International Journal of Humanities and Social Science Invention (IJHSSI)
ISSN (Online): 2319 – 7722, ISSN (Print): 2319 – 7714
www.ijhssi.org ||Volume 15 Issue 8 || August 2026 || PP. 66-69

Impact of AI on Teaching and Learning Sanskrit in Modern Times:

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Abstract:
Life is incomplete without education is the old verse, life is incomplete without the knowledge of Artificial intelligence is the new version. According to our ancient texts "सङ्गीतसाहित्यकलाविहीनःसाक्षात्पशुःपुच्छविषाणहीनः" but now it is the time to say "कृत्रिमबुद्धिमताविहीनःसाक्षात्पशुःपुच्छविषाणहीनः" , this implies that Artificial intelligence has occupied a very important space in the life.People completely rely on itand before they think and take any decisions, which is reflecting deeply. Many prefer to type their ideas into tools like ChatGPT to obtain quick answers. To that extent, AI has become integrated into everyday life.
Sanskrit is an ancient language, peopleare of the opinion that, it is restricted to the temples for chanting the mantras and it has become the language of priests,however the treasure of knowledge embedded in it is known to the people who knows about the depth and richness of the language. Sanskrit was once a very vibrant language of communication and literary language. But in modern days it is spoken only by few people and peopletry to understand the knowledge in Sanskrit texts through translation. But no one can guarantee that the translation given by the machine is correct. In this paper I would like to discuss how Artificial Intelligence can beeffectively usedin teaching andlearning our sacred and precious language, Sanskrit.
Key words: *Treasure, Precious, Knowledge, Ancient, Machine.*

Date of Submission: 05-08-2026 Date of acceptance: 17-08-2026

I. Introduction:

In 1956 John McCarthy introduced the term 'artificial intelligence' in Dartmouth conference, which marked the birth of AI as a formal field of study. The impact of the conference was an exceptional growth of AI research and applications in further research and for futuredevelopments. If we think of Artificial Intelligence as a machine, it can do intelligent things and think like human beings and can help people to do various tasks. The 'brain' of the machine is like a super-smart computer program. Though it is not made of natural brain tissue, it is designed to think and learn from information. The program uses lots of data and clever mathematical calculations to make decisions. AI learns by looking at many examples and information like, how we learn from books, videos and experiments. And we know that Sanskrit is used for coding, because of structured grammar and scientific syntax for computational purposes. Which equips the students with tools to create tech platforms using Sanskrit rather than viewing as language as limited to traditional or religious study.

A professor from Delhi university says that as global interest grows in natural language processing (NLP) and AI-driven translation tools, Sanskrit's mathematical structure could prove valuable in building language models, voice assistants, and semantic search systems.

More formally to say that AI is a multifaceted field that tries to emulate human like intelligence in machines. A critical aspect of human intelligence is the ability to 'think'. The ability to think comes from multiple elements like the ability to understand, learn, do reasoning, communicate and act. Artificial intelligence is an area in computer science that tries to replicate human intelligence into machines and in the process builds intelligent machines. AI tries to imbibe human like cognitive abilities. At its core, AI aims to create intelligent systems that can think, learn,adapt and perform tasks typically requiring human intelligence.

If we teach Sanskrit as online mode by using many techniques like PowerPoint, google classroom and Kahoot as a game people understood now AI does this using a branch called machine learning,that how we can learn from examples with the vast amount of data it gives us an immense outcome of learning.

Application of Artificial Intelligence in Sanskrit Education:

We know that AI has become a part of the modern world revolutionising in numerous industries and aspects of our everyday lives in all domains like Banking, Insurance, Medical, Retail, Education etc., including problem solving. The concept of Artificial Intelligence which is referred to as Strong AI represents a level of

machine intelligence capable of understanding learning and performing the intellectual task that a human being can do. It replicates like a human being like cognitive abilities, reasoning, problem solving, understanding and adaptability which is a highly advanced form of AI. the strong AI can learn from experiences and apply the knowledge to novel situations. They can generalise learning from one domain to another, showcasing adaptability and problem-solving skills.

AI has an impact on transforming education by introducing learning experiences, improving administrative efficiency and enhancing learner support. It is adaptive in teaching and learning platforms use AI to tailor educational content based on the student needs. For example, if a student is struggling in recognising the letter the AI can teach to read and write like a human being, it can assist the student in creating an article inSanskrit, it can make the student to understand the literature by translating the text in the student requirement. It can assist the research scholars to select the topic of his interest and guide them to do the work according to his wish. It can guide the scholar in giving the links and references for his research, the scholar may create the data source based on the guidance given by AI. As it provides the virtual assistance it can be customised to teach Sanskrit to suit the progress of the student. And it will save the teacher's time by grading his work and giving the feedback automatically. Virtual classrooms and the simulations powered by technologies like virtual Reality and Augmented Reality create Sanskrit learning experiences. As it is embedded with language processing tools like translation apps and language learning apps contribute to breaking down linguistic barriers.

AI translation tools have the potential to bridge the language barriers and facilitate communication and collaboration among the students and educators of Sanskrit background. It can support language leaning by providing feedback on pronunciation, suggesting vocabulary and by generating language exercises for practice.

There is a paradigm shift with the application of AI in education domain. Like.

Personalised learning: For the better learning of the student AI customises the lessons. If the student is good at Sanskrit literature and helps the student's need with which the student can learn better.

Tutoring: The tricky and difficult tasks like Samasa's will be explained by the AI like a tutor. as it is available any time the student can get help any time.

Grading and Feedback: AI can help the teachers in grading the assignments and tests and give the feedback quickly related to their tests.

Curriculum planning: As our language is very vast, it can help the teachers to choose the better material and methods for teaching to keep the lesson interesting and compulsory.

Language translation: AI can translate the Sanskrit language to any language making it easier for the learner to understand of their need of choice and access the content.

Accessibility: AI can assist the students with disabilities by providing text to speech, speech to text or other tools to make learning more accessible.

Analysis: AI looks at lots of data to spot trends and it helps to see what will work out and what needs improvement.

Virtual classrooms: AI powers virtual classrooms where students and teachers can interact online. This is especially useful for distance learning.

Study aids: it can create a study guidelines and practice tests tailored to what we need to learn.

Time management: AI helps students and teachers to organize schedules and deadlines ensuring everyone stays on track.

Natural Language Processing:

Natural Language Processing is a subset of artificial intelligence which refers to the ability of machines to understand and interpret any natural language whether in witing or in the form of speech. NLP allows the computers to read and respond in the natural language the way a human being would understand. There are several processes involved, and they are syntax that is grammatical checking, semantics that is meaning of the text and pragmatics that is the purpose of the text. It also deals with phonology that is systematic organization of the sound in language and morphology that is relationship of words with each other.

As there are large number of applications running with NLP, through the skype translators a live speech can be translated in many languages so also in Sanskrit, so that people can understand and communicate without any barrier. Though Sanskrit is spoken in very less places, but the people with the knowledge of language and literature can follow and give comments. Which can help us to revive Sanskrit like any other languages.

NLP is a sub field of AI which deals with the interaction between computers and the languages used by man. More simplistically this field of AI focuses on developing the capability of machines to interpret natural language like human beings.

1. It can ensure consistency and prevent duplication regarding the data.
2. It can split the text with which it makes the person to understand easily.
3. It will eliminate or removes he uninformative words that do not contribute for the analysis.
4. It removes unnecessary spaces, tabs and line breaks.
5. It will normalise the data to ensure consistency.

6. Splitting the text into segments or paragraphs depending on the analysis requirements.
7. It will ensure that sentences or documents are of consistent lengths for tasks like text classification.

Text classification for Sanskrit though it is little tricky still it is possible. Because Sanskrit possesses rich morphology, sandhi and samasa's, free word order, few large, labelled database compared to modern languages, though these may not be impossible still it will affect the process of classification done by us.

Approaches from simple process to large process:

1. Text Normalisation: - converting to a single script especially to Devanagari script and normalise the Unicode.
2. Tokenization: -Word-level tokenization (basic) Or Sandhi-splitting using tools like:
   Sanskrit Heritage ReaderUOH Sanskrit NLP tools
3. Stemming / Lemmatization: which is very important for Sanskrit to use morphological analyzers (e.g., INRIA Sanskrit tools)
4. Feature of extraction: This is the core of making Sanskrit text classification to work like;
   1. Bag of words-is a text as a vector of word counts. For example,रामःवनंगच्छति, Vocabulary (from dataset): ["रामः", "वनं", "गच्छति"] Vector: [1, 1, 1]. Still it works with Very small datasets, Afterlemmatization,Simple tasks (genre detection, verse vs prose)
   2. TF-IDF (Term Frequency – Inverse Document Frequency)
   - TF-IDF improves BOW by down-weighting common words and highlighting informative ones.
   - TF → how often a word appears in a document
   - IDF → how rare the word is across all documents

   So, the Common words like च, एव, तथा get low weight andTopic-specific words get high weight
   3. Character n-grams (very effective for Sanskrit) Thisis , instead of words, if we split text into sequences of characters of length *for example, रामः - रा, राम, आमः*

5. It is a Deep Learning with embeddings: Deep learning is the backbone of AI and large number of applications has been developed by using the methods of deep learning for example voice search and translation from speech to text and text to speech If we have more data, we can make use of;
   fast Text (great for morphologically rich languages) and Sanskrit-specific embeddings (where available) Modelslike -CNNs for text and Attention-based models

   Transformer-based models (best performance): This is the current state of the art.
   Models that support Sanskrit are: mBERT (Multilingual BERT) XLM-R (RoBERTa) ; IndicBERT / IndicBERT v2 , MuRIL Ithelps.

   1. To Prepare labelled Sanskrit text
   2. To Fine-tune a pretrained multilingual model
   3. To Classify using the [CLS] token representation

   It is very much advantageous.
      a. No need for explicit stemming or sandhi splitting
      b. Works even with limited labelled data
      c. Handles syntax variation well.

Challenges in Application of AI in Sanskrit teaching and learning: -

1. Sanskrit has limited digital data source, and many texts are not digitalised they are found in inconsistent format.
2. As the Sanskrit grammar is very vast, complex and highly systematic AI tools may often struggle to accurately parse and interpret such linguistic depth.
3. AI may provide literal translation of classical texts like Vedas, Upanishads, Mimamsa, Nyaya, Alankara shastra but miss deeper interpretative nuances.
4. Sanskrit learning strongly emphasizes on correct pronunciation (Śikṣā), Vedic chanting with swaras (intonation), Oral recitation traditions but the Current AI speech recognition tools are not fully accurate in identifying subtle phonetic differences like short vs long vowels, Retroflex vs dental sounds
5. It may translate inaccurately between regional languages and Sanskrit and fail to capture classroom cultural sensitivities.
6. There can be pedagogical alignment as the tools are designed for foreign languages it may not be supportive as Sanskrit pedagogy focuson grammar-translation method
   Textual interpretation, memorization and recitation

7. Students may rely on AI-generated translations avoid deep grammatical analysis, Use AI for assignments without understanding with which it may weaken critical thinking and analytical skills.
8. AI-generated essays or translation make it difficult to assess original student work. and challenge traditional assessment models.
9. Resistance to technology adoption in traditional Sanskrit departments and faculty may not be trained in using AI tools
10. There can be a chance of misrepresentation of traditional knowledge.

II. Conclusion:

Artificial Intelligence has emerged as a transformative force across multiple domains, including education, and its application in Sanskrit teaching and learning presents both remarkable opportunities and serious challenges. AI-driven tools such as Natural Language Processing, machine translation, adaptive learning platforms, and transformer-based models like mBERT and IndicBERT demonstrate significant potential in text classification, pronunciation support, personalised tutoring, curriculum planning, and research assistance. These technologies can enhance accessibility, improve administrative efficiency, and provide customised learning experiences that cater to diverse student needs. Particularly in higher education and research, AI can assist scholars in data organisation, reference identification, and structured analysis of Sanskrit texts.

However, the integration of AI into Sanskrit pedagogy must be approached cautiously. The language's rich morphology, complex grammatical system, sandhi and samāsa structures, free word order, and limited digitised corpora pose technical challenges for accurate computational processing. Furthermore, Sanskrit's philosophical depth and oral traditions—especially Vedic chanting and precise phonetics—require nuanced understanding that current AI systems cannot fully replicate. Pedagogical concerns, academic integrity issues, faculty preparedness, and the risk of superficial learning also demand careful consideration.

Therefore, AI can not replace the traditional guru–śiṣya model but function as a supportive and supplementary tool. A balanced approach that combines technological innovation with linguistic scholarship, ethical awareness, and cultural sensitivity will ensure that AI strengthens rather than dilutes the integrity and authenticity of Sanskrit education.

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