanding of their jobs. The ratio of job positions in the survey was relatively even

**Variables**

The study modified and used each item of a variable in reference to existing studies. We set individual creativity as the dependent variable and self-confidence and NFC as independent variables that affect individual creativity. We set the degree of IT support, a team-level variable, as a moderating

**Table 1** Demographic characteristics

Category	Frequency	(%)	Category	Frequency	(%)
Gender		Work experience			
Male	169	66	Less than 1 year	10	4
Female	87	34	1–3 year	36	14
Age		3–5 year			
20–29	46	18	5–10 year	37	15
30–39	158	62	10–15 year	62	24
40–49	52	20	15–20 year	85	33
Educational Background		More than 20 years			
High school	2	1	Job position	2	1
College	7	3	Clerk	39	15
Bachelor	219	86	Assistant Manager	75	29
Master	27	10	Deputy General Manager	89	35
Ph D.	1	0	General Manager	53	21
Total	256	100	Total	256	100

variable and gender as a control variable. We measured all variables except gender on a 7-point Likert-Type scale (from one: “strongly disagree” to seven: “strongly agree”). Descriptive statistics of the variables at the individual and team levels are presented in Table 2, while correlations are presented in Table 3.

**Verification of the Reliability and Validity of the Measures**

Validity determines whether the research truly measures what it was intended to or how accurate the results are. Construct validity was tested using exploratory factor analysis (EFA) with the varimax rotation option. The test determined that the factor loadings were greater than 0.50, and the eigenvalues exceeded 1. To test construct reliability, which represents internal consistency, we checked the Cronbach’s alpha for the factors extracted, all of which were greater than 0.60.

**Table 2** Descriptive statistics

Variables	Cases	M(SD)	Min. value.	Max. value.	Remarks
1-level(individual)					
Individual creativity	256	4.33 (1.01)	1.00	7.00	DV
Self-confidence	256	5.13 (0.69)	2.80	7.00	IV
Need for cognition	256	4.55 (0.96)	1.00	7.00	IV
Gender	256	1.34 (0.48)	0.00	2.00	CV
2-level(team).					
The degree of IT support	50	4.63 (0.59)	3.20	6.11	MV

SD standard deviation, DV dependent variable, IV independent variable, CV control variable, MV Moderating variable



**Table 3** Correlations among variables

Variables	Individual creativity	Self-confidence	Need for cognition.	Gender
Individual creativity	1			
Self-confidence	.372**	1		
Need for cognition	.321**	.268**	1	
Gender	-.184**	-.145*	-.022	1

\*  $p < .05$  (Two-way), \*\*  $p < .01$  (Two-way)

Therefore, reliability was confirmed. During these processes, we deleted two items with low factor loadings and reliability. The final factor analysis and reliability results are described in Table 4.

### Individual Level Variables

**Individual Creativity** Creativity is defined generally as the output of novel and useful ideas or solutions for problems. It also indicates not only the process of creating an idea or resolving a problem, but also the actual idea and resolution themselves (Amabile 1983; Sternberg 1988). We measured eight items based on studies conducted by Zhou and George (2001). The eigenvalue was 8.02, and Cronbach's  $\alpha$  was 0.96, thus confirming significant validity and reliability.

**Self-Confidence** Self-confidence is defined as the degree of perceived possibility of success at a task (McClelland 1987), and was measured using five items based on Kolb (1999). Its eigenvalue was 2.34, and Cronbach's  $\alpha$  was 0.84.

**Need for Cognition** In general, NFC is defined as the intrinsic motivation to engage in thinking and the pleasure associated with it (Cacioppo and Petty 1982; Cacioppo et al. 1996). Based on Cacioppo et al. (1984), we measured this variable with eight items, and used the data from the final six items chosen through factor analysis. Its eigenvalue was 3.15, and Cronbach's  $\alpha$  was 0.85.

**Team Level Variable: Degree of IT Support** Based on the previous studies, the degree of IT support is defined as how support and cooperation are progressed smoothly and effectively by using ICT and IS for task of employee. Measurement items for the degree of IT support were adapted from Ein-Dor and Segev (1982). Its eigenvalue was 2.03, and Cronbach's  $\alpha$  was .89. We also needed to ensure validity, which we assessed with *ICC* (Intraclass correlation coefficient) and the  $r_{wg}$  test to analyze the team data obtained by summing the individuals' responses.  $R_{wg}$  was developed by James et al. (1984) and is referred to as the within-group similarity or agreement index. It is measured by comparing the diversity among variables in

the unit measured with expected random variance. In general, when  $r_{wg}$  is greater than 0.70, it indicates that the individual level data can be regarded as a higher level construct (Klein and Kozlowski 2000). Further, *ICC* is a method used frequently in organizational research to verify reliability. *ICC* measures the consistency of the respondents' answers (Kozlowski and Hattrup 1992), and according to Glick (1985), the *ICC* should be greater than 0.60.

Therefore, we investigated each respondent's cognitive agreement when summing the survey results. Cognitive agreement can be measured as the degree of agreement among the respondents and the reliability. We measured the consistency of the survey responses and the degree of agreement of many( $k$ ) respondents. The results are shown in Table 5.

The level of significance of the reliability and the degree of agreement suggested in Table 5 exceeded the standards stated in the previous studies, and therefore, we concluded that the reliability and statistically significant degree of agreement among respondents permitted the use of their summed responses in the analysis.

**Control Variable: Gender** Previous studies have shown that women tend to score lower on measures of self-confidence and that this reduces their willingness to participate in group interactions (Arch 1992; Bandura 1992; Vollmer 1986). Kickul et al. (2008) found that self-confidence had a stronger effect on entrepreneurial career interests among teenage girls than it did among boys. These findings correspond with the existing research result that says the ultimate career choices of women is limited compared to men because they have a lack of confidence on their capability (Bandura 1992). Therefore, we included gender as a control variable.

### Analyses

**Multi-Level Analysis** As the study evaluated variables at both the team and individual levels, we adopted a multilevel analysis approach. Because the team-level construct not only includes a team member, but also the interaction among team members, it must be measured appropriately to reflect the team-level variable. The model used in this study included both an individual- and a team-level construct. Therefore, to test the study's hypotheses, we needed to use a relevant statistical strategy in the research design. The levels that we needed to consider can be categorized in three ways: theory, measurement, and analysis. All problems related to these three levels are called level issues. If these three levels do not coincide, many problems can occur in the analysis (Klein et al. 1994).

The ecological fallacy, which was mentioned first by Robinson (1950), is the most fundamental error that occurs due to the differences in the levels of theory, measurement, and analysis (Kerlinger and Lee 2000). It refers to the inferential error that occurs when organizational level content is

**Table 4** Factor analysis and reliability

Factor	Measurement items	Factor loading	Eigenvalues.	% of Variance.	Cronbach's $\alpha$
ICR	ICR6 I suggest creative solutions to problems.	.886	8.023	36.470	.961
	ICR4 I am a good source of creative ideas.	.886			
	ICR5 I often have new and innovative ideas.	.872			
	ICR3 I search out new technologies, processes, techniques, and/or product ideas.	.868			
	ICR8 I suggest new ways of performing work tasks.	.857			
	ICR1 I suggest new ways to achieve objectives or goals.	.843			
	ICR7 I often have a fresh approach to problems.	.838			
	ICR2 I suggest new and practical ideas to improve performance.	.810			
SC	SC2 I have confidence in my own decisions.	.819	2.337	10.621	.835
	SC3 I am able to articulate my beliefs as well as most people.	.806			
	SC4 I have confidence in my ability to handle most tasks.	.777			
	SC5 I have what it takes to succeed in my chosen career.	.725			
	SC1 If someone challenges my opinion, I defend my beliefs.	.657			
NFC	NFC8 I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.	.835	3.154	14.336	.854
	NFC1 I would prefer complex to simple problems.	.828			
	NFC3 I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.	.758			
	NFC7 I really enjoy a task that involves coming up with new solutions to problems.	.708			
	NFC2 I do not like to have the responsibility of handling a situation that requires a lot of thinking.	.684			
ITS	ITS3 Amendment and support is well-carried out for user-inconvenience.	.739	2.031	9.230	.887
	ITS2 Cooperation among users is easily done.	.731			
	ITS1 Amendment for the task is easy.	.637			

ICR Individual creativity, SC Self-confidence, NFC Need for cognition, ITS The degree of IT support

interpreted according to individual characteristics. The organization has multilevel characteristics because it includes both individuals and organizations, and, therefore, all constructs related to the organization are level issues. Therefore, in this study, we applied hierarchical linear modeling to test a multilevel model that included cross-level analyses. In general, social groups have relationships characterized by a multilevel structure, hierarchical structure, or nested structure. For example, the relationship of “students belong to a class and a class belongs to the school” is a three level relationship among students, class, and school. In this study, the relationship between teams and team members was a two level relationship. Accordingly, when multilevel data are analyzed, the effect of variables at the individual level (within group) needs to be separated from that of variables at the group level (between groups). To this end, separate regression functions at the individual and group level must be integrated in the model to analyze the effect of the group and that of the individual simultaneously (Raudenbush and Bryk 2002).

If multilevel data are analyzed with the ordinary least square of the conventional regression analysis, the following

two problems can occur. First, as we violate the basic assumption that individual data are independent, we are likely to underestimate the standard errors, and the estimated insignificant assumption coefficient may be significant. Second, the regression analysis coefficient is a fixed-effects coefficient that cannot explain group differences. Despite the fact that the regression coefficient  $\beta$  might vary depending on groups, all are regarded as identical, which leads to the convenience of coefficient assumption (Raudenbush and Bryk 2002). Therefore, it is difficult to ensure the validity of analytical results in multilevel data if a conventional regression analysis is used. Therefore, to analyze our multilevel data effectively, we performed a hierarchical linear model analysis using HLM (Hierarchical Linear Model) 7.0 Raudenbush (2004).

**Establishment of a Multilevel Study Model** We developed the following two level model to analyze the moderating effect that the team-level characteristic (degree of IT support) had on team members' creative activity.

**Table 5** The reliability and degree of agreement among the respondents

Self-report type construct	$r_{wg}$	$ICC(3,k)$
The degree of IT support	.85	.47

**One-Level Model: Within-Team Model** In the one level model, the dependent variable was the individual creativity of  $i$  team member of  $j$  team. The one level model can be represented as follows.

$$\text{Individual creativity}_{ij} = \beta_{0j} + \beta_{1j}(\text{self-confidence}_{ij}) + \beta_{2j}(NFC_{ij}) + \beta_{3j}(\text{gender}_{ij}) + r_{ij}$$

In the formula above, self-confidence and NFC are independent variables, and gender is a control variable.  $\beta_{0j}$  is the intercept, and  $\beta_{1j}$  and  $\beta_{2j}$  are the estimated values of each team member’s independent variables. The independent variables at each team member’s level were corrected by cluster-mean centering, which must be used with one level variables to clarify the moderating effect (Raudenbush 1989).  $r_{ij}$  was assumed to be distributed normally with a mean of zero and variance of  $\sigma^2$  due to random effect.

**Two-Level Model: Between-Team Model** A two level model explains the difference in creativity among teams by

$$\text{Individual Creativity}_{ij} = \gamma_{00} + \gamma_{01}(ITS_j) + \gamma_{10}(\text{self-confidence}_{ij}) + \gamma_{11}(ITS_j) \times (\text{self-confidence}_{ij}) + \gamma_{20}(NFC_{ij}) + \gamma_{21}(ITS_j) \times (NFC_{ij}) + \gamma_{30}(\text{gender}_{ij}) + \mu_{0j} + \mu_{1j}(\text{self-confidence}_{ij}) + \mu_{2j}(NFC_{ij}) + r_{ij}$$

inputting the team-level variable (degree of IT support, abbreviated as ITS hereafter) and is as follows:

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}(ITS_j) + \mu_{0j} \\ \beta_{1j} &= \gamma_{10} + \gamma_{11}(ITS_j) + \mu_{1j} \\ \beta_{2j} &= \gamma_{20} + \gamma_{21}(ITS_j) + \mu_{2j} \\ \beta_{3j} &= \gamma_{30} \end{aligned}$$

$\gamma_{00}$  indicates the total mean level of individual creativity, and  $\gamma_{10}$  and  $\gamma_{20}$  represent the effect of the variables at each team level. One level independent variables, such as self-confidence and NFC, were included in the two level model because it is related to the cluster-mean centering of the independent variables. By performing cluster-mean centering of the independent variables in the one level model, the cluster fluctuation explained by them is not represented in the dependent variable. Therefore, the cluster-mean of one level independent variables was incorporated into the two level intercept model ( $\beta_{0j}$ ) as a control variable (Raudenbush 1989).  $\beta_{1j}$  and  $\beta_{2j}$  reflect the team level variables needed to identify the moderating effect with regard to the self-confidence and NFC variables, respectively. According to the purpose of this study, the degree of IT support variable was added as well.  $\mu_{0j}$  establishes a normal distribution based on a mean of zero and a variance of  $\tau_{00}$ . The comprehensive model, which integrates the one level and two level models, is as follows.

## Results

In the multilevel analysis, we first checked the significance of the variance among the clusters by analyzing an unconditional model. Then, we examined the effect of the independent variable on the individual-level dependent variables through a within-cluster analysis, and finally, we analyzed the main effects and moderating effects that the team-level variable had on the individual-level variables.

### Analysis of Unconditional Model

A multilevel analysis first analyzes the unconditional model to determine the variance that exists at each level and to check between-group variance and its significance. If the between-group variance is not significant, it means that there is no effect of the group on the individuals, in which case, there is no need for a multilevel analysis (Hofmann 1997).

Accordingly, to check whether there was significant variance in individual creativity among teams due to individual self-confidence and NFC, we established the unconditional model as follows.

$$\begin{aligned} \text{One-Level} : Y_{ij} &= \beta_{0j} + r_{ij} & r_{ij} &\sim N(0, \sigma^2) \\ \text{Two-Level} : \beta_{0j} &= \gamma_{00} + \mu_{0j} & \mu_{0j} &\sim N(0, \tau) \end{aligned}$$

Note:

- $Y_{ij}$  Individual creativity by team member  $i$  of team  $j$
- $\beta_{0j}$  Average individual creativity by team member  $j$
- $r_{ij}$  Difference in individual creativity by team members in team  $j$
- $\mu_{0j}$  Difference in average by individual creativity among team

The results of the analysis of the unconditional model showed that the mean of individual creativity was 4.33 ( $\gamma_{00}$ ,

$t = 60.628, p < 0.001$ ) and that a significant amount of variance was explained based on intergroup differences in individual creativity ( $\chi^2(49) = 68.36, p = 0.035$ ). The results are shown in Tables 6 and 7.

The ratio of the team-level to the total variance ( $ICC = \tau / (\tau + \sigma^2)$ ) with regard to individual creativity was 0.07, which indicates that the difference among teams accounted for 7.4 % of the difference in individual creativity.

### Analysis of Random-Coefficients Regression Model

We examined the effect of self-confidence and NFC on individual creativity by analyzing the relationship model between

$$\text{Mixed Model : Individual creativity}_{ij} = \gamma_{00} + \gamma_{10}(\text{self-confidence}_{ij}) + \gamma_{20}(\text{NFC}_{ij}) + \gamma_{30}(\text{gender}_{ij}) + \mu_{0j} + \mu_{1j}(\text{self-confidence}_{ij}) + \mu_{2j}(\text{NFC}_{ij}) + r_{ij}$$

The analysis showed that there was a positive effect of self-confidence ( $\gamma_{10} = 0.409, p < 0.001$ ) and NFC ( $\gamma_{20} = 0.259, p < 0.001$ ) on individual creativity. Accordingly, both Hypotheses 1 and 2 were supported. The results are shown in Table 8.

### Analysis of Intercepts and Slopes as Outcomes Model

First, we examined the main effects that the team-level variable had on the individual-level dependent variable. Next, we assessed the moderating effects of the team-level variable and the effect of the individual-level independent variables on the individual-level dependent variable. Thus, we needed first to examine the effect of the degree of IT support on individual creativity and the moderating effect of the degree of IT support on the relationship between self-confidence, NFC, and individual creativity.

We developed Model 1 as follows. In the one level model, individual creativity was set as the dependent variable, and self-confidence and NFC were set as the independent variables, with gender designated as a control variable. The two level model added the variable of the degree of IT support to examine the main effect.

<Model 1>

$$\text{One-Level Model : Individual creativity}_{ij} = \beta_{0j} + \beta_{1j}(\text{self-confidence}_{ij}) + \beta_{2j}(\text{NFC}_{ij}) + \beta_{3j}(\text{gender}_{ij}) + r_{ij}$$

$$\text{Two-Level Model : } \beta_{0j} = \gamma_{00} + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j}$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j}$$

$$\beta_{3j} = \gamma_{30}$$

Note: Self-Confidence and NFC have been centered around the grand mean.

the independent and dependent variables, which are individual-level variables. The model we used was the following.

$$\text{One-Level Model: Individual creativity}_{ij} = \beta_{0j} + \beta_{1j}(\text{self-confidence}_{ij}) + \beta_{2j}(\text{NFC}_{ij}) + \beta_{3j}(\text{gender}_{ij}) + r_{ij}$$

$$\text{Two-Level Model : } \beta_{0j} = \gamma_{00} + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j}$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j}$$

$$\beta_{3j} = \gamma_{30}$$

Note: Self-confidence and NFC have been centered around the grand mean.

In the results of the analysis of Model 1, we found a positive main effect of the degree of IT support on individual creativity ( $\gamma_{01} = 0.298, p < 0.001$ ). Therefore, Hypothesis 3 was supported.

Model 2 was designed to determine the moderating effect that the degree of IT support had on the relationships between self-confidence, NFC, and individual creativity.

<Model 2>

$$\text{One-Level Model : Individual Creativity}_{ij} = \beta_{0j} + \beta_{1j}(\text{self-confidence}_{ij}) + \beta_{2j}(\text{NFC}_{ij}) + \beta_{3j}(\text{gender}_{ij}) + r_{ij}$$

$$\text{Two-Level Model : } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ITS}_j) + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{ITS}_j) + \mu_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}(\text{ITS}_j) + \mu_{2j}$$

$$\beta_{3j} = \gamma_{30}$$

Note: Self-confidence, NFC and the ITS have been centered around the grand mean.

$$\text{Mixed Model : Individual creativity}_{ij} = \gamma_{00} + \gamma_{01}(\text{ITS}_j) + \gamma_{10}(\text{self-confidence}_{ij}) + \gamma_{11}(\text{ITS}_j)(\text{self-confidence}_{ij}) + \gamma_{20}(\text{NFC}_{ij}) + \gamma_{21}(\text{ITS}_j)(\text{NFC}_{ij}) + \gamma_{30}(\text{gender}_{ij}) + \mu_{0j} + \mu_{1j}(\text{self-confidence}_{ij}) + \mu_{2j}(\text{NFC}_{ij}) + r_{ij}$$

The analysis showed that the interaction between the degree of IT support and NFC was significant ( $\gamma_{21} = -0.294, p = 0.019$ ). This suggests that the effect of NFC on individual creativity varied with the degree of IT support. The regression coefficient was negative, indicating that the effect of NFC on individual creativity decreased as the degree of IT support increased. Therefore, Hypothesis 5 was supported. However, we found that the interaction between the degree of IT support and self-confidence was not significant ( $\gamma_{11} = 0.203, p = 0.236$ ), which demonstrated that the degree of IT support



**Table 6** Final estimation of fixed effects (with robust standard errors)

Fixed Effect	Coefficient	Standard error	t-ratio	df	p-value
For intercept 1, $\beta_0$					
intercept 2, $\gamma_{00}$	4.333	.071	60.628	49	<.001

had no effect on the relationships between self-confidence and individual creativity; thus, there was no significant moderating effect. Accordingly, Hypothesis 4 was rejected. Tables 9 and 10 show the results of the analyses by model.

Figure 2 shows the degree of IT support divided by the average upper/lower quartile to indicate the relationships between NFC and individual creativity with high and low degrees of IT support. The effect on individual creativity was greater with a low (ITS = -0.407) than with a high degree of IT support (ITS = 0.438). Thus, the effect of NFC on individual creativity differed systematically depending on the degree of IT support and the cross-level moderating effect, indicating that the higher the degree of IT support for a team, the lower the effect of NFC.

As is shown in Fig. 3, the higher the degree of IT support (solid line), the lower the effect of NFC on individual creativity, and the lower the degree of IT support (dotted line), the greater the effect.

### Discussion and Conclusion

We examined the effect of the degree of IT support on individual creativity from the perspective of the self-confidence and NFC of the organization’s members. To examine specifically the effect of the team-level variable on the individual-level variables, we used a multilevel analysis. The results may be summarized as follows.

First, we demonstrated that individual self-confidence had a significant effect on individual creativity. Existing studies of creativity have shown that the way in which individuals see themselves affects creativity (Redmond et al. 1993; Tierney and Farmer 2002), but is not sufficient (Shalley et al. 2004). Therefore, self-confidence, an individual’s belief of the possibility of his success, offers many implications for this study. The results of this study are consistent with those of others (Davis 1986; Khatena and Torrance 1976; Martindale 1989; Sternberg and Lubart 1991), in that self-confidence was both a characteristic of creative people and a way to measure

**Table 7** Final estimation of variance components

Random Effect	SD	Variance component	df	$\chi^2$	p-value
For intercept 1, $\beta_0$	.275	.076	49	68.358	.035
intercept 2, $\gamma_{00}$	.972	.944			

**Table 8** Result of analysis on multi-level data (Random-coefficients regression model)

Fixed Effect	Coefficient	Standard error	t-ratio	df
For intercept 1, $\beta_0$				
intercept 2, $\gamma_{00}$	4.783	.154	31.118	49
For SC slope, $\beta_1$				
intercept 2, $\gamma_{10}$	0.409	.093	4.413	49
For NFC slope, $\beta_2$				
intercept 2, $\gamma_{20}$	0.259	.072	3.580	49
For Gender slope, $\beta_3$				
intercept 2, $\gamma_{30}$	-0.337	.093	-3.624	105

SC self-confidence, NFC need for cognition

$p < .001$

individual creativity. Therefore, to stimulate creativity, individuals need to trust themselves first.

Second, we also showed that NFC, the intrinsic motivation to think and the enjoyment of thinking, had a significant effect on individual creativity. Many existing studies of creativity have mentioned individual cognitive style in explaining the demonstration of creativity (Amabile 1996; Kwang and Rodrigues 2002). Amabile (1996), in particular, regarded personal intrinsic motivation as an important factor in demonstrating creativity. NFC may be interpreted as the intrinsic motivation to think and enjoyment of thinking (Cacioppo and Petty 1982; Cacioppo et al. 1996), and the level of NFC varies among individuals. People with high NFC are eager to think, enjoy the process, and thus demonstrate more creativity. This result has practical implications when combined with existing research results that indicate that positive affect can influence cognition and facilitate creative activity (Estrada et al. 1994; Hirt et al. 1996). Therefore, by designing the environment to enhance individuals’ positive affect, we may

**Table 9** Result of analysis on multi-level data (Intercepts–and–slopes–as–outcomes model)

Fixed Effect	Coefficient	Standard error	t-ratio	df	p-value
For intercept 1, $\beta_0$					
intercept 2, $\gamma_{00}$	4.758	.147	32.478	48	< .001
ITS, $\gamma_{01}$	0.298	.088	3.400	48	.001
For SC slope, $\beta_1$					
intercept 2, $\gamma_{10}$	0.420	.091	4.624	48	< .001
ITS, $\gamma_{11}$	0.203	.169	1.200	48	0.236
For NFC slope, $\beta_2$					
intercept 2, $\gamma_{20}$	0.264	.071	3.720	48	< .001
ITS, $\gamma_{21}$	-0.294	.122	-2.417	48	.019
For Gender slope, $\beta_3$					
intercept 2, $\gamma_{30}$	-0.316	.093	-3.386	105	< .001

ITS the degree of IY support, SC self-confidence, NFC need for cognition

**Table 10** Result of Verification of Hypothesis

Hypothesis	Result
H1: Self-confidence will positively contribute to individual creativity.	Accepted
H2: NFC would have the positive effect on individual creativity.	Accepted
H3: The degree of IT support of team would have the positive effect on individual creativity.	Accepted
H4: The degree of IT support of team would strengthen the relationship between self-confidence and individual creativity.	Rejected
H5: The degree of IT support of team would weaken the relationship between NFC and individual creativity.	Accepted

be able to increase the level of individual NFC so that they can engage better in creative activities.

Third, the degree of IT support, the team-level variable, had a significant effect on individual creativity; in the current user-friendly computerized environment, the service level and degree of support that users perceive is a very important factor in fostering the success of an information system (Doll and Torkzadeh 1988). Thus, from the team members' perspective, reliance on IT is increasing, such that the evaluation of information depends on the degree of IT support they receive. As Gallupe et al. (1991) showed empirically that more ideas are generated with the use of a computer support system, it can be deduced that IT stimulates individual cognition. Therefore, the degree of IT support affected the level of individual creativity positively. At an organizational or team level, rather than allowing limited resources to be used simply to develop an IT or related system, supporting individuals so that they can use the system actively will contribute to individual creativity.

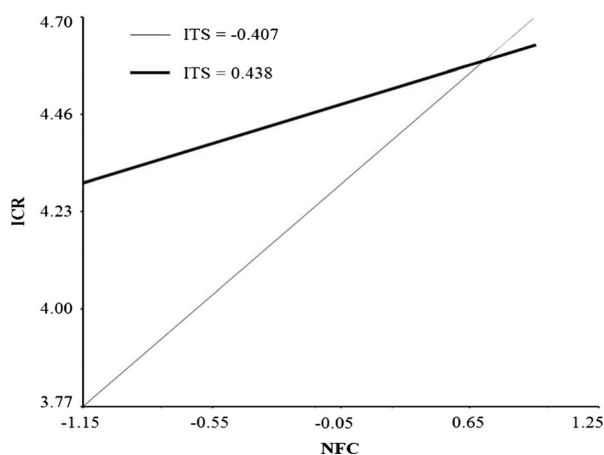
Finally, we found that the degree of IT support did not have a significant effect on the relationship between self-confidence and individual creativity, but had a moderating effect that weakened the relationship between NFC and individual creativity. When an individual perceived the possibility of his/her success, the degree of IT support did not have a significant effect on the relationship with creativity. However, people

with high NFC were willing to invest more effort in thinking and understanding. In such situations, it is possible that the introduction of IT will decrease the level of NFC. Because people come to rely on the system, IT actually can weaken the relationship between NFC and creativity. Further research on this relationship is needed, but it implies that IT support does not guarantee employees' creativity.

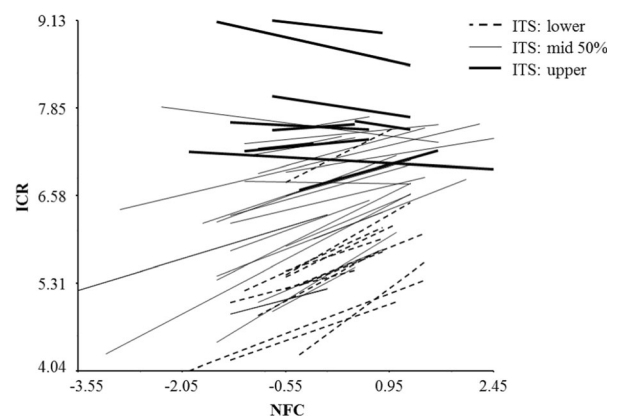
### Limitations and Future Research

This study used a multilevel analysis to investigate the effect of team-level variables on individual-level variables accurately, but had the limitation that the sample size was not large enough to examine the interaction. While we used data from 50 teams to determine the effect of the team-level variable, the number of team members ranged from four to six, which is not sufficiently large to measure the individual-level variables. Although we did not conduct the survey with students, but with actual employees and teams who worked in a company, our ability to generalize the results of this study is still limited somewhat.

Future research should explore various characteristics that affect creativity at the team level. Due to the small sample size that followed the regression analysis, we analyzed only one team-level variable, the degree of IT support. Therefore, in general, further experimentation with these methods and a larger sample will be worthwhile. Second, it would also be



**Fig. 2** Moderating Effect of The Degree of IT support (NFC-Individual Creativity). ICR = Individual Creativity. NFC = Need for Cognition. ITS = Degree of IT Support



**Fig. 3** Moderating Effect of The Degree of IT support: Slope of each team. ICR = Individual Creativity. NFC = Need for Cognition. ITS = Degree of IT Support

beneficial to observe the ways in which self-confidence and NFC change over time, and examine how team-level variables moderate the effects of individual creativity. Third, IT changes constantly as technology continues to evolve. IT serves various purposes, including supporting decision-making, interpersonal communication, and schedule management. Therefore, it also would be meaningful to examine the effects of the degree of IT support on creativity with reference to these purposes. Finally, it would be useful to conduct research on the effects of team diversity and type to compare the moderating effects on individual creativity of various team compositions, such as that of task force, permanent, and virtual teams.

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### Compliance with Ethical Standards

**Conflict of Interest** Min Hee Hahn declares that he has no conflict of interest. Kun Chang Lee declares that he has no conflict of interest.

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