



International Journal of Innovation, Creativity and Change. [www.ijicc.net](http://www.ijicc.net)  
Volume 2, Issue 1, May 2015

# **The Intersection between Complexity Dynamics and Faculty Creativity In Higher Education**

**Anthony Olalere**

**Clemson University, South Carolina, USA**

## **Abstract**

The work of the faculty has like never before been under scrutiny. Questions are being asked about the quality of productivity and its outcomes. The public is concerned about what results the taxpayers' money are producing in higher education, the lack of concern for undergraduates, and the irrelevancies of some researches (Johnrud, 2002). Other questions, including the priority given to teaching over research by certain institutions, have become common especially with the rising cost of education. Attention is now paid to the cost and benefit of the investment in higher education. Therefore, the call for more scrutiny and reform has never been louder with the 2006 National Conference of State Legislatures' (NCSL) issued report on the state of higher education in the United States. The report declared that there is a crisis in higher education while demanding a higher level of productivity. This article reports a study into this circumstance.



## Introduction

The work of the faculty has like never before been under scrutiny. Questions are being asked about the quality of productivity and its outcomes. The public is concerned about what results the taxpayers' money are producing in higher education, the lack of concern for undergraduates, and the irrelevancies of some researches (Johnrud, 2002). Other questions, including the priority given to teaching over research by certain institutions, have become common especially with the rising cost of education. Attention is now paid to the cost and benefit of the investment in higher education. Therefore, the call for more scrutiny and reform has never been louder with the 2006 National Conference of State Legislatures' (NCSL) issued report on the state of higher education in the United States. The report declared that there is a crisis in higher education while demanding a higher level of productivity.

Eugene Rice (1994), in the foreword to Ann Lucas's work on *Strengthening Department Leadership* asserts: "the time has come for us as faculty members to fundamentally reframe how we think about what we do and move from "my work" on to "our work" (pp. xi-xii)".

The social and political context continues to demand improved performance and productivity. The social factors include public requirements for faculty to justify the use of their time, which in effect results in productivity. The political context arises out of the demands by stakeholders for faculty to justify the use of taxpayer money in the midst of dwindling state funding. The issue is no longer how hard faculty work but what they should be doing with their time (Edgerton, 1993).

To thrive in the midst of complex challenges, higher education will have to create new ways to "do more with less" (Massey, 1995; Seymour, 1995). To be able to bring about this shift in a complex system, Green (1992) suggested a need for cultural changes within institutions that can foster creativity. According to Schuster and Finkelstein (2006), the domain of higher education is a "grounded portrait of a complex enterprise" (p. 323). Higher education operates in academic systems organized along departmental, college, or faculty lines. The typical college or university administration is formalized. The challenge for most



complex organizations is how to manage innovation in a complicated environment (Snowden & Boone, 2007). Every discipline and department has its separate values and sub-culture, even though it is interdependent and has a common institutional culture. However, it is the interaction of these interdependencies, disciplinary cultures, standards and changing dynamics that help foster creativity (Marion, 2008).

The goal of this paper is to examine the connection between complexity dynamics and faculty creativity, using the measures of Partial Least Square to understand how the complex systems of higher education work to foster faculty creativity.

### **Complexity and Higher Education**

Complexity is a theory that describes interactive systems or networks of patterned human behavior. According to Marion (2012), complexity is about patterns of behavior that emerge from interactive dynamics among groups. The parts of a complex system are constantly changing as they interact with one another. In complicated systems, by contrast, the parts are unchanged by their interactions; a ship, for example, is complicated and not complex (Cilliers, 1998). Higher education is complicated because it is comprised of formalized, unchanging, and typically bureaucratic-structure. Higher education system is, however, also complex because of the interaction of academic parts and their capacity to learn and produce new ideas. The question then is, how is complexity and creative activities enabled in an organization like higher education? How can people be creative either as collectives or individuals in their workplace environments? How can a creative environment be fostered within higher education? How can faculty be reoriented to lead from a complexity perspective?

In complexity, therefore, attempts are made to understand how interactions emerge and how they generate creativity. The traditional approach to leadership is that a leader is the central figures who controls, organizes and initiate change. This is a top-down approach to leadership. Theories like leader-member exchange (LMX), servant leadership and transformational leadership describe a leader centric interaction in some form. The traditional approach that views leader as the central actor suggests a cause and effect, linear and top bottom approach to leadership (Christensen, 2011). However, organization in higher



education is too complex, not static, and certainly not linear. Higher education is comprised of interactive agents who are interdependent and dynamic (Uhl-Bien, Marion, & McKelvey, 2007). The structures that emerge from these processes of interaction and interdependency are called mechanisms and their outcomes manifest in the generation of new ideas, creativity and innovations (Marion, 2008).

Complexity from a problem solving perspective is viewed as “catastrophic interruption” (Hoffman, Cropley, Cropley, Nguyen, & Swantman, 2005, p 165). This process can be explained through the evolution of complexity theory. Essentially, complexity is an intrinsic understanding gained from the task or activities carried out. This knowledge is learned over time and considered commonly understood views of the world by those in the field. As time goes on, new knowledge is explored, construed, invented, and implemented.

One characteristic of dynamic complex higher education systems is the amount of information that is generated. Universities are known as the citadel of learning and marketplace of ideas with much information processed on a daily basis. Complex organizations like higher education have at their disposal the ability to efficiently process large amounts of information that constantly are undergoing change. Each discipline and field in higher education constantly generates, gathers, and processes changing knowledge. Knowledge and information are disseminated through teaching, presentations, and publications. Such constantly changes information and knowledge are transformed into ideas, products, presentations, and publications by interactive agents in the system.

Higher education systems are complex because they employ interactive interdependent agents that cut across disciplines for problem solving. They are interdisciplinary, multi-disciplinary and trans-disciplinary in problem solving. The benefit is that problems are approached from multiple perspectives and in a decentralized manner to achieve faster and more effective outcomes. Dynamic complex systems of higher education are adaptive to change. They have multiple stakeholders and varying influences from the environment; they are equally susceptible to the changes because they are change agents that respond quickly to influences from the environment.



## **Theoretical Framework**

The KEYS constructs and complexity theory was used for this study. The KEYS model by Teresa Amabile (1996) identified inhibitors as obstacles to creativity in an organizational environment. Inhibitors in organization were divided into organizational impediment and workload pressure. The organizational impediments include organizational culture, management style, and organizational policies. The workload pressure could represent how faculty members spend their time and the implication of workload pressure on teaching and research productivity. The workload pressure mentioned by the KEYS model and pressure by complexity theory are similar, even though complexity extends the meaning of pressure to include task related conflicts. Additionally, Uhl-Bien et al (2007) identified the features of complexity as interdependence, heterogeneity, interaction, workload pressure and psychological safety (with psychological safety representing job security, risk taking, supervisor support etc. The two theories constructs were used in this study to examine and measure the intersection between complexity and faculty creativity in higher education.

## **Methodology**

This research sought to understand the connection between complexity (collectivist) dynamics and creativity (individual) among faculty members in higher education. In this paper, a non-experimental design was adopted which “in which the researcher collects data without introducing any new treatment or data” (McMillan & Schumacher, 2001; Polit & Hungler, 1983, p. 618).

The complexity theory and the KEYS model constructs were employed as a framework to make meaning of data and findings of this study while the post-positivist philosophy is used to verify and refine our understanding of the process (Creswell, 2009). This research is important because the KEYS model constructs have been tested in a business environment but little or nothing has been done in the higher education environment. Testing this model in a higher education workplace assesses the suitability of this model for higher education organization with its complex dynamics.

This research was situated in survey design. In survey design, the researcher used the population sample to infer, theorize, and make claims based on the result of the sample

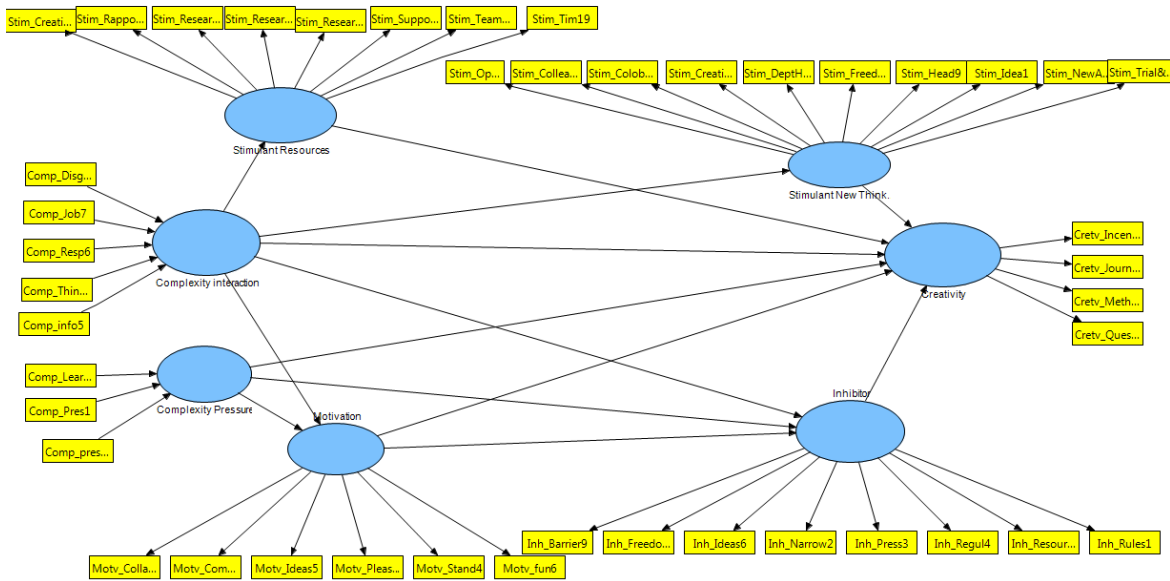


population studied. The setting for this study was a college of a research based university in a south eastern part of the United States. Tenure and tenure track faculty members received surveys in a college comprising the departments of education, public health, nursing, human resource development and park recreation and tourism.

Electronic questionnaires were sent out through an online survey instrument known as Qualtrics to 110 tenured faculty or tenure track faculty members. Data were collected within a space of eight weeks. The collectivist dynamic constructs measured interaction, interdependency, process conflict, heterogeneity and psychological safety as created by Marion (2013). Data collected was 73 responses after making appropriating for missing data. The selection of this sample size was based on the sample size recommendation of 59 responses with a significance rate of 5% for PLS-SEM for a statistical power of 80% for maximum amount of arrows in (path modeling) pointing at a construct (Hair et al, 2014).

### **Data Analysis**

The Partial Least Square (PLS) of the Structural Equation Model was used to analyze data. PLS is a predictive statistical approach “for modeling complex multivariable relationships among observed and latent outcomes” (Vinzi et al., 2010, p. 1). This approach allows for the estimation of a “causal theoretical network of relationships linking latent complex concepts, each measured by means of a number of observable indicators” (Vinzi et al., 2010, p. 2). This approach was selected because it can be used to analyze small samples like the research samples in this study, when data are not normally distributed and when data are complex and have multiple indicators and relationships (Hair, Hult, Ringle, & Sarstedt, 2014).



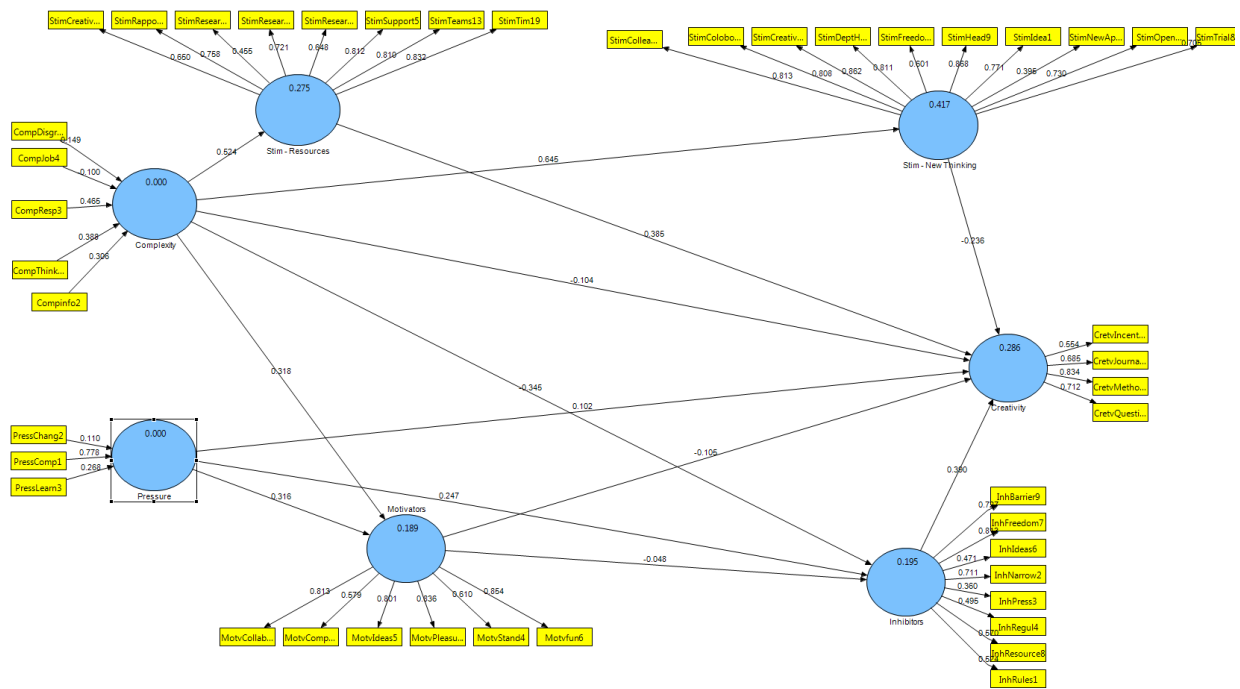
### The Analysis of Results of the Partial Least Square

The results for the structural model in this study are divided into four parts: first, the  $R^2$  value of the endogenous latent variable (variables/constructs with arrows pointing into them; the endogenous variables are creativity, motivation, inhibitor and stimulants). Second, is the path coefficients third, is the predictive relevance  $Q^2$  and mediating effects.

### Coefficient of Determination ( $R^2$ )

The PLS\_SEM algorithm reports the variance accounted for  $R^2$  in these predictions. The result in figure 2 show that variables with the highest explained variances are stimulant-new thinking ( $R^2 = 0.0417$ ), stimulant-resources ( $R^2 = 0.275$ ), and creativity ( $R^2 = 0.286$ ). The variables with the lowest  $R^2$  are inhibitors ( $R^2 = 0.195$ ), and motivation ( $R^2 = 0.189$ ), but even their explained variation is considered high in the social sciences.

The general rule for high  $R^2$  is 0.20, and values below 0.10 are considered to have low levels of predictive accuracy.



### Path Coefficients

Table 2 shows the construct path coefficients

*Constructs Path Coefficients*

	Complexity Interaction	Creativity	Inhibitors	Motivators	Pressure	Stim - New Thinking	Stim - Resources
<b>Complexity Interaction</b>		-0.104	-0.345	0.318		0.645	0.524
<b>Creativity</b>							
<b>Inhibitors</b>		0.380					
<b>Motivators</b>		-0.105	-0.047				
<b>Complexity Pressure</b>		0.102	0.247	0.316			
<b>Stim - New Thinking</b>		-0.236					
<b>Stim - Resources</b>		0.385					





Stimulant-resources ( $\beta = 0.385$ ) and inhibitors ( $\beta = 0.380$ ) have the strongest direct paths effects on creativity. While stimulant new thinking ( $\beta = -0.236$ ), motivation ( $\beta = -0.105$ ), complexity pressure ( $\beta = 0.102$ ), and complexity interaction ( $\beta = -0.104$ ) have the lowest direct path effects on creativity (See table 2).

Complexity interaction is a positive predictor of stimulant resources ( $\beta = 0.524$ ) but a negative predictor of the inhibitor ( $\beta = -0.345$ ) while complexity pressure is a positive predictor of inhibitor ( $\beta = 0.247$ ). Also, complexity interaction ( $\beta = 0.318$ ) and complexity pressure ( $\beta = 0.31$ ) both have a positive significance regarding motivation.

### Predictive Relevance $Q^2$

The  $Q^2$  statistic helps to determine the predictive relevance of the reflective (but not the formative) construct in a SEM model. Values that is higher than zero connotes that the construct predicts its data points for the given construct; if it is a zero or less, the items for the given construct are not accurately predicted. This study uses the cross-validated redundancy approach to determine the predictive relevancy of the constructs (Hair et al., 2014). The column labeled 1-SSE/SSO (squared prediction error/squared observations) is  $Q^2$ . Table 3 shows the construct cross validated redundancy.

Table 3. Construct Cross-validated Redundancy

Total	SSO	SSE	1-SSE/SSO
<b>Creativity</b>	292.000	262.666	0.100
<b>Inhibitors</b>	584.000	564.448	0.033
<b>Motivators</b>	438.000	405.647	0.073
<b>Stim - New Thinking</b>	730.000	587.404	0.195
<b>Stim - Resources</b>	584.000	522.859	0.104

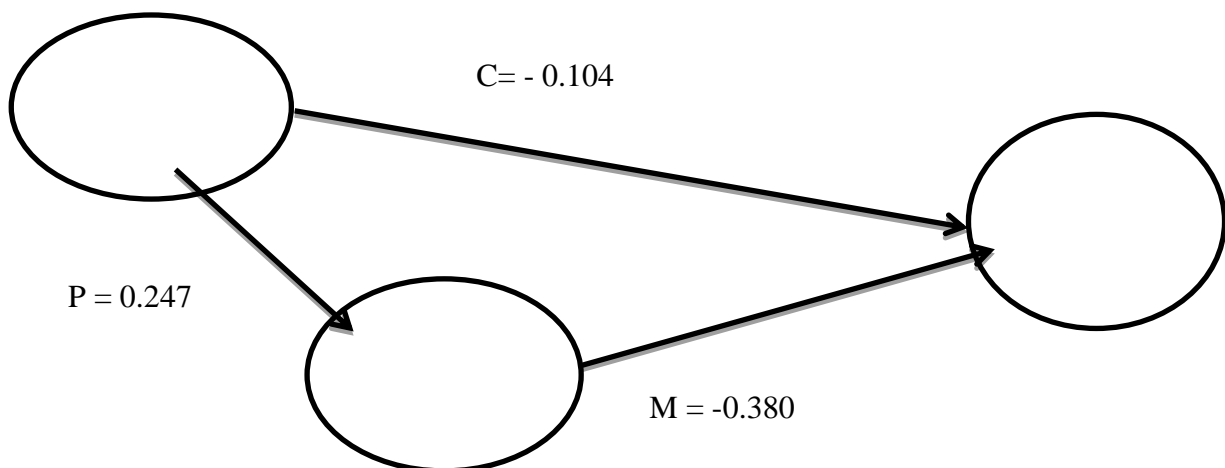
The result in the last column of each of the seven tables is 1-SSE/SSO, which is the value of the predictive relevance of  $Q^2$ . A summary of the results is represented in the first sub-table (labeled Total) in table 3. The highest predictive relevance is calculated for stim\_new thinking (0.195) and the lowest is for inhibitor with (0.033).  $Q^2$  values that are higher than 0 suggest that the construct has predictive relevance and values less than zero

suggest the construct lack predictive value. As can be seen in Table 3, all variables have predictive relevance.

### The Mediating Effects Analysis

The mediating effects analysis was calculated in this study. Mediating analysis involves establishing the theoretical indirect relationship between constructs; that is, it determines the degree to which indirect effects through the mediating variables modify the hypothesized direct paths. In this study, the entity variables for stimulants, inhibitors and motivators were hypothesized to mediate the relationship between the collectivist complexity variables and creativity. The goal is not only to identify significant path coefficients but also to expose significant and important indirect effects of relationships.

Figure 3 show the mediating effect of inhibitor on complexity and creativity



Direct effects are relationships between two constructs that are connected by a single line while the indirect effects are relationships between constructs that pass through one or more other constructs. Even though the direct effect between complexity and creativity is -0.104, the mediating effect causes the both the total and indirect effect to be positive. Calculating the mediating effect can enable the identification of a true total relationship between constructs. The purpose is to explain the total impact of exogenous constructs on endogenous constructs. In determining, the total effects of the exogenous construct, the bootstrapping total effects (Mean, STDEV, T-Values) procedure was applied.



## Conclusion and Implications

PLS suggests the use of theory to compare with data in order to predict and support a model's argument (Hair et al, 2014). It attempts to use data to confirm a model and to support the predictive relevance of a model. This approach supports the post-positivist assumption of this study that identifies a theory or model, collects data to validate or invalidate the theory/model, and making inferences about the model. PLS was used in this study to examine the effects of the exogenous variable (complexity interaction and complexity pressure) on creativity and the mediating effect of the entity based constructs (stimulant resources, stimulant new-thinking, inhibitor and motivation) on the interaction between complexity and creativity. The findings of this study revealed a positive significant effect of construct types like psychological safety, organizational impediment and freedom in explaining creativity.

The result of the study showed that the constructs inhibitors have positive effect on creativity. The constructs have indicators like "open-mindedness of colleagues/research collaborators" (work group), encouragement from colleagues/research collaborators to be creative in research (work group), rapport with department head/ supervisor (work group), confidence from other colleagues/research collaborators (organizational encouragement), encouragement from department head/supervisor to be creative in research (organizational encouragement), freedom to try new ideas/processes (freedom), suggesting a need for a new approach (organizational encouragement) and willing to learn through trial and error (challenging work).

The indicator for inhibitor with the highest level of significance is inh\_freedom7 0.812: "Lack of freedom to exercise creativity". It can be argued that organizational impediments like lack of freedom are the results of politicking and rivalry which stifles creativity. This argument is supported by Secor (1995) who identified factors that demoralizes faculty in higher education as polarization of departmental issues, ideological positions and disrespect between junior and senior faculty members causing tensions and discouragements. This study further examined the implication of findings on research, policy administrator and faculty members.



This research suggests that the questions that need to be asked involve the nature of the debate as it relates to creativity and the legitimization of knowledge in higher education, as well as what knowledge is considered creative and legitimate and how legitimate knowledge is decided (Kelly, 2006). We may begin to re-consider the way meanings are framed if data reveals that pressure is a catalyst to creativity. The call for policy-makers and legislators scrutinizing the time and productivity clearly exposes the gap between policy and practice if this data is to inform knowledge. This also explicates a lack of understanding about the criteria for what is considered legitimate by some constituencies. There is a need to carry out research that policymakers and administrators will more accurately be able to decipher in order to construct meaningful policies.

Further study may be needed to examine the moderating effects between complexity and creativity and unobserved heterogeneities associated with their interactions. Additionally, a differentiation between tenured and non-tenured faculty and inter-generational differences among faculty might also be needed for greater understanding of faculty creativity in higher education organizations.

## References

- Amabile, T. M. (1996). *Creativity in context. Update to the social psychology of creativity*, Harvard University, Westview Press. Colorado.
- Boyer, E. L., Altbach, P. G., and Whitlaw, M. (1994). *The Academic Profession: An International Perspective*, Carnegie Foundation for the Advancement of Teaching, Princeton, NJ.
- Bowen, H. R., and Schuster, J. H. (1986). *American Professors: A National Resource Imperiled*, Oxford University Press, Oxford.
- Boyer, E. (1990). *Scholarship reconsidered: Priorities of the professoriate* Princeton University Press.



- Creswell, J. (2009). *Research Design. Qualitative, quantitative, and mixed methods approaches* (1<sup>st</sup> ed). Sage. University of Nebraska-Lincoln. Sage Publication.
- Feldhusen, J. F & Goh, B. E. (1995). Assessing and accessing creativity: An integrative review of theory, research, and development. *Creativity Research Journal*, 8(3), 231-247-231247.
- Flynn, G. (1997), "How Do you know if your work teams work?", *Workforce*, Vol.76, No. 5, May, p.7.285-294.
- George, J. M. (1996). Trait and state affect. In K.R. Murphy (Ed.), *Individual differences and behavior in organizations*. San Francisco, CA: Jossey-Bass, pp.145–71.
- George, J. M. (2007). Creativity in organizations. *Academy of Management Annals*, 1, 439–477.
- Goncalo, J. A. & Shaw, B. M. (2005). Individual-collectivism and group creativity. In *Organizational Behavior and Human Decision Processes*. Cornell University ILR School
- Hair, J., F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A primer on partial least squares structural equation model (PLS-SEM)*, Sage, Los Angeles.
- Hargadon, P., & Bechky, B. A. (2006). When collections of creative become creative collectives: A field study of problem solving at work. *Organization Science*, 17(4), p. 484-500.
- Hennessey, B. (2003a). Is the social psychology of creativity really social? Moving beyond a focus on the individual. In P. Paulus & B. Nijstad (Eds.), *Group Creativity: Innovation Through Collaboration* (pp. 181-201). New York: Oxford University Press.
- Kanter, R. A. 1977. *Men and women of the corporation*. New York: Harper.
- King, N., & Anderson, N. (1990). Innovation in working groups. In M. A. West & J. F. Farr (Eds.), *Innovation and creativity at work*. Chichester, UK: Wiley.



- Kurtzberg, T. R. & Amabile, T. M. (2001). From Guilford to creative synergy: Opening the black box of team level creativity> Creativity Research Journal, 13 (3 & 4), p. 285-294.
- Johnsrud, L. K. (1996). Maintaining Morale: A Guide to Assessing the Morale of Mid-level Administrators and Faculty, College and University Personnel Association, Washington, DC.
- Johnsrud, L. K., and Rosser, V. J. (2002). Faculty members' morale and their intentions to leave: A multilevel explanation. The Journal of Higher Education 71(1): 34-59.
- Johnsrud, L. K. (2008). Faculty Work: Making our research matter-More. The review of higher education, Summer, Volume 31, No. 4, pp489-504.
- Johnsrud, L.K. (2002). Measuring the quality of faculty and administrative work life: Implications for college and university campuses. Research in Higher Education, Vol. 43. No3, June 2002.
- Marion, R. (2012). *Organizational leadership and complexity mechanisms*. In the Oxford handbook of leadership (Ed) by Rumsey, M. G., Oxford Library of Psychology, Oxford University Press, New York.
- McKeachie, W. J. (1979). Perspectives from psychology: Financial incentives are ineffective for faculty. In: Lewis, D. R., and Becker, Jr., W. E. (eds.), Academic Rewards in Higher Education, Balinger, Cambridge, MA, pp. 3-20.
- McMillan, J. H. & Schumacher, S. (2001). Research in Education; A conceptual introduction (5thEd), Longman, New York.
- Montuori, A. & Purser, R. (1997). Social creativity: the challenge of complexity. Translation of Ledimensioni sociali della creatività. Pluriverso, 1(2), 78-88.
- Osborn, A.F. (1963). Applied Imagination. New York: Scribner's.
- Orpen, C. (1990). Measuring support for organizational Innovation: A validity study. *Psychological Reports*, 67, pp.417-418.



- Paulus, P. & Nijstad, B. (2003). Group creativity: an introduction. In P. Paulus & B. Nijstad (eds.), *Group Creativity: Innovation Through Collaboration* (pp. 3-11). New York: Oxford University Press.
- Parnes, R. (1990). The effectiveness of research teams: In West, M. A & Farr, L. L (Eds.) (Ed.), *A reveiw of in innovation and creativity at work* (pp. 101-122). Chichester, England: Wiley.
- Parnes, S. J. & Noller, R. B. (1972). *Applied creativity: The creative studies project. Part II –*
- Perry-Smith, J., & Shalley, C. (2003). The social side of creativity: A static and dynamic social network perspective. *The Academy of Management Review*, 28(1), 89-106.
- Polite, D. F., & Hungler, B. P. (1987). *Nursing research: Principles and methods* (2<sup>nd</sup> ed.) Philadelphia: Lippincott. Results of the two year program. *Journal of Creative Behavior*, 6, 164-186.
- Price, I. (1995). Space to adapt: Workplaces creative behavior and organizational memetics. In Richard, T., Mark, A. L., & Moger, S. *The Routledge companion to creativity*, New York.
- Rosser, V. J. (2004). Faculty members' intentions to leave: A national study on their work life and satisfaction. *Research in Higher Education*, 45, 285-309.
- Rosser, J. V. (2010). Faculty members' intentions to leave: A national study on their workplace and satisfaction. *Research in Higher Education*. Vol. 45, No. 3 (May, 2004), pp.285-309.
- Secor, R. (1995). Recapturing departmental community: A tale of faculty morale, external pressures, and departmental collaboration. *AAHE Bulletin* February, 3-6.
- Runco, M. A. (2004). Creativity. *Annual Review of Psychology*, 55, 657.  
doi:10.1146/annurev.psych.55.090902.141502.
- 15 (1), 33–53.



- Shalley, C. E., Zhou, J., & Oldham, G. R. (2004). The effects of personal and contextual characteristics of creativity: Where should we go from here? *Journal of Management*, 30, 933-958. doi: 10.1016/j.jm.2004.06.007.
- Shalley, C. E., & Zhou, J. 2008. Organizational creativity research: A historical overview. In J. Zhou & C. E. Shalley (Eds.), *Handbook of organizational creativity*: 95–123. New York: Taylor and Francis.
- Taylor, I. (1975). A retrospective view of creativity investigation . In I. Taylor & J. Getzels (Eds), *Perspective in creativity in creativity* (pp. 6-39), Chicago; Aldine.
- Tucker, A., and Bryan, R. A. (1991). *The Academic Dean: Dove, Dragon, and Diplomat*. New York: American Council on Education, Mcmillan Publishing.
- Uhl-Bien, M., Marion, R., & McKelvey, B. (2007). Complexity leadership theory: Shifting leadership from the industrial age to the knowledge era. *Leadership Quarterly*, 18 (4), 298–318. DOI: 10.1016/j.leaqua.2007.04.002.
- Woodman, R. W., Sawyer, J. E., & Griffin, R. W. (1993). Toward a theory of organizational creativity. *The Academy of Management Review*, 18(2), pp. 293-321. Retrieved from <http://www.jstor.org/stable/258761>