A CROSS-TEXT ANNOTATION SHARING MECHANISM FOR ENHANCING STUDENTS' COMPREHENSION OF POETRY

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ABSTRACT
Poems are usually expressed with elaborate rhetoric techniques, which make them hard to be understood. In this study, a cross-text annotation sharing mechanism is proposed to help students comprehend poetry by creating and sharing individual annotations. Furthermore, relevant annotations among various texts can be retrieved to stimulate and help students make connections while reading. A quasi-experiment has been conducted to evaluate the effectiveness of the proposed approach. The experimental results show that a cross-text annotation sharing approach is significantly more helpful to the students for poetry comprehension than a conventional annotation sharing approach in terms of learning achievements; moreover, the students highly accepted the developed learning system in terms of "ease of use" and "usefulness."
Keywords: Annotations, Poetry, Cross-text, Taxonomy

INTRODUCTION

Poetry often draws on poets' inspiration and experiences and may be expressed with different kinds of poetic techniques or figurative languages. Undoubtedly, it becomes hard for students to comprehend such literary works in any kind of poetic forms (Cai, 2008; Eva-Wood, 2008). To help students learn poems, researchers have suggested various approaches such as situated learning (Su, 2007), multimedia learning (Lo, Zhang, Lin, Tseng, & Chen, 1999; Sun & Cheng, 2007), think-aloud (Eva-Wood, 2008), and annotation sharing (Shih, Tseng, Yang, Weng, & Liang, 2008). In this paper, a cross-text annotation sharing mechanism is proposed to enhance students' comprehension of poetry.

Nowadays, with the vigorous development of the Internet, a pedagogical approach called Computer-Supported Collaborative Learning (CSCL) is a promising method for improving teaching and learning with the help of modern information and communication (Chen & Chen, 2012; Lin, Chan, & Hsiao, 2011; Wang, 2009). In CSCL environments, annotations can be very useful for knowledge sharing (Glover, Xu, & Hardaker, 2007; Hwang & Hsu, 2011; Nokelainen, Miettinen, Kurhila, Floreen, & Tirri, 2005; Robert, 2009; Su, Yang, Hwang, & Zhang, 2010; Yeh & Lo, 2009). Researchers have also shown that annotation offers a useful tool to increase deep reading of textual materials (Marshall, 1997, 1998).

Researchers indicated that appropriate recognition of rhetoric devices and feelings expressed in poems could be helpful for poetry comprehension (Chen, 2001; Eva-Wood, 2008; Wang, 2010). However, any arbitrary annotations with free-form terms may result in the Out-Of-Vocabulary problem (Chechik, Ie, Rehn, Bengio, & Lyon, 2008). This makes the system unable to retrieve relevant stored annotation information among various texts for users to further understand poems. To increase interoperability, researchers suggested using a standardized ontology for annotations (Glover et al., 2007). Yeh and Lo (2009) showed the benefit of adequate scaffolding for learners to annotate by using a taxonomy. Therefore, a taxonomy-based annotation is demanded so that users can annotate objects easily and annotation sharing can be realized among various texts. This may help learners to develop new insights into the learning materials with which they are working and help reinforce existing knowledge by accessing different materials. Hence, a Cross-text Annotation Sharing System (CASS) has been built with the motivation to resolve the above mentioned issues so that sharing poetic knowledge with a friendly annotation becomes easier for students.

This study investigates how CASS helps students annotate poems and share their annotations in a supported collaborative learning environment. A quasi-experiment was conducted with two classes of 8th graders. According to the experiment results, most of students in the experimental group were satisfied with the use of CASS and thought the system to be particularly useful. Furthermore, the analytical results show that the use of CASS can increase learning achievements.

RELATED WORK

Chinese poetry learning

It is hard for novices to understand the deeper meanings of Chinese poems since poetry often packages language in forms that are both concise and precise (Cai, 2008). Recently, due to the rapid growth of information technology, many researchers have integrated information technology into Chinese language processing such as style identification (He, Liang, Li, & Tian, 2007; Yi, He, Li, & Yu, 2004; Yi, He, Li, Yu, & Yi, 2005), and Chinese language teaching methods such as writing (Tseng, Yang, Weng, & Liang, 2009; Wang, Tseng, Yang, & Su, 2005), and learning (Cai, 2003; Cao, Klamma, Gao, Lauz, & Jarke, 2009; Lo et al., 1999; Shih et al., 2008; Sun & Cheng, 2007; Weng, Tseng, Su, & Wang, 2008; Yao & Zhang, 2010; Zhao, Wang, Wu, & He, 2011). These studies reveal the need to use information technology to promote Chinese poetry learning. Since annotations can be useful to increase deep reading of textual materials (Marshall, 1997, 1998), this study uses annotations as a tool to assist students in comprehending or studying poems.

Annotation and annotation systems

The Web application technology (Web 2.0) facilitates interactive information sharing on the World Wide Web. Users use tags to categorize the online content, which has been proved to be useful in many Web applications such as the delicious (http://delicious.com), Flickr (http://www.flickr.com) or YouTube (http://www.youtube.com).

In fact, collaborative annotation provides an opportunity to make individual knowledge public, and has been proved to be effective in students' studies (Marshall & Brush, 2004). According to (Nokelainen et al., 2005), appropriate annotation systems can bring about students' learning motivation. Moreover, a personalized annotation management system is justified to enhance knowledge sharing and students' learning efficiency (Hwang & Hsu, 2011; Robert, 2009; Su et al., 2010; Yang, Chen, & Shao, 2004). So a well-designed management system to support a rich set of annotations in a consistent and systematic way is certainly demanded.

To manage and enhance semantic annotation elements, some researchers try to link the relations by tags (Auer, Dietzold, & Riechert, 2006; Bateman, Brooks, & McCalla, 2006; Tsui, Wang, Cheung, & Lau, 2010). Through the relation construction, annotation sharing can be realized among various texts. Therefore, an annotation sharing mechanism in a collaborative learning environment is constructed so that relevant and useful annotations could be retrieved for learning.

Prior knowledge

The main purposes of this research were to explore the usage of the cross-text annotation sharing tool and to investigate its influence on online learning. Cross-text annotation sharing refers to annotation sharing among various texts. The prior knowledge used in this study is defined below.

Annotation sharing

An annotation (AN) is expressed as a 5-tuple relationship, which denotes an annotated information (AI) made by a user on an annotated object (AO).

Definition 3-1. AN is expressed as a 5-tuple (uid, pid, AO, AI, plus)

- The uid is the user identification.
- The pid is the poem identification.
- AO could be a word, a sentence, a paragraph, or entire poem.
- AI = (type, sub-type, item)
  Type, sub-type, and item are the categories used in the proposed taxonomy "Content-rich Dictionary".
- A user can click +1 button on any annotation they like, thus sharing it.

To enhance students' comprehension of poetry, the annotation retrieval is presented to allow users to review or browse annotations made by themselves or others as shown in Figure 1. Users can use AN_i to retrieve AN_l, AN_m, AN_n, etc. with the same $user_i$, $text_i$, AO_i or AI_i. With the aid of annotation retrieval, users may benefit from others' annotations (Hwang & Hsu, 2011; Robert, 2009; Su et al., 2010).

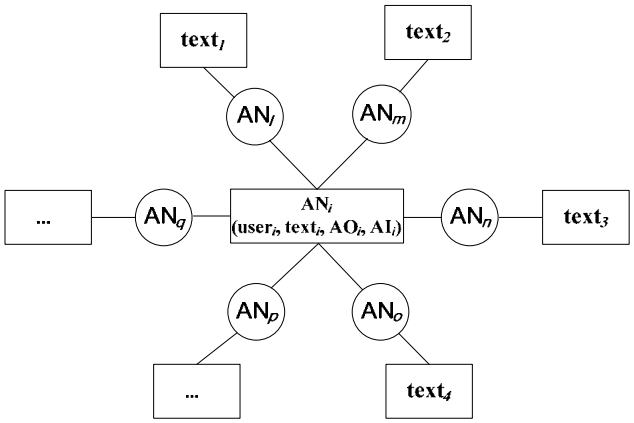

Figure 1. Annotation retrieval.

Content-rich Dictionary (CDict)

The kernel part of the system contains a Content-rich Dictionary (CDict) as our taxonomy. While annotating, learners can achieve personalized annotation with the aid of CDict. Since appropriate recognition of rhetoric devices and feelings expressed in poems could be helpful for poetry comprehension (Chen, 2001; Eva-Wood, 2008; Wang, 2010), CDict (a three-level dictionary) contains the type of rhetoric device and the type of common feeling as shown in Table 1. The difference between rhetoric type and common feeling type are the ways to collect each set of items. The set of items in rhetoric type are predefined, while the set of items in common feelings are incrementally acquired from users.

Rhetoric devices are classified into three sub-types, namely, lexical stylistic devices, syntactical stylistic devices, and phonetic stylistic devices (Chen, 1996; Chen, 2001; Wang, 2010; Zeng, 2007). Each sub-type contains several items and each item has its own explanation and model essay. The explanations and model essays are the providing scaffolds for students to become independent. Then, these supports can bridge the gap between what students can do on their own and what they can do with guidance from others (Vygotsky, 1978).

Previous studies show that model essays are good paradigms for students to imitate or learn language (Cumming, 1995; Wang, 2010). Cumming (1995) demonstrates the significance of rhetorical aspects of texts in model essays. For example, the model essay of metaphor could be “merry larks are ploughmen’s clocks (William Shakespeare)”. Hence CASS supports student users with friendly rhetoric annotation as well as a model essay for each type of rhetoric device. Through the assistance of a model essay, students can understand the usage of rhetoric devices which are common in poems and annotate them in a similar way.

As to the type of the common feeling, we treat it as an assistance option. This is because it may be difficult for some students to express their feelings with precise words. Feelings for a poem can be categorized into style, originality, and sentiment (Chen, 2001; Wang, 2010). To assist students in annotating their feelings for a poem accurately, two heuristics are offered for them. One is a matched common feeling selection in which previous accumulated annotations about feelings in reading poems are listed if the annotated terms occurrence frequencies are higher than a predefined threshold. The other is a synonym-based feeling suggestion in which synonyms are recommended from a Chinese synonym dictionary “Tongyici Cilin (TYCCL)” (Mei, Zhu, Gao, & Yin, 1984). Through folksonomy annotations, the number of words listed in common feelings of CDict increases as more users annotate.

Table 1. Content-rich dictionary.

Type	Sub-type	Item
Rhetoric device	Syntactical stylistic device	parallelism, antithesis, repetition, rhetorical question, inversion, climax, anticlimax, catchword repetition, zeugma, aposiopesis, ellipsis, quotation, apostrophe
	Lexical stylistic device	simile, metaphor, metonymy, synecdoche, allegory, personification, euphemism, irony, hyperbole, pun, oxymoron, imitation, transferred epithet, parody
	Phonetic stylistic device	alliteration, end rhyme

Common feeling	Style	homesick, farewell, …
	Originality	unique, novel, …
	Sentiment	yearning, affecting, …

Cross-text Annotation Sharing System for supporting poetry comprehension (CASS)
CASS is built with the aim of enhancing students' comprehension of poetry by using two kinds of collaborative annotation. One is rhetoric annotation; the other is personal feeling annotation. Other functions should be taken into account like annotation retrieval. Figure 2 illustrates the presented CASS, which includes a poetry editor, annotation creation, annotation retrieval, and databases. All the addressed processing modules are incorporated with a poem database, an annotation information database, a content-rich dictionary and TYCCL.

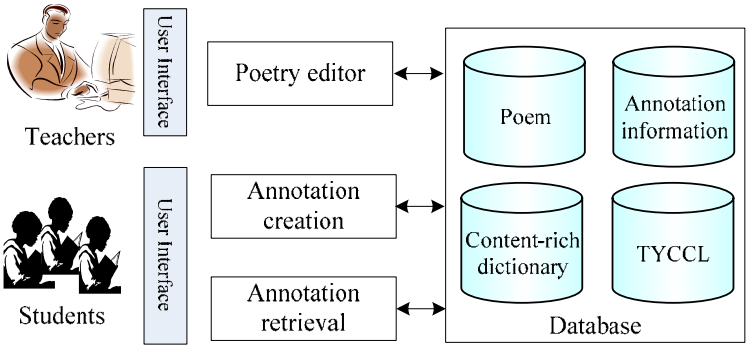

Figure 2. System architecture.

Poetry editor
Figure 3 illustrates the poetry editor, which is a kind of WYSIWYG (What You See Is What You Get) editor. The content displayed at editing is similar to the final outputs. A teacher can use this editor to add, edit, or delete a poem. Furthermore, s/he can use this editor to upload a file or picture to enrich the poem's content. To add a poem, a teacher may input its title and author and compose it online by typing it directly in the text box or using a copy-and-paste function. The system will convert it into an HTML document and save it in the poem database.

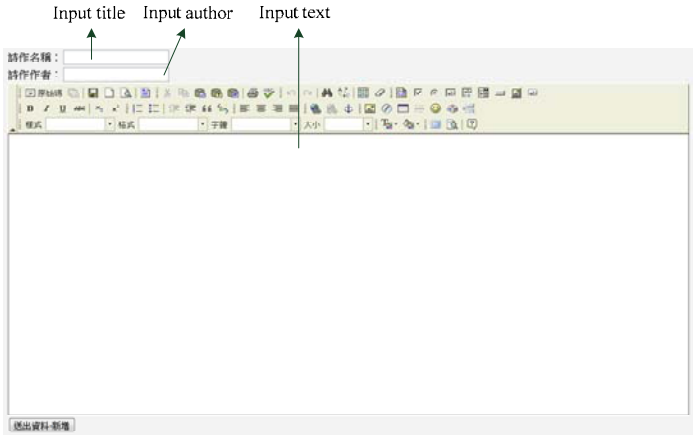

Figure 3. Poetry editor.

Annotation creation
In the beginning of annotations, students can choose an arbitrary poem. Then, CASS guides users to annotate poems by using the hierarchical structure in CDict. A user can choose his/her intentions by following the sequence: type, sub-type, and item. For example, when annotating personification used in a poem, a user can click rhetoric device, click lexical stylistic device, click personification, and then mark an object which uses the rhetoric device. After annotating, the created annotations are stored in the annotation information database.

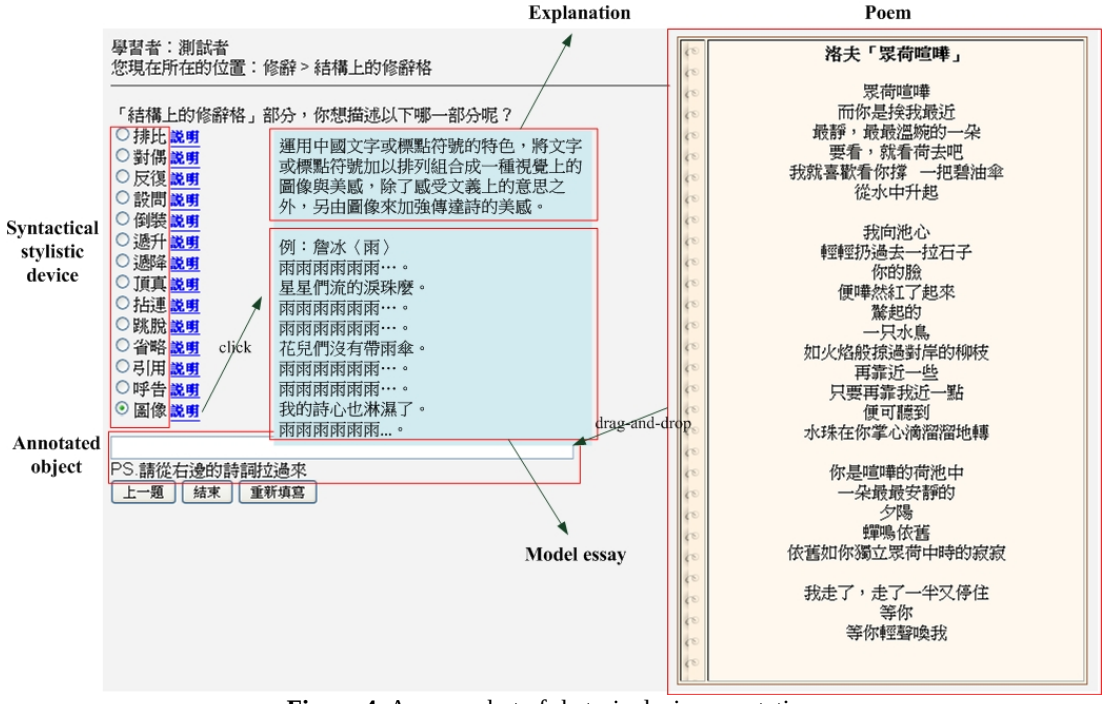

Figure 4. A screenshot of rhetoric device annotation.

Rhetoric device annotation. Figure 4 shows a screenshot of rhetoric device annotation. An annotated poem is allocated in the right of the figure. The illustrated poem is "**眾荷喧嘩** (zhong he xuan hua)" written by a poet "**洛夫** (Luo Fu)". The left of the figure lists syntactical stylistic devices for selection. Users can click "**說明** (instruction)" right behind each rhetoric device to read an explanation and model essay when they need the scaffolding. The bottom left of the figure shows that a user marks an object (AO) by typing it directly in the text box, using a copy-and-paste function, or using a drag-and-drop pasting function. The rhetoric annotation procedure is described as follows:

Step 1: A user chooses one option from three sub-types in CDict.
Step 2: Upon receiving the user's option, the system will list related items in CDict for the user.
Step 3: A pop-up window will come up to display an explanation and model essay when the user clicks the instruction of a rhetoric device.
Step 4: The user chooses one option (AI_j) from the items and marks an object (AO_i).

Personal feeling annotation. Students may use vague words or basic words like "not bad" or "OK" when annotating their feelings about a poem. To help students use appropriate annotation words, we built both a matched common feeling selection and a synonym-based feeling suggestion in CASS.

The matched common feeling selection allows users to express their feelings with a set of the items listed in the common feelings of CDict. These items are collected from users' annotations for the same poem if their frequencies are more than a predefined threshold (i.e. common feeling). The number of items in the common feelings of CDict increases as more users annotate.

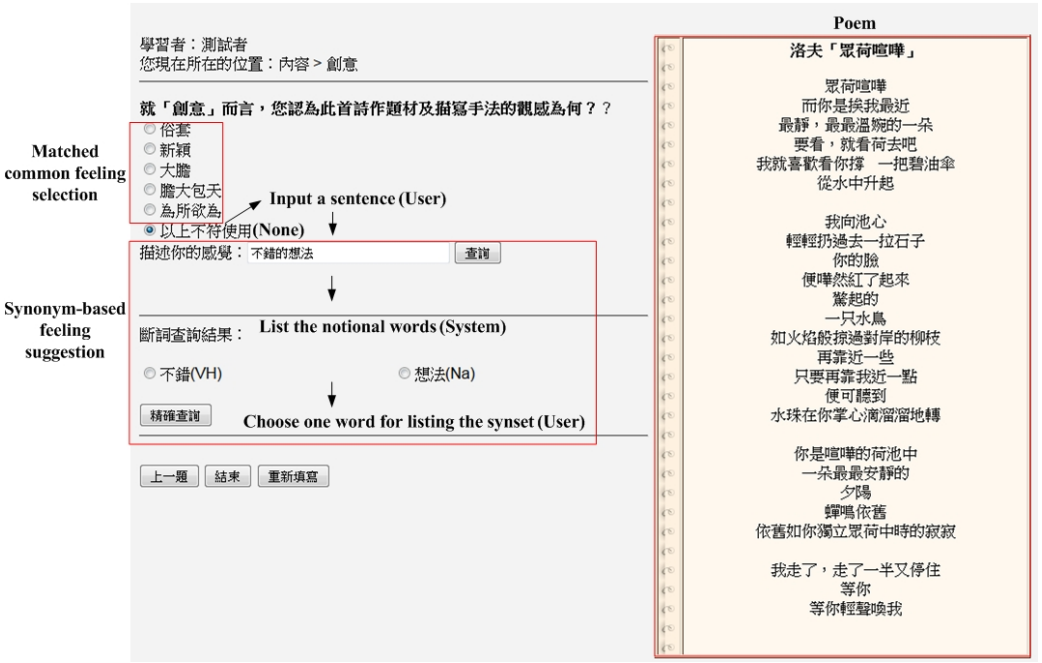

Figure 5. A screenshot of personal feeling annotation.

To give synonym suggestions, we employ a Chinese vocabulary-indexing thesaurus TYCCL which is a four-level thesaurus that collects allusions, idioms, common words, etc. The semantic meaning of a word in a higher level is more abstract than those in a lower level. According to their semantics, Chinese words are categorized into different classes. Owing to the characteristics, words in the same class (synonyms) are provided for reference based on students' words.

The synonym-based feeling suggestion provides annotators with a TYCCL's synset with respect to annotators' inputs. If the input is a sentence, then it will be firstly processed by a CKIP segmentation tool (http://ckipsvr.iis.sinica.edu.tw) and its notional words will be extracted. The notional words are the major elements in a sentence and they denote a person, a thing, an act, or a quality referred to in a sentence. In the latter, a notional word is identified and its synset will be promptly returned to annotators for their annotation.

Figure 5 is a screenshot of personal feeling annotation. An annotated poem is listed in the right of the figure. The matched common feeling selection and the synonym-based feeling suggestion are respectively provided in the bottom left and the upper left of the figure. The procedure of personal feeling annotation is described as follows:

Step 1: A user chooses one option from three sub-types in CDict.
Step 2: Upon receiving the user's option, the system will list related items in CDict for the user (the feeling annotations for this poem and their frequencies are larger than a predefined threshold).
Step 3: If the user does not satisfy the listed options, s/he can input a word/sentence in the text box.
Step 4: The system segments the word/sentence by using the CKIP segmentation tool and lists notional words.
Step 5: The user chooses a word from the notional words list.
Step 6: A synset based on the notional word is listed for selection.
Step 7: The user chooses a synonym (AI_j) from the synset and marks an object (AO_i).

Annotation retrieval

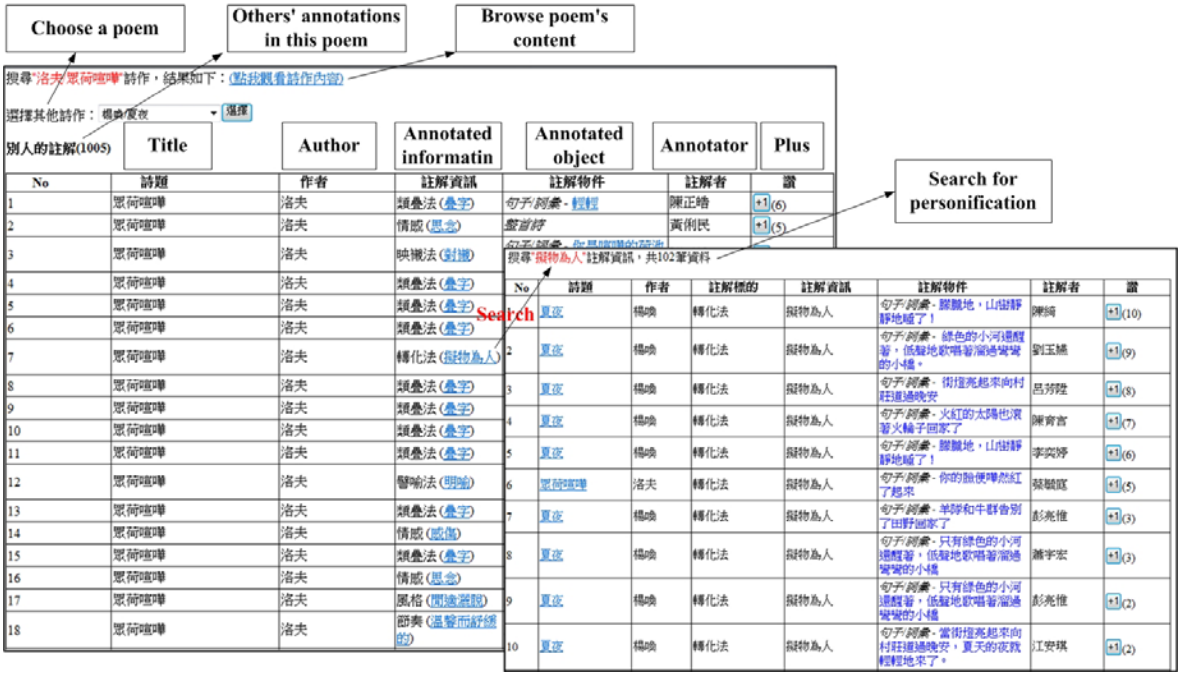

Figure 6. A screenshot of annotation retrieval.

With the aid of annotation retrieval, users can retrieve useful and valuable annotations based on username, poem name, annotated object, or annotation. Figure 6 illustrates the retrieved annotations. In Figure 6 (top-left), users can choose any poem they want. There are 1,005 annotations on this poem "眾荷喧嘩 (zhong he xuan hua)". During browsing, users can recommend others annotations by clicking the button "+1". Then the highest recommendation will be at the top of the annotations, which may help novice users. To further assist users in comprehending poems, users can click any annotated information or any annotated objects to search the relevant stored information. In the right of Figure 6, the user clicks personification to search the created annotations and a pop-up window will come up to display the search results, which contains 102 annotations; the highest recommendation being at the top of the list.

THE EXPERIMENTS

Participants

There were fifty native Chinese speaking eighth grade students participating in this research. The students were from two classes and taught by the same instructor under the same conditions. They had previously taken computer courses and possessed basic computer skills. The two participating classes were randomly divided into experimental group (N=24) and control group (N=26). The students in the experimental group were instructed and guided to participate in the annotation-based learning activity with the cross-text annotation sharing, while those in the control group were instructed and guided to participate in annotation-based learning activity without the cross-text annotation sharing (conventional approach). Note that all participants received the same treatment such as instruction, learning materials, and environment.

Experimental procedure

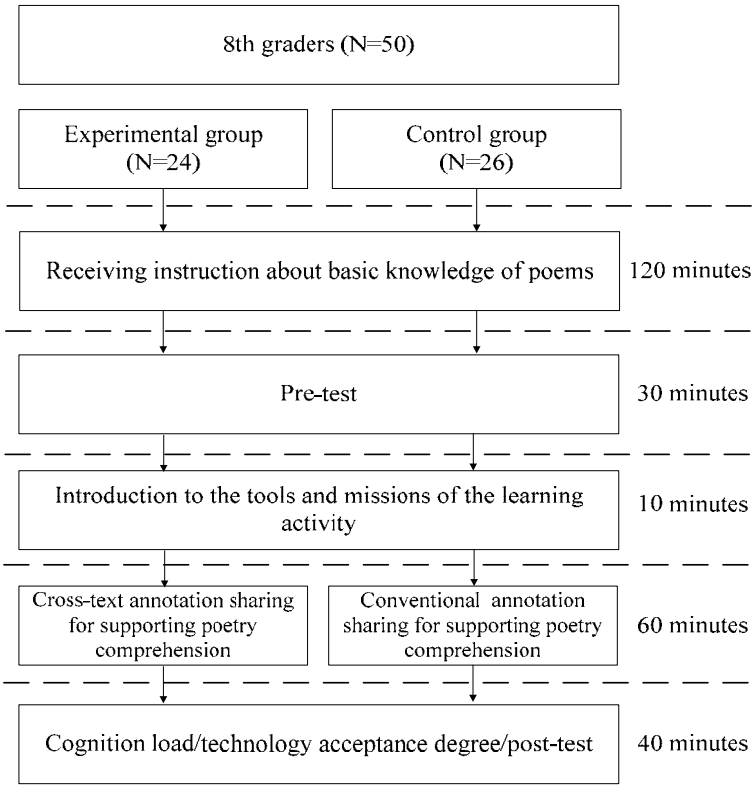

Figure 7. Experiment design.

Figure 7 shows the experiment design of this study. Before conducting the learning activity, the two groups of students received basic instruction about poems; moreover, a pretest was conducted to analyze the students' knowledge toward poems. Then, the students in two groups were instructed with the tools and missions of the learning activity.

Following the instruction, a 60-minute learning activity was conducted. During the learning activity, the students in both groups were guided to annotate the poems with the aid of the learning assistance of annotation creation. The students in the experimental group could review annotations created by their colleagues by using a flexible viewing mechanism which retrieves relevant annotations based on users' requirements. The annotations were ordered by the number of +1. Moreover, students who were industrious and generated more annotations were listed. Thus, students could be encouraged to achieve a higher position by making more annotations. On the other hand, the students in the control group could only review others' annotations by choosing the intended poem without cross-text annotation sharing. In the final stage, the students took a cognitive load questionnaire, a technology acceptance model questionnaire, and the post-test.

Measuring tools

The pre-test was conducted to evaluate the students' prior knowledge before annotating the poems. It consisted of twenty multiple-choice questions with a total score of 100. The post-test aimed to evaluate the learning achievements of the students after annotating the poems. It consisted of twenty multiple-choice questions with a total score of 100.

The questionnaires concerning cognitive load and technology acceptance were presented with a 7-point Likert scale, where '7' represented 'strongly agree' and '1' represented 'strongly disagree'.

The questionnaire of cognitive load was developed based on the cognitive load measure proposed by Sweller et al., (1998). It contained four questionnaire items. The greater the cognitive burden, the lower the users' satisfaction (Segall, Doolen, & Porter, 2005). The Cronbach's alpha value of the questionnaire was 0.726, showing adequate internal consistency in evaluating the cognitive load of students.

The questionnaire for technology acceptance was modified from the questionnaire items developed by Davis (1989). It was used to explore how students came to accept and use CASS while annotating the poems. The questionnaire included two subscales: four items for "usefulness of CASS" and three items for "ease of use". The Cronbach's alpha value of the questionnaire was 0.851. The result implies that the reliability of the questionnaire is sufficiently high. The students in the experimental group were asked to complete this questionnaire after the learning activity.

RESULTS

Learning achievements

Before participating in this learning activity, students from both the experimental and control group took a pre-test to evaluate their basic knowledge. Table 2 shows the means and standard deviations of the pre-test scores, which were 61.88 and 13.74 for the experimental group, and 66.92 and 11.67 for the control group. Internal consistency reliability was assessed using Kuder Richardson 20 (KR-20). The KR-20 coefficient of pre-test was 0.662, showing adequate internal consistency in evaluating the students' prior knowledge. A t-test performed on the result of the pre-test scores showed no significant difference between the pre-test results for the two groups with $t=1.404$ ($p>.05$), implying that the two groups of students had an equivalent base knowledge in Chinese poems before participating in this learning activity.

The scores of the students in the pre- and post- tests were analyzed to compare the learning achievement of the students in the two groups. A one-way independent-samples Analysis of Covariance (ANCOVA) was adopted for the analyses, in which the post-test scores were the dependent variable, the pre-test scores were the covariate, and the treatment for different groups was the fixed factor.

Before applying ANCOVA, the homogeneity of the regression coefficient was tested, which revealed that interaction $F(1, 46)$ between the covariance was 7.122 ($p>0.05$). This confirms the hypothesis of homogeneity of the regression coefficient.

Table 3 shows the ANCOVA result of the post-test scores of the two groups, the means and standard deviations of the post-test scores, which were 67.76 and 17.92 for the experimental group, 67.50 and 13.95 for the control group. The KR-20 coefficient of post-test was 0.753, showing adequate internal consistency in evaluating the learning achievements of students. It was found that the post-test scores of two groups were significantly different, with $F=7.122$ ($p<.01$); implying that the CASS was more helpful to the students in terms of improving their learning achievement; moreover, the adjusted mean of the experimental group's post-test scores (69.38) was higher than that of the control group (66.01). Consequently, it is concluded that cross-text annotation sharing was more helpful to the students in terms of improving their learning achievement.

Table 2. t-test result of learning achievements on the pre-test scores of the two groups.

Group	N	Mean	S.D.	*t*
Experimental Group	24	61.88	13.74	1.404
Control Group	26	66.92	11.67	

Table 3. ANCOVA result of learning achievements on the post-test scores of the two groups.

Group	N	Mean	S.D.	Adjusted Mean	Std. Error.	*F value*
Experimental Group	24	67.76	17.92	69.38	2.905	7.122^{**}
Control Group	26	67.50	13.95	66.01	2.788	

$^{*}p<.05$, $^{**}p<.01$

Cognitive load

A cognitive load questionnaire was given after the learning activity to investigate the cognitive loads of the two groups of students. The results are presented in Table 4. The mean and standard deviation are 3.48 and 1.10 for the experimental group and 3.41 and 1.17 for the control group. The t-test result showed no significant difference between the two groups with $t=-.205$ ($p>.05$), implying that the two groups of students had an equivalent level of cognitive load after the learning activity. Moreover, the average cognitive loads of the two groups were not high, implying that the annotation sharing approach provided an easy and comfortable way for the students (Paas,

Tuovinen, Tabbers, & Gerven, 2003).

Table 4. t-test result of cognitive load on the two groups.

Group	N	Mean	S.D.	*t*
Experimental Group	24	3.48	1.10	-.205
Control Group	26	3.41	1.17	

Technology acceptance

As Table 5 shows, the result show that most students felt satisfied with the proposed system. The average of the answers for all questions is above 5. Question 7 is especially high (6.08), implying that using this system to share annotations is easy. However, for question 5, the deviation of user satisfaction is slightly larger than other items. The reason is that the scaffolding offered in this research may not provide enough support to students.

Table 5. The result of technology acceptance on the experimental group (N=24).

#	Questions	Mean	S.D.
Usefulness			
1.	I think annotation types of CASS (e.g., rhetoric, feeling) were useful for sharing individual thoughts toward poetry.	5.71	.81
2.	I think CASS was useful for organizing individual knowledge.	5.67	.96
3.	I think CASS was useful for sharing individual thoughts.	5.54	.98
4.	I think CASS was useful.	5.46	.93
Easiness			
5.	I think the learning content of the learning activity was clear and easy to understand.	5.37	.92
6.	I think it was easy for me to learn how to use CASS.	5.79	1.06
7.	I think the GUI of CASS was easy to use.	6.08	.88

DISCUSSIONS AND CONCLUSIONS

In this study, CASS was implemented with the aim of helping students to create and share annotations toward poetry in a collaborative learning environment. In terms of annotation creation, the system provides well-defined rhetoric device annotation so that students can annotate poems with appropriate rhetoric annotation either using the offered scaffolding or not. CASS offers two kinds of personal feelings annotations, namely, matched common feeling selection and synonym-based feeling suggestion. The more frequently CASS is used, the larger will be the amount of items in the common feeling type of CDict and users' feelings for a specific poem may reach a consensus. In terms of annotation retrieval, with the proposed system, students are enthusiastic about viewing colleagues' annotations and thus generate more annotations.

The experimental results show that the cross-text annotation sharing approach had significantly better effectiveness in improving students' learning achievements than the conventional annotation sharing approach. Meanwhile, the analysis of the questionnaire results showed that the proposed learning approach did not increase the cognitive burden of students; moreover, most of the students held positive opinions on the "ease of use" and "usefulness" with the proposed system.

Students used to understand poems by using various reading strategies such as looking for hidden meanings and themes, addressing figurative language, and referring to other texts to understand what is being read (Eva-Wood, 2008). Oatley (2002) pointed out that when a reader reflects on an emotion through reading, "The reader may reach an insight and build a new piece of his or her model of the self and its relations". Based on the findings, CASS was proposed to assist students in understanding poems.

In addition, students can benefit from the function of annotation retrieval. Such a finding conforms to what has been reported by previous studies (Glover et al., 2007; Hwang & Hsu, 2011; Nokelainen et al., 2005; Robert, 2009; Su et al., 2010; Yeh & Lo, 2009). Furthermore, students could understand and comprehend text more effectively by making connections with background knowledge: text-to-self, text-to-text, and text-to-world (Vacca, Vacca, & Mraz, 2011). With the cross-text annotation sharing mechanism, this kind of connection could be achieved. As a result, the proposed system assists students in enhancing their comprehension of poetry.

Although the experimental results have shown the benefits of using CASS, there are some limitations in the

present study. For example, students need to have the ability to use analogy strategy to annotate the rhetoric techniques used in a poem. If they do not have this ability, the scaffolding given by this system will not be helpful to them.

A future work will be directed to the automation of annotation analysis. That is, students can get feedback automatically when they complete their annotations. Hence appropriate semantic similarity measurement, like ontology-based distance measurement, should be incorporated to achieve such annotation automation. So far, the proposed mechanism focused on poetry comprehension. Therefore, other future work will extend this study to other subjects to further evaluate the effectiveness of this approach.

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REFERENCES

Auer, S., Dietzold, S., & Riechert, T. (2006). OntoWiki - A tool for social, semantic collaboration *Semantic Web - ISEC 2006, Proceedings* (Vol. 4273, pp. 736-749).

Bateman, S., Brooks, C., & McCalla, G. (2006). Proceedings of the Fourth International Workshop on Applications of Semantic Web Technologies for E-Learning (SW-EL 2006) in conjunction with 2006 International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems (AH2006) *Collaborative Tagging Approaches for Ontological Metadata in Adaptive E-Learning Systems* (pp. 3-12).

Cai, L. W. (2003). Integrating information technology into Chinese language teaching, *Teaching and Learning for Nine-Year Integrated Curriculum* (pp. 64-79). Tainan: Office of Teacher Internship, Placement and Education Guidance, National University of Tainan.

Cai, Z. Q. (2008). *How to read Chinese poetry: A Guided Anthology*. New York: Columbia university press.

Cao, Y. W., Klamma, R., Gao, Y., Lauz, R. W. H., & Jarke, M. (2009). A Web 2.0 Personal Learning Environment for Classical Chinese Poetry *Advances in Web Based Learning - Icwl 2009* (Vol. 5686, pp. 98-107).

Chechik, G., Ie, E., Rehn, M., Bengio, S., & Lyon, D. (2008). Large-Scale Content-Based Audio Retrieval from Text Queries *Proceeding of the 1st ACM international conference on Multimedia information retrieval* (pp. 105-112).

Chen, C.-H., & Chen, C.-Y. (2012). Instructional Approaches on Science Performance, Attitude and Inquiry Ability in a Computer-Supported Collaborative Learning Environment. *The Turkish Online Journal of Educational Technology, 11*(1), 113-122.

Chen, D. A. (1996). *English and Chinese Rhetoric and Translation*. Taipei: Bookman.

Chen, Q. Y. (2001). The appreciation strategy of modern poetry *Modern poetry language and teaching* (pp. 89-122). Changhua: National Changhua University of Education.

Cumming, A. (1995). Fostering writing expertise in ESL composition instruction: Modeling and evaluation. In D. Belcher & G. Braine (Eds.), *Academic writing in a second language: Essays on research & pedagogy* (pp. 375-397). Norwood, NJ: Ablex.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *Mis Quarterly, 13*(3), 319-340.

Eva-Wood, A. L. (2008). Does feeling come first? How poetry can help readers broaden their understanding of metacognition. *Journal of Adolescent & Adult Literacy, 51*(7), 564-576.

Glover, I., Xu, Z. J., & Hardaker, G. (2007). Online annotation - Research and practices. *Computers & Education, 49*(4), 1308-1320.

He, Z.-S., Liang, W.-T., Li, L.-Y., & Tian, Y.-F. (2007). SVM-Based Classification Method for Poetry Style *Proceedings of 2007 International Conference on Machine Learning and Cybernetics* (pp. 2936-2940).

Hwang, W. Y., & Hsu, G. L. (2011). The Effects of Pre-reading and Sharing Mechanisms on Learning with the Use of Annotations. *The Turkish Online Journal of Education Technology, 10*(2), 234-249.

Lin, C.-C., Chan, H.-J., & Hsiao, H.-S. (2011). EFL Students' Perceptions of Learning Vocabulary in a Computer-Supported Collaborative Environment. *The Turkish Online Journal of Educational Technology 10*(2), 91-99.

Lo, F. J., Zhang, R. Y., Lin, J. W., Tseng, Y. Y., & Chen, Y. R. (1999). *The multimedia teaching system for 300 Tang Poems*. Paper presented at the first International Conference on Internet Chinese Education.

Marshall, C. C. (1997). Annotation: from paper books to the digital library *Proceedings of the second ACM conference on digital libraries* (pp. 131-140).

Marshall, C. C. (1998). Toward an ecology of hypertext annotation *Proceedings of the ninth ACM conference on Hypertext and hypermedia* (pp. 40-49).

Marshall, C. C., & Brush, A. J. B. (2004). Exploring the relationship between personal and public annotations *Jcdl 2004: Proceedings of the Fourth Acm/Ieee Joint Conference on Digital Libraries* (pp. 349-357).
Mei, J. J., Zhu, Y. M., Gao, Y. Q., & Yin, H. X. (1984). *Tongyici cilin Thesaurus*. Shanghai: Commercial Press.
Nokelainen, P., Miettinen, M., Kurhila, J., Floreen, P., & Tirri, H. (2005). A shared document-based annotation tool to support learner-centred collaborative learning. *British Journal of Educational Technology, 36*(5), 757-770.
Oatley, K. (2002). Emotions and the story worlds of fiction. In M. C. Green, J. J. Strange & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 39-69). Mahwah, NJ: Erlbaum.
Paas, F., Tuovinen, J. E., Tabbers, H., & Gerven, P. W. M. (2003). Cognitive Load Measurement as a Means to Advance Cognitive Load Theory. *Educational Psychologist, 38*(1), 63-71.
Robert, C. A. (2009). Annotation for knowledge sharing in a collaborative environment. *Journal of Knowledge Management, 13*(1), 111-119.
Segall, N., Doolen, T. L., & Porter, J. D. (2005). A usability comparison of PDA-based quizzes and paper-and-pencil quizzes. *Computers & Education, 45*(4), 417-432.
Shih, W. C., Tseng, S. S., Yang, C. C., Weng, J. F., & Liang, T. (2008). Interview-Based Photo Tagging for Expressing Course Concepts in Ubiquitous Chinese Poetry Learning *Proceedings of WSKS (2)'2008* (Vol. 19, pp. 586-592).
Su, A. Y. S., Yang, S. J. H., Hwang, W. Y., & Zhang, J. (2010). A Web 2.0-based collaborative annotation system for enhancing knowledge sharing in collaborative learning environments. *Computers & Education, 55*(2), 752-766.
Su, Y. (2007). Scenario design for Chinese poetry teaching. *Data of Culture and Education, 17*, 143-144.
Sun, P. C., & Cheng, H. K. (2007). The design of instructional multimedia in e-Learning: A Media Richness Theory-based approach. *Computers & Education, 49*(3), 662-676.
Tseng, S. S., Yang, C. C., Weng, J. F., & Liang, T. (2009). Multimedia-Poetry Composition and Sharing on Ubiquitous Environment *Proceedings of 2009 Joint Conference on Pervasive Computing* (pp. 103-108).
Tsui, E., Wang, W. M., Cheung, C. F., & Lau, A. S. M. (2010). A concept-relationship acquisition and inference approach for hierarchical taxonomy construction from tags. *Information Processing & Management, 46*(1), 44-57.
Vacca, R. T., Vacca, J. A. L., & Mraz, M. E. (2011). *Content area reading : literacy and learning across the curriculum* (10th ed.). New York: Pearson/Allyn and Bacon Publishers.
Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
Wang, M. T. (2010). *Chinese pedagogy research for junior middle school students*. Taipei: Wunan Book Co.
Wang, N. J., Tseng, S. S., Yang, C. C., & Su, J. M. (2005). *A tonal pattern diagnosis expert system of Chinese Jueju poem* Paper presented at the 10-th Conference on Technologies and Applications of Artificial Intelligence (TAAI2005).
Wang, Q. Y. (2009). Design and evaluation of a collaborative learning environment. *Computers & Education, 53*(4), 1138-1146.
Weng, J. F., Tseng, S. S., Su, J. M., & Wang, Y. J. (2008). Constructing an Immersive Poetry Learning Multimedia Environment using Ontology-based Approach *2008 First Ieee International Conference on Ubi-Media Computing and Workshops, Proceedings* (pp. 308-313).
Yang, S. J. H., Chen, I., & Shao, N. (2004). Ontological enabled annotations and knowledge management for collaborative learning in virtual learning community. *Educational Technology and Society, 7*(4), 70-81.
Yao, R., & Zhang, J. (2010). Design and Implementation of Chinese Ancient Poetry Learning System Based on Domain Ontology *2010 International Conference on E-Education, E-Business, E-Management and E-Learning: Ic4e 2010, Proceedings* (pp. 460-463).
Yeh, S. W., & Lo, J. J. (2009). Using online annotations to support error correction and corrective feedback. *Computers & Education, 52*(4), 882-892.
Yi, Y., He, Z.-S., Li, L.-Y., & Yu, T. (2004). Studies on traditional chinese poetry style identification *Proceedings of 2004 International Conference on Machine Learning and Cybernetics* (Vol. 5, pp. 2936-2939).
Yi, Y., He, Z.-S., Li, L.-Y., Yu, T., & Yi, E. (2005). Advanced studies on traditional Chinese poetry style identification *Proceedings of 2005 International Conference on Machine Learning and Cybernetics* (Vol. 6, pp. 3830-3833).
Zeng, Q. M. (2007). *English rhetoric appreciation & writing*. Shanghai: Tongji University Press.
Zhao, X., Wang, M., Wu, J., & He, K. (2011). ICT and an Exploratory Pedagogy for Classroom-Based Chinese Language Learning. *The Turkish Online Journal of Education Technology, 10*(3), 141-151.