

Teachers' Knowledge Management Based on Knowledge Innovation

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ABSTRACT

Studying teachers' knowledge management is also an entry point to studying knowledge management in the field of education. To guarantee the healthy and continuous development of teachers' knowledge management ability, it is crucial to evaluate their management level in a scientific, objective and comprehensive way. Using the expert consultation and analytic hierarchy process (AHP), we put forward and set up an evaluation index system for college teachers' knowledge management, we evaluated the knowledge management levels of college teachers. The results showed that rankings of knowledge management levels of college teachers were knowledge acquisition, knowledge organization, knowledge development and knowledge innovation from high to low. Their knowledge management was above the average as a whole. From all levels, the scores of knowledge acquisition and knowledge organization were relatively high.

Keywords: knowledge innovation, digital library, knowledge management, SPSS, influence factor

INTRODUCTION

With the advent of the era of knowledge economy, knowledge management has become an irreversible trend in the global economy and has overwhelmingly challenged all traditional knowledge, values, thinking modes and survival strategies. Knowledge management has become a hot topic. Due to changes in the learning style of the information age, higher requirements are needed for teacher's individual ability. Building a digital teaching resource library has become a key factor affecting the effective teaching of teachers. Therefore, teachers' personal knowledge management has emerged. Teachers are typical knowledge workers. They are engaged in various knowledge activities, from the collection of teaching materials, writing of teaching plans, accumulation of teaching materials, teaching in the classroom, assessment of students' learning and reuse of learning outcomes. These involve a series of knowledge production, creation, accumulation, transfer and use in the process of knowledge management. Knowledge management is one of teachers' key abilities to catch up with the knowledge society and keep pace with times.

Teachers' personal knowledge management means that teachers acquire, store, share, apply and innovate professional knowledge required in teaching, facilitate the switch between implicit knowledge and explicit knowledge, improve teaching efficiency and promote the better development of the subject, using tools and platforms of information technology and knowledge management, etc., by establishing a set of effective knowledge management systems and institutions. Digital libraries, as an important symbol of the information age, must be established and centered on service, understanding the current dilemma, managing knowledge reasonably according to the needs of users, increasing knowledge service in a timely manner, survival and development in the market competitions in the current field of knowledge service.

Contribution of this paper to the literature

- We put forward and set up an evaluation index system for college teachers' knowledge management, to provide a basis for the evaluation of their knowledge management.
- The digital library platform can enhance teachers' acquisition, storage and sharing of knowledge.
- This paper proposes countermeasures for improvement of knowledge management among teachers in institutions of higher learning.

LITERATURE REVIEW

"Knowledge management" first appeared in Horton's book written in 1979. Horton proposed the concept from the perspective of resource management evolution (Ibisch et al., 2016). Stewart (1997) put forth the concept of "knowledge capital" in 1991, pointing out that knowledge capital has become an important asset of the US (Edvinsson, 1996). The Center for Educational Research and Innovation (CERI) under the administration of the Organization of Economic Cooperation and Development (OECD, 2007) plays an important role in promoting research of knowledge management in the field of education. In 2000, it published the proceedings, *Knowledge Management in the Learning Society*, in which many major research findings in the field were included, such as *Knowledge and Innovation Systems* (2007) by Richard R. Nelson, a professor from Columbia University, and *The Learning Economy: Some Implications for the Knowledge Base of Health Education Systems* (2007) by Bengt-Ake Lundvall, a professor from Aalborg University.

Research in knowledge management was not started in China until 1998. Professor Wu Jiawei, a famous scholar, defined information management as a basis of knowledge management. In 1998, the first knowledge management specialized network, China Knowledge Management Network, was built and started operating. Nevertheless, domestic scholars' evaluation of knowledge management efficiency had not yet been systematic. In *Research into Evaluation of Knowledge Management Performance*, Yan (2001) divided corporate knowledge management into three periods, namely "short-term objective", "medium-term objective" and "long-term objective", according to the length of corporate objectives, and built a complete system of evaluation indices based on the characteristics of different periods. Wei Jiang expounded on core abilities of enterprises from the knowledge perspective. Gan and Zhu (2002) provided the knowledge management implementation process, knowledge objectives, and knowledge management evaluation tool, KMAT3. Zhao et al. (2008) thought that the focus of organizational management was ever-changing, so was the focus of knowledge management. Zhang (2008) advanced knowledge management performance evaluation based on the 4P model. Based on the Key Logic's learning organization ability 4P evaluation model, the index weight of every dimension was marked by experts.

Wang and Fan (2004) pointed out that knowledge management performance refers to the organization and implementation of knowledge management performance and achievements. Individually, knowledge management performance means improvement of individual performance and ability brought by individual implementation of knowledge management. Li et al. (2006) thought that knowledge management consists of knowledge recognition and acquisition, storage and organization, exchange and sharing, application and innovation. Based on the viewpoints of previous scholars, the knowledge management process consists of four links, namely knowledge acquisition, organization, development and innovation. Individual knowledge management constitutes a subset of knowledge management. Therefore, the process of individual knowledge management is also made up of the above four parts.

RESEARCH DESIGN

Building an Evaluation System for College Teachers' Knowledge Management

Building an evaluation index system

Knowledge management included four abilities, for example, knowledge acquisition, knowledge organization, knowledge development and knowledge innovation (Liu, 2013; Wen et al., 2015). They constituted primary indices of college teachers' knowledge management. They also provided an important reference when a digital library set the overall goal of knowledge service (Wang et al., 2013). Then we integrated primary indices, adopted the Delphi method, including the opinions of knowledge management experts in scientific research institutions and enterprises, screened and adjusted primary indices and optimized their names, and so on, so as to get an evaluation system for college teachers' knowledge management with four items and 16 indexes.

Table 1. The weights of evaluation indices of college teachers' knowledge management

Evaluation Item (Weight)	Evaluation Index	Index Weight	Total Weight
Knowledge acquisition ability (0.2753)	Knowledge acquisition	0.2608	0.0718
	The selection and control of knowledge	0.2322	0.0639
	Social capital storage	0.2421	0.0667
	Guarantee of knowledge acquisition	0.2649	0.0729
Knowledge organization ability (0.2381)	Dimension of knowledge revelation	0.2654	0.0632
	Depth of knowledge revelation	0.2613	0.0622
	Expression of knowledge structure	0.2383	0.0567
	Progressiveness	0.2350	0.0559
Knowledge development ability (0.2724)	Learning	0.2705	0.0737
	Analysis and decision-making	0.2375	0.0647
	Innovation	0.2487	0.0677
	Technical support	0.2433	0.0663
Knowledge innovation ability (0.2142)	Diversified service modes	0.2667	0.0571
	Integrity of service	0.3014	0.0646
	Convenience of service platform	0.2138	0.0458
	Technical maintenance	0.2181	0.0468

Table 2. Questionnaire statistics

Questionnaire	Distributed Questionnaire	Recovered Questionnaire	Valid Questionnaire	Response Rate (%)	Validity Rate (%)
Number	640	612	578	95.6	94.4

Determining the weights of evaluation indices

The weights of evaluation indices were determined using expert consultation and analytic hierarchy process. The weights of all levels are shown in [Table 1](#).

Criteria and grades of evaluation indexes

By consulting the relevant literature, combined with college teachers' actual knowledge management, we assigned a certain score to each evaluation index and divided the valid management evaluation criteria into four grades, excellent, good, medium and poor.

An Empirical Study of College Teachers' Knowledge Management

Respondents and method

While understanding the overall background of teacher's personal knowledge management, we conducted a questionnaire survey on teachers from eight colleges. Using the Delphi method, SPSS and AHP, we selected some teachers to carry out classroom observations and in-depth interviews, required respondents to understand the evaluation criteria for college teachers' objectively and evaluated the advantages and disadvantages of college teachers' knowledge management objectively (Tang et al., 2016).

Data collection

The response rate and validity rate of questionnaires satisfied basic requirements of questionnaire surveys (see [Table 2](#)). After eliminating invalid questionnaires, data on each valid questionnaire were encoded according to the nature of each variable. Later data on the questionnaire were entered using SPSS 18.0 statistical software. A 5-point Likert-type scale was used to score respondents' answers. 1~5 scores represented full disagreement, disagreement, neutrality, agreement and full agreement.

Table 3. Demographic characteristics of surveyed samples

Item	Variable	Frequency	Percentage (%)
Gender	Male	296	51.2
	Female	282	48.8
Age	Below 30	76	13.1
	30~40	273	47.2
	40~50	184	31.8
	Above 50	45	7.9
Education Background	Undergraduate	189	32.7
	Master	213	36.9
	Doctor	176	30.4
Professional Title	Junior	104	18.0
	Intermediate	170	29.4
	Sub-senior	221	38.2
	Senior	83	14.4
Subject Background	Arts	107	18.5
	Science	136	23.5
	Engineering	117	20.2
	Agriculture	89	15.4
	Medicine	129	22.4

RESULTS AND ANALYSIS

Validity Test of Evaluation Data of College Teachers' Knowledge Management

The reliability and validity were important indices to measure the scientific evaluation system for knowledge management. The overall Cronbach's α of evaluation data of college teachers' perception and cognition of influence factors of knowledge management was greater than 0.8. The split-half coefficient was greater than 0.5, suggesting that the evaluation system had good reliability. The KMO (Kaiser-Meyer-Olkin) value of each measure was between 0.886 and 0.893. There was no significant change. The content validity and construct validity were consistent with our theoretical hypothesis (Zhu, 2017).

Analyzing the Demographic and Behavioral Characteristics of Samples

Among the 578 surveyed samples, in terms of gender, the proportions of males and females were basically equal. Male teachers were slightly more than female teachers. In terms of age, the samples were mainly 30~50 years old young and middle-aged people. The proportion was up to 79%. 30~40 years-old teachers accounted for 47.2%. The proportions of different education backgrounds, professional titles and subjects were equivalent. The demographic characteristics are shown in **Table 3**. Our questionnaire about college teachers' knowledge management met demographic and behavioral characteristics for sampling surveys. The results provided a reliability guarantee for the study on evaluation of college teachers' knowledge management.

Differences between Teachers with Different Background Variables in terms of Knowledge Management

We conducted a one-way ANOVA, with age, education background, professional title and subject as independent variables, and different knowledge management levels as variables (Cai, 2015). Teachers with different education backgrounds, professional titles and subjects didn't differ significantly. The knowledge management of all subject teachers was at the same level. It can be seen from **Table 4** that the observed value of F-statistics at the level of knowledge acquisition was 2.573. The value of the significant level α was 0.05. The value of probability p was 0.041. The value of F-statistics at the level of knowledge sharing was 2.642, α was 0.05, p was 0.035. At these two levels, the values of p were both lower than the significance level. Therefore, teachers with different teaching experience differed significantly in knowledge acquisition and knowledge sharing. Further study showed that in terms of knowledge acquisition, the mean of knowledge acquisition of teachers with more than 20 years of teaching experience was far lower than that of teachers with other teaching experience. In terms of knowledge sharing, the mean of knowledge sharing of teachers with less than 10 years of teaching experience was significantly lower than that of teachers with more than 10 years of teaching experience.

Table 4. One-way ANOVA results of teaching experience versus knowledge management

		Sum of Squares	df	Mean Square	F	Sig.
Knowledge Acquisition	Between Groups	5.454	6	.909	2.573	0.041
	Within Groups	29.232	84	.348		
	Total	34.686	90			
Knowledge Organization	Between Groups	6.492	6	1.082	2.642	0.035
	Within Groups	33.348	84	.397		
	Total	39.840	90			
Knowledge Development	Between Groups	6.102	6	1.017	.473	.827
	Within Groups	40.824	84	.486		
	Total	46.926	90			
Knowledge Innovation	Between Groups	4.122	6	.687	1.558	.170
	Within Groups	34.608	84	.412		
	Total	38.730	90			

Table 5. Evaluation results of college teachers' knowledge management

Item	Variable	Mean	Standard Deviation
Knowledge Acquisition	Knowledge acquisition	4.37	0.861
	The selection and control of knowledge	4.21	0.883
	Social capital storage	3.05	1.267
	Guarantee of knowledge acquisition	4.13	0.901
Knowledge Organization	Dimension of knowledge revelation	4.28	0.854
	Depth of knowledge revelation	4.17	0.863
	Expression of knowledge structure	3.86	1.108
	Progressiveness	3.36	1.059
Knowledge Development	Learning	4.41	0.782
	Analysis and decision-making	4.19	0.863
	Innovation	3.21	1.105
	Technical support	3.68	1.073
Knowledge Innovation	Diversified service modes	3.13	1.058
	Integrity of service	3.24	1.141
	Convenience of service platform	4.12	0.871
	Technical maintenance	3.98	0.951

Evaluating the Influencing Factors of College Teachers' Knowledge Management

The results showed that (Table 5) the ability of college teachers' knowledge management was as-above the average. The total mean was 3.837. Among the four primary indices, the evaluations of "knowledge acquisition", "knowledge organization" and "knowledge development" were close. The means were above 3.87, suggesting that college teachers reached a certain level in knowledge acquisition, organization and development. The mean of "knowledge innovation" was 3.61, indicating that teachers underperformance in "knowledge innovation". The evaluations of "knowledge acquisition", "the selection and control of knowledge", "dimension of knowledge revelation", "learning" and other secondary indices were high, while the evaluations of "social capital storage", "innovation", "diversified service modes", etc. were low.

The Relationship between Teachers' Knowledge Management and Influence Factors

We conducted a multiple regression analysis with "knowledge acquisition", "knowledge organization", "knowledge development" and "knowledge innovation" as predictor variables, with "teachers' knowledge management" as the dependent variable. From Table 6, four factors influenced knowledge management were significant predictor variables. From the value of Beta, the rankings of four influence factors by evaluation power were knowledge acquisition, knowledge organization, knowledge development and knowledge innovation. By evaluating these four influence factors, we can effectively evaluate college teachers' knowledge management. The rankings of their influence factors were knowledge acquisition, knowledge organization, knowledge development and knowledge innovation.

Table 6. Multiple regression analysis of 4 influence factors and knowledge management level of college teachers

Predictor Variables	Regression Coefficient		Standardized Coefficient	T-value	Significance (Sig.)
	B	SD	Beta		
Constant	0.351	0.212		1.682	0.118
Knowledge acquisition	0.313	0.066	0.322	5.212	0.001
Knowledge organization	0.293	0.059	0.285	3.232	0.008
Knowledge development	0.241	0.058	0.275	2.621	0.014
Knowledge innovation	0.203	0.053	0.201	2.281	0.019

DISCUSSION

This research formulates the teachers' knowledge management evaluation index system, builds the evaluation system using a mathematical model, and conducts an empirical research of the mathematical model proceeding from the perspective of teachers. The purpose of this research was to stimulate other researchers to build partnership with teachers, learn teachers' knowledge management status, propose specific strategies concerning the existing problems, and enable teachers to better manage their knowledge. Some of the standards of the system overlap with those adopted by previous researchers such as Zhao and Wei (2017), Tian (2017) and Zhang and Han (2017), but some are put forward the first ever to make up the gap of the previous standards, which might be easily ignored. Not only are detailed materials provided for evaluation standards, but also reasons about the importance of standards are listed. The knowledge innovation evaluation is added. This makes the evaluation system more systematic, because the past just focused on one research aspect. Teachers to be evaluated can take the initiative to participate in formulating evaluation standards to make these standards more objective and credible. This research is a case study. Limited by quantity and conditions of responders, importance of evaluation standards is relative. Different users have different knowledge background, experience and preference. Their understanding of the importance of teachers' knowledge management evaluation standards also varies. The follow-up research can expand the scope of research objects by choosing more research samples so as to gain a more comprehensive understanding of the individual knowledge management of teachers. Besides, factors, such as school running concepts, regulations, systems and facilities, can also influence teachers' individual knowledge management. Therefore, the status and strategies of a school's knowledge management can also be examined. Meanwhile, diversified research methods can be adopted to collect data from different perspectives for the convenience of discussing teachers' individual knowledge management more deeply. Last but not least, more data collection methods, such as the journal analysis method and the interview method, should be adopted.

CONCLUSION AND SUGGESTIONS

We build an evaluation index system for college teachers' knowledge management, including four aspects, namely, knowledge acquisition, knowledge organization, knowledge development, knowledge innovation with 16 indices and conduct an empirical study using the weight-assigning evaluation method. College teachers' knowledge management is above the average as a whole. From all levels, the scores of knowledge acquisition and knowledge organization are relatively high. The performances are good. Knowledge development is average. The score of knowledge innovation was lower than average and the performance was poor. Apart from age, teachers with different education backgrounds, professional titles and subjects did not differ significantly in knowledge management levels. There were some common problems with teachers' knowledge management, such as lack of knowledge management guidelines, messy and disordered knowledge storage, inability to extract existing knowledge and unwillingness to share knowledge, and so on. According to the evaluation results, it is suggested that the following steps should be taken to improve the knowledge management level of college teachers:

1. The library should optimize the business process, build resources according to the requirements of teachers and implement knowledge management, centered on knowledge management processes, using soft and hard measures.
2. A digital library platform based on network environment should build some tools to support teachers' knowledge management, which have many functions, such as knowledge acquisition, storage and sharing.
3. Evaluate the effect of knowledge management scientifically, according to each link in the management process, reveal weaknesses in knowledge management by evaluating the relationship between knowledge required by a certain time point and knowledge holder and find an ideal method to evaluate the effect of knowledge management.

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