

A Feasibility Study of Machine Translations as a Means of Disseminating Information of Chemical Education on the Internet: An Introduction

Masato M. Ito*¹ and Yoshito Takeuchi²

¹Department of Environmental Engineering for Symbiosis, Faculty of Engineering, Soka University, 1-236 Tangi-cho, Hachioji, Tokyo 192-8577, Japan.

²Department of Chemistry, Faculty of Science, Kanagawa University, 2946 Tsuchiya, Hiratsuka-shi, Kanagawa 259-1293, Japan

*E-mail: itomasa@soka.ac.jp

The project with the rather long title has been proposed by Professor Yoshito Takeuchi and is approved as an IUPAC project [1]. This short article is expected to serve as an introduction to the articles prepared by the members of the project as its intermediate reports, most of which were presented as a symposium at the 18th International Conference on Chemistry Education [2].

The core of the philosophy of the project is based on his perspective on globalization and information exchange. The information exchange on the Internet has been considered as a clue for the globalization, and in its really practical sense it is only possible when everyone can get and disseminate information in one's own language (not in an 'international' one) on the Internet. This also holds for information of chemical education. In addition, there will be difficulties specialized to information in chemistry to be elucidated.

Almost all the contents disseminated on the Internet on the international basis, however, is written in English. In order for the benefit of globalization to be acquired by the people worldwide, including non-English-based people, feasible means of translation of the contents is required. This will only be achieved by the aid of the computers (machine translation). It will be implemented in the world-wide web for automatic translation and its performance will be improved in the future.

Thus, the objectives of the project is (1) to attempt the bi-directional translation of chemical education materials from English to other languages and *vice versa* using commercially available machine translation software, and (2) to carry out a feasibility study on the establishment of local translation centers where bi-directional translation suitable for dissemination by Internet is regularly carried out. The details of the concept and outline are described in the following Takeuchi's article [3].

Outline of the activities are described below.

Software: commercially available softwares for translation from English to each language (and vice versa) are used. Some softwares have a dictionary specialized to science or chemistry installed while others are not.

Sample: selected articles in Chemistry International and Chemical Education International (CEI) [4] are used for translation from English. This helps avoid the copyright problems and dissemination of the articles in a variety of languages. The articles in chemical education in the respective languages are used for translation into English.

Points of evaluation: (1) appropriate translation of terms, (2) appropriate transformation of syntax as necessary, and (3) translation of chemical terms.

The method of evaluation: for instance, the frequency of the words or sentences that need to be changed or the incorrect words relative to the total number of words in the sample document; the smaller the frequency, the better would be the performance of the translation software.

The details are shown in Cardillini's article [5].

Languages initially planned for examination include those in Spain, Portugal, Russia, France, Korea, China, Malaysia, Italy, and Japan. Currently extensive reports have been made for Italian [5], Russian [6], Portuguese [7] and Japanese [8] languages.

As was expected, machine translation has proved to be by no means simple mechanical substitutions of words and phrases. The software is equipped with some kind of Artificial Intelligence (AI) system which is based on knowledge of grammar and syntax, both in English and the

respective language. Even so, difficulty in (or performance of) translation depends on the type of languages. Indo-European languages marked a reasonable performance. Difference in character system seems to cause only minor problem because the Russian also gained the reasonable results.

Correct transformation of chemical concept is a requisite for communication in chemistry and its education. In particular, translation of technical terms and expressions specialized to chemistry often faces difficulty. This is because their counterparts in chemical usages are occasionally quite different from the counterparts in common usages, thus resulting in erroneous translation. In such cases, a chemical dictionary is required for the translation software for the terms and expressions used in a chemical context. The importance and availability of such dictionary also depend on the language.

The results in total are reasonable for web-based communication, although further improvement is expected. For details, please see the following reports [5-8]. The research will further be extended to other languages, in particular, those of non-Indo-European families such as Chinese, Korean, and other languages.

Reference

- [1] IUPAC Project Number: 2002-021-2-050, adopted September 2002.
- [2] 18th International Conference on Chemical Education Proceedings, Istanbul, August 2004, pp. 110-112.
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- [4] Chemical Education International: <http://www.iupac.org/publications/cei/>.
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- [6] N. Tarasova, to be published in Chemical Education International.
- [7] M. Elisa Maia, to be published in Chemical Education International.
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