The Development and Evaluation of the Teacher Science Fair Knowledge Sharing Community System

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Abstract: Science fair is one of the most common open inquiry activities which can facilitate learners to construct their science knowledge and develop science literacy in school. However, there are a great deal of difficulties and challenges for science teachers in their science fair instruction. Therefore, promoting teachers' professional development in science fair instruction should be crucial. Previous research has revealed the effectiveness of teacher community on teachers' professional development. This study developed a "Teacher Science Fair Knowledge Sharing Community System" (TSFKS) as a platform for teacher professional development community. After the development of the TSFKS, this study also conducted system evaluations of the TSFKS. A total of 182 elementary school teachers participated the system evaluation of the TSFKS. They expressed satisfactory perceived usefulness and ease of use of the TSFKS. Also, they expressed high willingness to use the TSFKS. Some suggestions and implications for teacher professional development, system design, and future work are also discussed.

Keywords: Science fair, Inquiry, Professional development, Online community

Introduction

Undoubtedly, inquiry is the core of modern science education. The major educational goal of Inquiry-based teaching or inquiry-based instruction is to help learners study science inquiry skills and enhance the understanding of science inquiry (NRC, 2000). According to the openness and the complexity of inquiry activities, Bell et al. (2005) has categorized four different levels of inquiry activities: confirmation, structured inquiry, guided inquiry, and open inquiry. Among the four levels, K-12 learners are expected to be able to conduct open inquiry. In science classes, science fair is also one of the most common open inquiry activities which can facilitate learners to construct their science knowledge and develop science literacy (Bell et al., 2005; Abd-El-Khalick et al., 2004). Through the science fair projects, learners have the chance to carry out open inquiry which may help them build deeper understanding of science knowledge, concepts, science skills, and positive attitude toward science (Bencze & Bowen, 2009).

In many countries, science fair is adopted as a tool to help learners explore science knowledge (Bencze & Bowen, 2009). However, lower and lower quality of the science fair projects conducted by elementary school students has been found in Taiwan. There is no doubt that science teachers' professional knowledge plays a very important role in promoting student learning outcomes derived from science fair. However, it was revealed that many teachers may lack of professional knowledge, time, recourses, and assistance

when conducting science fair instruction (Anderson, 2002). According to the literature, only few science teachers know how to guide students to conduct science fair projects or inquiry activities effectively (Justi & Gilbert, 2002). In addition, a lot of science teachers themselves did not have the experience regarding exploring science knowledge with inquiry activities (Windschitl, 2004). This probably caused the poor quality of science fairs. Therefore, how to help science teachers develop professional knowledge and solve the problems they may have in science fairs should be crucial. Previous research has revealed the effectiveness of teacher professional development community or learning community on teachers' professional development. With the development of learning community, more and more people are willing to share experience, information, and knowledge online (Jonassen, Howland, Moore & Marra, 2003).

Recently, online learning community has been advocated as a potential tool for teachers to promote professional development (Duncan-Howell, 2010). In order to help teachers develop pedagogical content knowledge (PCK) regarding science fair instruction, this study developed a "Teacher Science Fair Knowledge Sharing Community System" (TSFKS) as a platform for teacher professional development community which can help members create and share profession knowledge and teaching practices regarding science fair instruction and promote their professional development (Collins & Bielaczyc, 1997).

1. System development

1.1 Conceptual Framework

The TSFKS developed in this study aims to provide a platform for elementary teachers who are interested in personal professional development regarding science fair instruction. They can enhance their professional knowledge by using this platform to share relevant professional knowledge, give each other suggestions, and interact with others. In order to meet different teachers' habits of using Internet-based social media, this system designed two modes of knowledge management and sharing: community-based and user-based (Figure 1).

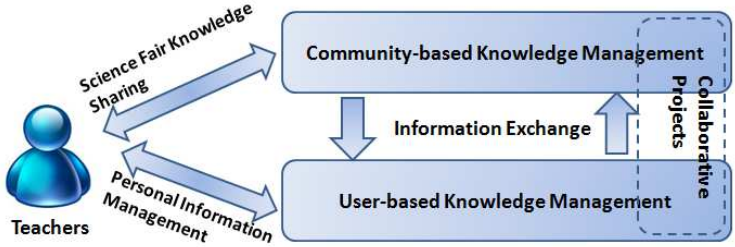

Figure 1. Conceptual framework of the TSFKS

1.2 System Framework

The system framework of the TSFKS is depicted in the following diagram (Figure 2). As shown in Fig. 2, this system framework consists of five main modules and four databases. The four databases store members' data, system information, science fairs documents, and the most important one, knowledge management and history database. The five modules are: Instant message notifying, administrator, project and interaction, science fair information, and Science files management module. With the four databases and five modules, teachers can use this community to share science fair information with other members.

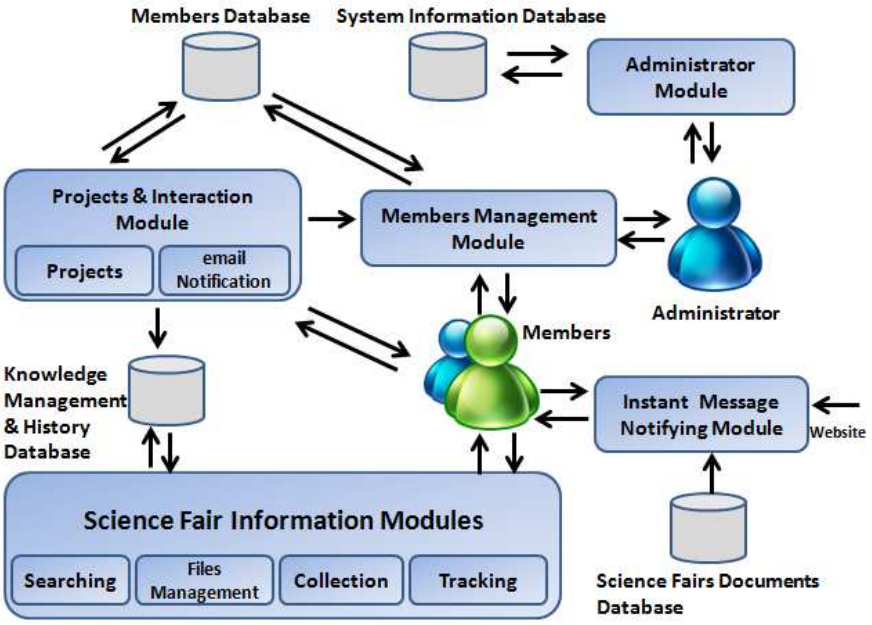

Figure 2. System framework of the TSFKS

1.3 System Functions

The functions of the above system modules are further explained in the following table (Table 1).

Table 1. Functions of the TSFKS

Knowledge management tools	Module	Function	Description
Communication	Instant Message Notifying Module	Offline message	Website members can send offline message, and the system will forward email alerts to other members automatically
		Project prompt discussion	Members can communicate with other online project members promptly
		Reply articles	Members can reply interesting articles
	Administrator module	Post system announcements	Administrators can post system announcements to all members
Coordination	Project and interaction module	Project calendar	Project members can share calendar
Collaboration	Science files management module	Manage pictures, videos, and documents of science fairs	Members can upload and download science fair files
	Science fair information module	Browse science fair information	Members can browse science fair information on the website.
		Post science fair information	Members can post science fair articles
		Article rating	Members can click icons to rate articles

2. Methodology (System evaluation)

2.1 Participants

There were 182 participants in this study. These elementary teachers were first given a brief instruction of how to use the system. They had two weeks to explore the online system by themselves whenever they had free time.

2.2 Instruments

In this study, the participant teachers' perceived usefulness and usability of the TSFKS as well as their willingness of using the TSFKS were evaluated. To this end, the 6 Likert-scale questionnaire developed in Phang, et al. (2009) was adapted and used in this study. The modified instrument consists of three scales: usefulness (6 items), usability (7 items), and willing of use (3 items). All the alpha reliability values of the three scales are greater than 0.8, and the overall alpha reliability value of the instrument is 0.95.

2.3 Data collection

There were two stages of data collection. First, the authors collected the participant teachers' background information before the teachers exploring the system. Second, after the exploration task, teachers evaluated the usefulness and the usability of the system by using an online questionnaire developed in this study.

3. Major findings and Discussion

3.1 Major findings

The collected data were analysed quantitatively. Table 2 shows that the teachers' average scores on usefulness, usability, and willingness are between 5.1 to 5.13, which were higher than the 6 Likert scale average score (i.e., 3.5). It indicates that the participants in this study generally held positive attitude toward the system and were willing to use it.

Table 2. The overall results of system evaluation of the TSFKS

	Mean	S.D.	Range
Usefulness (6 items)	5.13	0.49	3-6
Usability (7 items)	5.1	0.52	1-6
Willingness of use (3 items)	5.1	0.54	2-6

3.2 Discussion

The aim of this study is to develop a platform which can help teachers form a knowledge sharing community. Most participants expressed satisfactory perceived usefulness and ease of use of the TSFKS. Also, they had high willingness to use the TSFKS in developing their professional knowledge regarding science fair instruction. In the TSFKS, participants could choose either community-based or user-based modes. They might found it easy to use, and consequently they were willing to use this system to build their professional skills of science fairs. The participant teachers in this study also expressed that the information created by other members of the community might help build up professional science fair knowledge.

With the databases built in the TSFKS, abundant information regarding the participants' using habits, social network and behavior patterns can be collected and analyzed in the future research, and the research findings can be used in promoting the development of online teacher professional development community. To help teachers

being familiar with the TSFKS, workshops or relating tutoring in advance will be suggested.

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