INVESTIGATE ONLINE COLLABORATIVE LEARNING BASED ON THE STUDENTS DIFFERENCES OF INDIVIDUAL, TO ENHANCE CREATIVITY IN ONLINE SMALL GROUPS

**Mehrdad Ahmadifar[1], Bahman Saeidipour[2]
Mohammad Reza Sarmadi[3], Mehran Farajollahi[4]**

Abstract. The main purpose of this study was to investigate online collaborative learning based on the differences of individual students, to enhance creativity in small groups in an online learning environment. The relationships among gender, thinking styles, individual creative ability and group creativity were also explored. Both experimental and survey data were collected to provide a rich understanding of the related issues. Different grouping and structuring strategies were developed and manipulated in this work. The 3 x 3 factorial quasi-experimental design employed a pretest-posttest comparison group, with two independent variables: thinking styles and conference structure. The dependent variables were group creativity. 120 students' Thirty second year students Payame Noor University were selected as the participants for the study. The findings confirmed that male students tended to prefer the legislative thinking style more than the female ones. There was no significant difference between male and female students in the overall creative ability. However, the male students had significantly higher creative ability with regard to originality. The findings also supported Sternberg's argument that ability is different from style. In addition, this study found that there was no significant association between the average group member creative ability and the overall group creative performance. As for the test results for the influences of the two proposed factors in terms of group composition and conference structure on group creativity, no significant differences were found for these two factors or their interaction on group creativity.
Key words: Collaborative Learning; Group Creativity; Online

INTRODUCTION

Fostering students' creativity in school settings is increasingly often one of the aims of educational activities in a number of countries (Heilmann & Korte, 2010; Newton & Beverton, 2012). Creativity development has been increasingly accepted as one of the core missions in schools around the world. (Hong, Part, & Rowell, 2017). Generally, creativity is the ability to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive when it comes to task constraints) (Sternberg & Lubart, 1999). However, most creative acts occur in a collaborative context (Sonnenburg, 2004). For example, groups provide a sufficient pool of knowledge, experiences, and views to produce an optimal outcome at each stage of the problem- solving process (Lohman & Finkelstein, 2000). Littleton and his colleagues (2008) emphasized that, whilst research on creativity has frequently stressed the role of the individual as producer, contemporary work has afforded a characterization of the creative processes as dynamic, fundamentally social, and necessarily collective and collaborative. Similarly, contemporary literature on learning theory has suggested a move away from an individualistic conception of learning, locating it within a wider social-cultural context. Increasingly, knowledge is believed to be constructed in settings of joint activity, where people are dedicated to learn and collaborate around shared tasks and issues that matter to them (De Laat & Lally, 2004).

Research into creativity in the 1980s and 1990s became rooted in a social-psychological framework in which it was recognized that social structures affect

---

[1] Faculty of Member, Department of Education, Payame Noor University, Iran
[2] Assistant Professor, Department of Education, Payame Noor University, Iran
[3] Full Professor, Department of Education, Payame Noor University, Iran
[4] Full Professor, Department of education, Payame Noor University, Iran

individual creativity (Jeffrey & Craft, 2001). According to Rhyammar and Brolin (1999), there were major lines of development from the 1950s focusing on personality, cognition, and how to stimulate creativity. This was supported by the philosophical debate from the 1970s which saw creativity moving away from product outcomes and becoming connected with imaginativeness. During the 1980s, a new line was developed, that of social psychology and systems theory, where environmental conditions were taken into account. Within these four lines of development (i.e., personality, cognition, stimulating creativity, and social theories) there were the following specific focuses: the person who creates, the creative process, environmental factors, and the out- come. During the 1990s, due to the development of the fourth line—social psychology—research into creativity became more comprehensive, integrating these specific focuses, and it began to focus more on the creativity of ordinary people within the education system (Jeffrey & Craft, 2001). Accordingly, Sternberg (1990) points out that the development of scientific thinking about creativity has followed a particular trajectory: going from an early emphasis upon isolated individuals and their internal traits and capabilities, to developing a focus on the interaction between individuals and the environment.

Planning is important to any learning activity, but it is arguably more important to distance education due to the separation of the learners and teacher. While a teacher is able to adjust activities in traditional classroom setting, those in distance education must be thoroughly planned in advance to avoid leaving out critical components (Newby et al., 2006). In addition, the course goals and objectives, structures of the course, course activities and the number of students expected for the particular course will all determine how and what learning theory and technology will actually be applied (Heidt, 1989).

Putting learners in a group and simply providing them with a relevant platform for communication and knowledge will not automatically lead to productive collaboration (Hakkinen, 2004; Puntambekar, 2006). Collaboration can be promoted by effective grouping to favor the emergence of productive discussion. Some studies emphasize the effectiveness of heterogeneous groups (Johnson et al., 1998; Nurrenbern, 1995; Slavin, 1995), whereas other studies support homogeneous ones (Felder et al., 1995; Rosser, 1997; Sandler et al., 1996).

Moore &Kearsley (1996) noted that real or virtual groups can be used by course designers and instructors for generating content, especially when students can be organized into project teams and given responsibility for making presentations to their peers. During the cooperative process, group members have the opportunity not only to learn from one another about more effective thinking styles, but also learn how to tolerate differences among them, such as different values and ways of approaching a task and dealing with problems (Zhang, 2002).

Strategies for an online group discussion have a significant impact on the quality of collaborative learning. Online collaborative learning environments have the potential to support teaching and learning relying on social interaction between group members (Kreijns et al., 2004). For equal participation among group members, collaboration can be promoted by structuring the collaborative process or by different grouping methods to promote the emergence of productive interaction (Hakkinen, 2004). Research also shows that various conditions, such as group composition, task structure, and individual characteristics, influence the efficacy of collaborative learning (Schellens et al., 2005).

In relation to group composition, the most commonly mentioned factor is group size, which should not be either too large or too small, and the use of small groups, no more than 8, in online/distance education courses is preferred (Kumar, 2005). In addition to group size, some studies emphasize heterogeneous groups, whereas others support homogeneous ones. According to Sternberg (1988, 1990, 1997), the best way of grouping lies in each single group containing students with different thinking styles which bring forth better cooperative results. He argued that teachers should create a learning environment in which students with different thinking styles can capitalize on their strengths and compensate for their weaknesses of thinking and learning, and therefore proposed the theory of mental self-government to assist teachers to enhance the effectiveness of teaching and learning. Thinking style refers to personal preferences, not abilities. Sternberg also contended that although

someone might have creative ability, they may not enjoy coming up with novel ideals challenging prevailing view points (Sternberg & Lubart, 1995). Or conversely, that while someone might not be creative, they may prefer generating unorthodox ideas Sternberg & Zhang, 2005). However, in Zhang's (1999) cross-cultural study of the relationships between thinking styles and a number of student characteristics, she identified that legislative and liberal styles are creativity-relevant styles. Therefore, the complex relationships between people's willingness and their creative ability need to be further investigated. In addition, the validity of grouping people with different thinking styles is merely a theoretical assumption, and whether it actually leads to better cooperative results is still awaiting verification (Lee & Tsai, 2004). Theoretical and empirical research has contributed conceptual insights and practical guidance about the complexities of distance education, and has developed methods to enhance the distance teaching–learning environment (Chen & Willits, 1999). Unfortunately, in the online collaborative learning environment, in terms of computer conferencing, very few studies have focused on the promotion of creativity. Moreover, with regard to fostering creativity, research into the impact of grouping by thinking styles and conference structuring. In addition, the impact of small group activities on transactional distance via synchronous computer conferencing has yet to claim much attention from researchers. These issues are thus topics worthy of further investigation. In this study, it is therefore critical to investigate how collaborative activities can be implemented using appropriate strategies, i.e. the most suitable group composition and conference structure, to increase students' motivation to contribute diverse perspectives via computer conferencing. One main concern of the current research is to investigate effective online collaborative activities using synchronous computer conferencing to enhance creativity in small groups. A critical look at the literature will provide insights into how and why learning theory and Internet technology are integrated in this study. To sum up, the objectives of this research are to:

(1) investigate the relationship between thinking styles and creative ability;

(2) uncover the relationships among thinking styles, group composition, individual creative ability and group creativity;

(3) explore the effects of group composition and conference structure on group creativity.

METHODS

The target population for this work was full-time university students in Iran. Students from the Payame Noor University. Thirty second year students from three intact classes of the College of Education were selected as the participants for the main study.120 student from virtual courses took part in the research with most of them aged between 21 and 22. Among the three classes which were taught by the researcher, two were from the College of Engineering and one from the College of Humanities and Social Sciences. In this study, the medium used for group conferencing was Blackboard Academic Suite, an e-Education platform that enables users to post information and assignments, and to share their academic or social experiences. All classes included in this sample utilized the online course management system, Blackboard. In addition to the weekly face-to-face sessions, the Blackboard discussion board was a required element for each group to engage in collaboration to complete group assignment of this two-credit course (94 male and 26 female).

The primary mode of group communication in synchronous conferencing was text-based, and all groups were required to upload the complete transcripts of the messages exchanged during each period of conferencing for the researcher to review the messages, and thus better understand the group interaction processes. Because it provides message logs, and the capability to share pictures, videos and other files while chatting, MSN Messenger was chosen as the synchronous communication medium.

The 3 x 3 factorial quasi-experimental designs employing a pretest-posttest comparison group, with thinking styles being a measured factor and conference structure being a manipulated factor. Three research instruments were used to collect data: the Thinking Styles Inventory (TSI), the Abbreviated Torrance Test for Adults (ATTA), the Creative Product Semantic Scale (CPSS),

All the collected data were organized and compiled for analysis using SPSS Statistics. The variables of interest were analyzed with descriptive statistics, Pearson correlation tests, the *t*-test and analysis of variance (ANOVA). Descriptive statistics were obtained on the background and demographic variables to describe the sample. Inter-rater and internal consistency coefficients were obtained for the reliability assessment. Factor analysis was conducted to test construct validity. The assessment results of the reliability and validity of the research instruments used in the main study, namely, the TSI, ATTA, CPSS, and questionnaire of transactional distance, are reported in Chapter Four.

RESULTS AND DISCUSSION
Findings related to gender, thinking styles and creative ability: Are there any relationships among gender, thinking styles and creative ability?
This study first examined whether male and female students differ in their thinking styles, as measured by the TSI and in creative ability, as measured by the ATTA.
the statistical results show that the males did not differ significantly from the females on the executive (p= .61) and judicial thinking styles (p = .11).

Table1. Means, standard deviations and *t*-tests for thinking styles between male and female students

Thinking Style	Male (n=40)		Female (n=80)		t-test		
	M	*SD*	*M*	*SD*	*T (df =133)*	*p*	*d*
Legislative	5.69	.81	5.34	.84	2.14	.03*	.42
Executive	5.03	.94	5.14	.97	-.51	.61	
Judicial	4.63	1.09	4.32	.97	1.61	.11	

Note. M = mean. SD = standard deviation. df = degrees of freedom. *p < .05.

The frequency distributions of the Creativity Level for each group are shown in Table2.The results revealed that the majority of participants in both groups were at the Below Average level.

Table2. Distributions of overall creative ability

CI	1-49	50-56	57-61	62-66	67-70	71-75	76+
Creativity Level	Minimal	Low	Below Average	Average	Above Average	High	Substantial
Male Group n=40	1 (3.0%)	3 (9.1%)	13 (39.4)	8 (24.2%)	6 (18.2%)	0 (18.2%)	2 (6.1%)
Female group n=80	5 (5.3%)	18 (19.1%)	36 (38.3)	21 (22.3%)	6 (6.4%)	5 (5.3%)	3 (2.4%)

Independent-groups t-tests assuming equal variances were performed to test whether there were any significant differences in thinking styles between male and female groups. Means and standard deviations of the thinking styles by gender and t-test results are reported in Table 3.

Table3. Means, standard deviations and t-test for overall creative ability between male and female students

	Male (n=33)		Female	(n=94)	*t*-test	
Measure	M	SD	M	SD	T(df =125)	P
CI	61.7	6.48	60.29	6.96	1.02	.31

Note. M = mean. SD = standard deviation.
The correlation analyses between thinking styles (legislative, executive and judicial) and creative ability (the creative Index, fluency, originality, elaboration and flexibility) were undertaken to find out any possible associations. Demonstrates that there were some slight relationships between thinking styles and creative ability, although there were no significant results between any pair of variables (p > .05).

Table 4. relations between thinking styles and creative ability (N=120)

Measure Creativity Index	Fluency	Originality	Elaboration	Flexibility
Legislative .09	-.13	.13	-.06	.05
Executive -.14		-.15	-.06	.01
Judicial		-.09	.11	-.003

Findings related to individual creative ability and group creativity
Is individual creative ability related to the overall group creative performance?
The results reveal that the correlation coefficient for these two variables was $r = .007$, $p = .98$, and thus there was no significant association between the average result for group member creative ability and that for overall group creative performance.

Table5. Correlation between the average of member creative and the overall group creative performance.

Variable Pearson's (r) p	M	SD	Skewness	Kurtosis	Kolmogorov/Sig
Average of group member creative ability .007 .98	60.96	4.42	.16	.23	.113/.20
Overall group creative performance	13.58	.70	.86	1.03	.100/.20

Findings related to factors influencing on group creativity
Do group composition and conference structure have an effect on group creativity?
As is evident from the table 7, there were no significant differences among the legislative, executive and judicial groups ($F(2, 15) = 1.33$, $p = .29$, partial $\eta2 = .15$)). Moreover, there were also no significant differences among the high-structured, low-structured and no-structured conferences ($F(2, 15) = 3.56$, $p = .054$, partial $\eta2 = .32$). Furthermore, no significant interaction was found between group composition and conference structure ($F(4, 15) = 1.62$, $p = .22$, partial $\eta2 = .30$).

Table 6. Two-way ANCOVA table for group composition and conference structure

Source	Sumof Squares	df	Mean Square	F	Sig.	η^2	Power[b]
Corrected model	5.93[a]	9	.66	1.53	.22	.48	.48
Intercept	9.37	1	9.2	21.8	.000	.59	.99
Covariance (pretest)	.001	1	.001	.001	.97	.000	.05
Group composition	1.14	2	.566	1.33	.29	.15	.23
Conference structure	3.06	2	1.54	3.56	.05	.32	.57
Group composition *	2.78	4	.70	1.62	.22	.30	.38
Conference structure							
Error	6.44	15	.43				
Total	429.1	25					
Corrected total	12.37	24					

Note. n2 (eta squared) = effect size.
R squared = .469 (Adjusted R squared = . 164). b. Computed using alpha = .05

As shown in below, when controlling for the pre-existing group creativity, no significant effects were found for either the group composition or conference structure factor on group performance. Moreover, no significant interaction was found between these two factors.

Table7. Adjusted and unadjusted means and variability for the score of the second group blog using the score of the first group as a covariate

	Unadjusted			Adjusted	
Group Composition	N	M	SD	M	SD
Legislative	11	13.00	.69	13.4	.22
Executive	9	13.25	.90	13.5	.30
Mixed	8	12.9	.64	13.2	.31
Conference Structure					
High	9	13.3	.53	13.4	.26
Low	9	13.1	.82	12.6	.23
No	9	12.8	.60	13.61	.23

The main purpose of this study was to investigate the effects of online collaborative activities based on the differences of individual students, in order to enhance the creativity expressed in an online learning environment.

The results of the present study showed that some students got high scores in both legislative and executive thinking styles. It may be that what was originally supposed to be a homogeneous group became a heterogeneous one, and this might be the reason why no significant differences were found between the homogeneous and heterogeneous groups with regard to group creativity in this work.

Therefore, teachers should encourage students to develop different thinking styles, and provide them with opportunities to demonstrate their varied strengths by diversifying their teaching and assessment strategies, and designing a variety of group activities. Students' awareness of their own styles, as well as those of their partners, could be instrumental to the effectiveness of conflict resolution and group cohesiveness (Zhang & Sternberg, 2009).

Some group researchers claim that by providing many different perspectives for consideration, diversity within a group can help the creative process and promote more innovative outcomes (Austin, 1997; Bantel& Jackson, 1989; Kurtzberg&Amabile, 2001; Kurtzberg, 2005; Mamykina et al., 2002). Adiverse group consists of members who are different from each other with regard toone or more characteristics (Milliken et al., 2003). However, in this study, there was no significant association between the average group member creative ability and the overall group creative performance. Furthermore, using an experimental method, no significant main effects were found for the group composition and conference structure factors on group creative performance, and no significant interaction was found between these two factors, either. That is, heterogeneous groups (mixed groups) did not demonstrate better creative performance than the homogeneous ones (legislative and executive groups). These findings reveal the complexity of group creative performance. Creativity is both a process and an outcome - if one cannot understand the process that created it, and then the outcome is also not well understood (Milliken et al., 2003).

In addition, group members with substantial psychological safety are more likely to feel positive about the group and its task. In contrast, group members with low psychological safety generally feel disinterested in the group and are less like to engage with it. Moreover, negative moods are associated with a high level of emotional conflict and low levels of group satisfaction, and such conflict may lead to narrow and rigid thinking, thus reducing creativity. In contrast, a positive mood may enhance participation and increase members' capacity to generate unusual and creative ideas. An additional factor that may reduce group performance is conformity, the desire for social consensus, which induces agreement without

reflection and limits the ability of individuals' to think in alternative ways (Nemeth & Nemeth-Brown, 2003). Due to fear of social sanctions or the assumption that the majority is probably correct, people in groups often agree, and this conformity harms creativity. All of these factors may affect creative processes and outcomes, and are worthy of further exploration in future research.

CONCLUSION

The greatest strengths of online collaborative learning are its flexibility, independence, cost efficiency, as well as its powerful capability to enable direct interaction and communication. It is a challenge for the teacher to create an online environment that not only emphasizes the importance of learner autonomy, but also encourages distance students to participate in non-contiguous discussions. Advances in computer conferencing systems are facilitating new opportunities for two-way communication by which groups of students can practice reflection, critical thinking and problem solving (Sumner, 2000). In addition, the potential for greater enjoyment and relaxation when taking part in computer conferencing might help learners who had previously felt frustrated to overcome their fears, and thus build a more productive and structured learning environment with a social and subject-related consensus

(Nipper, 1989). Besides, the implementation of computer conferencing, an open and democratic medium, will move the locus of control from the teacher to the group and the processes generated by it, and consequently contribute to less authoritarian concepts of learning and teaching.

This research aims to uncover whether grouping and structuring are related to group creativity, through innovative uses of Internet technology, specifically synchronous computer conferencing. The descriptive results show that most of the respondents had positive perceptions and attitudes toward their online learning experience. In light of the findings discussed in this study, the findings of this work can assist practitioners in guiding their efforts to develop more effective collaborative activities connecting distance learners, thusThey can also inspire practitioners to consider how to use synchronous computer conferencing to encourage and promote student creativity.

REFERENCES

Austin, J. R. (1997). A cognitive framework for understanding demographic influences in groups. The International Journal of Organizational Analysis, 5(4), 342-359.

Bantel, K. A., & Jackson, S. E. (1989). Top management and innovations in banking: Does the composition of the top team make a difference? Strategic Management Journal, 10(S1), 107–124.

Chen, Y. -J., & Willits, F. K. (1999). Dimensions of educational transactions in a videoconferencing learning environment. American Journal of Distance Education, 13(1), 45–59.

De Laat, M., & Lally, V. (2004). Creativity and the net: How do re-searchers collaborate creatively using the internet? In D. Miell, & K. Littleton (Eds.), Collaborative creativity, contemporary perspectives (pp. 126-143). London: Free Associate Books.

Felder, R. M., Felder, G. N., Mauney, M., Hamrin, Jr., C. E., & Dietz, E. J. (1995). A longitudinal study of engineering student performance and retention. III. Gender differences in student performance and attitudes. Journal of Engineering Education, 84 (2), 151-174.

Hakkinen, P. (2004). What makes learning and understanding in virtual teams so difficult? Cyber psychology& Behavior, 7(2), 201-206.

Heidt, E. U. (1989). Media selection. In M. Eraut (Ed.), the international encyclopedia of educational technology (pp. 393-398). Oxford, England: Pergamon Press.

Heilmann, G., & Korte, W. B. (2010). The role of creativity and innovation in school curricula in the EU27. Seville: European Commission - Joint Research Centre Institute for Prospective Technological Studies.

Hong, E., Part, R., & Rowell, L. (2017). Children's and teachers' conceptions of creativity: Contradictions and implications in classroom instruction. In R. A. Beghetto, & B. Sriraman (Eds.). Creative contradictions in education: Cross disciplinary paradoxes and perspectives (pp. 303–331).

Jeffrey, B., & Craft, A. (2001). The universalization of creativity. In A. Craft, B. Jeffrey, & M. Leibling (Eds.), Creativity in education (pp. 1-13). London: Continuum International Publishing Group.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). Cooperative learning returns to college: What evidence is there that it works? Change, 30(4), 26-35.

Kreijns, K., Kirschner, P. A., Jochems, W., & Van Buuren, H. (2004). Determining sociability, social space, and social presence in (a)synchronous collaborative groups. Cyber Psychology & Behavior, 7(2), 155-172.

Kumar, R. (2005). Research methodology: A step-by-step guide for beginners. London, England: SAGE.

Kurtzberg, T. R., & Amabile, T. M. (2001). From Guilford to creative synergy: Opening the black box of team level creativity. Creativity Research Journal, 13(4), 285-294.

Lee, C. -I., & Tsai, F. -Y. (2004). Internet project-based learning environment: The effects of thinking styles on learning transfer. Journal of Computer Assisted Learning, 20(1), 31-39.

Littleton, K., Rojas-Drummond, S., & Miell, D. (2008). Introduction to the special issue: "Collaborative creativity: Socio-cultural perspec-tives". Thinking Skills and Creativity, 3, 175-176. doi:10.1016/j.tsc.2008.09.004

Lohman, M. C., & Finkelstein, M. (2000). Designing groups in prob-lem-based learning to promote problem-solving skill and self-directed- ness. Instructional Science, 28, 291-307. doi:10.1023/A:1003927228005

Mamykina, L., Candy, L., & Edmonds, E. (2002). Collaborative creativity. Communications of the ACM Special Section on Creativity and Interface, 45(10), 96-99.

Milliken, F. J., Bartel, C. A., & Kurtzberg, T. R. (2003). Diversity and creativity in work groups: A dynamic perspective on the affective and cognitive processes that link diversity and performance. In P. B. Paulus & B. A. Nijstad (Eds.), Group creativity: Innovation through collaboration (pp. 32-62). New York, NY: Oxford University Press.

Moore, M. G., &Kearsley, G. (1996). Distance education: A systems view. Belmont, CA: Wadsworth.

Nemeth, C. J., & Nemeth-Brown, B. (2003). Better than individual? The potential benefits of dissent and diversity. In P. B, Paulus & B. A. Nijstad (Eds.), Group creativity: Innovation through collaboration (pp. 63-84). New York, NY: Oxford University Press.

Newby, T.J., Stepich, D. A., Lehman, J.D., Russell, J.D., Ottenbreit-Leftwich, A.T. (2006). Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Newton, L., & Beverton, S. (2012). Pre-service teachers' conceptions of creativity in elementary school English. Thinking Skills and Creativity, 7(3), 165–176.

Nipper, S. (1989). Third generation distance learning and computer conferencing. In R. Mason, & A. Kaye (Eds), Mind weave: Communication, computers and distance education (pp.63-73). Oxford, England: Pergamon Press.

Nurrenbern, S. (1995). Experiences in cooperative learning: A collection for chemistry teachers. Institute for Chemical Education, University of Wisconsin Board of Regents, Madison, WI.

Puntambekar, S. (2006). Analyzing collaborative interactions: Divergence, shared understanding and construction of knowledge. Computers & Education, 47(3), 332-351.

Rosser, S. V. (1997). Re-Engineering female friendly science. New York, NY: Teachers College Press, Columbia University.

Ryhammar, L., & Brolin, C. (1999). Creativity research: Historical con-siderations and main lines of development. Scandinavian Journal of Educational Research, 43, 259-273.

Sandler, B. R., Silverberg, L. A., & Hall, R. M. (1996). The chilly classroom climate: A guide to improve the education of women. National Association for Women in Education (NAWE).

Schellens, T., Van Keer, H., & Valcke, M. (2005). The impact of role assignment on knowledge construction in asynchronous discussion groups: A multilevel analysis. Small Group Research, 36(6), 704-745.

Slavin, R. E. (1995). Cooperative learning: Theory, research, and practice (2nd ed.). Boston, MA: Allyn & Bacon.

Sonnenburg, S. (2004). Creativity in communication: A theoretical frame- work for collaborative product creation. Creativity and Innovation Management, 13, 254-262. doi:10.1111/j.0963-1690.2004.00314.x

Sternberg, R. J. (1988). Mental self-government: A theory of intellectual styles and their development. Human Development, 31(4), 197-224.

Sternberg, R. J. (1990). Metaphors of mind: Conceptions of the nature of intelligence. New York, NY: Cambridge University Press.

Sternberg, R. J. (1997). Thinking Styles. Cambridge, England: Cambridge University Press.

Sternberg, R. J., & Lubart, T. I. (1995). Defying the crowd: Cultivating creativity in a culture of conformity. New York, NY: Free Press.

Sternberg, R. J., & Lubart, T. I. (1999). The concept of creativity: Prospects and paradigms. In R. J. Sternberg (Ed.), Handbook of creativity (pp. 3-15). New York: Cambridge University Press.

Sternberg, R. J., & Zhang, L. F. (2005). Styles of thinking as a basis of differentiated instruction. Theory into Practice, 44(3), 245–253.

Sumner, J. (2000). Serving the system: A critical history of distance education. Open Learning, 15 (3), 267-85.

Zhang, L. F. (1999). Further cross-culture validation of the theory of the mental self-government. Journal of Psychology, 133(2), 165-181.

Zhang, L. F. (2002). Thinking styles: Their relationships with modes of thinking and academic performance. Educational Psychology, 22(3), 331-348.

Zhang, L. F. (2006). Preferred teaching styles and modes of thinking among university students in mainland China. Thinking Skills and Creativity, 1(2), 95-107.

Zhang, L. F., & Sternberg, R. J. (Eds.) (2009). Perspectives on the nature of intellectual styles. New York, NY: Springer Publishing Company.