Innovative Teaching and Learning of Sanskrit Grammar through SWAGATAM (स्वगतम्)

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Abstract

E-learning increases the level of teaching and learning, literacy and economic development in countries. Information Technology (IT) has fundamentally changed the methods of teaching and learning. In this age of IT education system is converting into Digital. E-Learning may play very important role to innovation in classroom teaching and it boosts teaching and learning process. There are an online learning tool called Swagatam (स्वगतम्) has been developed for teaching and learning Sanskrit Grammar in Higher education. Swagatam (स्वगतम्) is based on University of Delhi BA and MA Sanskrit syllabus. Swagatam is available at http://sanskrit.du.ac.in. Swagatam includes taddhita and sanadyanta analyzer under Language analysis tools, subanta, tinanta, sandhi and prtyahar generator under Language generation tools, subanta siddhi, tinanta siddhi, taddhita siddhi, sandhi siddhi, kridanta siddhi and samasa siddhi generator, Sanskrit meter and samkhya-yoga technical word information system under e-learning tools and Vedic literature and pauranic search under Sanskrit literature search tools.

Keywords: E-learning, E-Learning tools for Sanskrit, Innovative Learning, Online Learning, Sanskrit Grammar, Word Formation Process

1. Introduction

Grammatical tradition of Sanskrit is very rich. It was researched, compiled and programmed by Sanskrit grammarians from the later Vedic period. It was robustly programmed in
the Pāṇinian grammar about the 6th century BCE (Manji, et al., 2008; Girish, et al., 2009 and Subhash, 2010). The grammar of the Sanskrit language has a very complex and huge morphological system like verbal, rich nominal declension, and extensive use of compound nouns (Lennart, 2005; Subhash, 2010 & Chandra and Jha, 2011). Kātyāyana composed vārtikas (explanations) on the Pāṇinian sutras (Chandra, 2010; Chandra & Jha, 2011). The most important work based on word formation process was done by Bhaṭṭoji Dīkṣita in about 17th century in his Siddhānta Kaumudī. Sanskrit taught almost all Indian universities at under graduate (UG), post graduate (PG) and research level (Chandra et al, 2016). Therefore, Swagatam may play very important role in teaching learning process because there are no effective online tools are existing which cover courses of Sanskrit in higher education (Shopova, 2011 and Kalaivani, 2014).

Information technologies (IT) effected and impacted higher education teaching and learning (Gaebel, Kupriyanova, Morais & Colucci, 2004). Government of India has also launched Digital India (Digital India, 2016) scheme with the objective of making each government services digital. There is a complicated task to make available digital contents online in various Indian languages medium for the students and teachers. Many Indian researchers have been initiated various e-learning tools and techniques (Bijlani, Manoj & Rangan, 2008 and Bhatia, 2011; Chandra et al, 2016). Asthadhyayi (AD) of Panini is development of about 4000 rules of Sanskrit morphology, syntax and semantics. These rules are organized such a way like any computer programming languages (Jha, 2004; Chandra & Jha, 2011; Kulkarni & Shukl, 2009 and Jha et al, 2009).

Objective of this paper is to announce an innovative teaching and learning tools for Sanskrit Grammar called Swagatam (स्वगतम्) developed by Computational Linguistics Research group, Department of Sanskrit, University of Delhi, Delhi. Details of the each tools are discussed in section 2.

2. Features of Swagatam (स्वगतम्)

SWAGATAM is an online system for Sanskrit grammar teaching in higher education based on UG and PG Sanskrit syllabus of University of Delhi, Delhi. It provides an e-learning platform

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through online web based e-contents and tools in Sanskrit. The mission of SWAGATAM is to enhance the quality of Sanskrit education in the higher education in India by providing free online courseware for Sanskrit in various Indian language medium. Details description of the Swagatam is given below:

2.1 Language Analysis Tools

Currently, this tab has following two major tools are developed:

2.1.1 Taddhita Analyzer

This system does analysis of Sanskrit secondary derived nouns (taddhita). System accepts input in Devanagari Unicode and print the analyzed result in same format. Screen shot with result is shown in figure 1. This helps to learn taddhita analysis which is very essential for meaning.

![Figure 1: Screen Shot of taddhita Analyzer](image1.png)

2.1.2 sanadyanta Analyzer

This is very important component of the Swagatam. Sanskrit has approximately 2014 verb roots (including kandvādi (agroup of Sanskrit verb roots), classified in 10 groups (ganas). Secondary verbs derive with 12 derivational suffixes called sanadyanta. This system analyze sanadyanta in Sanskrit text. Screen shot with input and output of the interface is shown in figure 2.
2.2 Language Generation Tools

*subanta, tinanta, sandhi and prtyahar generator* are the main tools in this tab:

### 2.2.1 Subanta form Generator

This component generates nominal word forms from a base word. User need to give the input word and select the gender of the stem. Then it generates 24 forms of the given stem.

### 2.2.2 Tinanta form Generator

This tool has two components. One is primary verb form generator which generates verb forms from a verb root. User gives the verb roots as an input in given text area. Then this system generates verb forms in 10 lakaras. Second component is secondary verb form generator which generates sanadyanta verb forms in in 10 lakaras of given verb and suffix. Screen shot of the sanadyanta generator is shown in figure 3.
2.2.3 **Sandhi Generator**

Taddhita analyzer is a string set of two alphabets which contains a group of alphabets based on प्रत्येक ini alphabets system. Panini has explained the make and expansion of the pratyāhāras in AD rule 1.1.71. Pratyāhāras can be compared with a variable in any computer programming languages.

2.2.4 **Pratyahara Generator**

Taddhita analyzer is a string set of two alphabets which contains a group of alphabets based on प्रत्येक ini alphabets system. Panini has explained the make and expansion of the pratyāhāras in AD rule 1.1.71. Pratyāhāras can be compared with a variable in any computer programming languages.
2.3 E-Learning Tools

This tab includes subanta siddhi, tinanta siddhi, taddhita siddhi, sandhi siddhi, kridanta siddhi and samasa siddhi generator, Sanskrit meter and samkhya-yoga technical word information system etc.

2.3.1 Subanta siddhi Generator

This is very important component which generates complete word rūpasiddhi with Panini rules. This system first recognizes the input words with the help of recognition rule and example database then analyzes the input words with the help of analysis rule and example database. After this it generates Word Formation Process (WFP) based on Pāṇini Rules. The screenshot with the input and output result is shown in figure 5.
2.3.2 Tinanta siddhi Generator

It generates verb formation process with the help of rules and relational databases. It accepts Unicode Devanagari texts in the input text area and generates output in same format. User interface can be seen in Figure 6 and 7.
2.3.3 Taddhita siddhi Generator

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This system generates taddhita siddhi with the help of rules and relational databases. It accepts Unicode Devanagari texts in the input text area and generates output in same format. This system is under development.

2.3.4 Sandhi siddhi Generator

This component do sandhi and generates its siddhi with the help of rules and data set. This system is also under development. Demo version of the system is available till now.

2.3.5 Kridanta siddhi Generator

We have also proposed to develop kridanta siddhi in future because kridanta is very essential component of Sanskrit Grammar and play very important role in translation from other language to Sanskrit.

2.3.6 samasa siddhi Generator

This system if not completed right now. It will be added with the Swagatam. This will generate complete samasanta (compound words) siddhi as per Panini rules.

2.3.7 Sanskrit Meter Information System

Sanskrit meters are being taught in all Indian Universities offering Sanskrit courses. Therefore, a system called Sanskrit Meter Information is also added with Swagatam. It produce all information of selected meters (Meena, 2016).

![Figure 8: Sanskrit Meter Information System](image-url)
2.3.8 Sankhya-yoga technical word Information System

Technical terms informations and definitions of any discipline are very important to learn further. So we are also developing a database of Samkhya-Yoga technical word information. Which will produce whole information of any technical terms belongs to the Samkhya-yoga philosophy. Proposed interface for this system is shown in figure 9.

![Figure 9: Screen Shot of the Samkhya-yoga technical terms information system](image)

2.4 Sanskrit Literature Search

This component includes *Vedic literature and pauranic* search engine for Sanskrit texts.

2.4.1 Vedic Literature Search

This system is an advance search engine for vedic literature. User can search any words occurred in Veda and get complete reference for the input words. Screen shot of the system is shown in figure 10.
2.4.2 Pauranic Search

This system search reference of any words from the Puranas. User can search any words occurred in any puranas and get complete reference for the input words. Screen shot of the system is shown in figure 11.

3. Conclusion and Future Direction

SWAGATAM (स्वगतम्) is result of an initiative taken by the Computational Linguistics Research Group, Department of Sanskrit, University of Delhi, Delhi with the objective of development of web based teaching and learning tools for Sanskrit in Higher Education. Swagatam is being used by the UG and PG Sanskrit students and teachers for teaching and learning Sanskrit grammar. Apart from this various language resources such as database for Ashtadhayayi (AD) rules with Hindi meaning and Explanation and other relevant information, Computation rules for
identification and analysis, database for P\text{\char8}ini’s Dhatupatha (DP), various small dataset for Sanskrit grammar are also developed.

In future, it is planned to digitalize all recommended Sanskrit text used in Delhi University Sanskrit syllabus. The instructions and input/output methods of Swagatam will be multilingual (Punjabi, Sanskrit, English, Bangla, Telugu, Tamil etc.) because Sanskrit teach in various language medium in India.

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References


Meena, R.K. (2016). संस्कृत छन्द शिक्षण के लिए वेब आधारित सहायक तंत्र का विकास, M.Phil Dissertation, Department of Sanskrit, University of Delhi, Delhi

Jalaj, K. (2016). वेब आधारित ॠग्वेदीय खोज एवं अनुक्रमणिका तंत्र का विकास, M.Phil Dissertation, Department of Sanskrit, University of Delhi, Delhi

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