Research on the use of a knowledge management platform by mechanical teachers at vocational high schools

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ABSTRACT: In this article, the authors seek to establish a knowledge management platform that is suitable for mechanical teachers at vocational high schools in order to implement personal knowledge management. Through the participation and application of teachers involved in the case study, the authors aimed to explore the results of mechanical teachers using the platform for knowledge management. In-depth interviews, observations and surveys were used with self-compiling instruments. *SPSS 10.0* was utilised to analyse relevant information. The following conclusions were reached: teachers' attitudes towards using the knowledge management platform underwent a significant change, and teachers gained a better understanding about the meaning and content of knowledge management; the knowledge management platform was helpful for teaching and class management; the teachers involved in the study believed that the functionality, user friendliness and interactivity of the knowledge management platform were ideal.

INTRODUCTION

Since the invention of the computer, the application of data has undergone three main phases: from data management (1950-1970), information management (1970-1990) to knowledge management (1990→). The computer has played an essential role in promoting knowledge management because human beings rely on an effective tool called the computer to quickly accumulate, share and innovate human knowledge in the information era. As a result, Information Technology (IT) has now become one of the main elements of knowledge management [1].

Today, knowledge management is getting more and more important, but it is even more important to ask the following questions:

- *How can information technology assist knowledge management?*
- *How can knowledge management use information technology properly?*

Davenport and Prusak pointed out that knowledge management combines various elements, including human resources, knowledge, IT and sharing, so that individuals or organisations can effectively create or share knowledge [2]. Honeycutt believed that knowledge management is a discipline that considers intelligence capital as a manageable asset. The discipline involves three parts – organisation, technology and process. These three parts form a multi-layered and interactive relationship [3]. In other words, knowledge management is a process in which an organisation considers the structure and culture of the organisation and applies IT to search, organise, store, transform, distribute, share and apply knowledge in the organisation. Through this process, knowledge of the organisation is constantly innovated and regenerated to boost the productivity of the organisation and increase assets of the

organisation. It also helps the organisation to enhance its ability to cope with the outside world, as well as its ability to continue to improve itself.

The development of vocational education has played an essential role in Taiwan's economic development. As the economy took off, large factories, as well as small and medium-sized enterprises related to electronics, electric, machinery and information, have mushroomed. All the grass-root talented workers needed were mostly cultivated by vocational education. Now in the 21st Century, a century of knowledge management, knowledge is the key to enhancing competitiveness. The school is the main source of knowledge creation and innovation; it is also the best place to promote knowledge management. If vocational schools can make full use of knowledge management, then it can enhance the morale of the faculty, the solidarity of the school, the knowledge base of the school, as well as the competitiveness of the school [4].

SharePoint Team Services

SharePoint Team Services is a new technology for Microsoft Windows. It offers an easy-to-use and inexpensive way to construct a Web site for knowledge management. The features of the product include the following:

- Web site management is no longer limited to professional IT personnel. SharePoint Team Services uses pre-programmed Web templates to generate tables, so that non-professionals can also build a Web site with complete functions;
- Users can utilise Microsoft *FrontPage* to create and manage their Web sites. They can also link the information to create a homepage for the Web server and customise the content of the Web site to suit the needs of the team;

- The *Document Library* offers an effective way to conduct text searches and data presentations for users to share and search for documents in the Document Library;
- With *Subscription* and *Notification*, everyone in the team can be notified whenever a change is made to the Web site, which helps team members to share knowledge;
- The product offers great cross-platform compatibility and expandability [5].

The research engaged mechanical teachers at a vocational high school to apply SharePoint Team Services for the following research objectives:

- To establish a *knowledge management platform* with all the required functions and content for mechanical teachers at vocational high schools;
- To explore how mechanical teachers at a vocational high school utilised the knowledge management platform, including their attitudes towards the platform and the results obtained after using the platform;
- To propose substantial conclusions and suggestions as a reference for educational authorities, vocational high schools and mechanical teachers at vocational high schools to use the platform in the future.

DESIGN OF THE STUDY

Subjects

The research used purposeful sampling to select samples. Three experienced teachers and two classes of 11th graders with a total of 80 students from the Department of Mechanics of a vocational school of industry were selected as research subjects.

Instrument

The research used the following research tools:

- An attitudinal scale for teachers before and after using the knowledge management platform. The scale aims to explore mechanical teachers' attitudinal strengths towards using the knowledge management platform. The content of the scale includes three parts, namely: recognition, feeling and action. By using content validity and factor analysis, the accumulated eigen value was 52.750% and the Cronbach's α reliability analysis was 0.9496;
- An attitude scale to understand students' attitudes towards teachers using the class Web site. The scale was designed to help in understanding mechanical students' attitudes towards teachers and students using the class Web site. By using content validity, the Cronbach's α reliability analysis was found to be 0.945;
- An inventory of mechanical teachers' use of the knowledge management platform: This helped in investigating if the mechanical teachers participating in the experiment were satisfied with the functionality, user friendliness and interactivity of the knowledge management platform when they utilised the platform to acquire, share, apply and create knowledge. The inventory also helped in understanding teachers' use of Pedagogical Knowledge (PK), Content Knowledge (CK) and Pedagogical Content Knowledge (PCK);
- The observation records used in the knowledge management platform by mechanical teachers were designed to observe and record how frequent mechanical

teachers use the platform to download, browse, discuss, respond, upload and e-mail contents of PK, CK or PCK;
- Semi-structured in-depth interviews of mechanical teachers helped the authors to understand the opinions of mechanical teachers participating in the experiment about the application of the knowledge management platform before and after its use.

DATA COLLECTION

As part of the research presented in this article, the above-mentioned self-compiling *attitudinal scale for teachers before and after using the knowledge management platform* and the *inventory of mechanical teachers' use of the knowledge management platform* were administered to three teachers as a questionnaire. At the same time, the *attitudinal scale to understand students' attitude toward teachers using the class Web site* was administered to the 80 students. The attitudinal scale and survey have been designed to help the authors understand the attitudes of mechanical teachers towards the use of the knowledge management platform, the results from after using the platform and students' opinions.

The research used semi-structured in-depth interviews with three teachers before, during and after the experiment to explore if the teachers had different opinions about knowledge management and if they have different attitudes towards knowledge management.

The research also utilised *observation records of the knowledge management platform for mechanical teachers* to allow the authors to observe the use of the knowledge management platform by the three teachers.

DATA ANALYSIS

Surveys and observation records used in the research were analysed with *SPSS 10.0* in order to obtain descriptive statistics and conduct t-tests for the dependent sample. The in-depth interviews were transcribed into text and the contents were analysed using a qualitative research method.

RESULTS AND FINDINGS

Establishment of the Knowledge Management Platform for Mechanical Teachers at Vocational High Schools.

The system mode of the knowledge management platform for mechanical teachers at vocational high schools is shown in Figure 1. The relative content and functions are listed below:

- Knowledge database: Fields of knowledge for mechanical teachers can be divided into Content Knowledge (CK), Pedagogical Knowledge (PK) and Pedagogical Content Knowledge (PCK). Content Knowledge focuses on mechanical material and AutoCAD;
- Timing to apply knowledge: The timing required to apply knowledge can be divided into four phases, namely: knowledge acquisition, knowledge sharing, knowledge application and knowledge creation;
- Mechanisms of knowledge application: The mechanisms include an online discussion board, upload to and download from the Document Library, search engine, e-mail, online browsing, personal database, links, e-paper and class Web site.

Figure 1: The system mode of Knowledge Management Platform for mechanical teachers in vocational high schools.

- Internet resources: Web sites offered as Internet resources include businesses related to mechanicals, official organisations, universities, research institutions and educational institutions.

- Functions of the knowledge management platform: The platform offered the following functions:

  – Mechanical teachers could contact and communicate with members of the relevant organisation;
  – Memory space was allocated to the organisation and teachers for them to store information digitally;
  – The platform offered the functions to transfer, store and transform knowledge;
  – The sources and links of knowledge were increased;
  – Channels and mechanism for knowledge sharing were increased;
  – Users could create institutional memory to be used by the organisation;
  – The distance between teachers and students was shortened, and interaction between teachers and students could be enhanced;
  – The platform helped promote the development of a people-oriented platform;
  – The platform system was instant, integrative and flexible.

- Chief Knowledge Officer (CKO): The role of the CKO is to promote knowledge management, measure the impacts of KM, integrate existing knowledge with the knowledge management system, arrange loose knowledge and integrate organisational and technical procedures. Hence, an expert was selected who was familiar with the knowledge management and Internet platforms to be the CKO. The tasks of the CKO are as follows:

  – To optimise the procedures of knowledge management;
  – To create channels;
  – To integrate knowledge management;
  – To monitor the learning cycle;
  – To create value for the organisation;
  – To fulfil the tasks of the organisation;
  – To transfer tacit knowledge;
  – To support Information Technology (IT);
  – To eliminate gaps in the knowledge flow.

- Criteria and mechanism to select team members are as follows:

  – Teachers should have a certain level of understanding about IT;
  – Teachers should understand the concepts of traditional management and new knowledge management;
  – Members should be open-minded and trust others;
  – Members should be willing to share and create knowledge;
  – Members should be willing to acquire and apply new knowledge;
  – Members should know how to transfer knowledge, including document production and experience records;
  – Members should be willing to use the platform to contact teachers and students;
  – Members should be willing to follow suggestions and strategies as given by the CKO;
  – Members should bear the responsibility as a teacher to keep learning;
  – Members should be flexible and willing to try new things to motivate students;
  – Members should be willing to learn new things to support the core capacity of the team and to create new capabilities.

Attitude Scale for Teachers Before and After Using the Knowledge Management Platform

A t-test for the dependent sample was utilised in this research to analyse the attitudes of mechanical teachers at vocational high schools before and after applying knowledge management. The results revealed that the teachers thought that the knowledge management platform was useful for teaching. It was also beneficial to the acquisition, sharing, application and creation of knowledge.

As for their feelings, teachers participating in the experiment felt positive about the performance of the platform after operating it and became more familiar with all the functions. Their expectations about the platform was higher after the experiment, as they hoped the platform could help them acquire relevant knowledge and increase the opportunities to share and interact with others. Similarly, when talking about action, teachers were more active and eager towards using the platform after the experiment and they were willing to conduct relevant activities in knowledge management.

Interviews with Mechanical Teachers about Knowledge Management

Interviews were utilised to explore the results after teachers had applied knowledge management. The experiment lasted five weeks. In order to understand the differences made before

and after the experiment, the authors interviewed the three teachers before, during and after the experiment. The results after analysis are elaborated on below.

From Recognition to Implementation

After five weeks into the experiment, the teachers had a greater understanding about the knowledge management platform. They also had different feelings about the efficiency and stability of the platform, as well as its impact upon culture generally, compared to their feelings prior to the experiment. Initially, the teachers merely recognised the platform, but in the later period, they started to implement the platform.

Before the experiment, the teachers had some idea about knowledge management, but they did not really know how knowledge management worked. As the knowledge management platform was designed with functions and content to meet their needs and it was easy to use, the teachers gradually accepted the platform; they even used the platform in teaching. It was obvious that there was a significant change in the cognitive process of the three teachers.

Better Understanding of Knowledge Management

After five weeks of practice, the teachers had a better level of understanding about the meaning and content of knowledge management. By utilising the platform in teaching and with hands-on experiences, they had a clearer idea about the content, process and activities of knowledge management. For instance, they understood the meaning of the knowledge spiral, knowledge audit and tacit knowledge, as well as their overall effects. All these can be used in teaching, while teachers also gained more experiences.

Teachers' Appetitive Motivation Remains

Originally, the teachers participated in the experiment because of their curiosity. After the experiment, the three teachers saw the convenience and practicality of the platform, so their motivation remained unchanged. In the early period of the experiment, the teachers agreed to try the platform because they were curious about knowledge management, having seen successful examples in industry. However, over time, the teachers gradually spent more time applying the platform and accumulated more teaching experiences. They saw the outstanding efficiency of knowledge management and recognised the conveniences and practicality of the platform. Hence, they gradually recognised the efficiency of knowledge management. Even though they might have different feelings or understandings of the process, their motivation did not change when their curiosity gradually disappeared and they kept using the platform.

The Platform Helped in Teaching and Class Management

Even though the functions offered by the platform in this experiment did not meet all the needs of the teachers, the existing functions, including categorisation and links to professional Web sites, discussion board, Web hard disk, online search and e-mail, were considered practical and satisfactory for the teachers. Indeed, the teachers found the platform to be really useful for acquiring Content Knowledge (CK). In addition, they also praised the idea to integrate the platform with the class Web site, which assisted them with handling both teaching and class management.

The Platform Helped to Enhance Interaction

In the past, teachers often communicated face-to-face when they encountered problems, but the discussion board, message board or e-mail on the platform helped to digitalise their communication, making communication fast, convenient, diverse and free from the constraints of time and space. As a result, the teachers enjoyed better efficiency when they used the platform to transfer knowledge, interact with other teachers or manage the class. After the experiment, the teachers agreed that the platform helped to enhance the interaction between teachers and students. The frequency of the platform's use for these purposes also increased significantly.

The Platform Needs Improvement, But the Assessment was Still Positive

After using the knowledge management platform, the teachers provided some suggestions on how to improve the functions of the platform. This included a read-only function in the discussion board, difficulties when creating content in the database, problems with updating information, the management of the Web site, the role and function of the CKO, and the establishment of mutual trust between teachers for knowledge sharing. Further, generally speaking, the teachers held a positive view of the platform.

Inventory of Mechanical Teachers' Use of the Knowledge Management Platform:

Knowledge Acquisition

The following was found regarding knowledge acquisition:

- When using the Platform for *reading*, the three teachers thought the platform was ideal in terms of functionality, user friendliness, interactivity and being instant. The content they read was usually related to CK and PCK;
- When asked about the function of *downloading*, the three teachers thought that the platform was ideal in terms of functionality, user friendliness, interactivity and being instant. The contents they downloaded were usually related to CK.

Knowledge Sharing

The following was found regarding knowledge sharing:

- Regarding the function of *uploading*, the three teachers agreed that the platform was ideal for its functionality, user friendliness, interactivity and being instant. The contents they uploaded were mostly CK and PCK;
- Regarding the function of *forwarding e-mail*, the three teachers thought the platform was ideal in terms of functionality and user friendliness, but its interactivity and being instant were satisfactory. The e-mails they forwarded were mostly related to CK and PCK;
- When asked about the *discussion board*, the three teachers thought the platform was ideal in terms of functionality, user friendliness, interactivity and being instant. The contents they discussed were mostly related to CK.

Knowledge Application

When asked about *acquiring or sharing data for writing and editing teaching materials*, the three teachers thought that the

platform was ideal in terms of functionality, user friendliness and interactivity. Its being instant was considered satisfactory. The contents they applied were mostly CK and PCK.

Knowledge Creation

Regarding *acquiring or sharing data and combining with one's own teaching experiences to create knowledge*, the three teachers thought the platform was ideal in terms of functionality, user friendliness, interactivity and being instant. The content they created was mostly PCK.

Attitudinal Scale for Understanding Students' Attitudes towards Teachers Using the Class Web Site

The scale of the attitudinal survey facilitates the understanding of students' attitudes towards teachers and students' use of the class Web site after integrating the platform into the curriculum for experimental teaching. The scale was designed according to the Likert scale. The content of the scale was divided into basic information, recognition, feeling and action. Utilising this scale, the authors understood students' opinions about teacher's action when they used the platform in their teaching. Cronbach's α of the full scale was found to be 0.945.

The content of the recognition scale was designed to aid understanding of whether students recognised the efficiency of the platform for teaching after their teachers used the platform. The content of the feeling scale targeted the understanding of students' feelings regarding the teachers use of the platform for teaching. The action scale was designed to determine how students used the platform. The results revealed that students felt positive about the use of the class Web site by the teachers and students. In other words, students felt positive about the teachers using the platform in teaching, and they recognised the efficiency of the platform for teaching. Students also had positive expectations of the teachers when using the platform in teaching. In addition, students also actively used the platform.

Observation Records of the Knowledge Management Platform for Mechanical Teachers

From the daily observation log-files shown in Figure 2, in the first week, the three teachers were not familiar with the functions of the platform, so the frequency of use to acquire, share, apply and create knowledge was comparatively lower than in other weeks. As the authors placed content related to machinery on the platform beforehand and the teachers were became familiar with the functions of the platform in the second week, the frequency of use to obtain and share knowledge reached its peak.
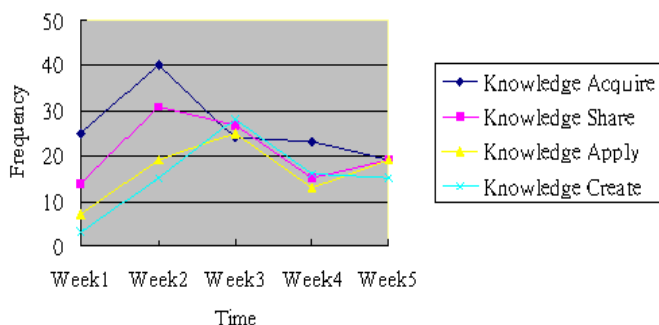

Figure 2: Observation record of the knowledge management platform for mechanical teachers.

In the third week, teachers had accumulated a lot of knowledge content obtained or shared by others from the previous two weeks, so the frequency of use for knowledge application and knowledge creation reached its peak in the third week. The fourth week was the term examination week. As the teachers were busy with lectures, examinations and other administrative affairs, their willingness to use the platform dropped, so the frequency of use also dropped rapidly.

Generally speaking, the frequency of the platform's use to acquire and share knowledge reached its peak in the second week. Cross-checking with the interviews, it was possible that the teachers were curious about the platform. In the third and fourth weeks, even though the frequency dropped, it was maintained at 20-25, which showed that the teachers continued to use the two mechanisms. As for using the mechanism of knowledge application and knowledge innovation, the graph shows the peak occurred in the third week. In other words, teachers needed to take more time to familiarise themselves with the mechanism to apply and innovate knowledge, compared with the time needed to acquire and share knowledge. The frequency in the last weeks was higher than for the earlier period.

CONCLUSIONS

From the findings, several conclusions can be reached; these are detailed below.

Motivation towards the Platform Remained High

Originally, the teachers participated in the experiment because of their curiosity. After the experiment, they saw the outstanding efficiency of knowledge management and recognised the conveniences and practicality of the platform. Even though they had different feelings or understanding about the process, their motivation levels did not change when their curiosity gave way to knowledge and they kept on using the platform.

From Vague Idea to Clear Idea

Before the experiment, the teachers only had a vague idea about knowledge management and they did not know how knowledge management worked. As the platform was designed with the functions and content to meet their needs and it was easy to use, teachers gradually accepted the platform and even utilised the platform in their teaching. It was obvious that there was a significant change occurring in the cognitive process.

From Recognition to Implementation

The results of the scales and the interviews revealed that the teachers recognised the value of applying the knowledge management platform before the experiment. They believed that the platform was useful for teaching activities and the cultivation of knowledge management; however, they were not sure about the efficiency of the platform. During the experiment, they gained a better understanding about the platform and they had different feelings about the platform's efficiency, stability, plus its cultural impact, compared with their feeling before the experiment. They recognised the platform's usefulness and gradually increased their frequency of use to acquire and share knowledge. In the later period of the experiment, they were more familiar with the platform, so they actively used the platform in teaching.

Greater Appreciation of Knowledge Management

After the experiment, the teachers gained a better understanding about the meaning and content of knowledge management. By applying the platform in their teaching, the teachers had a clearer idea about the content, process and functions of knowledge management. For example, they understood the meaning of the knowledge spiral, external and tacit knowledge, as well as the procedures for knowledge storing and sharing. All these can be utilised in teaching while also enhancing teachers' experiences.

The Platform Useful for Teaching and Class Management

The functions of the Platform, including PK, CK and PCK databases, categorisation and linkages to professional Web sites, discussion board, Web hard disk, online search, e-mail and links to the class Web site were considered to be practical and satisfactory for the teachers, even though the functions offered by the platform in this experiment did not meet all the needs of the teachers. They found the platform to be particularly useful in teaching and class management.

The Platform Was Helpful in Enhancing Interaction

After participating in the experiment and using the platform, the teachers agreed that the platform can enhance the interaction between teachers or between teachers and students. In the past, when encountered problems, teachers often communicated face-to-face, but the discussion board, e-mail, or message board on the platform can help digitalise their communication, making communication fast, convenient, diverse and free from the constraints of time and space. As a result, the teachers enjoyed better efficiency when they used the platform to transfer knowledge, interact with other teachers or manage the class. The frequency to use the platform for these purposes also increased significantly.

Students Felt Positive About the Platform and the Experiment Teaching

After participating in the experimental teaching of the platform, students felt the platform was useful for interaction between teachers and students, as well as for teaching. They were willing to continue to use the platform or participate in similar teaching activities. Some students said the discussion board on the class Web site was especially useful for teachers when giving advice for student assignments. The calendar on the class Web site was helpful for them to see their progress.

Additional Findings

The following were the additional findings:

- The level of functionality, user-friendliness and interactivity of the platform were considered to be ideal;
- The highest frequency was found in knowledge acquisition and knowledge sharing;
- The use of CK was the highest of all.

The teachers believed that the functionality, user friendliness and interactivity of the platform were ideal, but being instant was considered satisfactory. Among the four mechanisms of knowledge management, the frequency of knowledge acquisition was the highest and the frequency of knowledge creation was the lowest. In other words, in practice, the teachers were more accustomed to knowledge acquisition and knowledge sharing, but were not used to applying and creating knowledge. As for the knowledge they used, most of the knowledge was CK with the use of PK being the lowest. This was probably related to the teachers' own profession and activities during this experiment.

SUGGESTIONS

Based on the conclusion stated above, the following research suggestions can be proposed:

- The results of the experiment showed that the knowledge management platform under research was well-designed for teaching and class management. It could also help teachers in applying and implementing knowledge management, so it was worthwhile promoting the platform for its educational value and efficiency;
- It is important to establish mutual trust and the culture of sharing knowledge to promote knowledge management among teachers. With more teachers participating in the platform, the motivation for other teachers to use the platform would be stronger; the platform could then enhance the efficiency of teachers' individual knowledge management;
- Based on the experimental part of this research on establishing a knowledge management platform, future designers should undertake a comprehensive plan when designing similar knowledge management platforms in the future. They also need to constantly communicate with users in order to reach consensus about the environment for knowledge management, so that the efficiency of the platform can be optimised;
- By applying the platform in teaching, the authors were able to see how teachers actually used the knowledge management platform. By evaluating teachers' and students' feelings about knowledge management in teaching, the information could be utilised to evaluate the needs of educational support or intervention. From the finding of the experiment, one could see that the platform helped teachers to enhance their teaching. However, further research is needed to determine if knowledge management offers any other pedagogical benefits or applicable benefits to education.

REFERENCES

1. Ye, N.J., *Knowledge Management*. Taipei: Cyuan-Huang 20-42 (2004).
2. Davenport, T.H. and Prusak, L., *Working Knowledge: How Organizations Manage What They Know*. Cambridge: Harvard Business School Press (1998/1999).
3. Honeycutt, J., Knowledge-creating school. *British J. of Educ. Studies*, 47, **2**, 122-144, (2000).
4. Tseng, K.H. and Chen, R.J., Difficulties encountered by vocational schools when applying knowledge management strategies and corresponding strategies. *Technological and Vocational Educ. J. Bimonthly*, 62, 20-24 (2001).
5. Li, J.D. and Lin, F.Y., *Create Your Own Database for e-Learning: Manual for Dynamic Website SharePoint Team Services and* FrontPage2002. Taipei: Jinhe, 10-30 (2003).