

# Using Web 2.0 Technologies to Support Collaborative Learning in Herbal Medicine

Verayuth Lertnattee, Sinthop Chomya, and Virach Sornlertlamvanich

**Abstract**—With the increasing popularity of using herbal medicine, healthcare practitioners, including pharmacists, need knowledge of herbal medicine. To serve the need, a set of courses on herbal medicine is arranged for pharmacy students. However, it is hard for a student to familiar with several medicinal herbs with a limitation of time. In this paper, the KUIHerbRx, a Web-based supplement learning tool on herbal medicine, is introduced. The KUIHerbRx supports a collaborative learning to improve knowledge and skill in herbal medicine with a scientific method. Activities of collecting, contributing new opinions, vote to existing opinions, and providing useful information to the system, enhance skill in herbal medicine. With the assessment, the results show that this tool is useful for active and collaborative learning.

**Index Terms**—Collaborative learning, herbal medicine, KUIHerb, Web 2.0.

## I. INTRODUCTION

Due to the growing use of herbal medicine and other natural products by patients and consumers, pharmacists now need a basic knowledge of these topics for their professional practices [1, 2]. To serve this need, several courses on herbal medicine, e.g., general botany, medicinal botany, etc., are set in pharmacy curriculum. It is hard for a student to familiar with medicinal herbs with a limitation of time for study. Normally, students learn herbal medicine in both lecture and practice classes. In a practice class, some activities should be assigned to students such as taking pictures of some medicinal herbs or interview traditional practitioners. Students usually report the result into the simple file and print them out when they need. Using these conventional techniques, it is hard to find the way, which students to create a community for exchanging their information. With Web 2.0 system, it provides an opportunity for sharing information from a group of members on a topic of interest. The Knowledge Unifying Initiator for Herbal Information (KUIHerb), a system for collective intelligence on herbal medicine, is used as a platform for building a Web community for collecting the intercultural knowledge [3]. Information in the KUIHerb has been collected for a period

of time. Therefore, at least three reasons that it is not suitable to use as a learning tool. Firstly, it has only a little room for a non or a little experienced student to share a new opinion. Secondly, pharmacy students should contribute herbal information related with scientific evidences. Finally, several errors in content may occur during the learning process. The consequent is that members and visitors of the KUIHerb, may receive incorrect information. In this paper, we present an idea for building a new and clean Web site based on KUIHerb and use it as a Web-based and social network learning tool for herbal information creation, which is called KUIHerbRx. Three types of information creation, i.e., initial, voting and non-voting information are proposed. Information of herbs in several regions can be distributed and exchanged among groups of students. Several types of media can be contributed. Information about traditional and modern herbal medicine can be combined and linked together by collaborative work from students and professors. As mentioned above, the KUIHerbRx can be used as a tool to improve knowledge and skill in herbal medicine with a scientific method.

In the rest of this paper, learning herbal medicine in school of pharmacy is described in Section 2. Section 3 gives a detail of the concept of the social network with Web 2.0 and the future Web. Section 4 presents KUIHerbRx, a learning tool for herbal medicine. The experimental setting and results from students are described in Section 5 and Section 6, respectively. A conclusion and future works is made in Section 7.

## II. LEARNING HERBAL MEDICINE IN SCHOOL OF PHARMACY

Herbal information is a special type of information dealing with medicinal herbs. In a pharmacy curriculum, a series of courses about herbal medicine are arranged, i.e., general botany, medicinal botany, chemistry of natural products and quality control of natural products. The first course is usually general botany. For this case, students are introduced to morphology of plant organs, e.g., leaves, roots, seeds, fruits, rhizomes. They also study on plant physiology. The second course is medicinal plants. It also covers the nomenclature of medicinal plants in a scientific method. Common names in both Thai and English are also given. In these periods, students should be familiar with several herbs in both fresh form and dried form. Due to a limitation of time, it is hard for a student who living in a city or urban area to familiar with medicinal herbs. Normally, students learn herbal medicine in both lecture and practice classes. In a practice class, professors usually prepare some parts from medicinal plants for students. They study from these samples and some

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pictures, which are used for describing the dominant features of herbs. Some topics such as name of herbs and medicinal uses, which may be different among cultures, are still problems. Another way to make students familiar with herbs, they should see the whole plant and take pictures of those herbs in both whole plants and their parts used. Images of an herb are excellent sources for making decision about herb identity. From the images, students can discuss, which species (including varieties) it should be. The scientific name of an herb and its images are used for herb identification.

For more understanding in herbal medicine, each pharmacy student is assigned to search and collect herbal information for some particular herbs. Several mechanisms are used to acquire and collect information, for example

- Learning from some courses in herbal medicine.
- Knowledge from their experiences.
- Seeking information from several sources, e.g., standard references, proceedings, journal including information on the Internet or libraries.
- Interview some experienced traditional practitioners

In the traditional method, students report the result from their study in files and print them out when they need. With this method, it is hard to share information among students. Moreover, information about local names and medicinal usages may be different among different regions. Some herbs are hard to find in the region where students live in. Using a Web-based learning tool for sharing information of students is an excellent method for sharing and exchanging herbal information in several regions.

### III. SOCIAL NETWORK WITH WEB 2.0 AND THE FUTURE WEB

Nowadays, the Internet users contribute their opinions and resources easily. As a result, users can collectively contribute to the Web community and generate tremendous content behind their virtual collaboration [4]. For a system with collective intelligence, implementing scalability can indeed be challenging, but sensibility comes at variable sophistication levels. Several approaches are dealing with the sensibility, e.g., user feedback, recommender systems, search engine, and mashups. As suggested by Gruber T., if the data collected from all those participants is aggregated and recombined to create new knowledge and new ways of learning that individual humans cannot do by themselves, it will be considered as the true collective intelligence [5]. However, Opinions contribute from users may be controversial because Web 2.0 provided only a little bit on control of information.

We are going to the new generation of Web technology, i.e., Web 3.0 or the future Web. Although general agreement of its definition is not stable, some useful features of the future Web can be described. The control of sharing information is better than in Web 2.0. The decision for the opinions, which are provided in the future Web, is more accurate. The intelligence component will be added in the future Web while in Web 2.0, it is only the simple social Web [6]. Unlike Web 2.0, which participants are usually general Internet users, wisdom of the expert is essential for constructing more knowledge that is valuable. From these features of the future Web, it should be a better social

network system for building a supplement learning tool for herbal medicine. Due to the diversity of herbs and their applications, pharmacy students who are interested in herbal medicine from several universities, may contribute their knowledge about herbs based on their local area.

### IV. KUIHERBRX: A LEARNING TOOL FOR HERBAL MEDICINE

At present, the first version of the KUIHerb, has collected herbal information for three years. Several opinions of herbs are presented to public. For this reason, it has only a little room for a non or a little experienced student to share a new opinion. Furthermore, pharmacy students should contribute herbal information related with evidences from scientific background. However, the structure of the KUIHerb is very valuable. We can construct a new and clean Web site and use it as a learning tool for pharmacy students. This KUIHerb's version, which is used as a tool for a supplement learning herbal medicine, is called KUIHerbRx. Three types of information are created, i.e., initial, voting and non-voting types.

#### A. Initial Type

The initial information is created and provided by professors. Three topics are initialized, i.e., scientific and general names (both Thai and English), general characteristics and references. Professors select a set of medicinal herbs and assign some of them to students. Normally (but not limit to), these herbs are common in the region of which the campus is located.

#### B. Sharing Opinions with Voting System

The voting mechanism is widely used to improve accuracy of the system such as in [7]. For more accurate information, only registered students (and the administrator) in the system are able to contribute and modify their opinions. Any opinions or suggestions are committed to voting. While opinions may be different, majority votes determine the view of the communities. These features naturally realize the online collaborative works to create the knowledge communities. The weighting system for each opinion can be calculated by the formula

$$Wsum_{ik} = \sum_j w_{ijk}$$

Here,  $Wsum_{ik}$  is defined as the total weight of the  $i^{th}$  opinion of the  $k^{th}$  topic. The  $w_{ijk}$  is the weight of the  $i^{th}$  opinion, which is given by the  $j^{th}$  member who would like to vote in this opinion for the  $k^{th}$  topic. The value of  $w$  depends on the priority of the member. The weight from the member, who contributes more accurate opinion for a long period, should be higher than the new one. The  $w$  is needed to update from a period of time. A set of higher weight opinions for each topic, tends to be more believable. Three topics are applied by voting system, i.e., local names, medicinal usages and images of herbs. The voting system for local names and medicinal usages is explicit. It is represented by a voting score. A member can vote once for each opinion. On the contrary, voting system for herb image is an implicit hit counter. It is

applied for summarizing the frequency of zoomed images by members. Therefore, a member may give several hits for an image. When data from these topics has been collected for a period of time, several data mining techniques, e.g., association rules [8], may be applied for finding valuable knowledge in herbal medicine.

### 1) *Local names*

In the herbal world, the content is usually the scientific name and its pictures, which can be used for identification. However, local people know an herb with its local names. Name confusion may cause several serious problems. Students should be kept in their mind that an herb may have several names and one name may be referred to several herbs. The relationship between herbs and their names is many-to-many. The KUIHerbRx can be used as an excellent tool for gathering local names. These terms can be applied in an herbal dictionary that is useful for herbal search engine.

### 2) *Medicinal usages*

Medicinal uses may be different among cultures. For example, ginger is fried and eaten plain, and used in curry pastes in India. In Indonesia, it is grilled and used to flavor fish and meats or for making ginger tea. The KUIHerbRx is used for pharmacy students who concern to create link between beliefs of the communities to scientific methods. From this reason, opinions are given here should cite to reliable sources of information, e.g., scientific research, standard textbooks. Furthermore, more advance methods of representation can be used. For example, in the topic of method of preparation, video is applied instead of the simple text message. Due to different applications for an herb on each region, knowledge transfer is faster by using social network. Students in the northern region learn the way of the southern region to apply the same herb.

### 3) *Images of herbs*

In this system, images of an herb can be uploaded to the system. Students are assigned to take their own photos of herbs (from real herbs). The images should relate to the whole plant and the parts which are important for identifying (e.g., leaves, flowers). The parts which have medicinal usages should also be included. This is very useful to other students who would like to see parts used of an herb. The part used should be in both fresh and dry forms. The voting system may summarize the popularity and quality of the images. The basic idea is that images, which are high quality and useful for identifying should be more popular. To make these images more reliable, keywords and contributors' names should be given to the system. Keywords suggest visitors about focus points on the image. Contributors' names guarantee visitors for quality of their images. Comments from professors and other students help owners to provide more quality images. In case of an image has some problems, e.g., incorrect picture, an image is not clear. This comment can be used as a tool to inform the owner and visitors. The owner and administrator may have a decision to keep or delete the image.

### C. *Sharing Opinions with Non-Voting System*

Two topics are separated from the others. These are precaution/toxicity and additional information. These two

topics are free text without majority voting. For a precaution, any suggestions will be kept for warning when someone would like to use the herb. For additional information, other valuable information such as cultivation may also be given. This space can be applied for suggesting references for an opinion in order to make the opinion more reliable.

## V. EXPERIMENTAL SETTINGS

The third year pharmacy students in faculty of pharmacy, Silpakorn University that registered the course "health informatics", were assigned to share their opinions in the KUIHerbRx. The number of students was 160. The KUIHerbRx was initialed with information of 844 herbs. The 200 herbs begin with information on all topics to use as samples. The rest are initialed in topics of scientific name, English names and general characteristics. Three assignments were given to students: 1) each student was an initiator on three herbs (assigned by a professor) in all topics as much as possible 2) each student had to contribute information at least five herbs other than the main three herbs (as an initiator or not) and 3) the student should do the questionnaire about the KUIHerbRx. The period of two weeks is assigned for these assignments. Students are advised to take photographs by themselves. Opinions provided to the KUIHerbRx should be evidence-based information and avoid copyright violations.

## VI. EXPERIMENTAL RESULTS

### A. *The KUIHerbRx*

The homepage of the KUIHerbRx is shown in Fig. 1. The homepage composes of four components, i.e., information access, information providing, Web site's statistics and information sharing. For information access, information of an herb can be reached by two methods, i.e., keyword search and directory search. The KUIHerbRx provides the ability to keyword search by using a Thai common name, a Thai local name, an English name, a scientific name of an herb, a family name as well as an indication. It also provides the ability to browse categories of part used and symptom.

Two approaches are constructed for providing herbal information. The first approach is the current news about herbal information by Web links. The other approach, information of an herb is randomly selected from the KUIHerbRx database when users visit the homepage. It also provides a list of new herbs added to the database.

In KUIHerbRx, hit counters roughly indicate Web sites' relative popularity and users' activities. Three set of counters are created for these proposes. The first set is for herbal database activity. The second set is for describing the members of the community, i.e., the number of member, the newest member, the number of active members of that time. The last statistical set reports the total activities in a period of a day, a month and a year.

For the first version of KUIHerbRx, six topics are taken into account, i.e., general characteristics, pictures, local name, medicinal usages (i.e., part used with their indications and methods for preparation), precaution/toxicity, and additional information (extra information). Among these topics, a voting system is implemented on local names, medicinal

usages and herb images. A student may choose to work individually by posting his/her opinion about those topics. Any opinions or suggestions are committed to voting. In this version, all members are given equal weight. If other students

agree with the opinion, a simple click on the button "Vote" will increase the score by one. The opinion with higher score will be moved up to upper part of the window.

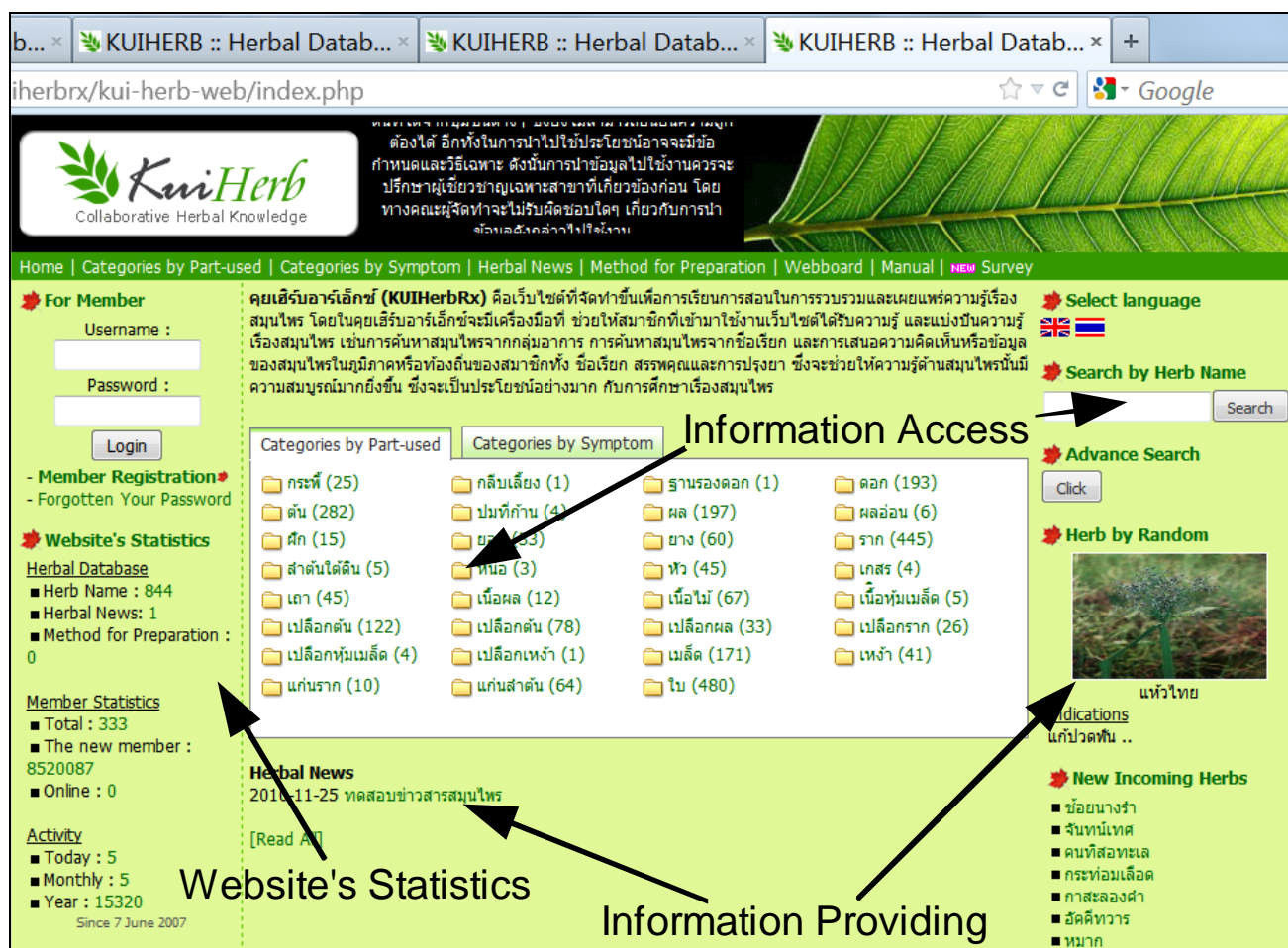


Fig. 1. The homepage of the KUIHerbRx.

TABLE I: DISTRIBUTIONS OF CONTRIBUTED INFORMATION FROM STUDENTS

Topics	Total Vote	New	Old	Total Herb	Maximum Con./Herb	Maximum Opinion/Herb	Maximum Vote/opinion
Local Name	3086	2211	-	550	32	32	7
Medicinal Usage	2407	1724	101	567	23	20	8
Image	-	591	-	399	8	-	-
Precaution/Toxicity	-	166	-	139	4	-	-
Additional Information	-	421	-	273	7	-	-

TABLE II: RATINGS FOR DATA COLLECTION, WEB SITE DESIGN AND USE ABILITY

Topics	Rating Score					Avg.
	1	2	3	4	5	
1. Collective Intelligence is important	0	0	3	41	10	4.09
2. Level of Interest in Herbal Medicine	1	4	23	26	2	3.43
3. Public Community gets benefit from Collaboration in the KUIHerbRx	0	0	8	33	15	4.13
4. Data Collection in the KUIHerbRx is a part of cultural preservation for herbal medicine	0	1	5	32	18	4.20
5. User's Satisfaction for Using the Web Site	0	0	16	36	4	3.79
6. Appropriate format for presenting herbal information on the KUIHerbRx	0	0	11	39	6	3.91
7. Contributions of opinions from members is an important mechanism	0	1	3	36	16	4.20
8. The KUIHerbRx is able to use as a tool to support learning herbal medicine	0	0	8	36	12	4.07
9. The KUIHerbRx supports students to familiar with herbs	0	1	5	32	18	4.20
10. The ability to apply the concept of collaboration on the Internet for the future work	0	1	9	39	7	3.93

The other two topics are separated from the others. These are precaution/toxicity and additional information. These two topics are free text without majority voting.

Each student is assigned to be a member of the system. Therefore, he/she can contribute and modify his/her own

information. The KUIHerbRx is a learning system, information or opinions given to the system should be supported by reliable references. Students are assigned to contribute opinions in five topics, i.e., herb images, herb names, medicinal usages, precaution/toxicity and additional

information. For herb images, students should take photographs of an herb by themselves. The whole plant and parts used for medicinal usages in both fresh and dry forms, should be added into system. Fig. 2 presents an image contributed by a student. When the “Zoom Image” was clicked, the large image was displayed. For local names and medicinal usages, a student who was assigned to be a creator for three herbs, contributed his/her opinions for these herbs. The other students can contribute their new opinions or vote for existing opinions. Fig. 3 presents the topic of medicinal usages of an herb. The first student created the two opinions. For each opinion, the reference about the usages is given. The other two students agreed with these opinions. Therefore, they voted these two opinions and the total score for each opinion is three. For precaution/toxicity and additional information, students may contribute their opinions with references for opinions. A list of detail in precaution/toxicity of an herb is show in Fig. 4.

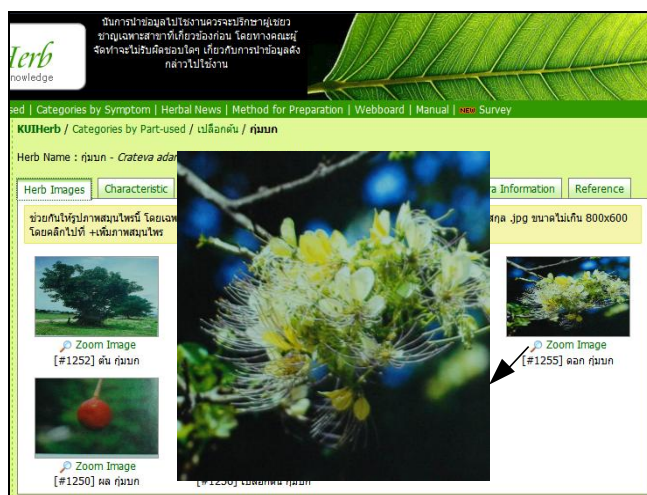


Fig. 2. Sharing herb images in the KUIHerbRx.

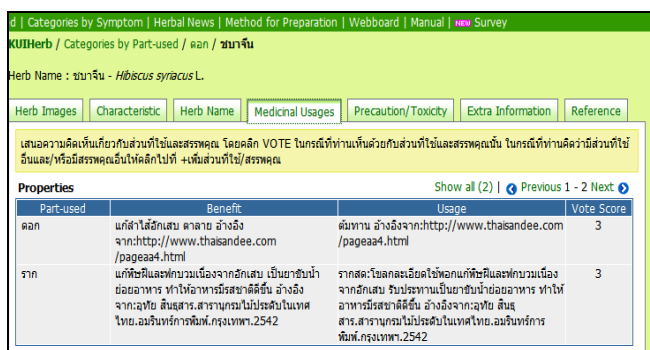


Fig. 3. Sharing medicinal usages in the KUIHerbRx.

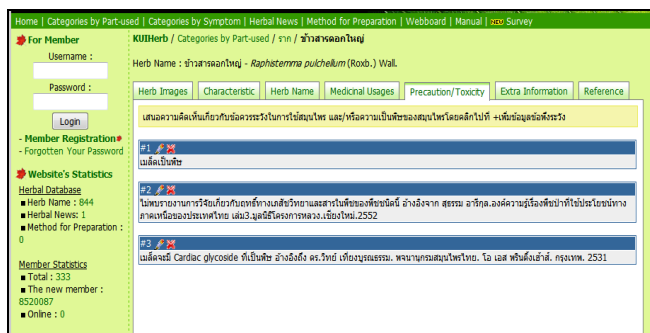


Fig. 4. Sharing herb precaution/toxicity in the KUIHerbRx.

### B. Contributed Information from Students

The 160 third year pharmacy students are assigned to contribute their knowledge and their material such as images of herbs. The result is shown in Table I. Seven patterns of statistics are taken into account. The total vote (Total Vote), this is the summation of the score given from the students. The new opinion (New) is the number of new opinion contributed from students. The old opinion (Old) is the number of opinions used as samples for 200 herbs. The total herb (Total Herb) is the number of herbs that students contributed information. The maximum contribution for an herb (Maximum Con./Herb) is the summation of score for all opinions. It presents the maximum number of students contribute opinions for a topic of an herb. The maximum opinion for an herb (Maximum Opinion/Herb) is the maximum number of opinions for a topic of an herb. The maximum vote for an opinion (Maximum Vote/Opinion) is the maximum score given to an opinion for a topic of an herb.

From the result, some observations can be made. The students can collaborative work and contribute knowledge on five topics. For local names, this topic is the most contributed knowledge. This indicates that one herb may have several local names. It is not hard for students to find local names. In the topic of medicinal usages, a large number of herbs are given opinions. Several references in herbal medicine have been suggested. For herb images, they are also contributed by students. The numbers of images and herbs are 591 and 399, respectively. Therefore, the average image/student and image/herb are 3.69 (591/160) and 1.48 (591/399), respectively. From the result, the number of images for an herb is low. Some reasons are 1) the limitation of time (two weeks for the assignment), 2) it is hard to find some herbs due to the location and 3) It is not easy to take a photograph of flower, fruit, seed, rhizome, etc. The quality of images are varies. Some students use digital cameras while some may use built-in digital camera from mobile phone. The quality of the digital camera, is normally better than built-in camera in mobile phone. Some students cannot find real herbs. They suggested images from the Internet or the book on herbal medicine in a comment. All images contributed from students are fresh form. The possible reasons are students may not be familiar with crude drugs and it is hard to find crude drug in modern drug store. Some suggestions about precaution/toxicity and additional information are given.

### C. Survey in the KUIHerbRx

In the KUIHerbRx, a questionnaire which assessed the students' satisfaction and other opinions, is used. The number of students who response to the questionnaire, is 56. Three types of questions are applied. The first type, 10 questions presented by a five-point Likert item, i.e., the scale on each question is divided to 5 levels from 1 (least satisfaction or least importance) to 5 (most satisfaction or most importance). The result is show in Table II. The second type is a set of check box, given by a respondent on the topics of sharing in the KUIHerbRx which topics he/she thought that they are very useful. The last type is an open question. They can suggest anything about the KUIHerbRx to make it more suitable for a learning system in herbal medicine.

From Table II, all questions except the question 2, gain the

average scale > 3.75. In summary, the KUIHerbRx is an important and useful tool for supporting on herbal medicine study and also preserving cultural knowledge. The numbers of respondents who special interested in herb images, local names, medicinal usages and precaution/toxicity are 36, 22, 49, and 25, respectively. Several suggestions are made. One suggestion which recommended by several respondents is that video presentations should be added into system, especially for the method of preparation in the topic of medicinal usages.

## VII. CONCLUSION AND FUTURE WORKS

In this work, the KUIHerbRx was used as a Web-based supplement learning tool on herbal medicine. Due to the diversities of herbs, geographic distribution and their applications, social network was important for enhanced learning. Three types of information creation, i.e., initial, voting and non-voting information were applied. The KUIHerbRx provides a supplement learning to improve knowledge and skill in herbal medicine with a scientific method. Information of medicinal herbs in several regions can be distributed and exchanged among groups of students. Several topics were assigned to students, e.g., local names, medicinal usages, herb images, precaution/toxicity and additional information. Activities of collecting, contributing new opinions or vote to exist opinions, and providing comments to the system, enhanced skill in herbal medicine. Students gained more experience on herbal medicine. Skill in searching information using traditional method such as books or modern technology such as the Internet, was improved.

In pharmacy curriculum, more advance topics such as chemistry in natural product and quality control of natural products are taught. Using webboard and/or blog will be considered to be a part of the learning tool. These topics should be included in the KUIHerbRx and will be implemented for our future works.

## REFERENCES

[1] L. Dvorkin, P. Gardiner, and J. S. Whelan, "Herbal medicine course within pharmacy curriculum," *J Herbal Pharmacother*, vol. 4, no. 2, pp. 47–58, January 2004.

- [2] G. Murtaza *et al.*, "An evaluation of Pakistani pharmacy students knowledge of herbal medicines in Pakistan," *Afr J Pharm Pharmacol*, vol. 6, no. 3, pp. 221–224, January 2012.
- [3] V. Lertnattee, S. Chomya, and V. Sornlertlamvanich, "Applying collective intelligence for search improvement on thai herbal information," in *Proc. 9<sup>th</sup> International Conference on Computer and Information Technology*, Xiamen, 2009, pp. 178–183.
- [4] K. J. Lin, "Building web 2.0," *Computer*, vol. 40, no. 5, pp. 101–102, May 2007.
- [5] T. Gruber, "Collective knowledge systems: Where the social web meets the semantic web," *J Web Semant: Science, Services and Agents on the World Wide Web*, vol. 6, no. 1, pp. 4–13, February 2007.
- [6] D. Glustini, "Web 3.0 and medicine," *Brit Med J*, vol. 335(7633), pp. 1273–1274, December 2007.
- [7] Y. Ko, J. Park, and J. Seo, "Using the feature projection technique based on a normalized voting method for text classification," *Inform Process Manag*, vol. 40, pp. 191–208, 2004.
- [8] X. Luo, K. Yan, and X. Chen, "Automatic discovery of semantic relations based on association rule," *J Soft*, vol. 3, no. 8, pp. 11–18, November 2008.



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