Hindi Shabdamitra: A Wordnet based Tool for Enhancing Teaching-Learning Process

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Abstract

Vocabulary building is fundamental to any language learning and effective communication relies on the mastery of vocabulary. Hindi is one of the widely spoken languages in the world. However, there is a scarcity of quality e-learning resources for Hindi. Also, there is lack of e-learning content which is in-sync with Hindi curriculum. This was the motivation in building educational application, *Hindi Shabdamitra*, for language teaching and learning. Hindi Shabhadamitra is an e-learning tool developed using Hindi wordnet for Hindi language learning. This is an insight of the work reported by Redkar et al. (2017) in which Hindi Shabdamitra enhances the teaching-learning process has been presented. The paper presents the teacher and user benefits of this e-learning tool. Further, the user evaluation information has been reported.

1 Introduction

Hindi language is a member of the Indo-Aryan group of the Indo-European language family[1]. Hindi is the official language of India and is 4th among the most spoken languages in the world[2]. Devanagari script is recommended as the official script for Hindi[3]. Hindi in Devanagari script is a part of most of the school curriculum and covers a large spectrum of learners in India, and around the world. A lot of digital content is available online for learning Hindi. Most of this content is in the form of conversation, stories, poems, games, etc. However, less attention is given to learning of the detailed grammatical and lexico-semantic features. Also, there is a scarcity of digital resources in the e-learning domain, especially in the formal setup or curriculum-based setup.

The rapid change in technology and availability of anytime, anywhere digital resources led to the reduction in the cost of delivering the education to the volume of students. As per Shams and Seitz (2008); Sankey et al. (2010), e-learning enhances the performance of the students due to its multi-sensory impact on education. As per Nation and Newton (1997); Lin (1997); Carter (1987), vocabulary teaching and learning should be done in a systematic and structured manner.

Vocabulary learning is considered to be a central activity for any language learning process (Alqahtani et al., 2015). Also, learning grammar is important to understand the syntax and semantics of the word usage. Knowledge of vocabulary is one of the primary reasons for learner's ability and confidence to communicate. Various languages learning strategies like repetition, context, usage and visual correlation were tested by language experts for enhancing the vocabulary (Atasheneh and Naeimi, 2015; Butler et al., 2010).

The multi-modal learning environments have been studied in different settings (Dale, 1969; Mayer and Moreno, 2003; Moreno and Mayer, 2007; Shams and Seitz, 2008; Sankey et al., 2010) which shows its positive impact on learners and always result in better learning and retention. Methods like self-directed technology (Lai et al., 2016), mobile assisted language learning (Yang, 2013) and gamification has arrived as an effective pedagogical strategies. These strategies help the learner to engage and motivate to learn in a relaxed manner (Werbach and Hunter, 2012; Figueroa Flores, 2015). Lexical and semantic relations of words help in better understanding of vocabulary (Lin, 1997).

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[1]urlhttps://www.britannica.com/topic/Hindi-language
[2]urlhttps://www.babbel.com/en/magazine/the-10-most-spoken-languages-in-the-world
[3]urlhttp://www.constitution.org/cons/india/p17343.html

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The Princeton WordNet[4] or WordNet, have been explored by Hu et al. (1998); Sun et al. (2011); Brumbaugh (2015); Hiray (2015) for vocabulary learning and other related language learning applications.

Keeping vocabulary and grammar learning as pivotal to language learning, an e-learning tool, *Hindi Shabdamitra*, has been developed based on Hindi Wordnet[5] (Redkar et al., 2017). This paper presents an insight of the features and enhancements in the teaching-learning process using Hindi Shabdamitra.

The rest of the paper is organized as follows - section 2 presents Hindi Shabdamitra, section 3 explains the functional and unique features of Hindi Shabdamitra and the comparative study, section 4 provides enhancements in teaching-learning and the benefits of end-users, section 5 describes the user evaluation and field response. Finally, in section 6 the paper is concluded with the scope for future work.

2   Hindi Shabdamitra

Hindi Shabdamitra (हिंदी शब्दमित्र, *hiMdI shabdamitra*)[6] is a digital aid designed for assisting in teaching and learning Hindi language (Redkar et al., 2017). The end users of this e-learning tool are students, teachers, parents and self-learners. It is developed for formal teaching-learning environment as well as informal learning environment. The formal setup is designed in correlation with school curriculum. Self-learners, organizations, NGOs, NRIs, *etc.*, belong to the informal learning environment. It uses Hindi Wordnet as a base resource that has been remodeled for this aid by incorporating the multi-modal features. Further, the concepts are grammatically enriched and simplified depending upon the understanding level of the learner.

A team of lexicographers, illustrators and native language speakers has contributed to build this multi-modal resource which has formed the base of Hindi Shabdamitra. The tool has an online web-based and app-based interface for wider reachability. Also, this tool can be made available offline for anytime, anywhere learning. The interface allows the search navigation in two ways – level wise (हिंदी ज्ञान स्तर के अनुसार, *hiMdii GYaana stara ke*

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[4]https://wordnet.princeton.edu/
[5]http://www.cfilt.iitb.ac.in/wordnet/webhwn/
[6]http://www.cfilt.iitb.ac.in/hindishabdamitra/

Figure 1: Features of a word पात (*pAta*, leaf) for Class 8, lesson 1 in class-wise search interface
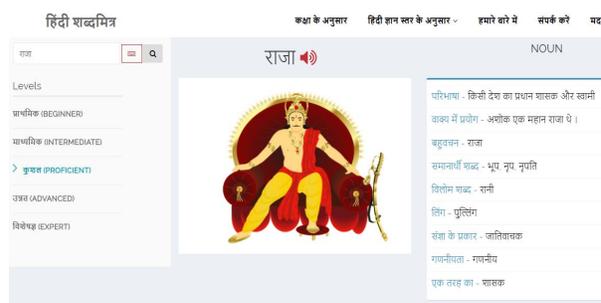

Figure 2: Features of a word राजा (*rAjA*, a king) for proficient level in level-wise search interface

anusaara) and class wise (कक्षा के अनुसार, *kaxaa ke anusaara*). This can be seen in figure 1 and 2.

Layered Interface

Hindi Shabdamitra interface has a layered architecture. Depending on the proficiency of the learner, the layers have been designed for learners, scaling from the beginner to the proficient. The level of a leaner is determined by using the class-wise proficiency selection criteria as shown in table 1.

The same word can be studied by the learners at all 5 levels. At each level, incremental information is displayed. The depth of content displayed vary from level to level. The detailed layer-wise list of features have been provided in the next section.

Layer	Level	Class
Layer 1	Beginner (प्राथमिक)	1 and 2
Layer 2	Intermediate (माध्यमिक)	3, 4 and 5
Layer 3	Proficient (कुशल)	6, 7, 8, 9 and 10
Layer 4	Advanced (उन्नत)	11 and 12
Layer 5	Proficient (विशेषज्ञ)	Above 12

Table 1: Proficiency selection criteria for Hindi Shabdamitra

3 Features of Hindi Shabdamitra

Hindi Shabdamitra provides functional features and unique features for the learners. These features help learners in clearly understanding the concept. Also, it aids the teachers and parents to explain the concept in detail. The list of features with respect to the classes and levels is given in table 2. Following are the detailed description of functional and unique features of Hindi Shabdamitra. These features are explained with the help of Matthews (2007), Oxford dictionaries[7], Online dictionary for language technology[8], Cambridge dictionary[9], Hindi Wordnet[10], *etc.*

Functional Features

The functional features are most commonly found in regular dictionaries or thesauri. These features are available for all the levels.

1. **Part of Speech (POS)**: Hindi Shabdamitra has content based on the part of speech *viz.*, noun, adjective, verb and adverb, as it is based on the original resource, Hindi Wordnet.

   - **Noun / संज्ञा (*saMGYaa*)** : One of the classes of words whose characteristic role is as an argument of a verb and which is characteristically that of words denoting concrete entities (Matthews, 2007). Nouns are known as संज्ञा (*saMGYaa*) in Hindi. Just like nouns in English, संज्ञा (*saMGYaa*) is also a names of people, places, things and ideas. For example:
     - कमला (*kamalaa*, name of a lady)
     - दिल्ली (*dillii*, the capital city of India)
     - मिठास (*miThaasa*, sweetness)
     - गणित (*gaNita*, mathematics)

   - **Adjective / विशेषण (*visheShaNa*)** : A word of class whose most characteristic role is as the modifier of a noun. Adjectives are known as विशेषण (*visheShaNa*) in Hindi. For example:
     - चतुर (*chatura*, clever)
     - काला (*kaalaa* , black)
     - लम्बा (*lambaa*, tall)

#	Features	Levels 1	2	3	4	5
	Classes	1, 2	3, 4, 5	6 to 10	11, 12	12+
	Features					
1	POS	Yes	Yes	Yes	Yes	Yes
2	Multiple Senses/Polysemy	Yes	Yes	Yes	Yes	Yes
3	Audio Pronunciation	Yes	Yes	Yes	Yes	Yes
4	Illustration/Picture	Yes	Yes	No	No	No
5 (a)	Simplified gloss & example	Yes	Yes	No	No	No
5 (b)	Original gloss & example	No	No	Yes	Yes	Yes
6	Gender	No	Yes	Yes	Yes	Yes
7	Synonym	Yes	Yes	Yes	Yes	Yes
8	Antonym	Yes	Yes	Yes	Yes	Yes
9	Number	No	Yes	Yes	Yes	Yes
10	Countability	No	Yes	Yes	Yes	Yes
11	Affix	No	No	Yes	Yes	Yes
12	Junction	No	No	Yes	Yes	Yes
13	Kinds of POS	No	No	Yes	Yes	Yes
14	Indeclinable	No	No	Yes	Yes	Yes
15	Spelling Variation	No	Yes	Yes	Yes	Yes
16	Transitivity	No	No	Yes	Yes	Yes
17	Hypernymy/Is Kind Of	No	No	Yes	Yes	Yes
18	Hyponymy/Type Of	No	No	Yes	Yes	Yes
19	Meronymy	No	No	No	Yes	Yes
20	Holonymy	No	No	No	Yes	Yes
21	Modifies Verb	No	No	No	Yes	Yes
22	Modifies Noun	No	No	No	Yes	Yes
23	Troponymy	No	No	No	No	Yes
24	Causative	No	No	No	No	Yes
24	Entailment	No	No	No	No	Yes
25	Link Type	No	No	No	No	Yes
26	Attribute	No	No	No	No	Yes

Table 2: Class-wise and level-wise features of Hindi Shabdamitra

   - छोटा (*ChoTaa*, small, young)

   - **Verb / क्रिया (*kriyaa*)** : One of a class of lexical units whose characteristic syntactic role is as a predicate or predicator and which is characteristically that of words denoting actions or processes. The verb, specifically the action verb, is known as क्रिया (*kriyaa*) in the Hindi language. For example:
     - खाता है (*khaataa hai*, eats)
     - पीता है (*piitaa hai*, drinks)
     - जाता है (*jaataa hai*, goes)
     - खेलता है (*khelataa*, plays)

   Note that the verbs given in the example are for singular masculine subjects. For feminine gender and singular number, the verbs are conjugated as खाती है (*khAtI hai*), पीती है (*pItI hai*) and जाती है (*jAtI hai*). The plurals of the verbs for both the genders are खाते हैं (*khAte haiM*), जाते हैं (*jAte haiM*) and पीते हैं (*pIte haiM*).

- **Adverb / क्रियाविशेषण (*kriyaavisheSha-Na*)** : A word of class whose most characteristic role is traditionally that of modifying a verb or verb phrase. For example:
  - धीरे (*dhiire*, slowly)
  - जल्दी (*jaldii*, fast)
  - पास) (*paasa*, near)
  - आज) (*aaja*, today)

2. **Multiple Senses/Polysemy** : Polysemy refers to the situation where the same word has two or more different meanings. In level-wise interface of Hindi Shabdamitra polysemy is provided where a user can click on the next button to get the another meaning of same word, if available. However, in class-wise interface there is only one word meaning, as it corresponds to the meaning with the textbooks.

3. **Audio pronunciation** : The audio pronunciations are recorded by the native Hindi speakers, as to promote 'Standard Hindi'. Hindi Shabdamitra is provided with the audio of the search-word.

4. **Illustration (Image / Picture)** : Illustrations are drawn, keeping in the mind Indian context. Illustrations are targeted to the learners of level 1 and level 2 of the Hindi Shabdamitra. Following are the things taken into consideration while illustrating a concept:

   - Omitting the sensitive context, *e.g.*, शव (*shava*, a dead body). As it may cause adverse effect on the kid, such illustrations are omitted or expressed in a different way.
   - Overlapping: If an illustration is drawn for पूजा करना (*pUjA karanA*, to worship), it overlaps with आरती करना (*AratI karanA*, do ritual) as well. Such instances are avoided.
   - One illustration for multiple concepts: The illustration for बड़ा (*baDaA, big*) has its counterpart *i.e.*, छोटा (*ChoTA*, small). Here, for these concepts single illustration can be used.
   - Abstract nouns: Abstract nouns are illustrated with the base of provided example or a specific situation. For *e.g.*,

Figure 3: Illustration of a word साथ (*saatha*)
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साथ (*saatha*, company). A sample illustration of an abstract noun साथ is shown in figure 3.

5. **Gloss or Definition** :
   The concept is defined by providing gloss or definition of a word. Gloss is usually picked from Hindi wordnet, however, it is simplified in special cases.

   (a) **Simplified Gloss and Example**: Hindi Shabdamitra has provided simplified gloss for level 1 and 2, *i.e.* for class 1 to 5. The gloss and example sentence from original Hindi Wordnet is further simplified by providing the simple words in the definition so that the students at these levels can easily pick-up and learn concept comfortably.

   If Hindi Wordnet gloss is completely or partly difficult to understand then it is simplified. For example, for a concept नदी (*nadI*, river) having IndoWordNet[11] Synset id 4430, the original Hindi Wordnet gloss is जल का वह प्राकृतिक प्रवाह जो किसी पर्वत से निकलकर निश्चित मार्ग से होता हुआ समुद्र या किसी दूसरे बड़े जल प्रवाह में गिरता है (*jala kA vaha prAkRRitika pravAha jo kisI parvata se nikalakara nishchita mArga se hotA huA samudra yA kisI dUsare baDae jala pravAha meM giratA haiM*, a large natural stream of water) (Bhattacharyya, 2010).

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[11]http://www.cfilt.iitb.ac.in/indowordnet/

This concept is difficult to understand by a level 1 and 2 learners, hence this gloss is simplified as पर्वत से निकलकर अपने आप बहती हुई पानी की धारा (*parvata se nikalakara apane Apa bahatI huI pAnI kI dhArA*, river). Similarly, original Hindi Wordnet example sentence, गंगा, यमुना, सरस्वती, सतलुज, कावेरी, सरयू आदि भारत की प्रमुख नदियाँ हैं। (*gaMgA, yamunA, sarasvatI, sataluja, kAverI, sarayU Adi bhArata kI pramukha nadiyAMN haiM*, Ganga, Yamuna, Saraswati, Satluj, Kaveri, Sharayu, *etc.* are India's major rivers) is simplified to "गंगा, यमुना बड़ी नदियाँ हैं। (*gaMgA, yamunA baDaI nadiyAMN haiM*, Ganga, Yamuna are major rivers).

(b) **Original Hindi Gloss** : If Hindi Wordnet gloss is easy to understand, it was kept as it is for level 1 and 2. For *e.g.*, for a concept पैदल (synset Id: 6274), Hindi Wordnet gloss is पैरों से चलकर (*pairoM se chalakara*, afoot) and Hindi Wordnet example is वह विद्यालय पैदल जाता है। (*vaha vidyAlaya paidala jAtA hai*, he is going to the school afoot). For levels 3, 4 and 5, the original gloss is kept as it is, as at these levels, learners will understand the concepts by reading the original Hindi Wordnet gloss and examples, hence it is not simplified further.

6. **Gender / लिंग (*liMga*)** : Grammatical category dividing nouns into classes basically characterizable by reference to sex. In Hindi, there are two genders:

   - **Masculine / पुल्लिंग (*pulliMga*)**: nouns denoting males.
   - **Feminine / स्त्रीलिंग (*strIliMga*)**: nouns denoting females.

7. **Synonym / समानार्थी शब्द (*samAnArthI shabda*)** : Two lexical units with a shared meaning. A synonym is a word or phrase that means exactly or nearly the same as another word or phrase in the same language. Words that are synonyms are said to be synonymous, and the state of being a synonym is called synonymy. For example, मित्र (*mitra*, friend) and दोस्त (*dosta*, friend) are synonyms.

8. **Antonym / विलोम शब्द (*viloma shabda*)** : Words that have opposite meaning. In lexical semantics, opposites are words lying in an inherently incompatible binary relationship, like the opposite pairs बड़ा (*badaa*, big) - छोटा (*ChoTaa*, small).

9. **Number / वचन (*vachana*)** : Inflectional category basically distinguishing reference to one individual from reference to more than one.

   - **Singular / एकवचन (*ekavachana*)**: Term in the category of number, at least one of whose roles is in referring to one individual as opposed to more than one.
   - **Plural / बहुवचन (*bahuvachana*)**: Term in the category of number, referring to more than one, or more than some small number of individuals.

10. **Countability / गणनीयता (*gaNanIyatA*)** :

    - **Countable / गणनीय (*gaNanIya*)**: A noun whose syntax is that of ones denoting individuals that can be counted.
    - **Uncountable / अगणनीय (*agaNanIya*)**: A noun whose syntax is characteristic of a class whose members do not denote individuals that can be counted.

Unique Features

These features provide the deeper grammatical information, *i.e.*, lexico-semantic relations. These are not commonly found in regular dictionaries or thesauri. These features are made available from level 3.

11. **Affix** : Any element in the morphological structure of a word other than a root.

    - **Prefix / उपसर्ग (*upasarga*)**: An affix which comes before the form to which it is joined.
    - **Suffix / प्रत्यय (*pratyaya*)**: An affix that comes after the form to which it is added.
    - **Root word / मूल शब्द (*mUla shabda*)**: A form from which words or parts of words are derived and which is not itself derivable from any smaller or simpler form.

12. **Junction / संधि (*saMdhi*)** : Ancient Indian term for the modification and fusion of sounds at or across the boundaries of grammatical units. The major are स्वर (*svara*, vowel), व्यंजन (*vyaMjana*, consonant) and विसर्ग (*visarga*).

13. **Kind of POS**

Kind of Noun / संज्ञा के प्रकार (*saMjñA ke prakAra*) :

- **Proper noun /** व्यक्तिवाचक संज्ञा (*vyaktivAchaka saMjñA*) : It is a name that identifies a particular person, place, or thing. These nouns refer to something particular. For example, writeHi (*govA*, Goa) and शिवाजी (*shivAjI*, Shivaji) are proper nouns.

- **Common noun /** जातिवाचक संज्ञा (*jAtivAchaka saMjñA*) : Common Nouns are words used to describe similar items or a class of things. For example, a person who studies is a student, a person who practices medicine as a profession is a doctor. किताबें (*kitAbeM*, books), आदमी (*AdamI*, man), दोस्त (*dosta*, friend), and लड़की (*laDakI*, girl) are common nouns.

- **Abstract Noun /** भाववाचक संज्ञा (*bhAvavAchaka saMjñA*) : It is a noun which refers to ideas, qualities, and conditions - things that cannot be seen or touched and things which have no physical reality. सत्य (*satya*, truth), बहादुरी (*bahAdurI*, bravery), खुशी (*khushI*, happiness) are examples of abstract nouns.

- **Collective Noun /** समूहवाचक संज्ञा (*samUhavAchaka saMjñA*) : It refers to groups of people or things. Names are given to a collection of persons or things are known as समूहवाचक संज्ञा (*samUhavAchaka saMjñA*). These words are used to refer to the whole group as one. Examples are सेना (*senA*, army), सभा (*sabhA*, assembly), परिवार (*parivaar*, family) are examples of collective nouns in Hindi.

Kind of Adjective / विशेषण के प्रकार (*visheShaNa ke prakAra*) :

- **Qualitative /** गुणवाचक (*guNavAchaka*) : Describes the qualities of a person or thing. Examples are अच्छा(*achChA*, good, nice), लम्बा (*lambA*, Long), बाहरी (*bAharI*, outsider), लाल (*lAla*, red), *etc.*

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- **Numeral /** संख्यावाचक (*saMkhyAvAchaka*) : Denotes number of person or things. Examples are दो (*do*, two), कई (*kaI*, many), थोड़े (*thoDae*, few), *etc.*

- **Quantitative /** परिमाणवाचक (*parimANavAchaka*) : denotes the amount or quantity. Examples are दो किलो (*do kilo*, two kilograms), ज्यादा (*jyaadA*, Plenty, More), *etc.*

- **Pronominal /** सार्वनामिक (*sArvanAmika*) : A pronoun that is being used as an adjective to modify a noun or another pronoun. Examples are मेरी पुस्तक (*merI pustaka*, my book), किसका काम (*kisakA kAma*, whose work), आपका सामान (*ApakA sAmAna*, your stuff).

Kind of Verb / क्रिया के प्रकार (*kriyaa ke prakaara*) :

- **Simple verb /** सरल क्रिया (*sarala kriyaa*) : In Hindi, there are some verbs that are composed of single word. These verbs are called simple verbs. For example, पूछना (*puuChanaa*, to ask), होना (*honaa*, to be), *etc.*

- **Conjunct verb /** संयुक्त क्रिया (*saMyukta kriyaa*): It has different combinations of more than one POS categories, *viz.*, Noun + Verb, Adjective + Verb. A conjunct verb is formed by joining either a noun or an adjective with a verb. For example, वह साफ़ करती है (*vaha saapha karatii hai*, she cleans).

- **Compound verb /** यौगिक क्रिया (*yaugika kriyaa*): It has Verb + Verb combination, where one verb is semantically contented and the other verb acts as a modifier. For example, ले जाना (*le jaanaa*, to carry away), *etc.*

- **Causative verb /** प्रेरणार्थक क्रिया (*preraNaarthaka kriyaa*): Causative verb denotes an action which is not directly performed by the subject but indirectly through some other agent. These are verbs which end in "वाना" (*vaanaa*) and

"आना" (*aanaa*). Example are, करवाना (*karavaanaa*, to cause to do) and कराना (*karaanaa*, to cause to do).

Kind of Adverb / क्रिया विशेषण के प्रकार (*kriyA visheShaNa ke prakAra*) :

- **Manner /** रीतिवाचक (*rItivAchaka*) : Manner adverbs tell us about the way something happens or is done. For example:ध्यानपूर्वक (*dhyAnapUrvaka*, carefully).
- **Place /** स्थानवाचक (*sthAnavAchaka*) : Place adverbs tell us about where something happens or where something is. For example: ऊपर (*Upara*, above).
- **Time /** कालवाचक (*kAlavAchaka*) : Time adverbs tell us about when something happens. For Example : अभी (*abhI*, now).
- **Quantity /** परिमाणवाचक (*parimANavAchaka*) : Quantity adverbs modify the quantity or intensity of an adjective or verb. For example : बिल्कुल (*bilkula*, surely, totally).

14. **Indeclinable /** अव्यय (*avyaya*) : A form which does not have a distinct inflections. For example पश्चात (*paSHchaat*, subsequently).

15. **Spelling variation /** शब्द−विन्यास विविधता (*shabda-vinyAsa vividhatA*) : Words which are having variation in their spellings. For example नज़र (*najara*, vision) and नजर (*najara*, vision) has spelling variations.

16. **Transitivity /** संक्रामिता (*saMkrAmitA*) :

- **Transitive /** सकर्मक (*sakarmaka*) : Construction in which a verb is related to at least two nouns or their equivalent, whose semantic roles are characteristically those of an agent and a patient. For example खाना (khaanaa, to eat).
- **Intransitive /** अकर्मक (*akarmaka*) : A construction in which a verb is related to a single noun or its equivalent. For example सोना (sonaa, to sleep).

17. **Hypernymy (is a kind of) /** एक तरह का (*eka taraha kA*) : A semantic relation between two synsets to capture super-set hood. For example, hypernymy of आम (*aama*, mango) is फल (*phala*, fruit).

18. **Hyponymy (type of) /** प्रकार (*prakAra*) : A semantic relation between two synsets to capture sub-set hood. For example, hyponymy of आम (*aama*, mango) is दशहरी (*dashaharii*, Dashahari).

19. **Meronymy (part of) /** का हिस्सा (*kA hissA*) : Relation between lexical units where the objects, *etc.*, denoted by one are parts of those denoted by other. For example, meronymy of आम (*aama*, mango) is गुठली (*guThalii*, seed).

20. **Holonymy (whole of) /** अंगिवाची (*aMgivAchI*) : A semantic relation that holds between a whole and its parts. For example, Holonymy of गुठली (*guThalii*, seed) is आम (*aama*, mango).

21. **Modifies Verb /** अर्थ−संकुचन क्रिया (*artha-saMkuchana kriyaa*) : Certain adverbs can only go with certain verbs. Modifies Verb is a relation to show connection between such words. For example बाद (*baad*, beyond) modifies verbs होना (*honaa*, to be) and काम करना (*kaam karanaa* , to work).

22. **Modifies Noun /** अर्थ−संकुचन संज्ञा (*artha-saMkuchana saMGYaa*) : Certain adjectives can only modify certain nouns. For example अधिक (*adhika*, much) modifies nouns वस्तु (*vastu*, thing), जीव (*jiiva*, being), *etc.*

23. **Troponymy /** प्रकारवाची (*prakaaravaachii*) : Troponym denotes a specific manner elaboration of another verb. It shows manner of an action, *i.e.*, X is a troponym of Y if to X is to Y in some manner. For example, मुस्कुराना (*muskuraanaa*, to smile) is a troponym of हँसना (*hansnaa*, to laugh).

24. **Causative /** प्रेरणार्थक क्रिया (*preraNaarthaka kriyaa*) : The Causative relation links the causative verbs with the base verbs and show interdependency between them. For example, खाना (*khaanaa*, to eat) has causative verb खिलाना (*khilaanaa*, to make someone eat).

25. **Entailment /** अपरिहार्यतावाची (*aparihaaryataavaachii*) : Entailment refers to a relationship between two verbs. Any verb A entails B, if the truth of B follows logically from the truth of A. The relation of entailment is unilateral, *i.e.*, it is one way relation. For example, खर्राटा लेना (*kharraaTaa lenaa*, to snore) entails सोना (*sonaa*, to sleep).

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26. **Link Type** : This has major three links as followed:

   - **Ability Link** आन्तर−योग्यता निर्देशी क्रिया (*aantara-yogyataa nirdeshii kriyaa*) : This link specifies the inherited features of a nominal concept. For example मछली (*maCHlii*, fish) has ability link to तैरना (*tairnaa*, to swim).

   - **Capability Link** बाह्य−योग्यता निर्देशी क्रिया (*baahya-yogyataa nirdeshii kriyaa*) : This link specifies the acquired features of a nominal concept. For example व्यक्ति (*vyakti*, person) has capability link to तैरना (*tairnaa*, to swim).

   - **Function Link** क्रम निर्देशी क्रिया (*krama nirdeshii kriyaa*) : This link specifies the function of a nominal concept. For example शिक्षक (*shikshak*, teacher) has functional link to पढ़ाना (*paRhaanaa*, to teach).

27. **Attribute** गुणवाची (*guNavaachii*) : This denotes the properties of noun. It is a linkage between noun and an adjective. For example, पक्षी (*pakshii*, bird) has an attribute पंखदार (*pankhdaar*, having wings).

3.1 A Comparative Study

A study of current digital resources used by various educational institution was done as a part of the background study. The outcome showed a big gap of quality resources which can cover aspects of language learning *viz.* grammar, concepts, usage and pronunciations in an effective manner; and which are based on the curriculum.

Some of the applications for language learning which offer Hindi learning are Duolingo[12], Hindipod[13], Rocket Language[14], Italki[15], *etc.* Some applications made specifically for children are dinolingo[16] , akhlesh[17], galligallisimsim[18], *etc.* Other online resources for Hindi language learning are bilingual dictionaries which provide only the meanings of the words, such as Shabdkosh[19],

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[12]https://www.duolingo.com/
[13]https://www.hindipod101.com/
[14]https://www.rocketlanguages.com
[15]https://www.italki.com
[16]https://dinolingo.com
[17]http://www.akhlesh.com/
[18]http://www.galligallisimsim.com/
[19]www.shabdkosh.com/

Collins dictionary[20], *etc*.

The common factor among all the above resources is their inability of customization for formal school setups. They are more focused on individual learning (Redkar et al., 2017).

Advantages of Hindi Shabdamitra over the above e-learning tools:

- Hindi Shabdamitra provides an insight about deep grammatical features of a word/concept.

- It caters to school teachers, students and parents by providing the curriculum based vocabulary.

- It is based on a lexically rich resource, Hindi Wordnet, whose features like lexico-semantic and ontological relations provide much more information.

- It provides both, systematic learning as well as random learning approaches.

4 Enhancing Teaching-Learning Process

According to (Dike, 1989), audio-visual resources do not only increase the motivation of the teachers and learners, they add clarity to the topic taught and make learning more interesting. The impact of new technologies in educational contexts has been mostly positive as new technologies have given educators the opportunity to enhance their knowledge, skills, and therefore enhance the standard of education. Researchers have found that student engagement, achievement and motivation are enhanced through integration of such technologies.

Hindi Shabdamitra facilitates learning with the help of illustrations and pronunciation for multi-sensory impact. This tool can assist the teachers in better classroom management and make learning Hindi an interesting activity (Redkar et al., 2017).

Learning Benefits

With the help of audio-visual methods for learning, small children learn easily and effortlessly. Hence, for the initial phases, in Hindi Shabdamitra, concepts are pictorially depicted by providing illustrations for level 1 and 2, as to understand a concept easily. Most of the illustrations are simple and convey the exact information.

Also, the words are provided with the audio pronunciation. These words are recorded by native

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[20]https://www.collinsdictionary.com

speakers of the language. The best thing about having audio pronunciation is that the teacher can play it multiple times, until the student understands it properly. Another advantage is that the audio reaches to the entire classroom, *i.e.,* till the last bench.

Hindi Shabdamitra promotes following aspects with the help of audio-visual aids for learning:

- **Experiential Learning:**
  Digital learning redefines the boundaries of a classroom. Sitting in a class, the students experience the application of a concept through dynamic content [21]

- **Flipped Classroom approach:**
  The reversal of traditional teaching which provides active learning. Students are accustomed to interacting with audio and video on electronic devices, so it stands to reason that they would digest educational content in this manner as well[22].

Teaching benefits

- **Validation**:
  Words and their respective illustrations and audio pronunciations give an advantage to the teacher to validate whether the students understood the entire concept or not. S/he is able to present the image and audio multiple times for the clarity of the concept.

- **Sharing the burden**:
  It is certainly difficult for a teacher to provide the meaning of every word. Since Hindi Shabdamitra is focused on vocabulary learning, the teacher has an aid. Whenever a student has a doubt about a specific word s/he can simply search the word. The tool will share the burden of the teacher.

- **Effectiveness as an aid**:
  The teaching profession is filled with countless opportunities to enrich the academic lives of students, while some concepts and educational objectives will be easy for students to grasp, other will require you to think creatively to ensure that important learning objectives are met. Using audiovisual aids in teaching is one way to enhance lesson plans and give students additional ways to process subject information (Kunari, 2006).

5 Field Trial and User Response

As a part of testing the tool, the field trial of Hindi Shabdamitra interface was done at some schools with students & teachers' participation in the exercise. Also, an online survey was conducted. The feedback was sought for the content, ease of handling the application, classroom impact and overall experience by teachers and students. Following are the summarized observations:

- Hindi Shabdamitra helped teachers in explaining concepts clearly with the help of illustrations and simplified concepts.

- The aid assisted the teacher in better classroom management

- Reduced effort of reiterating the concepts for better retention.

- Audio clips helped in understanding the pronunciation of a given word.

- Having the standardized pronunciation by the native Hindi speaker.

The application has been improved based on the feedback received by students and teachers.

6 Conclusion and Future Work

The paper presents an insight of a Hindi Shabdamitra, an e-learning tool for teaching and learning Hindi language by Redkar et al. (2017). A comparative study of the existing technologies with Hindi Shabdamitra was done where it is found to have much more features. The field trial and survey was conducted with which the observations and student & teacher benefits have been reported here. This tool definitely enhances the teaching-learning experience and has an exhaustive feature list which is not there in many of the other e-learning products. It caters to a wide range of audience and is available in both web-based and app-based formats.

In future, the authors intend to record the learning process of student, provide a teaching-learning process flow, an interactive assessment module for evaluations and other game based assessment modules for fun learning.

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[21]`https://www.academia.edu/33866288/DIGITAL_CLASSROOMS_A_BOON_FOR_ACHIEVING_QUALITY_EDUCATION_IN_INDIA`

[22]`https://www.academia.edu/16071067/Effects_of_Flipped_Classroom`

Acknowledgements

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