

Science Worksheets for Children in Regional Languages: A Translator's Perspective

UTHRA DORAIRAJAN &
MANIKANDAN SAMBASIVAM

Abstract

The STI Policy (Science, Technology and Innovation 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 popularise science amongst students and the general public, reaching them in their regional languages is imperative. Science communication is the art of conveying content to the public, importantly building their trust in science, technology and innovation. Especially in a multilingual country like ours, the challenges to make STI reach everyone needs a futuristic vision with careful planning and execution. In this article, the authors discuss various aspects and their observations from their experience in translating science worksheets into 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

The scientific heritage of India is an impressive one. From ancient times, scientific research has been carried out in the Indian subcontinent in various fields such as mathematics, astronomy, medicine and materials science. Despite that, there

is a great gap in scientific knowledge reaching the common masses. In this paper, we try to analyse the reason for this and the need for the evolution of suitable scientific vocabulary in regional languages with time. In a study comparing science coverage in Hindi and English newspapers of India, Meenu Kumar (2013) indicates that Indian Print Media covers anywhere less than 5 percent of science and technology in its entire news/article coverage. From our experience, we find this even poorer 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. Review of Literature

It is important to maximize the number of people that participate in and contribute to the scientific discussions and processes in the country. A remarkable gap has persisted between this scientific knowledge and the 'common' public. Manoj Patariya has discussed various challenges in science communication in India and its future in his article (2003). Unfortunately, many of these challenges still exist, though we have come a long way thanks to digital technology and due to the continuous efforts of science policymakers. The reasons for this gap are multi-pronged and are common in many of the colonies which were used by the West as a supplier of resources and manpower mainly after the Industrial revolution. Usage of English in non-native English speaking (NNES) countries where English is the second language, has been studied 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). To bridge this now there is a need to address S&T policies, innovations, government schemes, funding processes, R&D efforts and such across Indian languages. This requires efforts to develop scientific literature in various languages.

3. Why Science in Regional Languages?

Mass science education in our country still faces many challenges due to different factors including a large population, a plethora of languages and limitations in infrastructure. As per the 2011 Census of India, the number of Scheduled languages in our country is twenty-two. As per the Census of India 2011 report, 270 identifiable mother tongues have returned 10,000 or more speakers each at the all-India level, comprising 123 mother tongues grouped under the Scheduled Languages and 147 mother tongues grouped under the Non-Scheduled languages (Census of India 2011 report).

“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 at least 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 (Drubin 2010). At the same time, the usage of English as the universal scientific language creates distinct challenges for those who are not native speakers of English. With the fast growth in STEM (Science, Technology, Engineering, and Mathematics), 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.

At 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 (Bharathi 2012: 60) as is clear from the below verses:

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

It is very apt to follow this strategy. To build content and concepts in any given regional language especially in science, technology, engineering and medicine-related fields translating authentic works in regional languages is the first step. As well, we need to translate already available peer reviewed research papers published in these fields. The 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.

4. Shift in Knowledge Transfer (KT) Perspective during the Pandemic

In the article discussing the hidden bias of using English as science's universal language, Adam Huttner-Koros points out how just French, English, and German accounted for the bulk of scientists' communication and published research in the early 19th century. "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.

In Non-Native English Speaking (NNES) countries, 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 usually as observed by many teachers and researchers. Though science education in colleges is mostly conducted in English this does not ensure a strong technical vocabulary among science graduates. This may be attributed to the complex effort needed for processing. Monserrat Lopez, a McGill University biophysicist originally from Mexico observes “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” as quoted in the article “Overcoming Language Barriers by Translating Scientific Research” (Morningside 2017). In addition, the language priorities of children’s education are many times decided by the economic priorities of families. In countries where there are more disparities based on the economy, this eventually becomes even more complex. “English classes in public schools in LMICs (Low Middle-Income Countries) 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 programmes in Non-Native English Speaking countries, students are sometimes admitted with only a modest ability to comprehend and converse in English” (Flowerdew J. 1999: 243-264).

So, it is time the scientific community and science communicators in tandem with linguists tackle this challenge.

This would help the advancements reach the public to a better extent which would create equity and equality in Science & Technology. With the recent pandemic, the scientific community across the globe has come together to address the issues on war footing as World Health Organization reports in an article titled “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 Indian scientists and academicians and the public too have engaged themselves in science outreach and knowledge translation approaches through a collaborative initiative named Indian Scientists’ Response to CoViD-19 (ISRC) with their website <https://indscicov.in/about-us/> . Probably, this is the right time to re-enforce 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 such existing networks and to create new ones. This will help/ensure the stakeholders make informed decisions while implementing S&T projects and policies. This would also facilitate non-native English speakers to participate and collaborate with the international scientific community and benefit the community.

5. 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 the 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. STIP 2020 (Science, Technology and Innovation Policy 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.

6. Science Communication as Dialogue

We understand the world is shifting from a deficit model towards a dialogue model. It becomes necessary for every communication on science in different languages to catch up with this trend. Textbooks, workbooks, worksheets, even articles need to engage the reader while talking science, if it has to reach them. “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 the 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)

Bearing this in mind, 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).

7. Science Popularization as Outreach

Various people's science movements in our country have made a tremendous impact in helping our masses understand science related to health, the environment and has even led to social revolution through science. It is not just the content, but the initiatives related to science have always helped our country grow right from independence days. These initiatives have been a local or sometimes regional or national level initiative from Government as well from various non-governmental organisations. While some of the initiatives are still ongoing and evolving, the impact of every such initiative has been huge. Their genesis and role 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) "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).

Vigyan Prasar is an autonomous organization under the Department of Science and Technology, Government of India, with the principal objective to serve India's popularisation agenda enhance its outreach in regional languages, it 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, it has launched an initiative in Tamil through '*Ariviyal Palagai*'. Through these initiatives seminars, creation of databases, year-long science communication and popularisations 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.

8. Translation of Science Books

It is not far away, especially with the advent of machine translation, AI (Artificial Intelligence) and the internet age, science journalism courses will be implemented in regional languages to strengthen and create manpower for science communication in local languages. “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” observes Manoj Patairiya (Patairiya 2011).

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 a translator becomes crucial and critical in taking the content to the masses.

9. Science Communication in Tamil – Challenges in Diglossic Language

Tamil is one of the top twenty most popular languages in the world, and is taught in schools and universities across the globe. The diglossia of Tamil presents a unique challenge in presenting/creating scientific vocabulary/texts to students and the common public. “Tamil diglossia involves two language varieties: the formal or H (High) variety that is Literary Tamil and the spoken or L (Low) 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). Literary Tamil is taught in schools, and it is the language of instruction generally. While colleges specifically focus on learning science through English mostly. Very few institutes offer undergraduate science degree programmes in Tamil. The textbooks that are currently used for these are usually written in literary Tamil. It becomes very pertinent that we have come to a position these textbooks needs revision and rewritten especially with the advancement in the field of S&T. Especially with new disciplines in the field of applied science courses being introduced, it becomes more relevant. “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 programmes etc. L. P. Krysin named a similar tendency in Russian “the Colloquialisation and jargonisation of the public spheres of communication” (Smirnitskaya 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. So that science worksheets or textbooks make an impact on school children, a balance has to be struck in choosing the words.

9.1 Choosing Age-appropriate / Context-appropriate Language

Here are a 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 classes 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* which 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 of 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 thiranaï mempaduththikolluthal*" 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.

9.2. Building Collaborative Attitude through Words

Most of the time 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. The 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 that 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 guiding 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.

9.3. Building Vocabulary by Blending Words

While the word *schematic* is closer to scheme or project, the schematic diagrams in the worksheet were about the diagrammatic representation of the flow of the process. Hence the translators have coined the word “*Siththarippu – varai – padam*” blending the words which are in common usage in that age group conveying it is a pictorial representation of the process.

School children are used to the word collage and use it for many of their projects 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.

9.4. 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* was used in the worksheet. In some instances, the term “*Manavamanaviyarkku*” which address both 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 a 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 the 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 content in biology on the topics concerned with reproduction, a 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 way 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 high school or higher secondary.

Conclusion

We need to address Indian languages and their diverse geographies, to develop scientific literature and media. Every science communicator in regional languages has a huge responsibility in evolving terms to suit the language, dialect, age, and knowledge level of their readers. Maybe an online platform these days to help them spread the newly coined words or already existing vocabulary along with the challenges would go a long way in building science vocabulary in our

language-rich country. This would definitely inspire future generations to venture into translation and help media people to enhance their science communication skills. 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. With a lot of technology-assisted teaching-learning evolving methodologies, science communicators, media persons, technocrats, and teachers can join hands to create worksheets for children and the public that could be used to assist the learning process. Such collaborations will surely bring in people from different walks of life from mainstream towards nurturing STI related activities. In years to come, these can be turned into engagement activities for captivating classrooms. This will lead to bridging the existing gap due to the dearth of resources in regional languages, pave way for building life-long learners in their own languages, and translation to regional languages is the way forward to achieve these.

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