資訊系統開發團隊創造力之衡量：量表建置與驗證

[*1]汪美香、[2]楊棠堯
南台科技大學資訊管理系
*[1]shiang@mail.stust.edu.tw,[2]tyyang@mail.stust.edu.tw

摘要

團隊創造力已不斷地被資訊系統開發領域學者所研究與討論，但卻一直沒有測量資訊系統開發團隊創造力的工具。本研究針對資訊系統開發過程，進行文獻探討，以發展出一套具有信效度的資訊系統開發團隊創造力量表。本研究總計收集 113 份受測者問卷，進行各種信度與效度分析。根據資料分析結果，建構一個包括六個構面，十九題問項之 ISD 團隊創造力量表。此量表當可提供後續資訊系統開發團隊創造力相關研究之參考。

關鍵詞：資訊系統開發、團隊、創造力、量表發展

Measuring Team Creativity in an Information Systems Development Context: Scale Development and Validation

Mei-Hsiang Wang, Tang-Yao Yang
Department of Information Management, Southern Taiwan University of Science and Technology

Abstract

Team creativity has long been studied in information systems development (ISD) theory, but there is still no proper measurement of the construct among academic researchers. The present study develops a comprehensive scale of creativity in ISD teams. This paper presents evidence of the scale's factor structure, reliability, content validity, criterion-related validity, convergent validity, and discriminant validity based on data analysis of a sample of 113 respondents in Taiwan. From the analysis, a six-factor, nineteen-item instrument with good psychometric properties for ISD team creativity was developed. This empirically validated instrument will be useful to researchers developing and testing ISD team theories as well as to organizations investigating issues related to team creativity in ISD.

Keywords：Information Systems Development, Team, Creativity, Scale Development

Received: Aug. 4, 2011; accepted: Dec. 2011.
Corresponding author: M.-H. Wang

I. Introduction

Creativity is essential for business success in today's competitive environment. When teams are a primary mechanism for accomplishing organizational work, creative teamwork becomes an important organizational issue. Information systems development (ISD) teams is one particular area where creativity plays an important role and it address the importance and challenges of managing team-based work that requires knowledge and experience (Faraj & Sproull, 2000; Grant, 1996). The ISD process typically involves developing a model of the application domain and translating the model into formalizations that aid the construction of the solution (Korpela, Mursu & Soriyan, 2002; Yang & Tang, 2004). It exhibits conditions of (1) dependence, where temporally team members are dependent on each others' knowledge domains; (2) novelty, as, by nature, most systems projects are either new for the business domain or require the application of a new technology, or both; (3) specialization, where a variety of skill sets is required to take a project from initialization to system installation. Furthermore, as technology advances and business environment change, ISD team members must identify the real needs for users and further seek the tailored solutions to users problems all required creative thinking and solutions.

In recent years, creativity issues are receiving increased attention from the IS research community. Unfortunately, the contemporary ISD literature has not explicitly developed the team creativity scales. It was found that the team creativity construct in the ISD environment was somewhat different than the team creativity of other areas. The majority of existing creativity research that either focuses on the scales development of marketing, new product development, R&D, customer service (Im & Workman Jr., 2004; Wang & Netemeyer, 2004), or stresses the antecedents and consequences of the creativity (Wang, Lin, & Li, 2009; Wang, Yang, & Huang, 2009; Wang, Chen, Lin, Lin, & Lee, 2011). However, there are relatively few studies in measuring ISD team creativity. The measurement of ISD team creativity will be helpful in identifying team creativity content, assessing activities in the ISD process, and providing valuable references for further empirical studies. Therefore, it is necessary to develop a valid and reliable measure of this construct to measure ISD team creativity.

The purpose of this paper is to take the first step in closing this gap in the ISD literature. Based on social psychological theory of creativity and the qualitative study, the research develops an instrument to measure ISD team creativity. Although the construct of team creativity for ISD setting has yet to be studied, extant literature suggests it may be related to a variety of interactions and behaviors, including communication and learning. For instance, Domsch & Gerpott (1995) pointed out that by means of communication, ideas and contributions can be shared, discussed, and evaluated with other team members more quickly and efficiently. Masse et al. (2008) noted that Software development involves collaborative work, including task-related and social interactions, within teams. Faraj & Sproull (2000) found that system development requires the application of knowledge. To achieve development outcomes effectively, the exchange and combination of knowledge is required. Lei, et al. (1999) stressed that team learning can be collectively used to develop intelligence and abilities. Accordingly, creative ideas should be constantly exchanged among team members through formal and informal means of communication so that the teams can learn from each other and improve their knowledge and skills. Following the above argument that team creativity can be assessed by appropriate judges. Therefore, this study developed and validated a multi-dimensional model for assessing ISD team creativity from the perspective of collaboration, coordination, communication, and team learning.

II. Domain of team creativity

1. Conceptualization of team creativity

(1) Communication

The most elementary component of a creative team is communication within the team. Communication provides a means for exchanging information among team members (Pinto & Pinto, 1990). Accordingly, creative ideas should be constantly exchanged among team members through formal and informal means of communication so that they can learn from each other and improve their knowledge and skills. The communication within a team can be described in terms of the frequency, formalization, structure, and openness of the information exchange. By means of communication, ideas and contributions can be shared, discussed, and evaluated with other team members more quickly and efficiently (Domsch & Gerpott, 1995). A lack of openness within a team hinders the most fundamental function of teamwork, namely, the integration of team members' knowledge on ISD work.

(2) Collaboration

Based on the relevant literature, a team can be defined as a social system that is embedded in an organization and whose members collaborate on a common task (Wiendieck, 1992; Guzzo & Shea, 1992). Software development involves collaborative work, including task-related and social interactions, within teams. In our study, the collaboration is defined as the quality of interactions within teams rather than team members' activities. Therefore, the collaboration as a multifaceted dimension is conceptualized, including satisfaction with collaboration, impact of collaboration, and trust/respect (Masse et al., 2008).

(3) Coordination

ISD teams that are better able to coordinate or share knowledge of stakeholders are also more creative. System development requires the application of knowledge. To achieve development outcomes effectively, the exchange and combination of knowledge is required. Although the centrality of knowledge in the ISD process is now well recognized, little research has focused on the coordination and sharing of knowledge (Larson & Schaumann, 1993; Brannick et al., 1995).

The degree of common understanding regarding the interrelatedness and current status of individual contributions also influences the creativity of ISD teams' performance. While teams must work together on fundamental aspects of a common task, many activities in the task process are delegated to individual members working on parallel subtasks. One important component of creativity in ISD teams is the harmonization and synchronization of these individual contributions. Expertise coordination becomes more important during teamwork so that the team can recognize where expertise is located, needed, and accessed (Faraj & Sproull, 2000).

(4) Learning

According to some researchers, teams are able to learn from the skills and approaches of its members. These skills can be collectively used to develop intelligence and abilities, known as team learning (Lei, et al., 1999). Creativity requires a high level of relevant skills to generate and evaluate novel solutions (Amabile, 1983). New technologies, products, and customers emerge constantly in today's environment, the software development professional should put into learning affects their ability to generate and evaluate creative solutions. Team learning is gaining importance as a strategy for gaining greater competitive advantage. In Edmondson's (1999) study, team learning-orientated behavior has two sub-dimensions: internal team learning behaviors and external

Table 1 The Dimensions of Team Creativity

Dimensions	Sub dimensions	References
Collaboration	.Satisfaction with collaboration .Impact of collaboration .Trust and respect	Masse, et al. (2008), Tiwana & McLean (2005), Saeki (1995)
Coordination	.Expertise location .Expertise needed .Bring expertise to bear	Faraj & Sproull (2000), Saeki (1995), Malone & Crowston (1994)
Communication	.Frequency .Formalization .Structure .Openness	Hoegl & Gemuender (2001), Gemuenden & Lechler (1997), Domsch & Gerpott (1995)
Learning	.Internal team learning .External team learning	Edmondson (1999), Chan et al. (2003), Watkins & Marsick (1993)

team learning behaviors. Edmondson (1999) defined internal team learning as follows: The extent to which team members engage in behaviors to monitor performance against goals, obtain new information, test assumptions, and create new possibilities. External team learning was further designated by Edmondson (1999) as follows: An assessment by several of the team's customers and/or managers about the extent to which a team engaged in behaviors such as seeking new information or asking those who receive or use its work for feedback.

The dimensions used to measure teamwork creativity and the relative literature is listed in Table 1. Detailed indicators are not enumerated because of limited space.

2. Hypotheses for testing nomological validity

The primary purpose of developing team creativity measures is to predict certain behavior. An instrument has nomological validity if it "behaves as expected with respect to some other dimensions to which it is theoretically related" (Churchill, 1995). Studies on new product success and failure have suggested that new product creativity provides competitive product advantage by enhancing novel and useful perspectives of the product (Song & Montoya-Weiss, 2001; Song & Parry, 1999). This study proposes a positive relationship of team creativity on ISD performance for the following reasons. ISD creativity plays a critical role in solving problems associated with software development and launches by providing divergent ideas in a meaningful way, which guarantees the software development. Furthermore, ISD creativity that is accumulated as team intelligence about novel and meaningful ideas can lead to the total solutions by meeting users demands in meaningful ways, which in turn results in superior ISD performance. According to Jiang, Klein, Hwang, Huang, and Hung (2004), project performance was defined as the extent to which the software development process has been undertaken as well as performance of the delivered system from the viewpoint of the users. It is important to study both the process performance and the product performance, because even though the software delivered by the project may be of high quality, the project itself may have significantly exceeded time and cost. On the other hand, well-managed projects which adhere to cost and schedule may deliver poor systems. In this study, the project performance was divided team efficiency and team effectiveness aspects. In other words, team members that possess high levels of creativity enable the team to envision new combinations of means and ends and ultimately to devise more creative solutions to current problems. Due to team members are more likely to find better answers to novel problems inherent in projects (higher effectiveness) within the project's time and budget constraints (higher efficiency). Therefore, creativity is likely to improve the performance in a number of ways, the following two hypotheses were tested to validate the nomological validity of the proposed team creativity instrument:

H1: A positive relationship exists between team creativity and team efficiency.

H2: A positive relationship exists between team creativity and team effectiveness.

III. Generation of scale items

In the field of information systems, Churchill's scale developing paradigm has been adopted by many scholars. Hence, the methodology of this study follows the steps of Churchill's (1979) scale development process as follows: (1) define the research conceptualization/construct, (2) identify the measuring concept and initial items pool through pilot study, (3) collect the data, (4) refine the measuring items pool through exploratory factor analysis, and (5) assess the reliability and validity through confirmatory factor analysis. The procedures used in conceptualizing ISD team creativity dimensions, generating items, collecting data, and validating a multiple-item scale for measuring ISD team creativity are described below.

IV. Data collection and scale purification

Following the guidelines of development procedures proposed by Churchill's (1979), this study first used EFA to identify the underlying factors structure on one sample, and then followed with CFA to confirm such factor structure on another sample. The detail is as follows:

1. Pretest and pilot test

After identification of the first questionnaire, to gain a well understanding of ISD team creativity, a few respondents were chose, which include three scholars in the management information systems (MIS) field and six information systems personnel who have over five years' experience in ISD practice from various industries. The purpose of the pretest was to obtain the responders' assessment of the test contents, questionnaire format, choice of items pool, and understandability of the questions. Based on the responders' opinions, the questionnaire is adjusted. Then 67 participants who have above four years' experience were asked to proceed with the pilot test and provide suggestions on improving the questionnaire. Finally, the questionnaire according to their suggestions is made adjustments. After the pretest and pilot test, 36 questions were selected to measure ISD team creativity.

2. Item analysis and reliability estimates

The 36-item instrument was refined by analyzing the collected data. The first step in purifying the instrument was to calculate the coefficient alpha and item-to-total correlations, which were used to delete non-essential items (Cronbach, 1951). The 36-item instrument had a reliability of 0.94. At the same time, in this stage, the 36 items were filtrated according to the correlation of item-to-total with 0.3 as the cutoff point (Guieford, 1965), and eliminated 2 items with item-to-total correlation below 0.3.

3. Item refining and exploratory factor analysis (EFA)

To gain a deeper understanding of team members of software development and to test the measurement model, this study chose ISD teams from various software industries (i.e., systems design, systems integration, and software services) in Taiwan. The investigation included 43 valid teams and 113 questionnaires. Approximately 75% of the respondents were male and 25% were female. The mean age of the respondents was 31 years. They had 4.12 years experience in the software field. Most respondents were highly educated, with 62% having completed college. Approximately 33% of the respondents had a masters degree or higher. In addition, approximately 13% of the respondents were team leaders, 38% were programmers, 44% called themselves system analysts, and another 5% identified themselves as specialists or consultants. An exploratory factor analysis was conducted to further examine the factor structure of the 34-item instrument. The sample data of 113 responses were examined using principal components factor analysis as the extraction technique and varimax as the rotation method. The cutoff value was 0.5, and all items were deleted with factor loadings less than 0.5 on all factors or greater than 0.5 on many factors. The factor analysis is performed on the six structures of ISD team creativity separately, and calculated the Cronbach’s alpha for each factor in every process. As shown in Table 2, with the exploratory factor analysis, 19 questions were obtained belonging to six dimensions.

Table 2 Summary of results from the scale purification

Dimension/ Item	Reliability	Loading	Item-to-total correlation
Team collaboration:			
Team is an organized or structured collaboratively team.	0.84	0.90	0.50
Team has the ability to capitalize on the strength of different team members.		0.77	0.58
Team members communicate among collaborator.		0.67	0.57
Team has productivity in information systems development.		0.62	0.40
Team accepts of new ideas.		0.59	0.67
Trust and Respect:			
In general, team members respect each other.	0.66	0.84	0.66
In general, team members are open to criticism.		0.81	0.44
Knowledge coordination:			
Team members are assigned to tasks commensurate with their task-relevant knowledge and skill.	0.86	0.89	0.64
Team has a good map of each others’ talents and skills.		0.88	0.67
Team members know what task-related skills and knowledge that each possess.		0.83	0.74
Team members know who on the team has specialized skills and knowledge that is relevant to their work.		0.74	0.49
If someone in our team has some special knowledge, team member is not likely to tell the other member about it[R].		0.73	0.64
Internal learning:			
In our team, members discuss ways to prevent and learn from mistakes.	0.84	0.89	0.51
Team members regularly take time to figure out ways to improve team work processes.		0.86	0.60
External learning:			
Team keeps others in the organization informed about what we plan an accomplishment.	0.84	0.91	0.63
Team members go out and get all the relevant work information they possibly can from others.		0.83	0.58
Team communication:			
In our team there were conflicts regarding the openness of the information flow[R].	0.76	0.85	0.52
Team members communicated mostly directly and personally with each other.		0.82	0.34
Project-relevant information was shared openly by all team members.		0.79	0.54

4. Confirmatory factor analysis (CFA)

In order to test the factor structure more rigorously, the study conducted confirmatory factor analyses. A convenience sample of 91 teams was selected from project courses students with majors in software development at a large university in Taiwan. Although the study used a student sample in this process, the results of descriptive analysis of data revealed that the students who participated in this study had had sufficient software development experience which justified the use of a student sample. Then, Amos 7.0 is used to perform the confirmatory factor analysis for the processes of collaboration trust, knowledge coordination, communication quality, and team learning separately, and to test the result from the exploratory factor analysis (Figure 1). The overall model fit was assessed using seven common measures: chi-square/degree of freedom(χ 2/d.f.), GFI, CFI, PNFI, PGFI, RMSEA and RMR. As shown in Table 3, all the indices exceeded their commonly accepted ranges, demonstrating that the measurement model exhibited a good fit with the data collected.

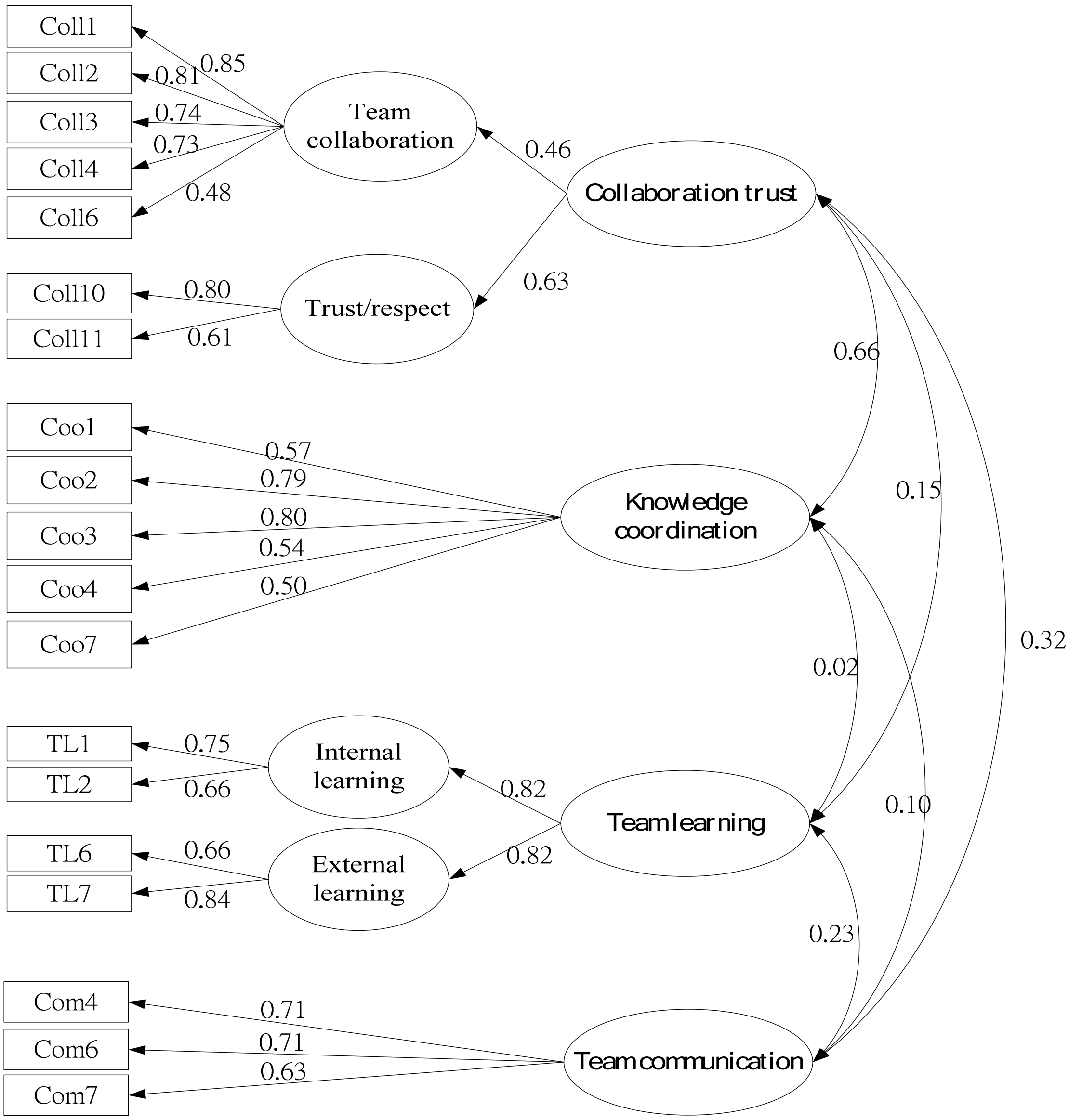

Figure 1 CFA for team creativity

Table 3 Overall fits of models

Fit index	Recommended criteria	Results	Suggested by authors
χ^2/d.f.	<3	1.23	Diamantopoulos and Siguaw(2000)
GFI	>0.8	0.85	Joreskog & Sorbom (1984)
CFI	>0.8	0.94	Joreskog & Sorbom (1984)
PNFI	>0.5	0.64	Mulaik et al. (1989)
PGFI	>0.5	0.63	Mulaik et al. (1989)
RMSEA	<0.05	0.05	McDonald and Ho(2002)
RMR	<0.05	0.04	McDonald and Ho(2002)

V. Reliability and validity test

Reliability was evaluated by assessing the internal consistency of the items representing each dimension using Cronbach’s alpha. The Cronbach’s alpha of each dimension was above 0.7, indicating that the 19-item instrument has good reliability. Validity testing is another important index to measure whether the instruments are good or not. At the stage of choosing items, relative theories and previous literature were referenced. After completing the initial questionnaire, the content and format of the questionnaire with many MIS scholars and ISD experts were discussed. Therefore, this study can guarantee that the ISD team creativity instrument has strong content validity. The convergent validity was assessed by factor loading. In our confirmatory factor analysis, the study determined that the factor loading of the items is greater 0.5, establishing that the instruments have good convergent validity. In our study, nomological validity was evaluated by testing hypotheses H1 and H2. A positive relationship was expected between the total score on the ISD team creativity instrument and the two measures representing team efficiency and team effectiveness if the instrument has nomological validity. Using correlation analysis, hypotheses H1 and H2 were significantly supported at $p < 0.01$, thus supporting the nomological validity of the proposed ISD team creativity measures.

VI. Discussion and Conclusions

What are creative teams, and how can they be measured? In this study, a comprehensive concept of software development creativity and provided empirical validation of the dimensions and its underlying dimensionality for measuring ISD team creativity were developed. The validated 19-item ISD team creativity instrument consists of six facets: team collaboration, trust/respect, knowledge coordination, internal learning, external learning, and team communication. Most researchers believe that team creativity departs significantly from these four concepts (Domsch & Gerpott, 1995; Masse et al., 2008; Faraj & Sproull, 2000; Lei, et al., 1999). Thus, this study developed a relevant instrument to measure ISD team creativity and verified it empirically. This study concluded that the instrument can measure ISD teamwork reliably and effectively. Within an organization, to some extent, ISD team creativity measurements can be used as a benchmark for the implementation of team activities. Consistent with He, Butler, and King (2007) claim, this study found that software development performance can be detrimental to the generation of novel perspectives in information technology firms.

In general, the significance of this study is primarily two-fold. Firstly, departing from the majority of existing creativity research that focuses on the fields of marketing teams, new product development, R & D teams, customer service (Im & Workman Jr., 2004; Wang & Netemeyer, 2004), the proposed ISD team creativity construct captures the principal elements of software development, and thus depicts a team’s overall ability to produce team outcomes. Secondly, the proposed construct incorporates a team interaction orientation as a prime factor of creative capability. This essentially means that the construct assesses the potential creative capability and demonstrates a future orientation. This sets it apart from most of the existing constructs that measure a team's activities from a current and static viewpoint. For researchers, the instrument can be used to test the relationship between ISD team creativity and project performance in the future relevant studies. For managers, the 19 items across six factors can serve a useful diagnostic purpose. The managers can use the validated scale to measure and improve team creativity. The study has its limitations. The data were collected from respondents relevant to software development in Taiwan. To apply the six-dimension scale to various situations still need to be viewed with caution. In other words, modifications may be necessary when the scale is used in other software development setting.

VII. Limitations

Even though rigorous validation procedures allowed us to develop the instrument for measuring ISD team creativity, this work has certain key limitations that should be addressed in future studies. The first limitation is related to the choice of sample frame. The selection of firms in information technology industries for the sample excludes other segments. Second, while a valid instrument was developed using sample data from Taiwan, testing it with a cross-country sample is required for future generalization of the instrument. Third, the criteria of the validity and reliability adopted in this study were lower level limited the team-level data. This result should be interpreted with caution since the ISD team creativity is a newly developed scale and still needs to be tested to ensure the scales' stability over times. Further studies can be undertaken to validate the proposed scale in a wider range of situations and using broader categories of software project teams to match the higher level of the criteria which are adopted in most research.

References

Bagozzi, R. P., & Yi, Y. 1988. On the evaluation of structural equation models. *Journal of Academy of Marketing Science, 16*(1): 74-94.

Brannick, M. T., Prince, A., Prince, C., & Salas, E. 1995.The measurement of team process. *Human Factors, 37*(3): 641-651.

Chan, C. C. A., Pearson, C., & Entrekin, L. 2003. Examining the effects of internal and external team learning on team performance. *Team Performance Management, 9*: 174-181.

Churchill, G. A. Jr. 1979. A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research, 16*(1): 64-73.

Churchill, G. A. Jr. 1995. *Marketing research: methodological foundations* (6^{th} Ed.). Chicago: The Dryden Press.

Cronbach, L. J. 1951. Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(13): 297-334.

Domsch. M. E., & Gerpott, T. J. 1995. *Fuchrung in forschung and entwicklung*. Kieser, A. ed. Handwoetterbuch der Fuehrung. Schaeffer-Poeschel, 369-380.

Edmondson, A. 1999. Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*: 350-383.

Faraj, S., & Sproull, L. 2000. Coordinating expertise in software development teams. *Management Science, 46*(12): 1554-1568.

Faraj, S., & Sproull, L. 2000. Coordinating expertise in software development team. *Management Science, 46*(12): 1554-1568.

Galletta, D. F., & Lederer, A. L. 1989. Some cautions on the measurement of user information satisfaction. *Decision Sciences, 20*(3): 419-438.

Gemuenden, H. G., & Lechler, T. 1997. Success factors of project management: The critical few reviewed paper. *Portland International Conference*, 27-31.

Grant, R. M. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal, 17*: 109-102.

Guzzo, R. A., & Shea, G. P. 1992. *Group performance and intergroup relations in organizations.* M. D. Dunnette, L. M. Hough, eds. Handbook of industrial and Organizational Psychology, 3rd ed. Consulting Psychologists Press. Palo Alto, CA, 269-313.

He, J., Butler, B. S., & King, W. R. 2007. Team cognition: Development and evolution in software project teams. *Journal of Management Information Systems, 24*(2): 261-292.

Hoegl, M., & Gemuenden, H. G. 2001. Teamwork quality and the success of innovative project: A theoretical concept and empirical evidence. *Organization Science*, *12*(4): 435-449.

Hoegl, M., & Parboteeah, K .P. 2007. Creativity in innovative projects: How teamwork matters. *Journal of Engineering and Technology Management.*

Hoyle, R. H. 1995. *Structural equation modeling: Concept, issues, and applications*. Sage, Thousand Oaks, CA.

Jiang, J. J., Klein, G., Hwang, H. G., Huang, J., & Hung, S. Y. 2004. An exploration of the relationship between software development process maturity and project performance. *Information and Management, 41*: 279-288.

Joreskog, K. G., & Sorbom, D. 1984. *LISREL VI: Analysis of linear structural relationships*. By the Method of Maximum Likelihood, Chicago, IL: National Educational Resources.

Korpela, M., Mursu, A., & Soriyan, H. A. 2002. Information systems development as an activity. *Computer Supported Cooperative Work, 11*: 111-128.

Larson, J. R., & Schaumann, L. J. 1993. Group goals, group coordination, and group member motivation. *Human Performance, 6*(1): 49-69.

Lei, D., Slocum, J. W., & Pitts, R. A. 1999. Designing organizations for competitive advantage: the power of unlearning and learning. *Organizational Dynamics, 27*: 24-38.

Malone, T., & Crowston, K. 1994. The interdisciplinary study of coordination. *ACM Computing Surveys*, *26*(1): 87-119.

Masse, L. C., Moser, R. P., Stokols, D., Taylor, B. K., Marcus, M. S. E., Morgan, G. D., Hall, K. L., & Croyle, R. T. 2008. Measuring collaboration and transdisciplinary integration in team science. *America Journal of Preventive Medicine, 35*(2): 151-160.

Mulaik, S. A., James, L. R., Van Altine, J., Bennett, N., Lind, S., & C.D. Stilwell. 1989. Evaluation of goodness-of-fit indices for structural equation models. *Psychological Bulletin, 105*(3): 430-445.

Pinto, M. B., & Pinto, J. K. 1990. Project team communication and cross-functional cooperation in new program development. *Product Innovation Management, 39*(10): 200-212.

Saeki, M. 1995. Communication, collaboration and cooperation in software development-how should we support group work in software development? *Software Engineering Conference,* 12-20.

Song, X. M., & Parry, M. E. 1999. Challenges of managing the development of breakthrough products in Japan, *Journal of Operations Management, 17*: 665–688.

Song, X. M., & Mitzi, Montoya-Weiss. 2001. The effect of perceived technological uncertainty on Japanese new product development, *Academy of Management Journal, 44* (1): 61–80.

Tiwana, A., & Mclean, E. R. 2005. Expertise integration and creativity in information systems development. *Journal of Management Information Systems, 22*(1): 13-43.

Wang, Y. S., & Liao, Y. W. 2007. The conceptualization and measurement of M-commerce user satisfaction. *Computers in Human Behavior, 23*: 381-398.

Wang, C. W., Lin, P. C., & Li, H. P. 2009. The influences of web-based group decision support system on the effects of creativity training, *Journal of Management & Systems, 16*(4): 611-636.

Wang, M. H., Yang, T. Y., & Huang, K. C. 2009.The impact of knowledge sharing types and team learning capability on team creativity, *Journal of Information Management, 16*(1): 181-202.

Wang, C. W., Chen, A. Y., Lin, Y. C., Lin, P. C., & Lee, C. M. 2011, Exploring the creativity performance of virtual teams from the perspectives of leadership and creative personality, *Chiao Da Management Review, 31*(1): 135-168.

Watkins, K. E., & Marsick, V. J. 1993. *Sculpting the learning organization: Lessons in the art and science of systemic change.* San Francisco, CA: Jossey-Bass Publishers.

Wiendieck, G. 1992. Teamarbeit Frese. Erich. Eds. *Handwoertrebucher Organization*, C. E. Poeschel Verlag, Stuttgart, Germany.

Yang, H. L., & Tang, J. H. 2004. Team structure and team performance in IS development: A social network perspective. *Information & Management, 41*: 335-349.

Appendix A The instruments used to measure ISD team creativity

Team collaboration

1. Team is an organized or structured collaboratively team.
2. Team has the ability to capitalize on the strength of different team members.
3. Team members communicate among collaborator.
4. Team has productivity in information systems development.
5. Team accepts of new ideas.

Trust/respect

1. In general, team members respect each other.
2. In general, team members are open to criticism.

Knowledge coordination

1. Team members are assigned to tasks commensurate with their task-relevant knowledge and skill.
2. Team has a good map of each others' talents and skills.
3. Team members know what task-related skills and knowledge that each possess.
4. Team members know who on the team has specialized skills and knowledge that is relevant to their work.
5. If someone in our team has some special knowledge about how to perform the team task, team member is not likely to tell the other member about it[R].

Internal learning

1. In our team, members discuss ways to prevent and learn form mistakes.
2. Team members regularly take time to figure out ways to improve team work processes.

External learning

1. Team keeps others in the organization informed about what we plan an accomplish.
2. Team members go out and get all the relevant work information they possibly can from others.

Team communication

1. In our team there were conflicts regarding the openness of the information flow[R].
2. Team members communicated mostly directly and personally with each other.
3. Project-relevant information was shared openly by all team members.