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Validation of Senge's Learning Organization Model with Teachers of Vocational High Schools at the Seoul Megalopolis

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This study measured and applied Senge's (1990) fifth discipline model of learning organizations in a culturally distinct population, namely teachers in 17 vocational high schools located in the Seoul megalopolis. The participants were 976 full-time vocational and academic teachers in public trade/industry-technical and business high schools in the Seoul megalopolis. Exploratory factor analysis was used to examine responses from Korean vocational high school teachers to questionnaire items designed to test the theoretical constructs and indices of Senge's learning organization model to establish a measurement model. The hypothesized model was tested using confirmatory factor analysis. Strong evidence was provided for the construct validity of the measurement model (i.e., instrument) to measure the learning organization concept in school contexts. The results also support the notion that the theory of learning organization and related concepts, initially developed against the background of Western culture, can apply to a South Korean school context, reflecting Asian culture.

Key words: learning organization, measurement, cross-cultural application, vocational high schools

Since the early 1990s, the term 'learning organization' "has become one of the new buzzwords in the management, psychology, and human resource development literature" (Garavan, 1997, p. 18). In fact, the notion of the learning organization has become an accepted organizational development or change strategy in business and industry. Increasingly, the learning organization concept is being applied in public or non-profit institutions such as schools, hospitals, and the military in the context of defining values, organizational structure, and prescriptive strategies (Fenwick, 1996; Marsick & Watkins, 1999). The inevitability of change caused by advances in information technology, worker diversity, and non-traditional family composition calls for new ways of re-culturing and restructuring schools to be effective and adaptable in rapidly changing environments (Diggins, 1997).

Increasingly, attention has been given to understanding school change through the notion of learning organization in both theory and practice (Hajnal, Walker, & Sackney, 1998). Two primary strategies have emerged for applying the learning organization concept in school settings to target school change; as a school reform strategy (Duffy, 1997; Fullan, 1995; Weller & Weller, 1997) and as professional development for teachers (Dilworth & Imig, 1995; Lashway, 1998; Redding & Kamm, 1999; Waddock, 1994; Zederayko & Ward, 1999).

Despite a growing need, few systematic empirical investigations have examined the constructs of the learning

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organization concept in schools (Griego & Gerory, 1999; Silins, Zarins, & Mulford, 1998). When the proposition that schools should become learning organizations is addressed without confirmation or identification of a concrete construct or variables defining the construct, school efforts to become learning organizations exist in name only (Zederayko, 2000). In the same vein, Moilanen (2001) argued that the discussion on learning organizations has been extensive and diversified over the past many years, whereas efforts to diagnose and measure this concept have been rare.

More research is essential to empirically confirm and assess the existing models and concepts of learning organization in school settings, which can lead to generalizing a concept and establishing a theory of learning organization. This study represents a necessary step to identify and test the constructs of Senge's (1990) fifth discipline model of learning organizations in a culturally different population. This effort is important in that it attempts to verify the extent that the learning organization concept, which originated and evolved in the U.S., is applicable in Korean vocational high school settings.

Learning Organizations and Senge's Model

Despite the abundance of publications focusing on learning organizations, a uniform or consistent conceptual definition has not been articulated in the research literature. Researchers tend to define the concept of learning organization differently, relying on their own personal experiences and perspectives. Senge (1990) first defined the learning organization as a place "where people continually expand their capacity to create results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free and where people are continually learning how to learn together" (p. 3). Watkins and Marsick (1993) later identified the learning organization as "one that learns continuously and transforms itself" (p. 8). Gephart, Marsick, Van Buren, and Spiro (1996) defined a learning organization as one "that has an enhanced capacity to learn, adapt, and change. ... It is an organization in which learning processes are analyzed, monitored, developed, managed, and aligned with improvement and innovation goals" (p. 36). Many researchers agree that a learning organization is the ideal structure for achieving continuous change and improvement.

Senge's (1990) fifth discipline model was developed from his field work conducted through the Center for Organizational Learning at MIT's Sloan School of Management. Senge suggested that learning organizations required five key disciplines: personal mastery, mental models, shared vision, team learning, and systems thinking. Systems thinking is a main discipline which functions as an ensemble in building a learning organization. It integrates the other four disciplines but also needs each of them to realize its potential. Therefore, systems thinking is both separate from and embedded in each of the other four disciplines.

The five disciplines model is the most popular learning organization model currently available and crosses the boundaries of many other models. "The learning organization as a model has been initially originated from system thinking in the U.S. and this systemic approach is typified by Senge's model" (O'Sullivan, 1997, p. 222). Garavan (1997) indicated that "the most influential commentator in the U.S. context is Senge" (p. 24). Fenwick (1996) declared that "the Fifth Discipline was cited so often in seminars and business journals of the early 1990s that its status became not unlike that of a manifesto" (p. 7).

The five disciplines are divided into two categories according to the primary focus of individuals or groups (Senge, 1990). The first category includes personal mastery, mental models, and systems thinking which focus on individual behaviors and practices in an organization. Personal mastery involves "continually clarifying and deepening our personal vision, of focusing our energies, of developing patience, and of seeing reality objectively" (p. 7). It is a process of personal commitment to vision, excellence, and life-long learning. Mental models are "deeply ingrained assumptions, generations, or even pictures and images that influence how we understand the world and how we take action" (p. 8). When establishing mental models, Senge notes that people need to maintain a balance between inquiry and advocacy, "where people expose their own thinking effectively and make that thinking open to the influence of others" (p. 9). Systems thinking focuses on interconnectedness. System archetypes and simulation are components for practicing systems thinking.

The second category includes the disciplines of shared

vision and team learning. "The disciplines of building shared vision and team learning differ from the other three in that they are inherently collective in nature" (Senge, 1990, p. 375). The practice of these two disciplines is activities engaged in by groups. Shared vision means that individual vision or goals are integrated into a shared organizational vision. According to Senge, "unless teams can learn, the organization cannot learn" (p. 10).

Even if comprehensively approaching the transformation of schools into learning organizations at the level of theory and practice is limited, quite a few school models and educational research focusing on building a learning organization are rooted in and explained by Senge's (1990) five disciplines. Senge, himself, has shown great concern in transforming schools into learning organizations. He advocates that the learning organization model originally developed for business is relevant for teachers and schools. The five disciplines provide "important insight into how educators can achieve meaningful change and transform schools into learning organization that renew themselves" (Isaacon & Bamburg, 1992, p. 42).

Overview of Present Study in Measuring Learning Organizations

Several instruments purport to measure the dimensions of learning organizations, e.g., Marquardt's (1996) Learning Organization Profile, the Dimensions of Learning Organization Questionnaire by Watkins and Marsick (1997), the Learning Organization Assessment by Kline, Saunders, and Kline (1995), and Wyckoff's (1998) Learning Organization Inventory. The first three instruments were developed for business and industry, and the constructs they measure are, to greater or lesser degrees, different from Senge's learning organization model. In contrast, Wyckoff's instrument was developed for school contexts and based on Senge's five disciplines. Nevertheless, in determining construct validity, the factors and loading structures derived from Wycoff's data differed from Senge's five theoretical constructs and item structures.

More recently, a few studies have examined the dimensions and features related to schools as learning organizations. By synthesizing the findings from three independent studies, Leithwood, Leonard, and Sharrat (1998) reported specific conditions that foster organizational learning in elementary and secondary schools. School culture (collaborative and collegial), school structures allowing active teacher participation in decision-making, and policies and resources supporting professional development were identified as school-level conditions necessary to foster organizational learning. Similarly, Marks and Louis (1999) identified five dimensions required for creating school capacity for organizational learning: (a) school structure leading to participative decision-making grounded in teacher empowerment, (b) shared commitment and collaborative activity, (c) new knowledge and skills, (d) decentralized and facilitative leadership, and (e) feedback and accountability.

Through exploratory factor analysis, Hajnal et al. (1998) evaluated a scale of 15 behavior items related to organizational learning in a project identifying school improvement, school initiative, and indicators of the institutionalization of change. They identified three underlying dimensions of organizational learning in school settings: collaboration, individual learning, and a sense of vision. The first dimension, a collaborative process, focused on sharing professional expertise among colleagues. The second was more individually focused, representing each person's willingness to engage in professional learning and growth, and to reflect on and experiment with on-going practices. The third dimension pertained to aligning activities to school mission and goals. Hajnal et al. found that leadership and organizational learning were critical to school improvement.

In a more extensive study involving South Australian and Tasmanian secondary schools, Silins, Zarins, and Mulford (1998) identified seven characteristics of schools as learning organizations including environment scanning, vision/goals, collaboration, taking initiatives/risk, review, recognition/ reinforcement, and continuing professional development. By analyzing the responses of 2000 teachers and principals, they confirmed four of these factors for viewing secondary schools as learning organizations: collaborative climate, taking initiative and risks, improving school performance, and professional development.

While this previous work exists, evidence of the constructs or variables of schools as learning organizations is still thin (Zedrayke, 2000). Moreover, the constructs examined by most previous works have not been approached from the original learning organization model

defined by Senge (1990). Additionally, efforts to operationally define, measure, and validate the learning organization are still rare (Moilanen, 2001). Specifically regarding the issue of measurement, Yang, Watkins, and Marsick (1998) pointed out that little is known about how to measure the learning organization. In a similar sense, Moilanen argued that "the traditions of measuring learning organization are not well established or validated, which means that the development of new measuring tools has no solid or common ground to be utilized as a basis" (p. 6).

Method

Participants

Participants in the study were 976 full-time vocational and academic teachers in 17 public vocational high schools located in the Seoul megalopolis. The participants, vocational and academic teachers in public vocational high schools, were employed by city and provincial Offices of Education during the 2005-2006 academic year. Seoul megalopolis includes 3 (Seoul metropolitan city, Gyeonggi province, and Incheon metropolitan city) of 16 municipal and provincial government agencies of education (7 metropolitan cities, 9 provinces) in South Korea. This region was selected because it functions as a hub in politics, economy, social-cultural matters, and education in South Korea. More than half of the total South Korean population (about 25 million people) lives within this defined area.

I selected 17 schools (24.6%) from the total of 69 public vocational high schools located in the Seoul megalopolis area. For sampling, by means of direct contact, lists of vocational high schools were obtained from each city and provincial Office of Education. After numbering each school, schools included in this sample were randomly selected by using a random numbers table. All full-time teachers working in the selected 17 schools were included in the sample. Based on the strategies and procedures of data collection, 976 teacher respondents returned usable surveys, which yielded a final response rate of 71.29%.

Data Collection and Procedures

Several specific activities were completed to collect data. First, necessary contacts with Seoul and Incheon Metropolitan Offices of Education and Gyeonggi provincial Office of Education in South Korea were made to obtain permission to collect data. To obtain a higher response rate, an administrative staff member in each public vocational high school was identified to serve as a data collector. I directly contacted the related superintendents of the Offices of Education to assign school staff members as data collectors. Through a direct visit, survey questionnaire packets were delivered to the identified support staff member in each school. School staff members distributed each questionnaire packet to all full-time teachers at her/his school. After completing the questionnaire, each teacher placed it in the return envelope, sealed it, and returned it to the staff member. Finally, each staff member mailed the large sealed envelopes to the researchers.

In determining sample size, I considered the needs associated with using factor analysis. The necessary sample size in factor analysis is theoretically dependent on several aspects, including communality of selected variables and the level of over determination of factors (MacCallum, Widaman, Zhang, & Hong, 1999). Considering the use of two factor analyses (exploratory and confirmatory), the number of items to be analyzed (n = 41), and the rule of thumb for determining sample size, the size of the sample needed was calculated at, a minimum, 900 teachers. Therefore, the corrected full sample (N = 976) was reasonable for this study.

The complete sample was coded in sequence and by school by using the Statistical Package for the Social Science (SPSS 12.0) and, subsequently, divided into two portions. Half of the sample (respondent cases with odd numbers, n = 488) was used to conduct the exploratory factor analysis (EFA). To statistically test the measurement model defined by EFA, the second analysis used sample data from the other half (respondent cases with even numbers, n = 488) by using confirmatory factor analysis (CFA) with LISEREL 8.3 (Jöreskog & Sörbom, 1996).

Instrumentation

A new instrument was required to measure and test the degree of the learning organization's five disciplines through Korean vocational school teachers' attitudes or perceptions of educational practices and organizational

behaviors. The survey instrument served as a tool to determine individual teachers' perceptions toward the psychological factors of Senge's (1990) learning organization. To develop the instrument, I observed the major steps recommended by Crocker and Algina (1986), including identification of the domain(s) representing the construct of interest, the development of an initial pool of items, the use of an expert panel to review and revise items, formatting items and conducting a pilot study, field-testing items on a large sample of the population for whom the test is intended, and designing and conducting reliability and validity studies for the final instrument.

I first created operational definitions for each factor domain, which would result in empirical observation representing the factors in the real world (see Table 1).

All items were then generated by writing or selecting statements characterizing the principles of each factor domain definition. Two procedures to construct content validity were used. First, the initial pool of 70 items was reviewed and refined by a panel consisting of a professor and four doctoral students who were high school teachers or had teaching experience in American high schools. In the second round of constructing content validity, the 47 items refined by the first panel were reviewed by three experts including a scholar in the learning organization field, Dr. Karen Watkins, and two professors at the University of Georgia (one with a human resource development emphasis, the other with a social and contextual learning background).

To obtain the validation of the Korean version, I asked a review group consisting of three Korean graduate students at the University of Georgia to indicate any words or phrases of the Korean translated items that were inappropriate or unclear compared to the English version. Based on their responses, the Korean version of the questionnaire was refined. The revised Korean version was back-translated into English by a Korean American, a graduate student at the University of Georgia. The back-translated result was compared to the original English version. Items showed similar meanings in their content between both versions.

The instrument developed and used in this study is a psychometric or attitude survey instrument. I selected a 5-point Likert-type scale format which consisted of 1=Almost never true, 2=Usually not true, 3=Sometimes true or sometimes not true, 4=Usually true, 5=Almost always true. Before administering the instrument, a small-scale study, a pilot test, was conducted to obtain information about how well the instrument would work to elicit desired responses. A total of 147 teachers from the three Korean vocational high schools in the same population voluntarily participated in this pilot test. Through the pilot survey, the construct reliability of the instrument, as well as item analysis, was

Table 1

Operational Definition of Each Factor

Factor	Operational definition
Personal mastery	At the school, teachers expand personal growth and capacity by having a strong desire to improve professionally, engaging in continual learning, and focusing on the future vision in order to make choices about their development.
Mental models	At the school, teachers continually reflect on assumptions about schooling; openly dialogue, share views and develop knowledge about each other's assumptions; and engage in their own work with flexibility.
Shared vision	Vision and goals of school are planned and created through a process of shared commitment, participatory activities, and consensus of all school members including students and parents; and a teacher's personal vision is aligned with the school vision and goals.
Team learning	At the school, various group or team activities are encouraged to address schooling issues or teacher's professional work; teachers become committed to, skilled at, and involved in collaborative work.
Systems thinking	Teachers understand and manage their own work in an interrelationship within the school environment that includes processes of change; they consider the impact of their own work on the entire school organization and the stakeholders' interests.

ascertained using SPSS 12.0.

As a field test in the context of vocational high schools in South Korea, exploratory factor analysis was conducted to establish the construct validity of the instrument. A method of common factor analysis known as principal axis factoring, was employed. Based on a theoretical assumption that high correlations exist between the theoretical constructs of learning organization, an oblique rotation method was used. After several oblique rotation techniques were tested on the original 41 items, the Promax method (Kappa=5), which tries to make low and moderate loadings lower while maintaining high loadings, was selected.

The 35 items which loaded on the five factors possessed a high level of internal consistency (α=.954). The construct-related evidence of validity for the learning organization instrument consisted of 35 items loaded on five factors that were derived from teachers in the context of Korean vocational high schools (see Appendix A). Reliability (alpha) coefficients ranged from .856 to .897, with an overall value of the internal consistency for all 35 items equal to .954. The reliability coefficients of the five factors derived from the EFA were all much higher than .70. Obtaining evidence of reliability and construct validity based on EFA resulted in the final psychometric instrument I used to measure the degree of learning organization in Korean vocational high schools.

Analysis and Result

To cross- validate the theoretical model of Senge's (1990) learning organization, the measurement model found in EFA was tested using CFA with LISEREL 8.3 (Jöreskog & Sörbom, 1996). The values for skewness and kurtosis were examined as part of a data screen process to check the distribution of scores and were all less than |2.0|. The multivariate normality test was conducted using PRELIS 2.53, with a relative multivariate kurtosis value of 1.112. This result indicated there were no serious deviations from multivariate normality. It also verified the appropriateness of maximum-likelihood estimation used in this study (Bandalos, Finney, & Geske, 2003). There were no items found to be nonnormally distributed. Therefore, maximum likelihood was selected as an estimation method. Gable and Wolf (1993) argued that maximum likelihood is the most frequently used estimation method and its estimates are very robust.

A Hypothesized Model

The model tested in this CFA was a higher-order factor model based on results of the EFA. The higher-order hierarchical factor model consisted of 35 observed variables (items), five primary factors, and a second-order factor (see Figure 1). The second-order factor accounts for the relationships between the five primary factors.

Examination of Parameter Estimates

The initial steps of this analysis assessed the model using CFA with LISREL 8.3 (Jöreskog & Sörbom, 1996). The first step was to determine if parameter estimates were reasonable (Byrne, 1989; Mueller, 1996). According to the parameters estimated by LISREL, there were no negative variances, standard errors ranged from .02 to .05, and all covariance matrices were positive definite. Next, the adequacy of both the measurement and structural part of the model were determined by examining the squared multiple correlations (R^2) and loading values for the 35 observed items and five latent primary factors (see Table 2).

The path values of item loadings were moderately high. Seven items possessed loading values less than .50. Path values of the 5 latent factors were considerably high to the learning organization, e.g., the higher-order factor. With the exception of the personal mastery factor, r = .74, the path values of 4 latent factors were more than .80. In addition, I found that as latent variables, the 5 primary factors all correlated with each other at levels greater than .60.

Assessment of Overall Model Fit

CFA with LISREL 8.3 (Jöreskog & Sörbom, 1996) was used to produce various fit indexes to assess model fit. Gable and Wolf (1993) suggested that to answer the question of whether or not the empirical data confirm the existence of the hypothesized constructs, researchers need to examine four indicators: the chi-square to degrees of freedom ratio, two Goodness-of-Fit values (GFI and AGFI), and the Root-Mean Square Residual (RMR). Hu and Bentler (1998) did not recommend using the GFI and AGFI because these two indexes are not sensitive to model

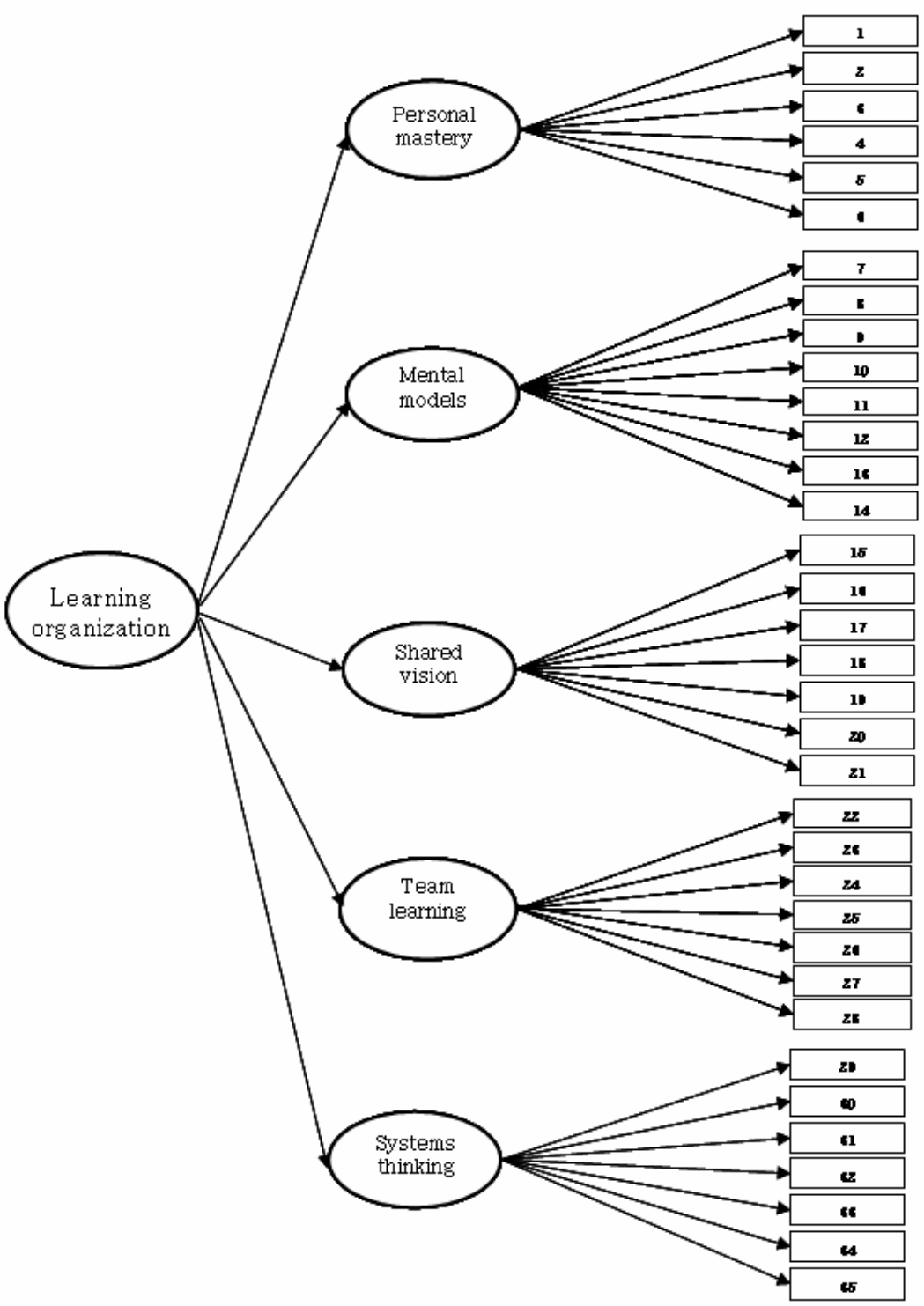

Figure 1. A hypothesized learning organization model for the CFA

Table 2

Major Parameter Estimates and Loading Values

Factor	Item	Factor loading	t-value	Error variance (SE)	R^2
Primary factors					
Personal mastery	1	0.52		0.23 (0.017)	0.55
	2	0.53	16.01	0.21 (0.017)	0.58
	3	0.49	13.74	0.33 (0.023)	0.43
	4	0.48	13.73	0.31 (0.022)	0.43
	5	0.52	15.24	0.24 (0.019)	0.52
	6	0.53	15.89	0.21 (0.017)	0.57
Mental models	7	0.51		0.39 (0.028)	0.39
	8	0.55	12.91	0.29 (0.022)	0.51
	9	0.42	10.77	0.37 (0.025)	0.33
	10	0.42	10.73	0.37 (0.025)	0.32
	11	0.51	12.15	0.34 (0.024)	0.44
	12	0.56	12.92	0.30 (0.022)	0.51
	13	0.46	11.54	0.34 (0.024)	0.38
	14	0.47	11.93	0.31 (0.022)	0.42
Shared vision	15	0.63		0.39 (0.028)	0.51
	16	0.61	15.43	0.31 (0.023)	0.55
	17	0.60	15.94	0.25 (0.019)	0.59
	18	0.63	15.52	0.32 (0.023)	0.55
	19	0.62	15.73	0.29 (0.021)	0.57
	20	0.58	15.45	0.27 (0.020)	0.55
	21	0.55	15.36	0.25 (0.019)	0.54
Team learning	22	0.50		0.58 (0.039)	0.30
	23	0.53	10.38	0.43 (0.031)	0.39
	24	0.60	10.95	0.41 (0.030)	0.46
	25	0.55	11.06	0.33 (0.024)	0.48
	26	0.55	11.42	0.26 (0.020)	0.54
	27	0.52	11.31	0.25 (0.019)	0.52
	28	0.56	11.22	0.31 (0.023)	0.50
Systems thinking	29	0.50		0.31 (0.022)	0.45
	30	0.55	14.17	0.25 (0.019)	0.54
	31	0.48	12.27	0.36 (0.025)	0.39
	32	0.50	13.58	0.26 (0.019)	0.49
	33	0.59	13.94	0.32 (0.024)	0.52
	34	0.55	13.81	0.29 (0.022)	0.51
	35	0.53	12.98	0.35 (0.025)	0.44
Higher-order factor					
Learning organization	SV	0.84	14.92	0.30 (0.043)	0.70
	PM	0.74	13.67	0.45 (0.058)	0.55
	TL	0.84	11.33	0.29 (0.056)	0.71
	MM	0.90	13.50	0.20 (0.041)	0.80
	ST	0.81	13.59	0.34 (0.052)	0.66

Note. SV= Shared vision, PM= Personal mastery, TL= Team learning, MM= mental models, and ST= Systems thinking.

misspecification and are sensitive to sample size. Instead, they recommended a 2-index strategy, which includes reporting the SRMR or RMSEA and supplementing it with either the NNFI, IFI, or CFI. Regarding evaluation of overall model fit, Vandenberg and Lance (2000) found major recommendations from their review of relevant literature. The first one was to interpret the chi-square value to infer support for a well-fitting model. The second was to select a variety of practical fit indexes to supplement the chi-square test. They recommended using four fit indexes, including (a) TLI, often referred to as the Non-Normed Fit Index (NNFI), (b) RMSEA, (c) RNI, and (d) SRMR. No index of model fit is generally accepted as superior to the others, so several fit indexes are needed to ensure that multiple aspects of model fit can be captured (Hu & Bentler, 1995). Accordingly, five fit indexes were selected as criteria to assess the fit of the hypothesized model (see Table 3) because there was consistent support for them from the literature in terms of their ability to examine well-fitting models.

In the case of the chi square goodness of fit statistic shown above, the statistically significant result yields a rejection of the fit of the hypothesized model. On the other hand, Stevens (1996) argued that the chi-square statistic is very sensitive to sample size, rendering it unclear in many situations whether the statistical significance of the chi square statistic is due to poor fit of the model. As an alternative method, Gable and Wolf (1993) recommended using specific criteria to assess the ratio of a chi-square value to its degrees of freedom. According to them, "if the ratio is larger than 5:1, the model is seriously flawed. If the ratio is less than 2:1, break out the champagne! Ratios between 2:1 and 5:1 are in the gray area of model fit" (p. 163). The smaller ratio indicates better fit. In this study, the ratio of the chi-square value to its degree of freedom in this study was 2.67:1. Thus, the chi-square ratio reflects an adequate fit for the hypothesized model.

Table 3
Model Fit Indices of the Hypothesized Hierarchical Model

Index	Value
Chi-square	1485.04(df=555)*
Standardized RMR (SRMR)	0.052
Root Mean Square Error of Approximation (RMSEA)	0.060
Non-Normed Fit Index (NNFI)	0.970
Comparative Fit Index (CFI)	0.980

Note. **p* value = 0.000. This indicates that there is statistically significant difference in the observed and theoretical covariance structure matrices.

The Root-Mean Square Residual (RMR) is the square root of the average of the residual element. LISREL also provides a standardized RMR (SRMR) value which essentially puts this index into a correlation-type metric. Hu and Bentler (1998) recommended reporting SRMR because it is the most sensitive to simple model misspecification and also moderately sensitive to complex model misspecification. They suggested a cutoff of .08 or less for RMR and SRMR. The SRMR value of .052 in this study is a very reasonable value to reflect a good model fit.

Root-Mean Square Error of Approximation (RMSEA) is a standardized measure of the lack of fit of the population data to the model. It represents the discrepancy per degrees of freedom. A cutoff close to .06 is recommended as a reasonable value to indicate a close fit (Hu & Bentler, 1998). The RMSEA value of .06 obtained in this analysis indicates that the data reasonably fit the model.

The Non-Normed Fit Index (NNFI) and Comparative Fit Index (CFI) are both considered incremental fit indexes. The NNFI or Tucker–Lewis Index (TLI) is a variation on the Normed Fit Index where the difference between the fit of the target and baseline models is compared to the difference in fit between the baseline model and its expectation. CFI compares the noncentrality parameters of the target and baseline models. Hu and Bentler (1998, 1999) recommended the fit criteria for these two indexes to be .95 for NNFI and CFI≥ .95. Compared to these cutoff values, obtained values for NNFI = .97 and CFI = .98 both indicate adequate model fit.

Analysis revealed that the learning organization model hypothesized in this study adequately fits the actual data. Based on the 2-index strategy recommended by Hu and Bentler (1998, 1999), the empirical data strongly confirmed the existence of the hypothesized constructs and model of Senge's (1990) learning organization. In terms of cross-validation, results from the assessment of model fit supported the construct validity of the learning organization instrument in Korean vocational high school contexts.

Discussion and Implications

The CFA was conducted to examine whether or not the hypothesized model fit the data both conceptually and empirically. The hypothesized test model was a hierarchical factor model that comprised a higher-order factor (i.e., learning organization) and five primary factors (i.e., personal mastery, mental models, shared vision, team learning, and systems thinking) derived from responses to 35 items. The hypothesized higher-order factor model was, in fact, supported by the teacher data, which fit the hypothesized learning organization model well. From conceptual and measurement perspectives, the five primary factors could be examined individually (as subscales). More specifically, the use of the CFA latent factors' loading values in describing the learning organization model and its structure proved beneficial because it provided a means of reducing the number of parameters being estimated, and it reduced the number of observed variables. Further research using structural equation modeling, can reduce measurement errors by using the factor loading values rather than item loading scores. Their use can also be parsimonious for indices to measure learning organizations.

The overall good model fit produced by the CFA confirms that the 35 items used in this study precisely detected the theorized constructs. Thus, the results provide strong evidence for the construct validity of the measurement model (i.e., instrument) to measure the learning organization concept in Korean school contexts. In terms of cross-validation, CFA results strengthen the evidence of construct validity through precisely confirming, a priori, the model structure defined by the EFA. In many psychometric instruments, including the measurement model in this study, construct validity is perhaps the most fundamental of all types of measurement validity (Gable & Wolf, 1993; Messick, 1989). Successfully establishing and confirming a measure of learning organization has supported the construct validity of the constructs which underlie the learning organization model.

My results provide strong evidence in support of the notion that the five disciplines of Senge's (1990) learning organization theory can be operationalized, measured, and applied in Korean educational contexts. More specifically, an empirically-based system that can be used to identify and measure the constructs of Senge's learning organization theory has been developed. The measurement model (instrument) has also allowed us to identify and study the relationships between the five theoretical constructs of the learning organization model and to test the generalizability of the hypothesized model.

The five disciplines of Senge's (1990) learning organization model were employed as theoretical constructs for the measurement model I defined and confirmed. Therefore, all indices (items) developed to reflect and represent theoretical constructs represented varying practices of achieving the five disciplines in organizations. In addition, the measurement model targeted school organizations as learning organizations. Thus, all indices (items) for the measurement model focused on activities and behaviors conducted by the teachers or the school organization in relation to educational practices within schools. In these model indices, teacher activities or organizational behaviors for educational practices were conceptualized as practices for achieving the five disciplines of Senge that are the targets of measuring the learning organization concept. They were also formatted with model indices (items) to be measured through teacher perceptions. The statements of model indices are related to the beliefs and attitudes that teachers may have about activities and behaviors conducted by themselves, their colleagues, or school organization. As a result, the measurement model established in this study measured teachers' range of recognition of their school as a learning organization.

The measurement model (instrument) I defined is similar to other existing instruments–e.g., Marquardt's (1996) Learning Organization Profile, and the Dimensions of Learning Organization Questionnaire by Watkins and Marsick (1997)–that measure some aspects of learning organization. However, two points may be noted regarding the characteristics of this measurement model that distinguish it from these other approaches. First, successful establishment of the measurement model shows that Senge's (1990) learning organization theory can be appropriately applied to school organizations, as well as culturally different contexts. At the level of extending and generalizing learning organization theory, the creation of a measurement model related to the idea of schools as learning organizations and confirmation of the generalizability of Senge's learning organization theory to culturally different organizations are important contributions to the literature on

learning organizations.

My results support the notion that the theory of learning organization and related concepts, initially developed against the background of Western culture, can also apply to a South Korean school context, which reflects Asian culture. This is interesting and useful information since past research on Senge's work has been conducted primarily in the U.S. It does not appear that the learning organization model was unduly influenced by cultural differences. From a cross-cultural perspective, individualism refers to an emphasis on personal goals, autonomy, and supremacy of self-interest, and is noted as an acceptable attribute in Western countries, particularly the United States; whereas collectivism is a pervasive attribute embedded in all domains of Korean society (Shinn, 1986; Son, 2000). In Korean society, collectivism is a unique cultural attribute where strong group orientation encourages organizational members to develop and strengthen positive attitudes toward group work and collective confidence in the workplace. The Confucian tradition in Korea, an additional cultural characteristic, fosters high levels of social capital in the form of hard work and a high premium placed on education (Sorensen, 1994). Confucianism affects the Korean zeal for seeking advancement in individual learning and vision. These two Korean cultural attributes (the strong group orientation of collectivism and zeal toward individual learning/personal mastery by Confucianism) fit in very well overall with the behavioral practices of the five disciplines for Senge's (1990) learning organization theory. As a result, the validity of Senge's learning organization theory that was demonstrated by the CFA empirically explain the consistency between practices of the five disciplines developed with American cultural backgrounds, and the cultural characteristics of both Korean collectivism and Confucianism.

While these results contribute to theory and practice in the field of learning organization, research participants, who were all full-time teachers, responded to an instrument that focused on teacher perceptions and teacher behaviors. Since school organizations involve various members such as principal, vice-principals, administrative staff, students, and external stakeholders (e.g., parents and community members), the findings derived from teacher perceptions are limited and can not be generalized to the whole dimension of school organizations. Analysis of the whole school organization (both locally and nationally) as a learning organization system should also be conducted.

For further research, the external validity of the learning organization theory should be studied in additional school contexts. While I confirmed the internal validity of a measure of Senge's (1990) learning organization theory, the model was only verified in Korean vocational high schools. This study did not deal with the external validity or criterion-related predictive validity of such a measure. Evidence of external validity should be supported by examining relationships between the degree of becoming a learning organization and other exogenous variables such as effectiveness of school organizations, students' academic performance, or organizational change adaptability. In this vein, replication of this study with different educational contexts may also be fruitful in enlarging the body of evidence about the generalizability of the learning organization theory in South Korea and other Asia-Pacific countries. For example, investigations of people who provide education or training to workers in business and industry settings or postsecondary vocational and academic institutions are seen as being particularly important.

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Appendix A

Developed Items and the Five Factors

Item	Content	Factor				
		1	2	3	4	5
V15	Teachers and staff together build the school's vision and goals.	**.837**	-.142	.067	-.101	.086
V16	Teachers develop their personal goals to align with the whole school vision or goals.	**.804**	.029	.124	-.129	-.029
V19	Teachers are committed to a shared vision for the future of school.	**.780**	.054	-.122	.053	-.022
V17	Teachers align personal class or teaching goals with the school vision and goals.	**.775**	.043	.059	.057	-.153
V20	Teachers agree on the principles necessary to achieve the school vision.	**.670**	.004	.041	.123	-.049
V18	Teachers feel comfortable in sharing ideas with other teachers about the school vision.	**.577**	-.009	-.109	-.011	.296
V21	When changing educational practices, teachers consider the impact on the school vision and goals.	**.502**	.142	-.113	.274	-.055
M11	Teachers change their old teaching style or pattern to implement new and better approaches in educational practices.	.073	**.784**	-.010	-.136	-.023
M12	Teachers actively explore assumptions and ideas with each other about educational practices.	-.044	**.746**	-.040	-.111	.129
M13	Teachers are highly aware of how their own beliefs and assumptions affect educational practices.	.009	**.741**	-.054	.023	-.032
M9	Teachers learn and change as a result of students' reactions during teaching.	-.182	**.663**	-.040	.183	-.010
M10	Teachers often use the significant events of the school or classroom to think about their own beliefs about education.	-.003	**.628**	-.115	.033	-.030
M7	Teachers often reflect on assumptions about schooling activities with other teachers to ensure that they are in line with educational principles.	.110	**.546**	.022	-.157	.141
M14	Teachers at the school can effectively explain their own assumptions underlying their reasoning.	.222	**.478**	.050	.042	-.013
M8	Teachers inquire about the appropriateness of their own course or program with respect to the goals of schooling.	.205	**.409**	.247	-.020	-.078
P 2	Teachers continually work to clarify professional goals at the school.	.053	-.153	**.933**	-.041	.026
P 1	Teachers engage in continuous learning and reflection activities as to achieve personal growth.	.007	-.142	**.931**	-.059	.045
P 3	Teachers view the current reality more clearly in terms of career goals.	.048	-.062	**.675**	.083	-.030
P 5	At the school, teachers continually learn to bridge the gap between current reality and the desired future.	.015	.215	**.584**	.035	-.031
P 6	Teachers strive to supplement the lack of skills and knowledge in teaching and subject area.	-.090	.389	**.486**	.041	-.046
P 4	Teachers have learning opportunities in teaching or other professional work.	-.125	.189	**.426**	.070	.096

Item	Content	Factor				
		1	2	3	4	5
S33	Teachers attentively link the current schooling with students' career pathways.	-.049	-.087	.025	**.803**	.046
S35	When dealing with school challenges, teachers consider the effect on students.	-.043	-.150	.136	**.753**	.038
S34	When changing and creating school rules, teachers consider consistency with the policy of the governments and educational acts.	.027	-.028	-.001	**.650**	.021
S31	When dealing with a student discipline problem, teachers consider the impact on other teachers.	.067	.086	-.154	**.620**	.010
S30	When changing educational practices, teachers consider the impact on their results to the inside and outside of the school.	.165	.123	.010	**.449**	.032
S29	When developing lesson plans, teachers consider the different needs and abilities of students.	-.005	.155	.041	**.404**	.153
T25	Teachers share information across course subjects and grade levels with other colleagues.	-.060	.082	.015	-.013	**.750**
T28	Teachers participate in open and honest conversations to share their best educational practices.	-.013	.219	-.083	-.092	**.689**
T24	Teachers are treated equally in team or committee activities.	.253	-.191	.006	-.010	**.681**
T26	Teachers believe that sharing information or knowledge through team activities is useful for solving complex school problems.	-.138	.098	.076	.017	**.635**
T27	Teachers respect other colleague's ideas and opinions by viewing them from their colleague's perspective.	-.148	.124	.015	.170	**.619**
T22	Teachers feel free to ask questions of other teachers or staff regardless of gender, age, and professional status at the school.	.115	-.208	.073	.099	**.545**
T23	At the school, group or team works are used in teacher professional development.	.363	-.030	-.011	-.043	**.420**

Note. P = Personal mastery; M = Mental models; V = Shared vision; T = Team learning; S = Systems thinking.