

# Science Worksheets for Children in regional languages – A Translator’s Perspective

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## Abstract

STI Policy aims to bring about a national level science movement for popularising science among students and inculcating interest among the masses. This policy outlines strategies to mainstream science communication and public engagement through capacity building avenues, research initiatives and outreach platforms. In order to achieve this and to popularize science amongst students and the general public, reaching them in their regional languages is imperative. Science communication is an art of conveying content to the public, importantly building their trust on science, technology and innovation. Especially in a multi-linguistic country like ours, the challenges to make STI reach everyone, needs futuristic vision with careful planning and execution. In this article, the authors discuss various aspects and their observations from their experience translating science worksheets to Tamil for children. This paper also discusses the issues where a translator needs to be cautious about the dialects and age-appropriate vocabulary, more so while translating to reach children.

**Keywords:** Science Communication, Translation, Tamil, Science vocabulary, STIP

## 1. Introduction

To maximize the number of people that participate in and contribute to the scientific discussions and processes in the country, there is a need to address across Indian languages and develop scientific literature. “India has an impressive scientific heritage. Scientific research — in fields such as mathematics, astronomy, medicine and material science — has been carried out in the Indian subcontinent since ancient times. However, a remarkable gap has persisted between this scientific knowledge and the ‘common’ man and woman and until recently almost no effort has been made to bridge this gap”, says Manoj Patariya (2003). Indian Print Media covers anywhere less than 5 percent of science and technology in its entire news/article coverage in a study comparing science coverage in Hindi and English newspapers of India (Meenu Kumar 2013). This becomes even more poor when it comes to regional print media and the scenario has not changed much in the last decade. Many a time, news reporters find that scientific vocabulary is limited, while reporting scientific inventions or even activities, conferences, seminars related to S&T. Sometimes in regional languages during translation the crux gets diluted, diverted or lost sometimes. This is one reason why S&T vocabulary must be enriched as we evolve.

## 2. Why science in regional languages?

Mass science education in our country still faces many challenges due to different factors including large population, plethora of languages and limitations in infrastructure. As per 2011 Census of India, the number of Scheduled languages in our country is twenty two. There are 270 identifiable mother tongues which have returned 10,000 or more speakers each at the all-India level, comprising 123 mother tongues grouped under the Scheduled Languages (Part A) and 147 mother tongues grouped under the Non-Scheduled languages (Part B). ([https://censusindia.gov.in/2011Census/C-16\\_25062018\\_NEW.pdf](https://censusindia.gov.in/2011Census/C-16_25062018_NEW.pdf))

“Science communication or science popularisation entails taking science, its discoveries to lay public who are non-scientists” (Davis 2010). In a country with such diversity in language, communicating science atleast in major languages and in all the scheduled languages is needed for building scientific temper to create a knowledge society.

English is now used almost exclusively as the language of science (David Drubin; 2010). At the same time, usage of English as the universal scientific language creates distinct challenges for those who are not native speakers of English. With fast growth in STEM, this becomes much more challenging for the learners and the public to understand the revolutions happening in S&T, if English is the only language in which science communication is available.

In the beginning of the twentieth century, the great Tamil poet Subramania Bharathiyar stressed the importance of translating works from across the globe to Tamil and then creating new works to enrich the language.

*Piranaattu Nallaringar Satthirangal*  
*Thamizh mozhiyil Paerththal Vendum*  
*Iravaatha Pugazhudaiya Pudhunoolgal*  
*Thamizh mozhiyil Iyattral Vendum*

Following this strategy seems very apt, translating already available peer-reviewed and authentic works in regional languages is the first step to build content and concepts in any given regional language. Next step is to create scientific and technical vocabulary continuously, propagate it among scientists, academicians, littérateur, journalists and the public to build original works of STEM in those languages.

### **3. Shift in Knowledge Transfer (KT) perspective during pandemic**

“By the early 19th century, just three—French, English, and German—accounted for the bulk of scientists’ communication and published research; by the second half of the 20th century, only English remained dominant as the U.S. strengthened its place in the world, and its influence in the global scientific community has continued to increase ever since” (Adam Huttner-Koros 2015). The scientific vocabularies of many languages have failed to keep pace with new developments and discoveries. Once this happens, such languages cease to become effective means of communication. Building scientific or technical vocabulary is a massive

task. More so, the next step of taking it to the public needs a lot of planning, execution, funding over a long period of time.

“In non-native English speaking (NNES) countries where English is the second language, students frequently use translation tools to read articles in their native language, to present a seminar , or to write a dissertation, rather than reading manuscripts in their original English” as observed by Camilla H. Coelho et al (2019). “Although there are exceptions such as former British colonies in India or Africa, for example, in low- and middle-income countries (LMICs), reading and comprehending an article in English is often not an option due to inadequate resources or education” (Flowerdew J 2008, 77-86; Kam M 2007, 1097-1106). “English classes in public schools in LMICs can be poorly taught” (Nunan D 2003, 589-613; Reay D 2006, 288-307), “and while some level of English is required for admission to the majority of graduate programs in NNES countries, students are sometimes admitted with only a modest ability to comprehend and converse in English” (Flowerdew J 1999, 243-264). Though science education in colleges is mostly conducted in English this does not ensure a strong technical vocabulary among science graduates. “This is because processing the content of the lectures in a different language required a big energetic investment, and a whole lot more concentration than I am used to in my own language,” said Monseratt Lopez, a McGill University biophysicist originally from Mexico” (Adam Huttner-Koros 2015).

So, it is time the scientific community and science communicators in tandem with linguists, tackle this challenge. This would help the advancements reach public to a better extent which would create equity and equality in S&T. With the recent pandemic the scientific community across the globe has come together to address the issues on war footing. (<https://www.who.int/news-room/feature-stories/detail/global-scientific-community-unites-to-track-progress-on-covid-19-r-d-identifies-new-research-priorities-and-critical-gaps>) This has made knowledge transfer (Francesca Dal Mas 2021, 139-150) not only between different labs but also in different languages possible. Many scientists and academicians and the public too have engaged themselves in science outreach and knowledge translation approaches. (<http://indscicov.in/>) Probably, this is the right time to re-inforce such collaborations and continue this trend of Knowledge Transfer.

In the post-CoVID era, with global and national networks, it is definitely possible to achieve this knowledge transfer. The same networks can be strengthened and tweaked to transfer knowledge in different regional languages. It becomes necessary to devise policies and practices, to invest in strengthening of such existing networks and to create new ones. This will help/ensure the stakeholders to take informed decisions while implementing S&T projects and policies. This would also facilitate non-native English speakers to participate and collaborate with international scientific community and benefit the community.

#### **4. Science communication in STIP**

There exists a disconnect between science and society at large with limited scope for citizen engagement in the STI ecosystem. The scarcity of professional and vibrant science outreach

and education programmes, along with limited science communication systems for addressing language and regional diversity of India hampers the understanding of grassroots issues. The dearth of online and multimedia platforms for reciprocal engagement between scientists and society act as a barrier to taking science to the masses equitably and inclusively. (<https://www.psa.gov.in/stip>) STIP 2020 aims to create develop scientific literature and media across Indian languages and geographies to maximize the number of people that participate in and contribute to the scientific discussions and processes in the country.

## 5. Science communication as dialogue

“Science communication has been telling a story of its own development, repeatedly and almost uniformly, for almost a decade. The story is a straightforward one: Science communication used to be conducted according to a ‘deficit model’, as oneway communication from experts with knowledge to publics without it; it is now carried out on a ‘dialogue model’ that engages publics in two-way communication and draws on their own information and experiences.” (Brian Trench 2008) When the world is shifting from deficit model towards dialogue model and conversation model science communication in Tamil needs to catch up with these at a faster pace. Consistent and continuous efforts are needed for making translation meaningful for the intended audience of different age groups, considering their (knowledge, background, exposure).

## 6. Science popularization as outreach

“Throughout history, there have been attempts to take science to the common people. For example, Vigyan (Science) — a monthly popular science magazine in Hindi — has been published by Vigyan Parishad (a learned society of scientists and academics) since 1915.” (Manoj Patairiya 2003) “The genesis and role of various people science’s movements in our country have been elaborately discussed in the article “Understanding People’s Science Movement in India: From the Vantage of Social Movement Perspective” The basis of PSM in several states has been science communication and science education.” (Pattnaik 2012)

In its endeavour to enhance its outreach in regional languages, (<https://vigyanprasar.gov.in/about-us/renewed-vp-framework/>) Vigyan Prasar has chosen Bengali, Tamil & Marathi in its first phase of the Project Outreach in Indian Languages. As part of pan-India efforts to popularise science and imbue scientific temper in vernacular languages, Centre’s autonomous organisation Vigyan Prasar has launched an initiative in Tamil through ‘*Ariviyal Palagai*’. (<https://vigyanprasar.gov.in/ariviyal-palagai-tamil/>) Through these initiatives seminars, creation of databases, year-long science communication and popularizations have been planned and executed. For the past 18 months various S & T initiatives of the government have been taken to the public in Tamil through this initiative as newsletters published

monthly. The readership has been tremendously increasing for this e-magazine as well as for the various seminars arranged by this forum in Tamil through online platforms.

## **7. Translation of science books**

The inherent purpose is to impart knowledge and skill of different aspects of science communication, besides inculcating a scientific temper into the minds of students, enabling them to eventually spread scientific awareness and scientific temper amongst masses. (Manoj Patairiya 2011) It is not far away, especially with the advent of machine translation, AI and internet age, science journalism courses will be implemented in regional languages to strengthen and create manpower for science communication in local languages.

Science communication research requires locally relevant and culturally-context-specific models for public engagement in regional languages. In order to reach the people effectively we need to communicate using proper dialects. Many times, the content/concept gets misrepresented during loose translations. Hence, the job of translator becomes crucial and critical in taking the content to the masses.

## **8. Science communication in Tamil – challenges in diglossic language**

“Tamil is a South Dravidian language with a long history, dating back more than two millennia. It is one of the 22 scheduled languages of India. It has an official status in the State of Tamil Nadu and the Indian Union Territory of Puducherry, and it is also one of the official languages in Sri Lanka and Singapore. The total number of its speakers is approximately 77 million people, thus it is one of the top twenty most popular languages in the world” (Dubynskiy 2013) “Tamil diglossia involves two language varieties: the formal or H (High) variety that is Literary Tamil, and the spoken or Low (L) variety used in informal conversations, that is Colloquial Tamil. Both varieties complement each other in function, as was described in detail by Francis Britto” [Britto 1986; 2017 revised].

“As of now, Literary Tamil is taught in schools, and it is the language of instruction (except colleges specifically focused on learning English). Tamil textbooks are widely used, though there is no nation-wide program. In higher education in Chennai the situation is more complex: the main language of instruction is English, while only few institutions offer education in Tamil. So, we can say that Literary Tamil is in the process of losing its functions, giving way to English. In addition to it, there is a tendency of penetration of Colloquial speech into traditionally formal spheres: literature, radio, TV programs etc. L. P. Krysin named a similar tendency in Russian “the colloquialisation and jargonisation of the public spheres of communication”” [Smirnitckaya 2018; Krysin 2011: 446].

When we try to build scientific vocabulary by blending the existing words, one also needs to take into account this diglossic nature of the language we are dealing with. In order that science worksheets or textbooks make an impact on school children, a balance has to be struck in choosing the words.

## 8.1. Choosing age-appropriate/context-appropriate language

Here are few examples from our recent work translating science worksheets from Vigyan Prathiba, HBCSE. These have been translated from English to Tamil, targeting the age group belonging to class 8 to 10.

In the learning unit “Rediscover, Describe and Draw Birds” for Class 8 (<https://vigyanpratibha.in/index.php/rediscover-describe-and-draw-birds/>), in the teacher’s version we are presented with this line – “Observational skill in this context would mean the ability to be perceptive about the details of a complex natural environment.” The word complex can be understood and translated in different ways. A direct translation would lead one to translate it as *Sikkalaana* that implies entangled or difficult in Tamil. This may create a negative impression and make a child feel unequipped to handle nature. As the original author here stresses the importance about the intertwined, interlinked, interdependent natural environment, *Pinnipinaintha* which translates to ‘interlinked’ here is a better option in this context.

In the learning unit “Can you Map?” for Class 8 (<https://vigyanpratibha.in/index.php/can-you-map/>), in the teacher’s version of the document under the topic Unit-specific Objectives translation of the following phrase is another good example – “To develop the ability to visualise directions and manipulate them mentally”. A direct translation of the word manipulate using virtual dictionaries gives us words like *kaiyaalvathu*, or *soozhchiyudan kaiyaalvathu*, indicating being manipulative or tricky in the negative connotation. This does not convey the actual intention of the teacher or original authors. Based on the context, the phrase “*Manakanakku seiyyum thiranai mepaduththikolluthal*” which conveys the meaning that this learning activity tries to develop the skills of mental calculation. These instances clearly show the need for context-based translations.

## 8.2. Building collaborative attitude through words

Most of the times we find science textbooks use deficit model or many times have an authoritative tone and sometimes with an expectation of a particular result. This intimidates growing minds usually and alienates them from textbooks. While translating such activity sheets, care needs to be taken that the child or learner does not equate it to another textbook and moves away from it. It is pertinent to connect with young learners that too, especially when helping them learn through STEM activities. A friendly encouraging tone goes a long way in making this possible. Tamil language fortunately has different suffixes to address the readers of different age-groups and with different emotive tones.

In the learning unit ‘Micro-organisms at Our Doorstep’ for Class 8 (<https://vigyanpratibha.in/index.php/microorganisms-at-our-doorstep/>), the students are asked to see around the school ground/backyard and locate some puddles/drainage cover. Here, *paar* which is equivalent to see is a direct word which may sound authoritative and also makes the learner feel isolated. Rather the translators consciously used *Paarungalen*, which



asks the child to observe through an encouraging tone treating her/him as an adult. This word also helps the student to visualize her/him in a team along with a guide teacher. This would definitely make the child feel less anxious about performing the activity, eventually make them feel confident and slowly help them to become team players.

### **8.3. Building vocabulary by blending words**

When English-Tamil dictionary suggests the Tamil meaning of the words schematic to be more close to scheme or project. The schematic diagrams in the worksheet was about diagrammatic representation of flow of process. Hence the translators have coined a word “*Siththarippu – varai – padam*” blending the words which are in common usage in that age group conveying it is a picture representation of the process.

School children are used to the word collage and use it for many of their project works. *Ottu Vadivam/Inaiottu padam* are the two words one can find from (tamilvu) for collage, while the authors tried to form a new word “*Padam + Kalavai = Padakalavai*” using two very commonly used words, that is student friendly and tongue friendly.

### **8.4. Being sensitive about gender and marginalised communities**

The learning unit, ‘An experiment in Measuring Volumes’ for class 8 has an instruction (<https://vigyanpratibha.in/index.php/an-experiment-on-measuring-volume/>) – “The students may be given a hint to first obtain the volume for “n” marbles in this task and then the average volume of one marble.” Many Indian languages address girls and boys with different suffixes. In these translations we have consciously addressed girls to carry out the experiments. Also, we have addressed girls and boys, specifically in that order wherever the word *students* appears in the worksheet. Some instances, the term “*Manavamanaviyarkku*” which address both the genders has been used instead of “*Manavargalukku*” though the latter is considered a gender neutral term generally. This trend will help increase women in STEM if the tone of the books is inclusive.

There is a huge risk involved when one tries to translate by just using dictionaries, before understanding the sentimental implications that it may cause to a group of individuals. Most of the dictionaries may suggest a word in the regional language which may even be in common usage in some households. While the usage may not be age-appropriate or it may be hurtful for certain group of people involved based on their ethnicity/involved in a particular job/physical disabilities. Utmost care has to be taken while translating for children who are going to be the advocates of inclusivity in the near future. “They help in pollination and seed dispersal, control crop pests, are predators to disease spreading animals like rats, and can also be scavengers.” is a sentence in the learning unit “Rediscover, Describe and Draw Birds” for class 8 (<https://vigyanpratibha.in/index.php/rediscover-describe-and-draw-birds/>). The word *scavengers* in this context indicates a certain class of animals based on their habit of consumption. Here, a translator needs to be very sensitive while translating this word as the same word may also indicate a group of people in a derogatory manner. Using tamil translation for such words looking up into dictionaries without being sensitive to its

implications is definitely not a right practice. It is time that we take an audit of such words in various online platforms too and create new words which inculcate sensitivity and inclusivity.

While translating contents in biology on the topics concerned with reproduction, lot of care is needed in creating a positive view along with objectivity, removing the taboos. A translator also needs to be aware of the prior knowledge of the children who would be the readers. In such contexts, it becomes pertinent that a translator uses age-appropriate vocabulary. In the learning unit “Rediscover, Describe and Draw Birds” for Class 8, the list of terms describing bird behaviour includes *courtship*. This word ‘courtship’ has been translated as “*Anbai Velipaduthuthal*”, which literally translates to English again as ways of showing love and affection, as the book targets pre-teens. The above term can also be translated differently while teaching the same topic to slightly older children in highschool or higher secondary.

## Conclusion

We need to address across Indian languages and its diverse geographies, to develop scientific literature and media. A strong base of scientific vocabulary has to be built for various age-groups in order to communicate science effectively. Now is the time to do this to have well-trained translators, mass media communicators in regional languages to achieve STIP goals, which aims to revitalise the science communication ecosystem and promote the reciprocal relationship between science and society by the democratisation of science through upstream engagement and a citizen-centric approach.

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