A Framework of Hypertextual Vocabulary Support for Collaborative Learning

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Abstract

This article proposes a framework for designing support systems to enhance communications in collaborative learning activities using computer networks. Based on models of situated cognition and learning and research findings on vocabulary knowledge and learning, the importance of contextual information (including situational meanings and actual usage in discourse community) and hypertextual presentation of such information is emphasized. Two projects implementing this framework are described. The Language Mediation Assistant is a hypertextual system designed to help novice participants or those with limited language abilities to become involved in network-based projects. It provides contextual meanings and actual message texts from the projects hypertextually to help learners understand the meanings and usage of words in particular domains or in particular communities. Impact! Online is a project to provide ESL learners with an integrated language learning environment for reading, writing and vocabulary. News articles with hypertextual vocabulary aid and a mailing list for discussions on news topics are the core of this project. In these two projects, it has been observed that the framework of hypertextual situational support for vocabulary understanding is useful in computer network-based learning activities, especially with students using foreign language in communication.

Keywords — Hypertext, vocabulary, network-based collaborative learning.

1. Introduction

It has been demonstrated that computer networks can provide ideal environments for collaborative learning in many areas, including science, social studies, writing, foreign languages, and teacher education. Among advantages of using computer networks in education is a potential of including a variety of people in collaborative learning activities. Interactions and collaborations among learners from different backgrounds and between novices and experts are important elements in network-based collaborative learning. But it is not always easy to get people with different backgrounds and/or different perspectives involved in interactions effectively. One issue is that newcomers to a particular community of interactions have difficulties in comprehending the vocabulary used there. Also, with the growth of a potential of getting a wider variety of learners around the globe involved in particular learning activities though computer networks, it is becoming a more and more important issue how to support participants who use a second or foreign language. In the first part of this paper, I propose a framework for designing hypertextual vocabulary support systems to help learners to participate in collaborative network-based learning activities. In the second part, I describe two projects implementing this framework.

2. Framework of Vocabulary Support

In this section, I discuss two essential aspects for designing vocabulary support systems for collaborative learning activities: situatedness and complexity of word meanings. Before discussing these two concepts, I will first discuss the limitation of dictionaries as a means of vocabulary support for learning activities.

2.1. Limitation of dictionaries

When students encounter words whose meanings they are unfamiliar with, they are usually encouraged to consult with dictionaries to check the meanings of the words. Dictionaries are thought to be the most useful and reliable information source about word meanings. But the kind of roles dictionaries play in vocabulary comprehension and acquisition are questionable when we consider the research findings about learning of word meanings.

Miller and Gildea [5] reported that fifth and sixth grade children who had been given dictionary definitions of unfamiliar words generated many incorrect sentences containing those words because of the inaccurate understandings of the word meanings. Scott and

Nagy [6] showed that the children's failure to appreciate the overall structure of the definition was observed even when they were given unconventional, more explanatory formats of definitions. McKeown [4] analyzed conventional dictionary definitions and found major problems with them. Based on the analyses she revised dictionary definitions and examined the effects of the revised definitions. The result indicated that the revised definitions went a long way toward capturing the essence of the word meanings from dictionary definitions, but still the subjects given revised definitions made many errors.

These studies show a limitation of dictionary definitions as a tool to help learners to comprehend meanings of unfamiliar words. There are two important reasons for this limitation. One is that dictionary definitions are abstract in the sense that they are extracted from the contexts and situations in which those words are actually used. The second point is that word meanings are not what we can specify as necessary and sufficient definitions and that knowledge of word meanings should be regarded as complex and ill-structured one. In the next two sections, I discuss these two points and suggest a framework for designing effective tools for vocabulary supports.

2.2. Contextual and situated support for vocabulary understanding and learning

Word meanings depend highly on situations and social interactions and can not be totally captured by definitions [2]. In order to learn word meanings so that learners can use them in actual situations instead of just retaining them as inert knowledge, it is important to place them in situations of use.

Jargon words and acronyms are good examples of demonstrating the importance of situations in word meanings. They are shared with people only in certain communities and not understandable without being involved in those communities and knowing their vocabularies and discourses.

Many words have different meanings according to domains and communities of discourse. For example, when we are talking about spaceships, the most likely meaning of the word "gravity" would be different from when we are talking about poetry.

Almost any word has more or less similar features. One difficulty for learners is that it is often hard for them to realize that certain words are used in special meanings or in special ways in the community. To help students to comprehend verbal interactions and to get involved in communication effectively, it is essential to provide sufficient clues to the meanings and usage which are used in specific contexts and situations. Useful information for this purpose should include descriptions of meanings used in specific contexts and actual sentences and texts containing those words used in them.

2.3. Hypertextual support for vocabulary understanding and learning

A meta-analysis of research on vocabulary instruction [8] indicated that "the methods that did appear to produce the highest effect on comprehension and vocabulary measures were methods that included both definitional and contextual information about each to-be-learned word (or "mixed" methods)." The reason why we need multiple information sources in learning word meanings is that knowledge of word meanings is not so simple that we can acquire them just by being given simple information such as definitions or contextual clues only. To "truly know the meaning of a word is to possess complex and ill-structured knowledge" [1]. As they suggested based on Spiro and his colleagues' studies (e.g. [7]), one aspect of ill-structuredness is the contextual interaction of concepts. The meaning of a sentence is not a simple compositional function of the core meanings of individual words, and in order for learners to understand sentence meanings, they have to have complex knowledge beyond simple core meanings which dictionary definitions provide. Also, in an ill-structured domain, knowledge of the domain can not be reduced to a single generalization or organizational scheme. Complex structures of related word meanings can be characterized exactly as this kind of case.

Considering the complexity and ill-structuredness of knowledge of word meanings, it is important to provide learners with multiple sources of information nonlinearly and nonuniformly to help them gain sufficient information about word meanings in a way which allows them to acquire usable and applicable knowledge about the words. Hypertext systems are ideal for providing multiple information in this way.

Information relevant to word meanings include "definitions" of the words showing general and crystallized essence of the meanings, example sentences and texts showing in what contexts those words are used, and related words including synonyms, antonyms, derivatives, and so on. Even though the dictionary-type of word definitions have limitations as discussed above, they can be useful information about clues to some aspects of word meanings. Knowledge about concrete examples about word usage should be important parts of knowledge about word meanings [1].

Hypertextual systems enable us to provide learners with this variety of information in a way that learners can obtain necessary information in their reading. Not only do hypertexts show different types of information, but also learners can get such information interconnectedly.

3. Two Applications of the Framework

This section describes two examples of instantiating the framework described above in designing collaborative learning environments. The first one, the Lan-

guage Mediation Assistant, is a hypertextual system to help novice learners participate in network-based learning activities by giving vocabulary help. The second one, Impact! Online, is a hypermedia news reader for second language learners and less skilled readers which provides hypertextual support for learning and acquiring vocabulary.

3.1. The Language Mediation Assistant - Hypertextual vocabulary support for network communications

The Language Mediation Assistant is a hypertextual vocabulary support system to help novice participants and those with limited language abilities to get involved in ongoing network-based learning projects [10].

It is sometimes difficult for newcomers to ongoing projects to participate in the discussions already going on. One major source of difficulty such novice participants often face is the lack of sufficient knowledge about vocabulary used in the community. In the process of communication within a particular community, some words often come to have specific meanings, having particular connotations. Without knowing how such words are used in the community, participants may have difficulties in understanding what the people there really mean.

In addition to the problem of special meanings, those participants who use a second or foreign languages to communicate in network-based projects often suffer from lack of sufficient vocabulary knowledge. Even when they have learned general or abstract meanings of words which they have been taught in second/foreign language classes, they often have difficulties in figuring out what the words mean in particular contexts at hand.

Considering these situations, it is quite important to develop a tool to support these participants' understanding of the ongoing communications in network-based projects. This section describes a hypertextual vocabulary support system, named the Language Mediation Assistant (LAMEA), created by using HyperCard on Macintosh computers.

The LAMEA stack consists of two different kinds of cards, word information cards and message cards. A LAMEA stack contains actual messages exchanged in network-based projects in a specific domain and information about important and/or difficult words used in them.

Message Card. Each message card has a message text on it. Those words with information included in the stack in the form of word information cards are highlighted in the text. When users click on one of the highlighted words, a small box appears near the word which show the meanings of the word. If they want to get more information about the word, they can look at the word information card for that word by clicking on the button "More Information." As described below, on a word information card, users can see not just meanings but also look at a list of related words and a list of other messages containing that word. By clicking on an item in these lists, learners can access to more information about the word to understand what meanings it has and in what way it is used in messages exchanged in communication in the domain.

Word Information. Each word information card provides users with a variety of information about a word. It contains "*meanings*," "*related words*," and "*list of messages containing this word.*"

Related words include derivations, synonyms, antonyms, and so on. Those words which are highlighted have word information cards for them. If users click on a highlighted item in related words, they can look at the word information card for that word.

Users can read other messages which contain the particular word. If they click on an item in the *list of messages containing this word*, they can go to the message card for that message text, so that they can read the whole message as a context of use of that word.

Effects of this system in theunderstanding of word meanings in use. A pilot study was conducted to explore the effectiveness of this system in understanding and learning word meanings in communications. Messages exchanged in a newsgroup were used. Non-native speakers of English who hadn't looked at the newsgroup before read articles in the newsgroup by using this system. It was found that readers used not only the meanings provided to difficult words but also information about related words and other messages containing unfamiliar words. Many subjects commented that they prefer this kind of non-linear system providing contextual information, rather than conventional dictionaries.

3.2. Impact! Online - An integrated learning environment for ESL learner's reading, writing and vocabulary

Impact! Online is a project of providing learners of English as a second/foreign language with an integrated learning environment for reading, vocabulary, and writing by using World Wide Web and an electronic mailing list [9]. The purpose of this project is to prepare an environment where ESL learners can read about and discuss current issues to improve their reading, writing and vocabulary skills. Two components of this project are hypertextual news articles with vocabulary help and a mailing list for learners to have discussions about topics introduced in the articles.

Hypertextual newsletter with vocabulary help. We have developed a hypertextual newsletter for ESL learners and placed it on an educational World Wide Web server. Each month, a few new articles on current national and international topics are added to our WWW server. Difficult words in each article have hypertextual links to explanations of those words.

By selecting unfamiliar words, readers can access information about those words. Explanations about words include meanings, related words, pronunciation, example sentences, and links to relevant information servers. The meanings provided are contextually appropriate ones, not general or abstract dictionary definitions. Related words and example sentences are provided on each word information screen. Difficult words in related words and example sentences have links to the word information screen on those words. From some word information screens, we are implementing links to actual messages exchanged in the mailing list, so that learners can access more contextual and authentic "example" sentences.

On-line discussion. Learners participating in this project can have opportunities of not just reading our newsletter articles with vocabulary help but also having discussions on topics related to the articles. By getting involved in discussions on specific topics provided by the articles, learners can practice applying the vocabulary knowledge they acquired when reading annotated newsletter articles to authentic communication situations.

Effects of the integrated learning environments with vocabulary help. The log showing which files learners accessed indicated that there are many accesses to word information files during the reading of articles. And not only do they access meanings in word information but they often get more information about related words and relevant background knowledge (provided in the form of links to other information servers on related topics). In the discussions on the mailing list, the ESL learners use many important words used in the news articles whose explanations are provided in word information screens, which indicates that they acquire those words correctly and in a way that they can actually use them in communications.

4. Conclusions

In this paper, I proposed a framework of vocabulary systems to support collaborative network-based learning. I emphasized contextuality and situatedness as well as hypertextuality. In the two projects described here, the effectiveness of this framework has been supported.

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