Teachers' Creativity in Career Technical Education: The Mediating Effect of Knowledge Creation Practices in the Learning Organization*

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This study examined the structural relationships among learning organization culture, teachers' knowledge creation practices, and the level of teachers' creativity in Career Technical Education (CTE) schools and investigated the mediating effect of teachers' knowledge creation practices to explain the relationship between learning organization culture and the level of teachers' creativity. A total of 304 CTE teachers across one of the central states in the US were used as the research sample. The study employed hierarchical multiple regression and structural equation modeling. The study found the structural relationships among the research variables including learning organization culture, teachers' knowledge creation practices, and the level of teachers' creativity. Furthermore, knowledge creation practices of teachers were found to mediate the relationship between learning organization culture and teachers' creativity levels. Results

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suggest that CTE schools could be creative institutions and thus be more effective by building the learning organization culture along with promoting knowledge creation practices among teachers.

Key words: Learning Organization Culture, Teachers' Knowledge Creation Practices, Teachers' Creativity, Career Technical Education

I. Introduction

It is now widely agreed that creativity is the vehicle for enhancing not only individual productivity but also organizational performance (Delong, 2004; Grant, 2001; Teece, Pisano & Shuen, 1997). With the convincing cases showing its considerable impact on values of products and services (e.g., the well-known case of Apple), creativity is one of the most interesting areas of interest among not only business mangers but also education leaders. In recent years, educators have become more aware of the role of creativity in improving educational achievement of students as well as in promoting the effectiveness of public schooling. Moreover, given the significance of teachers' roles in promoting school performance, how to enhance creativity of teachers is becoming the primary concern in the US (McCharen, Song & Martens, 2011).

Of note, the development of teachers' creativity has become a cutting edge issue in the area of workforce education and development, particularly in career and technical education (CTE) at the high school level. Fueling the attention on CTE teachers' creativity is the recent change in labor market conditions and the chronic problems of CTE institutions. Reviewing trends in routine and non-routine task input in US occupations from 1960 to 2002, Levy and Murnane (2005) suggested that non-routine analytic and interactive tasks have kept increasing, while routine cognitive and manual work has continued to decrease. Likewise, the European Foundation for the Improvement of Living and Working Conditions (2007) reported that skills to solve unforeseen problems and learn new knowledge are considered the key competency among European workers in maintaining jobs. Given these labor market situations, it follows logically that creativity would become a labor market advantage and that teachers at CTE high schools are asked to be creative in order to teach students to be creative workers. The second reason relates to the continued problem of CTE institutions being considered the second-class institution chosen by second-class students showing allegedly low academic performance (Bae, Gray, & Geogia, 2007; Gray, 2004). According to this view, in order for CTE educators to overcome such problems and make CTE schools competitive, they should be further innovative and creative in

teaching students and managing institutions. In this context, considerable efforts have been made to promote CTE teachers' creativity, thereby enhancing their performance in teaching and classroom management, and finally improving the performance of students as well as schools (Gray & Herr, 1998; Song, Martens, McCharen, & Ausburn, 2011).

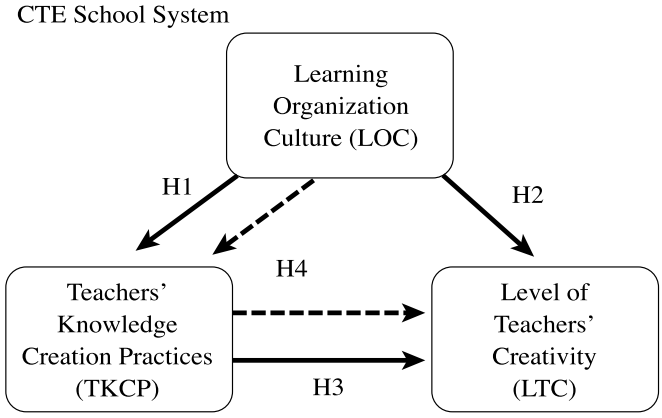
Among many efforts to make CTE teachers be more creative and help schools become creative organizations, the one observed with the keenest interest by organizational development experts has been the application of the concept of learning organization to schools (McCharen, Song, & Martens, 2011; Song, Martens, McCharen, & Ausburn, 2011). The concept of the learning organization, which was originally developed in the organization development field, was defined as "an organization which learns powerfully and collectively and is continuously transforming itself to better collect, manage, and use knowledge" (Marquardt, 1996, p. 19). With the recent spread of the learning organization approach in public schools, however, little research has been done to uncover in what ways the learning organization helps teachers become creative and more effective. Furthermore, very few studies have been conducted on what variables play roles in promoting teachers' creativity in learning organization culture, particularly in CTE schools.

II. Research Purpose and Conceptual Framework

The purpose of this study is twofold. First, the study sets out to examine the structural relationships among three variables—*supportive learning organization culture*, *teachers' knowledge creation practices*, and *teachers' creativity*. Second, it intends to investigate the mediating effects of teachers' knowledge creation practices to explain the relationship between the supportive learning organization culture and teachers' levels of creativity in CTE schools.

The main concept of this study is guided by several management- and education-related theories including organizational learning theory, knowledge conversion theory, and social network theory (Cummings & Worley, 2008; Nonaka & Takeuchi, 1995; Perry-Smith, 2008; Watkins & Marsick, 1993). From the industry standpoint, Song, Yoon, and Yoon (2011) found that leadership supports, collaboration, and individuals' reflective learning process are critical enabling factors for dynamic knowledge creation for improving the level of the creativity based on the content analysis approach. In addition, in the school perspective, according to Collinson and Cook (2001), one of the critical inhibitors for school performance is the lack of time and opportunities for teachers' continuous learning as well as knowledge creation activities. Put differently,

Figure 1. The Conceptual Framework of this Study



*Dotted-line –H4: Mediating effect of TKCP between LOC and LTC

learning-based, knowledge-oriented activities are fundamental for both teachers' personal development and schools' performance improvement in terms of sustaining long-term innovation in the school system (Leithwood & Louis, 1998; Marks & Louis, 1997). To date, however, many studies in the CTE field have mainly focused on the educational policies and external problems outside schools, not on the internal relationships among the system, people, and behaviors (McCharen et al., 2011; Song, Martens, McCharen, & Ausburn, 2011). The current research is of importance in that it attempts to look at the management-oriented complex relationships between the environment and organizational behaviors in the school system.

The complicated relationships among the three variables above along with the four hypotheses are illustrated in Figure 1. The theoretical foundations and relevant literature support the proposed research framework as comprehensively addressed in the following literature review. In addition, each hypothesis is discussed along with integrative theoretical foundations.

III. Review of the Literature

A. Learning Organization and its Outcomes

The concept of the learning organization has increasingly gained attention in the organizational literature as environmental aspects for organizational effectiveness since the early 1990s. Senge (1990) conceptualized the learning organization as an

organization that enhances the capacity to learn and develop collective intelligence, thereby achieving significant strategic advantages for several types of performance improvement. Watkins and Marsick (1993) viewed the learning organization from a cultural perspective, and they explained that a learning organization is characterized by collaborative relationships that promote continuous learning and performance at individual, organizational, and system levels through continuous knowledge creation (Yoon, Song, Lim, & Joo, 2010). From the practical standpoint, Marquardt (1996) defined the concept of the learning organization as "an organization which learns powerfully and collectively and is continually transforming itself to better collect, manage, and use knowledge for corporate success. It empowers people within and outside the company to learn as they work" (p. 19).

In the school setting, the concept of the learning organization has been widely considered in response to recent educational reforms and innovation efforts (McCharen et al., 2011). Several studies have attempted to apply the cultural aspects of the learning organization to the school context. DuFour (1997) indicated that schools need to function as learning organizations in order to achieve sustainable development in the face of challenges. He suggested that educators continuously deliberate on strategies to encourage engagement to learn and collaboration among teachers. According to Brandt (2003), a school culture that encourages persistent learning and social interaction among individuals leads to improvement of student achievement. In this context, Brandt (2003) emphasized the roles of educational leaders in embedding organizational learning practice into the culture of the schools. Consistent with this perspective, Vescio, Ross, and Adams (2008) emphasized that transforming schools into professional learning communities is of importance. According to them, it is critical to encourage learning-based cultural change efforts based on student learning, teacher empowerment, and continuous learning in the current complex educational environment.

Strong empirical support of the effects of learning organization culture on organizational outcomes has been well documented in the business context. It was shown to be positively related to job satisfaction and individuals' motivation to transfer learning, but negatively associated with turnover intention (Egan, Yang, & Bartlett, 2004). Research has also revealed that learning organization culture affects organizational innovation (Bates & Khasawneh, 2005), financial performance (Ellinger, Ellinger, Yang, & Howton, 2002), the level of new knowledge creation (Song, 2008; McCharen et al., 2011), and organizational commitment (Joo, 2010). Finally, learning organization culture was found to be associated with individuals' creativity (Bramwell, Reilly, Lilly, Kronish, & Chennabathni, 2011; Yoon et al., 2010).

Despite few empirical studies focusing on the outcomes of the learning organization culture and teacher creativity in the educational setting, some studies found the

importance of teachers' learning and knowledge sharing for developing creative teaching methods and knowledge creation practices for providing innovative learning approaches. For instance, Esquivel (1995) linked open interaction, cooperative learning activities, and reflective thinking with enhancing teacher creativity. That is, the key for improvement of teachers' creativity is the culture that encourages collaborative teamwork and cooperation among members (Amabile, 1988; Tushman & O'Reilly, 1997). In their syntheses of qualitative and quantitative studies, Bramwell et al. (2011) indicated that teachers' creative behaviors are dependent upon the level of their learning, empowerment, and building communities which promote interactive and collaborative learning climates. They specifically highlighted the importance of interaction and learning communities, stating that "teachers' creative processes grow out of the interaction between their personal characteristics and the communities in which they live and work … community reflects the extent to which teachers' creativity is embedded in the professional and personal communities to which they belong" (p. 229). McCharen et al. (2011) asserted that supportive school learning culture significantly promotes collaborative creativity of the teachers in CTE schools.

From the more practical standpoint, knowledge creation relies on whether systems exist for rewarding learning, providing lessons, and encouraging working together with the outside community (van Aalst, 2009). Moreover, Zárraga and Bonache (2005) found that relationships among organization members critically determine the level and quality of the knowledge creation, and knowledge creation practices become more effective when a close relationship among organizational members exists (Nonaka, von Krogh & Voelpel, 2006).

According to Watkins and Marsick (1993), learning organizations contribute to developing supportive learning culture that leads to the creation of new knowledge through collective interactions with each other. Hargreaves (1999) explained that when schools engage in school-based initial teacher training, educational knowledge creation is more likely to be effective. More specifically, he found the conditions and factors which affect knowledge creation in schools—"a culture of, and an enthusiasm for, continual improvement and provision of regular opportunities for reflection, dialogue, enquiry and networking in relation to professional knowledge and practice" (p. 126). According to this concept, learning-oriented school culture that encourages teachers' continuous learning and collaboration could affect teachers' knowledge creation activities. Empirically, McCharen et al. (2011) found that a supportive school learning culture is a major influence on teachers' knowledge creation practice in CTE schools. Based on their findings, they emphasized the creation of a learning organization culture that constructs knowledge creation in the school system. Based on the review of literature above, the following hypotheses were developed:

H1: The learning organization culture will positively impact teachers' knowledge creation practices

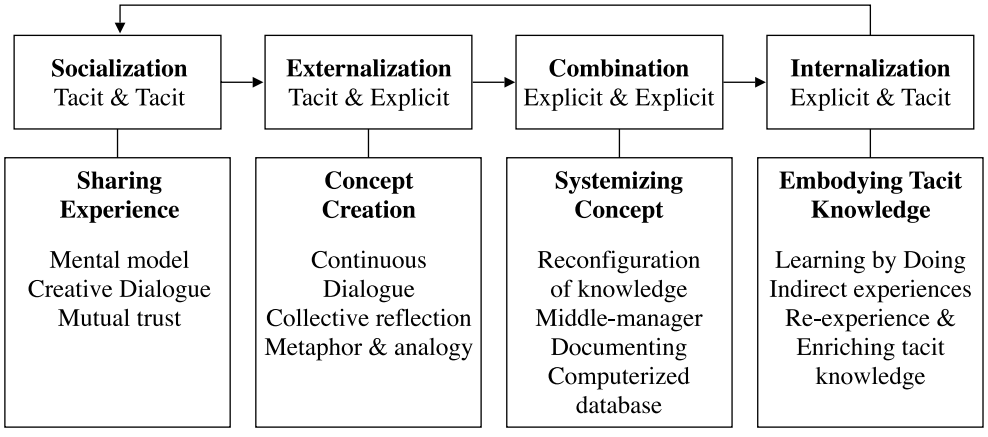
H2: The learning organization culture will positively impact the level of teachers' creativity

B. Knowledge Creation Practices and Teachers' Creativity

In the knowledge-oriented society, knowledge creation is a vital source for organizational success (Song & Kolb, 2009). It is also undoubtedly important in educational fields in terms of students' achievement and teachers' performance improvement. In this regard, it is essential to help students develop high levels of knowledge and skills (McCharen et al., 2011). To do that, teachers must continuously develop new ideas and new teaching methods through collaboratively engaged knowledge creation practices.

The term 'knowledge creation' is used to explain how companies and educational institutions develop ideas that are related to innovation and creativity through the members' collaborative knowledge conversion process (Gundling, 2000; Nonaka & Takeuchi, 1995). Knowledge is created by interactions of individuals and social structure (Nonaka & Toyama, 2003). The interaction enlarges knowledge through the conversion of tacit and explicit knowledge (Nonaka & Takeuchi, 1995). This concept may be explained by four phases of the knowledge creation process (SECI theory) (see Figure 2): (a) sharing experiences (socialization), (b) dialoging and reflecting (externalization), (c) combining explicit knowledge (combination), and (d) internalizing explicit knowledge into tacit knowledge (internalization). This SECI process explains the dynamic process

Figure 2. Organizational Knowledge Creation Process (Song, 2008, p. 92)



of knowledge creation. In socialization, new tacit knowledge is acquired by sharing experiences in daily interaction such as spending time together. In externalization, the tacit knowledge is converted into explicit knowledge through the articulation process. This explicit knowledge can be shared by other members through continuous dialogue and the collective reflection process. In combination, explicit knowledge that is collected from inside or outside of organizations is combined (Nonaka & Takeuchi, 1995). Finally, explicit knowledge is converted into tacit knowledge through the internalization process (Nonaka & Toyama, 2003).

Due to its complex and diffuse construct, creativity has been defined in various ways (Shalley, Gilson, & Blum, 2000). The most generally accepted definition involves the production, conceptualization, or development of novel and useful ideas, processes, or procedures by an individual or by a group of individuals working together (Amabile, 1988; Shalley, 1991; Shalley et al., 2000). Creativity at both the individual and team levels is considered the cornerstone for innovative change in an organization (West, Sacramento, & Fay, 2006). Likewise, in public schools, teacher's creativity has gained more attention as a critical factor for teacher's personal development as well as performance improvement of students and schools (Ambrose, 2005).

According to Plsek (1997), "creativity is the connecting and rearranging of knowledge to generate new, often surprising ideas that others judge to be useful" (p. 28). Given that creative knowledge is generated through the continuous and collaborative knowledge creation practices under an organization's supportive culture (Nonaka & Takeuchi, 1995), teachers could be more creative through the continuous knowledge creation activities at both the individual and team levels. Furthermore, in order to promote employees' creativity, organizations need to encourage idea sharing and knowledge creation practices through encouraging collaborative work and rewarding the creativity of employees (Amabile, Conti, Coon, Lazenby, & Herron, 1996).

In a nutshell, an interactive and collaborate learning climate promotes teachers' creativity (Bramwell et al., 2011; Esquivel, 1995; McCharen et al., 2011). Knowledge creation involves a dynamic and interactive process, as well as the relationship that engages in creation of new knowledge (Samaddar & Kadiyala, 2006). Based on these ideas, it may be possible to expect that knowledge creation plays an important role in strengthening the influential relationship between learning and creativity. Especially in the CTE schools, according to the nature of the discipline (e.g., skill-based learning process), the level of teachers' creativity could be the critical driver for students' performance levels. The more creative teachers could not only provide more effective knowledge transfer methods but also create the more knowledge creation opportunities for students in terms of curriculum development and informal learning activities.

Koh (2000) also linked learning, knowledge creation, and creativity. He insisted

that the transition from simple learning to an advanced level of learning, which is reinforced by new knowledge creation, causes the increase of organizational creativity. Based on Koh's linkage model (2000), it could also be expected that the effects of learning organization culture on teachers' creativity is increased by the level of dynamic knowledge creation engagement. Synthesizing all the relevant studies above, this study proposed the two hypotheses below:

H3: Teachers' knowledge creation practices will positively lead to a higher level of teachers' creativity

H4: The influential relationship between the learning organization culture and the level of teachers' creativity will be mediated by teachers' knowledge creation practices.

C. Theoretical Foundations of the Conceptual Framework

The frameworks of 'organizational knowledge creation theory' (Nonaka, 1994) and 'absorptive capacity theory' (Cohen & Levinthal, 1990) serve as the theoretical foundation to explain the relationship between learning organization culture and teachers' knowledge creation practices. As mentioned earlier, the interplay between individuals' tacit knowledge and organizational explicit knowledge leads to the formation of creative ideas and applicable concepts. While knowledge creation is an experience of the individual teacher, it does not occur in isolation (Nonaka, Toyama, & Byosiere, 2001).

Learning and knowledge are indispensable to each other. Cohen and Levinthal (1990) suggested an important relationship between learning capacity, communication, and knowledge creation. The accumulated previous knowledge intensifies memory capacity, which allows new knowledge to be stored and utilized (Nonaka & Takeuchi, 1995). Hence, individual learning is a critical element to knowledge development. Organizational learning culture is also considered important for disseminating knowledge (Bhatt, 2000).

According to Amabile's (1996) 'componential theory,' enhancing individual creativity encompasses three ingredients: expertise, creative thinking skills, and motivation. These factors interplay with the three organizational components of resources—management practices and organizational motivation, which then lead to overall organizational creativity. Personal expertise includes technical skills or personal knowledge; that is, creativity cannot be separated from knowledge. In addition, Amabile et al. (1996) identified six elements that determine the work environment for creativity. According to them, stimulants to creativity were work group supports, challenging

work, organizational encouragement, supervisory encouragement, freedom, and sufficient resources. Thus, it may be assumed that the level of creativity depends on individual knowledge based on continuous learning and thinking along with a collaborative organizational environment involving effective communication.

The impact of a collaborative organizational environment, such as a supportive learning environment, on creativity of teachers could be strengthened by teachers' knowledge creation practices. Ford (1996) provided the theory of individual creative action within organizational settings, which is composed of an intertwined group and organizational, institutional, and market domains. This research illustrates how intentional action and evolutionary processes interact to facilitate multilevel creativity and innovation. Woodman et al. (1993) provided 'the inter-actionist model of creativity.' This model identifies the interactions among individuals, groups, and organizational characteristics that influence the process, resulting in creative outcomes for the organization (Kickul & Gundry, 2001). These theories explained the importance of interactions among teachers to promote their level of creativity.

Knowledge creation is a dynamic, continuous, and comprehensive process requiring knowledge conversion and interaction with organization members. By interacting and sharing knowledge with others, "the individual enhances the capacity to define a situation or problem, and apply his or her knowledge so as to act and specifically solve the problem" (Nonaka et al., 2006, p. 1182). Nonaka and Takuchi (1995) explained how knowledge creation processes lead to new product development and services. They asserted that engaging in creative and cognitive processes such as sharing information and co-working with other teachers could lead to the discovery of new meaning and new ideas. By bringing together different views and ideas, teachers may gain fresh ideas and experiences.

Finally, 'the social network theory' provides a lens to understand how being socially connected is related to being creative (Perry-Smith, 2008). According to the social network theory, when teachers' social world involves interaction with people who have different views, this social relation promotes the creative ideas of teachers. Therefore, engaging teachers' knowledge creation processes to create new knowledge such as dialogue, reflection, and learning by doing could spark teachers' creativity (Perry-Smith, 2008).

IV. Methods

A. Sample and Data

In order to acquire contact information of available survey participants, the permission from the State Department of Career and Technology Education was granted. An invitation letter to participate in the survey was distributed via an intra-net server to all CTE teachers in one of the central States in the US. A total of approximately 2,000 were selected as potential survey participants, and 304 teachers participated in the survey—a return rate of 15.2%. With regard to sample demographic distribution, approximately 35% were male; around 60.5 % had less than 10 years of work experience, and 30.2% had more than 10 years of experience in CTE institutions. In terms of the educational level, almost 5% had an associate degree, 37% had a 4-year college degree, and around 51% had a graduate-level degree.

B. Instruments

This study aimed to examine (a) the influence of the learning organization culture on the teachers' knowledge creation practices and the level of teachers' creativity as well as the impact of teachers' knowledge creation practices on the level of teachers' creativity and (b) the mediating effects of teachers' knowledge creation practices on the relationship between the learning organization culture and the level of teachers' creativity in CTE schools. In order to measure the variables, survey questionnaires with a five-point Likert scale (1 = Strongly disagree to 5 = Strongly agree) were provided via an on-line survey system called SurveyMonkey.

In order to measure the learning organization culture of schools, the dimensions of the learning organization questionnaire (DLOQ) was used (Watkins & Marsick, 1993; Yang, Watkins & Marsick, 2004). The DLOQ includes seven dimensions of the learning organization culture to measure the learning supportiveness of the organization, learning-oriented leadership, and collaborative team-based learning process. This study used the abbreviated seven-item version, which has been validated in the literature (Song, Uhm, & Yoon, 2011).

To capture teachers' knowledge creation practice, this research employed 10 items of the knowledge creation inventory, which was developed and validated by Song and colleagues (Song, Uhm, & Yoon, 2011). The original concept of the knowledge creation measures was developed based on knowledge conversion theory (Nonaka & Takeuchi, 1995). Specifically, this knowledge creation inventory measures the level of knowledge sharing, creating new concepts and process, applying a new process, and

evaluating the application for creating a new process and ideas (Yoon et al., 2010).

Finally, to evaluate the level of teachers' creativity, six items based on the concept of team creativity measures were used (Zhou & George, 2001). Scott and Bruce (1994) developed the original version of these measures, and Zhou and George (2001) modified the measures to increase the item internal consistency of the items. These measures were widely used in the literature, and reliability of the items and construct validity were examined in several studies (McCharen et al., 2011; Yoon et al., 2010).

C. Data Analysis

All statistical assumptions for multivariate analyses were checked along with the data screening process. The normal distribution assumption was met (n = 304) according to the central limit theorem (Schneeberger, 2009). In order to detect extreme outliers, which may cause inaccuracy of the results, Mahalanobis D^2 test was performed. As a result, four extreme outliers were deleted based on the Z-values. After excluding 18 system-missing values, a total of 282 cases were used for further analyses. Cronbach's alpha coefficients and confirmatory factor analysis (CFA) were used to evaluate the internal consistency and construct validity of the proposed constructs.

In order to determine the general relationships among the variables, hierarchical multiple regression along with R^2 magnitude change were examined. To evaluate the mediating effects of teachers' knowledge creation practices on the relationship between the learning organization culture and the level of teachers' creativity, two structural models—the *full research model and the controlled model*—were compared using structural equation modeling (SEM). The study used SPSS 19.0 and LISREL 8.80 (Jöreskog & Sörbom, 2001).

V. Results

A. Reliability and Construct Validity

Item internal consistency estimates were tested using Cronbach's alpha. In addition, the inter-constructs' correlation coefficient estimates of summative latent variables were examined. Results are shown in Table 1. The item internal consistency estimates were in acceptable ranges (from .89 to .96). Furthermore, the research constructs' correlation coefficient estimates were acceptable at the significant level—ranging from .351 to .609 (p < .001). Although the correlation coefficient between learning organization culture and knowledge creation practices was slightly high, no violation

Table 1. Descriptive Analysis, Inter-item Correlation, and Internal Consistency Estimates

Variable	M	SD	α	1	2	3
1. Learning organization culture (LOC)	3.54	0.80	.96	–		
2. Teachers' knowledge creation practices (TKCP)	3.55	0.79	.94	.609**	–	
3. Level of teachers' creativity (LTC)	4.02	0.57	.89	.351**	.378**	–

Notes: ** Correlation is significant at the .01 level.
α = Cronbach's alpha coefficient estimates.

of multicollinearity or auto (serial) correlation was detected based on the Durbin-Watson value and the Variance Inflation Factor (VIF) value (VIF=1.589). These results support the general reliability of the observed items and the inter-construct validity of the latent variables.

Results of CFA to evaluate the construct validity of the proposed measurement model are shown in Table 2. The results supported well-defined construct validity of the measurement model in terms of the model fit to data (GFI = .87), and lower values of error variances (RMSEA =. 08 and RMR = .06). Approximately 87% of the variance and covariance of the proposed research construct structure was explained by the collected data in the CTE school system. Although the chi-square estimate did not support the acceptable measurement model, caused by the large number of the collected data (n = 302), all other model-fit indices supported well-proposed research constructs in terms of the comparative fit index (CFI = .97), and the non-normed fit index (NNFI = .96). Finally, all factor-loading values of the observed items of each latent variable were acceptable, ranging from .65 to .92.

Table 2. Results of Confirmatory Factor Analysis (CFA)

Model Fit Indices	*df*	χ^2	χ^2/df	RMSEA	RMR	GFI	CFI	NNFI
Measurement Model	132	378.50	2.87	.08	.06	.87	.97	.96

B. Hierarchical Multiple Regression Analysis

To examine the pattern of the variables' magnitude of explanation for the amount of shared variance between the independent variables and the dependent variables, two-step hierarchical multiple regression analysis was conducted. Table 3 describes the results by adding each independent variable, while blocking one variable—*learning organization and knowledge creation*. As a variable was added, the change in the R^2 magnitude and the pattern of the β-value were primarily examined to measure the general mediating role of the knowledge creation practices.

Table 3. Results of Hierarchical Multiple Regression

Predictor	*B*	*SE B*	*β*	*t*	VIF	*Adjusted* R^2	*F*	*p*	ΔR^2
Step 1						.120	39.6	.001	.120
Learning organization (LOC)	.25	.04	.35	6.29	1.00			.001	
Step 2						.160	28.0	.001	.040
Learning organization (LOC)	.14	.05	.19	2.80	1.59			.006	
Knowledge creation (TKCP)	.18	.05	.26	3.80	1.59			.001	

Note: VIF stands for variance inflation factor
Dependent variable: Level of teachers' creativity (LTC)

In the first model, the learning organization culture (LOC) was found to be a significant predictor to explain the dependent variable—*the level of teachers' creativity (LTC)*. By adding the additional predictor, *teachers' knowledge creation practices (TKCP),* the second model increased the adjusted R^2 value to .040. Approximately, 16% variance of the criterion variable could be explained by the proposed two-predictor variables jointly.

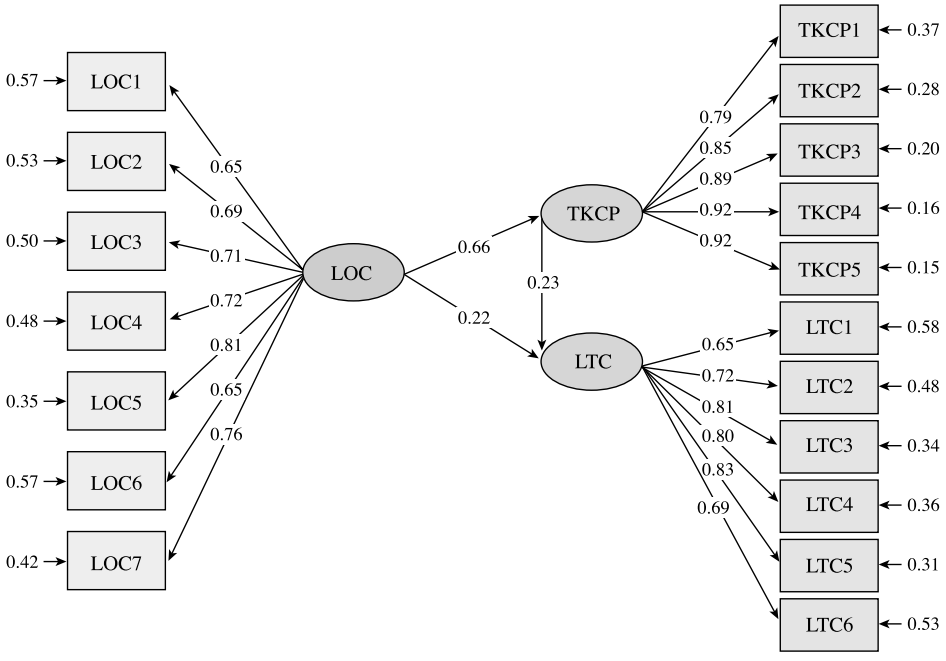
In summary, hierarchical regression analysis showed that two predictors—LOC and TKCP—independently play as significant constructs to explain the outcome variable—LTC. According to the considerable change in adjusted r-square values between regression models 1 and 2, the construct of teachers' knowledge creation practices (TKCP) was found to be a mediating construct to explain the relationship between learning organization climate (LOC) and the level of teachers' creativity (LTC) ($R^2 = .160$, $p < .001$, $\Delta R^2 = .040$).

C. Structural Equation Modeling (SEM) Analysis

In order to examine the complicated influential relationships among the proposed constructs, SEM analysis was conducted. Standardized path coefficient (SPC) estimates were mainly used to examine the effect size among the paths adapting the t-value criteria [*t*-value is greater than |1.96| to be significant] (Byrne, 1998; Hair, Black, Babin, Anderson, & Tatham, 2006; Kline, 2005). The results of the influential relationships among the research constructs based on the proposed conceptual framework are illustrated in Figure 3.

All direct paths among the constructs were found to be statistically significant at t-value |1.96|. The direct paths between learning organization culture and teachers'

Figure 3. SEM Results with SPC Estimates



knowledge creation practices and between learning organization culture and level of teachers' creativity were found to be statistically significant (SPC = .66, t = 8.73; SPC = .22, t = 2.41, respectively). In addition, the relationship between two endogenous constructs—TKCP and LTC—was found to be significant (SPC = .23, t = 2.60). Finally, in order to provide more specific information regarding the path coefficient estimates between exogenous and endogenous variables, the path decomposition in terms of the direct and indirect effects and total effects among the constructs' relationships is described in Table 4.

Table 4. Decomposition of Effects

Paths			Standardized Path Coefficient		
			Direct effect	Indirect effect	Total effect
Learning organization (LOC)	→	Knowledge creation (TKCP)	.66	–	.66
	→	Teachers' creativity (LTC)	.22		.37
	→	(Through TKCP)		.15	
Knowledge creation (TKCP)	→	Teachers' creativity (LTC)	.23	–	.23

SEM is one of the most efficient and precise approaches to find the mediating variable (Baron & Kenny, 1986). In this study, to investigate the mediating effects of teachers' knowledge creation practices on the relationship between learning organization culture and the level of teachers' creativity, two SEM models were compared (full model and controlled model). The following steps were performed as the basic process for model comparison (Baron & Kenny, 1986; Byrne, 1998; Hair et al., 2006; Kline, 2005):

1. Comparing correlation coefficient estimates among three variables;
2. Examining the linear and direct path among three variables (controlling the direct path between learning organization culture and level of teachers' creativity)
3. Comparing the model fit changes between the full model (conceptual framework) and the controlled model (controlling the direct path between LOC and LTC to zero) based on the chi-square change

As shown in Table 5, the general model fits of the two SEM models were almost identical, which met the basic assumption of the model comparison. The chi-square difference between the controlled and full models was smaller than 3.96 ($\Delta = 2.15$, $\Delta df = 1$, $p < .05$). Namely, the proposed mediating variable, teachers' knowledge creation practices (TKCP), was found to be a full mediator in strengthening the impact of learning organization culture on the level of teachers' creativity in CTE schools.

Table 5. Model Comparison Between Full Model and Controlled Model

Model Fit Indices	*df*	χ^2	χ^2/df	RMSEA	RMR	GFI	CFI	NNFI
Full Model	132	378.50	2.87	.08	.07	.87	.97	.96
Controlled Model	133	380.65	2.86	.08	.09	.87	.97	.96

VI. Conclusions and Implication

This study examined (a) the structural relationships among three variables—learning organization culture, teachers' knowledge creation practices, and the level of teachers' creativity in the CTE institutions, and (b) the mediating role of teachers' knowledge creation practices in explaining the relationship between learning organization culture and the level of teachers' creativity. A total of 282 responses of CTE school teachers in one of the central States in the US were used for the current research. Hierarchical multiple regression and structural equation modeling (SEM) were employed to test the

four research hypotheses.

The key findings can be summarized as follows. First, a positive relationship was found between learning organization culture and teachers' knowledge creation practices. Thus, the first hypothesis was confirmed. This result is consistent with 'organizational knowledge conversion theory' suggested by Nonaka and Takeuchi (1995) and is similar to what has been reported by studies conducted in industry settings (e.g., Song, 2008; Song & Kolb, 2009; Yoon et al., 2010). Second, it was shown that a positive association exists between learning organization culture and the level of teachers' creativity. Therefore, the result confirmed the second hypothesis. This finding is consistent with those of previous studies (McCharen et al., 2011; Watkins & Marsick, 1993). Third, as suggested by many theorists such as Amabile (1996) and Perry-Smith (2008), teachers' knowledge creation practices were found to be a significant predictor of the level of creativity perceived by teachers. Accordingly, the third hypothesis was confirmed. Finally and importantly, the current study positively confirmed the fourth hypothesis, asserting the mediating effect of teachers' knowledge creation practices on the association between learning organization culture and creativity levels of teachers in CTE schools. In other words, when teachers interact more actively with their colleagues to develop and share ideas, experiences, and knowledge in schools, the effects of learning organization culture on teachers' creativity become stronger. Furthermore, through the dynamic knowledge creation practices among teachers in CTE schools, more creative teaching and learning processes could occur, which ultimately positively enhance students' performance level. In addition, the learning organization culture strongly supports effective and collaborative knowledge creation practices among teachers; thus, as suggested in this research, dynamic knowledge creation practices in the CTE schools, which have learning organization culture, would lead to the creative performance of CTE students.

In practice, the study results offer important clues to strengthen CTE schools. Teachers' creativity is currently gaining greater attention as a critical factor for improving educational outcomes of students as well as overall performances of schools. This is particularly true for career and technical high schools, which are expected to develop a creative workforce in response to an ever-changing business environment. Results of this study suggest in what ways CTE teachers become further creative and CTE schools accomplish their mission of developing a creative workforce. Given the sobering reality that CTE schools are viewed as low-performing, second-class institutions, the results of this study also offer the critical information that CTE schools may be creative and thus more effective by building a learning organization climate along with promoting knowledge creation practices among teachers.

In theory, the study results are also insightful. In the context of business and industry,

considerable research has been conducted to examine the importance of organizational knowledge creation. On the contrary, there have been few attempts to apply organizational development and knowledge creation perspectives to public schooling. This study provides empirical evidence that knowledge creation practices among teachers play a significant role in strengthening the impact of learning organization culture on the creativity of teachers in CTE schools. In other words, the effects of supportive learning environments of schools on teachers' creativity could be further strengthened by helping teachers actually engage in sharing knowledge and information with peers in their workplace.

Several limitations need to be acknowledged. First, the data were collected from one state in the US, which could limit generalization of the results. Future research may be conducted with more samples to increase generalization and overall research reliability. In addition, comparison of the results of CTE schools with those of general high schools might provide more comprehensive and meaningful information and contribute to improving the quality of the entire education system.

Second, considering the primary purpose of the research, the current study included behavioral and learning climate-oriented variables. However, because the school system has more dynamic factors, future research may consider other complicated variables including state- and national-level policy issues, community-related factors, and labor market-related variables.

Third, this study was conducted using data based on perception-based, self-response methods. Therefore, the study results may be interpreted with caution.

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