

Scientific Writing

The Predicament of Weather and Climate Scientists in India

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Writing is integral to science, whether for research papers, grant proposals, conference papers, press releases, or routine correspondence with colleagues. Scientific writing is an essential part of the toolkit of a successful scientist, but unfortunately, it remains a neglected skill in too many academic programs. This neglect has serious implications for nonnative English-speaking (NNES) scientists in particular. As a result, these scientists may experience considerable delay in publication or even miss opportunities for funding. Problems with writing can impede their own—and their institution's—productivity. Worse yet, poor communication about weather and climate, especially uncertainty and risk, can be disastrous for the public as a whole.

I find that many weather and climate scientists in India experience difficulty in presenting their research in English (be it writing a paper or talking at a conference). Little is known about how Indian scientists cope with scientific writing in the backdrop of their ethnolinguistic diversity. Based on anecdotal evidence and an online survey, I try to explore their perceptions and dilemmas in scientific writing.

I surveyed weather and climate scientists in Pune, India, during October–November 2016 about their experiences, perceived skills, and training needs in scientific writing. The potential respondents were associated with Indian Institute of Tropical Meteorology (IITM), India Meteorological Department (IMD) Pune, Savitribai Phule Pune University (SPPU), and

Indian Meteorological Society, Pune chapter (IMSP). They were invited through e-mail to voluntarily and anonymously fill out a questionnaire online. A total of 80 anonymous responses were received. The demographic details of survey respondents are shown in Table 1.

Scientific writing does not come to many naturally but requires practice and learning. I recognized this while helping scientists/scholars to improve their manuscripts. Many of them use long sentences with intertwined complex clauses and phrases, making comprehension difficult. In addition to grammar and usage errors, ambiguous pronouns like “it” or “these” are a frequent annoyance in complicated sentences. Scientific writing is understood to be objective, but unfortunately, many scientists misinterpret this to mean they cannot refer to themselves in manuscripts. So they indulge in indirect and passive (often, passive of the passive) writing, leading to frequent and annoying abstractions. The resulting weak and unpersuasive scientific arguments lack clarity. Abstract nouns derived from verbs often replace actual direct verbs. Such writing is vague, verbose, and sometimes, as noted by Balaram (2015) in *Current Science*, impossible to correct.

A senior atmospheric scientist says that his colleagues and students write scattered first drafts, lacking continuity and flow. A recent paper by a midcareer scientist has been returned thrice by a reputable journal for revision on the grounds of poor language. A reviewer claims the sentences are too big and overloaded with information. The author admits that his big challenges in writing acceptable manuscripts are 1) how to start, 2) how to translate his ideas into English (his third language), and 3) finding the words to express his ideas clearly and concisely.

Such sentiments and experiences seem common in the Indian scientific community. Almost all survey respondents (97.5%) believe that “effective scientific writing and communication skills” are very important in their career, but most of them feel that they should be more skilled in scientific writing. The survey results

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DOI:10.1175/BAMS-D-17-0072.1

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TABLE 1. Demographic information of survey respondents (N = 80); postgraduate (PG) and undergraduate (UG).

Demographic variables	Percentage
Gender	
Male	65%
Female	35%
Age groups (in years)	
<25	22.5%
25–35	33.75%
35–45	17.5%
45–55	20%
>55	6.25%
Affiliation	
IITM	63.75%
IMD	17.5%
SPPU	16.25%
Others	2.5%
Professional/academic status	
Scientist	41.25%
Professor/lecturer	5.0%
Scientific/technical staff	17.5%
Postdoctorate/research associate	2.5%
Ph.D. scholar	20.0%
Student (M.S./M.Tech.)	13.75%
Educational qualifications (highest degree)	
Ph.D.	35.0%
PG (science)	31.25%
PG (engineering/technology)	15.0%
UG (science)	10.0%
UG (engineering/technology)	8.75%
Research experience (in years)	
0	15.0%
1–5	40.0%
5–10	13.75%
10–15	8.75%
15–20	7.5%
>20	15.0%

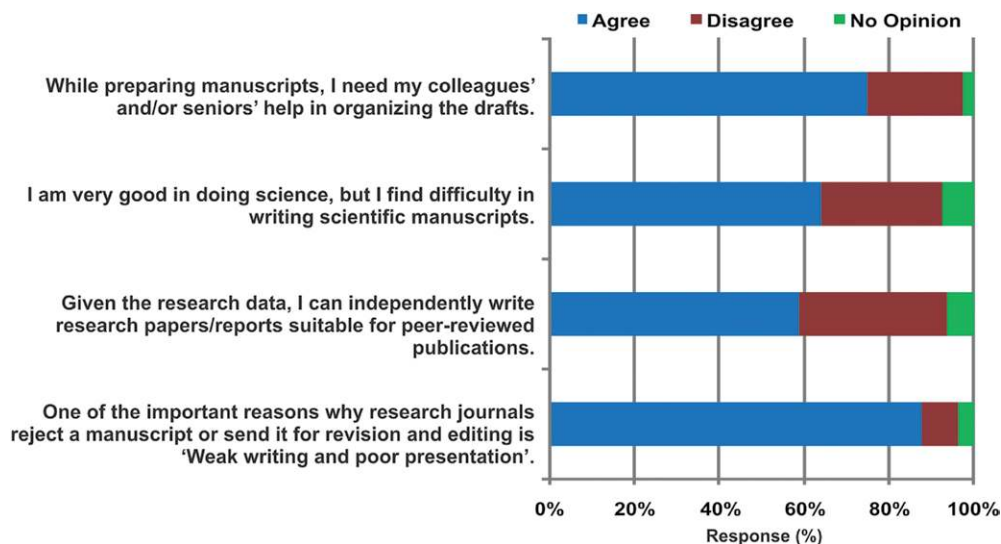
reveal that most of the scientists (63.75%) have difficulty in writing scientific manuscripts, many cannot independently write research papers/reports suitable for peer-reviewed publications, three-quarters (75%) of them need their colleagues' or seniors' help in organizing the drafts, and the vast majority (87.5%) believes “weak writing and poor presentation” is a reason for their papers getting rejected or being sent back for revision (Fig. 1).

Most survey respondents learned English as a second language (71.25%) or third language (25%), and only 3.75% of them said that they learned English as a mother tongue. This is undoubtedly common in India, a multilingual, multiethnic society in which many scientists think in their mother tongue while reporting their research in English as their second/third language. This multilingual heritage can influence the syntactical structure and seriously impact clarity and precision. Different languages have different syntax, or ordering of sentence parts, and people often find it difficult to transfer statements from the syntax of one language to the syntax of another.

Such linguistic and syntactical differences between Hindi (an Indian language) and English are briefly illustrated in Fig. 2. Almost all Indian languages are structured in a subject–object–verb (SOV) pattern, while English uses a subject–verb–object (SVO) pattern. Even the direct and indirect objects in a simple sentence generally reverse order between Indian languages and English. When the simple sentences used in the figure illustrate significant differences in the word order between the two languages, we can imagine the difficulty level in addressing such differences while working on complex sentences that are routine in scientific writing. This linguistic barrier stands firmly between many NNES scientists and clear writing. I observe that Indian scientists may write sentence structures that are not natural to English but are appropriate for Indian languages.

In a high-pressure “publish or perish” culture, frequent rejections or rounds of revision can dishearten and stress a researcher. A large majority (87.5%) of the survey respondents agree that language and presentation are “important reasons” for revision requests and rejections from journals. My interactions with several scientists reveal that many of them were advised by journal editors to get their manuscripts edited by English language experts or native English speakers. Such language-editing services can be expensive, and many scientists in developing countries cannot afford that.

FIG. 1. Scientists' perceptions about their experiences and perceived skills in scientific writing. It shows their responses to different statements about scientific writing.



A number of authors have noted that such stresses may lead scientists to indulge in unethical practices to compensate for weak writing skills. Some may lift the wording of others without knowing that this amounts to plagiarism. Others, biologist Mark Eberle points out, may find it challenging to paraphrase or

summarize others' text without distorting the original meaning and the level of certainty (Eberle 2013).

Scientists generally communicate their research more with their peers. The survey reflects this reality (not shown); nonetheless, more than half considered writing popular science articles, writing for newspapers/magazines, and talking to the press/media to be either "important" or "most important." A majority expressed a need to enhance their writing skills not only for peer-to-peer communications but also for popular science articles and press releases (Fig. 3). This inclination is good in democracies where public support for science is gained through engagement and dialogue.

The general perception in scientific circles is that if you know science and have substance to write about, then writing will come naturally. This perception needs to be debunked: it may be a reason why formal training in scientific writing remains neglected. Scientific writing is missing from the science curricula at most of the Indian colleges and universities, yet the vast majority of the respondents (85%) say that attending training and/or workshops in scientific writing would be useful.

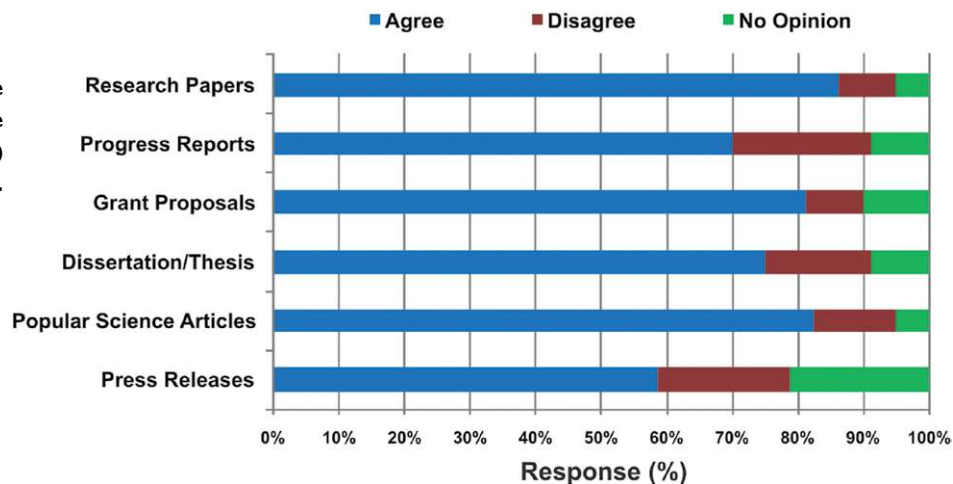
	Active Voice
a	<p> S O V मैं एक प्रयोग कर रहा हूँ। [Hindi in Devnagri script (HD)] main ek prayog kar raha hoon. [Hindi in Roman script (HR)] I am doing an experiment. [English (EN)] </p>
b	<p> S iO p dO V मैं कृत्रिम बारिश पर एक प्रयोग कर रहा हूँ। [HD] main kritrim barish par ek prayog kar raha hoon. [HR] I am doing an experiment on artificial rain. [EN] </p>
	Passive Voice
c	<p> एक प्रयोग मेरे द्वारा किया जा रहा है। [HD] Ek prayog mere dvara kiya jaa raha hai. [HR] An experiment is being done by me. [EN] </p>
d	<p> कृत्रिम बारिश पर एक प्रयोग मेरे द्वारा किया जा रहा है। [HD] Kritrim barish par ek prayog mere dvara kiya jaa raha hai. [HR] An experiment on artificial rain is being done by me. [EN] </p>

Legend: S = Subject, V = Verb, O = Object, dO = Direct Object, iO = Indirect Object, p = preposition.

FIG. 2. Differences in sentence structure between Hindi (an Indian language) and English. Equivalent sentence parts in both languages are coded in the same color for ease of identification. (a) Differences in syntactical pattern (SOV and SVO) when only one object is used. (b) The reversal of positions of objects between the two languages when two objects are used. Syntactical differences in active voice are illustrated in (a) and (b). (c),(d) As in (a) and (b), but for passive voice.

A WAY AHEAD. To address this predicament of NNES scientists, working scientists should receive formal training in how to write clear, precise, and original papers. These scientists could improve their writing considerably by becoming familiar with linguistic differences and barriers, grammar and usage, copyright, fair use and plagiarism, consistency of narration, construction of clear and logical arguments, and other concerns. Research institutions should

FIG. 3. Response to the question: I need to enhance my scientific (manuscript) writing skills in these formats.



provide assistance to NNES scientists in improving their manuscripts.

As it takes time and practice to develop proficiency in a language, especially for scientific purposes, interested scientists should form self-help or peer groups for learning by doing and sharing their best practices in scientific writing and ethics. Informal scientific writing clubs or online forums for discussions could be useful to NNES scientists. Reading quality publications regularly is of great help. Also, training sessions on how to engage with nonexperts would be useful to improve scientists' connection with society. Introducing scientific writing as a formal subject within science curricula, especially at postgraduate and doctoral programs, will bear dividends in science productivity in the long run. Here, I suggest that further systematic investigations are needed to better understand this predicament and devise training interventions.

FOR FURTHER READING

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