

A Language Learning System with Automatic Feedback: An Application Based on a English-Chinese Parallel Corpus

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Abstract: The learners of English as a second language generally need many practices on writing English, identification of the mistakes in their English, and feedback hints on how to correct their mistakes. A computer-assisted online system is designed to address these issues in a context of learning from a corpus of parallel English-Chinese corpus of New York Times news articles. In the system, students match chunks of English words to chunks of Chinese strings and order chunks of English to produce the original English sentences. Results from an empirical experiment indicated that the students found the tasks challenging and felt that the learning activities were meaningful in improving their knowledge of English. Their score improvement increased when they practiced more.

Keywords: Learning English as a second language, computer-assisted language learning, E-learning

Introduction

In Taiwan, a common method of teaching translation is the translation of knowledge. For learners of English as a second language, using translation can help them understand and memorize the grammar of English, which reduces their frustration and anxiety. Using translation to learn foreign language is a kind of learning strategy for many learners [2]~[13]. According to Catford, translation can be an excellent strategy for learning a foreign language if it is used properly [1].

According to overseas research, designing an effective English learning system with automatic scoring mechanism (e.g. e-rater version 2.0, an automated essay scoring system) and effective grammar feedback (e.g. Critique, a system to provide feedback on test-taker's composition errors) is more helpful for students in learning English grammar. In addition, the system should be able to reduce the burden on individual manual score and let teachers have more time to prepare materials and assist students.

Research results indicate that E-rater scores are significantly more reliable than human scores and that the true-score correlation between human and e-rater scores is close to perfect [14]. The Critique system makes decisions that simulate how teachers grade students' essays. Teachers may make explicit that there is no thesis statement, or that there is only a single main idea with insufficient support. This kind of feedback helps students to develop the discourse structure of their writing [15] [16].

With goals similar to those of e-rater and Critique, we design an online computer-assisted learning system to help students in learning English. Our system does not only grade a student's English sentence and produce a score, but also points out which parts

of the sentence are correct and which parts are not. In addition, the system provides feedback hints to help student correct her mistakes.

Our system asks students to do two tasks. In the first task, the Chinese translation of an English sentence is provided. The Chinese sentence is segmented into chunks of words/phrases manually and so is the English sentence. The student's job is to match each English chunk to its translated Chinese chunk. In this task, the English sentence is not given in its original form (with correct ordering of its chunks). In the second task, students are given the correctly matched chunks and are asked to reorder the English chunks to produce the original sentence.

1. System Components

The system of computer-assisted language learning is composed of a front-end user interface and three back-end modules—grading, feedback and record. The user interface includes one used by students and one used by the instructor. Fig. 1 shows the architecture of this system.

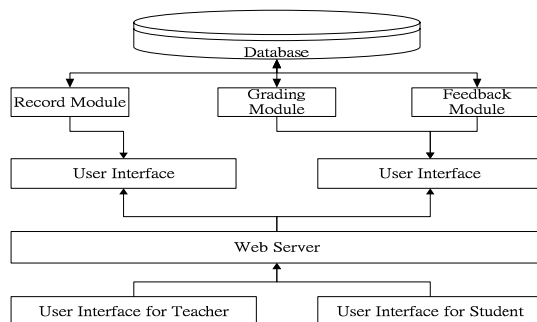


Fig. 1 System architecture

1.1 First task: chunk matching

The interface for the first task is shown in Fig. 2. A student reads the Chinese sentence in region A of the interface. The chunks of the Chinese sentence are listed vertically in region B while the English chunks are listed at random in region C. The student can drag an English chunk to swap with another English chunk within region C. Each swap is recorded by the recording module. When the student wants her answer to be graded, she can submit her answer. The grading module grades her answer and returns a score. Also, in region D of the interface, the feedback module shows which pairs of her answer are correct and which are not. Then the student needs only to revise the incorrect pairs and resubmit her answer. For each sentence, she can submit at most six times.

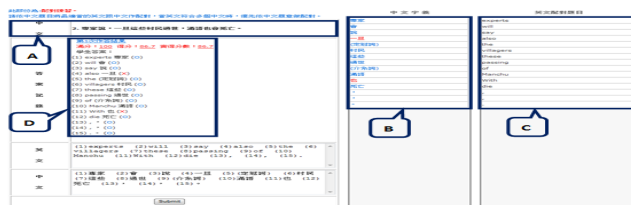


Fig. 2 First task: match English chunks to Chinese chunks

1.2 Second task: reorder the English chunks to produce the original sentence

The interface for students to do the second task is shown in Fig. 3. Like the first task, the Chinese sentence is shown in text area A of the interface and the Chinese chunks are shown in column B. In column C, each English chunk is displayed to the right of its corresponding Chinese chunk. The student can drag an English chunk to any entry in the table in column C and the entries and their Chinese counterparts in column B will be pushed down one slot but the entries above the chosen slot will not change. After each drag, the English chunks in their top down order will also be displayed horizontally in text area D of the interface, since some people might be more comfortable in reading horizontally. Similarly, the corresponding Chinese chunks, whose ordering will not form a grammatical Chinese sentence in general, will be displayed horizontally in an area below area D.

Every drag will be recorded by the recording module. When a student wants her answer to be graded, she will submit her sentence and the grading module will return a grade. Moreover, the feedback module will indicate in areas E and F which parts of the submitted sentence are correct and which parts are not. In this way, the student can improve her answer and submit again. For each sentence, the student submits answers for at least three times, if full score is not obtained earlier, and at most six times. Whenever she obtains full score, she proceeds to work on the next sentence.



Fig. 3 Second task: reorder the chunks to produce the original English sentence

1.2 Feedback module

First of all, the feedback module must identify which chunks are correctly ordered and which are not. The former is underlined in the feedback region. Consider an example. The target sentence, the student's submitted answer, and the feedback information follow:

Target: *Skills shortages have become a common feature of the global economy, particularly in aging countries.*

Feedback: Skills shortages have become the global economy a common feature of particularly in aging countries . .

Hints: *Skills shortages have become* + <noun phrase>
the global economy + <adverbial phrase>
a common feature of + <noun phrase>

The student might use these hints to produce the target sentence.

1.3 Grading module

The grading scheme for chunk ordering is more involved and Table 1 shows the grading formula. $Length(T)$ is the number of elementary chunks (the initial chunks provided by the system) in the target sentence, $Length(S)$ is the number of elementary chunks and $Chunk(S)$

is the number of chunks of correct word strings in the submitted answer. If the student's answer is identical to the target, $Chunk(S)$ is 1.

Table 1 The grading formula for chunk ordering

<i>The second part of Grading formula</i>	
Grade	$= \left[1 - \frac{ \text{Length}(T) - \text{Length}(S) + \text{Chunk}(S) - 1}{\text{Length}(T)} \right] \times 100$

2. Experiment and results

2.1 Participants and Teaching Materials

Twenty-nine students in the experiment were selected from a technological university in Central Taiwan. All of them were juniors and seniors in the college of engineering. Students used the computer-assisted online system to do the two tasks in an English course every week. We collected data for four weeks of the course. The texts used in this study were selected from *New York Times*, translated into Chinese and published in a Chinese-English bilingual form by *United Daily News* in Taiwan.

2.2 Results and Discussion

Students progressed from first construction to the final construction in all eight texts, four for bilingual chunk matching and four for ordering English chunks. Table 2 and Table 3 show students' mean scores at the first and final sentence construction in each text in the word phrase matching and translation.

Table 2 Results of chunk matching

Text	First score	Last score	Progress (P)	Average #submissions (A)	P/A
1	75.3	98.7	23.4	2.8	8.4
2	78.9	99.1	20.2	2.3	8.7
3	76.2	97.4	21.2	2.4	8.8
4	76.1	98.4	22.3	2.5	8.9

Table 3 Results of chunk ordering

Text	Avg. sentence length	First score	Last score	Progress (P)	Avg. #submissions (A)	P/A
1	20.1	50.4	84.4	34.0	3.2	10.6
2	13.2	68.1	92.2	24.1	2.8	8.6
3	21.8	57.0	92.1	35.1	3.3	10.63
4	20.9	55.7	91.6	35.9	3.2	11.2

3. Conclusion

A primary goal of this study is to provide an E-learning environment that detects the errors in each student's answers to tasks related to translation. The first task is to match chunks of English words/phrases to Chinese chunks, which are translated by professionals from the original English sentence, so that the students can learn more English vocabulary. The second task is to order chunks of English words/phrases to produce the original sentence from which the Chinese sentence is translated. The purpose of this task is for the students to apply their knowledge of English grammar and sentence patterns.

An empirical experiment was done with a class of 28 senior students using the system in an English course. Results indicated that they enjoyed using the system, found the tasks challenging, and felt that they became more aware of the difference in sentence structures between English and Chinese. Furthermore, recorded data showed that students were actually using the hints to improve their answers. Quantitative results indicated that their average score improvement increased and the mean score improvement per each submission increased as they practiced more.

Future experiments should test their vocabulary and grammar before and after using the system for a considerable amount of time, such as half a semester. This might provide more evidence on what they actually learn from the computer-assisted online system.

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