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Language challenges in earthquake science communication through mass media in Nepal

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Abstract

The occurrence of earthquakes and the ongoing construction of structures without following building code have made immediate effective earthquake communication necessary in Nepal. Across the country, government and nongovernment authorities use different mass media channels to deliver earthquake-related communication to the public. Likewise, people depend on mass media as their source of information about related disasters and safety measures for various reasons. Nepali media are still a powerful information source and suitable for crisis communication in Nepal. The Gorkha earthquake hit Nepal in 2015, causing heavy losses of infrastructures and casualties. The disaster exposed a communication gap between science and society and indicated the need for an improved science communication strategy tailored to the Nepali context. Hence, this study aims to detect specific linguistic aspects of this potential gap between science and society, analyzing the frequency and impact of problematic linguistic features, namely English words, jargons, and complex structures in Nepali texts used to communicate earthquake information. A questionnaire survey was initially done on the perspectives of house owners and construction workers. Only a small percentage of participants (19.1%) ever grasped the information given to them about earthquakes. The majority of them blamed their understanding problems on the communicators' use of jargon, technical terms, and communication style. Then, quantitative content analysis was carried out on the earthquake-related articles written by the experts and published in the Gorkhapatra, a government national daily, from 2015 to 2023. The quantitative content analysis of newspaper articles revealed frequent use of English terminology, technical words (jargons), complicated sentences, and passive voice. It implied that the linguistic problem of inaccessible science communication is significant, if not entirely, due to the usage of English terminology, technical words (jargon), and complicated sentence structures coupled with the prevalence of passive structures. Linguistic standards may be required to be adopted by science communicators for successful communication to empower communities to be better informed and prepared at large.

Keywords: Disaster risk reduction; Earthquake preparedness, Earthquake communication; Science communication; Technical communication; Comprehension; Readability.

1. Introduction

The history of modern science education in Nepal is marked by significant milestones, from the introduction of formal science teaching to establishing institutions and programs to facilitate science communication and education. There are obvious issues for enhancing science communication and education in Nepal, such as addressing linguistic barriers, cultural relevance, and practical applications. The current issues faced by science communication in Nepal underscore the need for continued efforts to improve the accessibility of scientific knowledge to lay people, ensuring that it caters to the country's needs. Thus, one significant obstacle may be the language barrier in the country, as a large segment of the public still does not understand English, which is frequently the language of scientific discourse. Although there is a universal need for efficient science communication, it encounters specific obstacles due to a multilingual environment. Moreover, research has shown that non-native English speakers in science make more linguistic efforts than native English speakers while reading and writing research papers, presenting research findings, and publishing works [1].

The impression of a well-informed and engaged audience facilitated by clear communication rarely represents the real situation of science communication in Nepal. Rather, many individuals may feel they are struggling in a sea of scientific knowledge due to an unclear image impeded by linguistic and comprehension barriers.

1.1. Earthquake knowledge and preparedness in Nepal

Earthquake experts emphasize the importance of constructing resilient structures, and the primary focus of earthquake engineering communication revolves around risks and safety measures communication. Despite Nepal's high seismic risk, the country still severely lacks earthquake knowledge and preparedness [2]. Studies show Nepal's vulnerability is exacerbated by poor governance, a lack of preparedness for disasters and public knowledge [3]. It seems that the general population is not sufficiently aware of the potential dangers posed by earthquakes, despite specialists' warnings that such disasters can occur at any time. Similarly, public knowledge about earthquake preparedness remains limited despite the constant threat of seismic activity. According to Subedi et al. [4], educational efforts have shown potential to improve public and schoolchildren's information about and readiness for earthquakes. Risk perceptions, however, have remained unchanged, highlighting the need for more comprehensive approaches. This situation underscores the urgency to communicate earthquake-related matters to the public and professionals effectively. This critical condition of earthquake awareness in Nepal further de-

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mands an investigation of the complex interplay between language and comprehension.

The observations, including anecdotal evidence and firsthand experience by the author, also show a low perception of earthquake risks among the public, policy, and decision-makers. Most of Nepal's fatalities and financial losses during earthquakes have resulted from buildings with insufficient earthquake resilience. Few locals in the Kathmandu Valley have taken precautions despite the region's significant earthquake danger [5]. More than 9,000 people lost their lives in the 2015 Gorkha earthquake, which also severely damaged historic buildings and unreinforced masonry [6]. In rural regions, where 83% of Nepal's population lives, structures with inadequate earthquake resistance were the primary cause of fatalities and monetary losses [7]. The disaster clarified that better risk communication techniques specific to the Nepali environment are required as proper structure design is crucial for lowering the danger of earthquakes [6, 7]. These results highlight the urgency of effective communication strategies tailored to the Nepali context.

Nepal's Scientists and engineers may rely on technical language and English terminology to convey earthquake information. Foreigners in Japan who didn't speak Japanese well had trouble getting important information after the Great East Japan Earthquake in 2011 [8]. According to Cognitive Load Theory, Complex words with many components require more effort to process, which may hinder comprehension, especially for audiences with limited language proficiency [9]. This linguistic barrier may have hindered effective earthquake communication, potentially leading to inadequate preparedness and avoidable casualties in a disaster.

1.2. Linguistic scenario and science communication in Nepal

With more than 124 languages spoken in many areas, Nepal is a linguistically varied country that reflects its rich ethnic and cultural variety [10]. The official language and lingua franca is Nepali, although several native languages, including Maithili, Bhojpuri, Tamang, and Newari, are highly valued in the region [11]. Effective communication may be hampered by this multilingual environment, especially when conveying technical or scientific knowledge to linguistically heterogeneous audiences. In line with the Sapir-Whorf hypothesis, people understand scientific content in their mother tongue effectively and adopt the knowledge practically [12]. Even when scientific content is available in Nepali, it may be challenging for readers due to complex phrase patterns and jargon [13]. In this context, communicating earthquake knowledge in a language characterized by lexical and syntactic complexity may be challenging.

Researchers indicate of context-specific linguistic choices, encouraging voice and sentence structure flexibility to suit the audience and message. A study by Kessler et al. [14] further highlights the need for scientific communities to engage in public communication. The study suggests considering the mental models of the audiences when crafting messages. Research indicates that excessive use of technical language and scientific jargon hinders understanding, particularly for audiences with low levels of scientific literacy [15]. These difficulties may worsen in multilingual environments, like Nepal, where readers must switch between several language systems, frequently resulting in cognitive overload. Effective earthquake communication could be weakened by this mismatch, leaving susceptible groups—like construction workers—ill-prepared to carry out safety measures.

Other related difficulties in this field may be perceptions and attitudes of scientists and other stakeholders of society. A scientist prefers to pay more attention to his research work and write research papers for scientific communication.

Thus, investigating the linguistic complexities, using both survey and content analysis approaches, becomes a vital effort to examine the prevalence of technical terminology with English words and complex structures by analyzing communicated documents published in Nepali. To assess the impact of these linguistic choices on comprehension, I will draw upon responses from a targeted audience, exploring their understanding of the content and identifying specific sources of difficulty.

This paper aims to paint a picture of the linguistic challenges impeding effective science communication in Nepal by exploring the following questions:

- Which specific language elements influence the readability and accessibility of Nepali earthquake-related writings for lay audiences?
- How do certain linguistic choices within Nepali texts, such as word choice and sentence structure, affect Nepali audiences' comprehension of earthquake-related information?

By answering these questions, the study can guide the creation of more understandable and accessible communication techniques by identifying obstacles, including technical jargon, English terminology, and complex sentence patterns.

1.3. Potential lexical and syntactic elements in science communication

In science communication, excessive jargon, foreign words, passive voice *(karma and bhava vachya)*, and complex sentences are possible linguistic problems. These potential linguistic complexities can create barriers to understanding for non-expert audiences, a fundamental concern of this research. In scientific writing, sentence structure is crucial in conveying complex ideas effectively. Sentences in scientific papers are often longer and more detailed than those in general publications. This can challenge readers, especially those not well-versed in the specific scientific domain.

1.4. Rhetoric and linguistic elements

Rhetorical practices, in a direct sense, comprise the persuasive elements of a text rather than its syntactic structure. Nevertheless, grasping the syntax of a text can be a valuable tool in comprehending its rhetorical effectiveness. These practices involve how language is utilized to persuade or inform an audience by analyzing aspects such as the author's intent, target audience, tone, and use of evidence, focusing on the overall meaning and impact of the text. Understanding the structure of sentences can provide valuable insights into the author's rhetorical decisions. Factors like sentence length and complexity can influence the tone and formality level, while word choice and order can impact emphasis, persuasion, and emotional resonance. Different sentence types can affect how the message is delivered. Although not technically part of the core elements of a rhetorical analysis, knowledge of lexicon and syntax can significantly enhance one's ability to comprehend and analyze the rhetorical effectiveness of a text [16]. Syntax plays a significant role in shaping rhetorical effectiveness. To enhance the clarity and effectiveness of scientific communication, writers must adopt strategies that prioritize accessibility. Gopen and Swan [17] argue that clarity in communication can be achieved without oversimplifying scientific concepts by applying rhetorical principles. Syntactic and lexical complexity can affect readers' understanding [18]. Studies have indicated that textual factors in science communication have a major influence on the comprehension and attitudes of lay audiences toward scientific content. In particular, among less-qualified audiences, stylistic and rhetorical manipulations like sentence length, vocabulary difficulty, and analogy use have been found to affect audience characteristics including enjoyment, attitudes, and knowledge acquisition [19]. When communicating scientific information to ordinary audiences, these findings have significant ramifications for science communication,

emphasizing the need of taking into account both communicators' rhetoric and textual complexity.

2. Literature review

It involved reviewing relevant linguistic and communication theories related to language complexity and information accessibility, incorporating existing research on science communication and earthquake communication to indicate the implications of the examined literature for the study and a research gap.

Jakobson's communication model identifies six key elements: addresser (sender), addressee (receiver), message, context, code, and contact (channel) [20]. Each element is the focal point for a specific language function, such as referential, emotive, conative, phatic, multilingual, and poetic [20]. This model provides a functional perspective on communication that is applicable across various disciplines [21]. While conceptualizing Jacobson's communication model in the specific context of science communication in Nepal, the interaction between communication function and linguistic challenges must be emphasized. The model emphasizes adapting the code (language and style) to the audience's capabilities for effective message transmission [22]. It provides a structural approach to analyze and address barriers in conveying scientific knowledge in diverse linguistic and cultural settings. Jacobson's communication model concerning specific linguistic challenges in science communication in Nepal suggests each communication function is related to the unique linguistic center of Nepal.

2.1. Deficit, dialogic and participatory models

In science communication, three main models are identified: dissemination (deficit), dialogue, and participation [23]. The deficit model in science communication assumes that public misunderstanding of science stems from a lack of knowledge, which can be addressed by providing more information [24]. The continued use of the deficit model is influenced by factors such as the purpose of science communication, the conceptualization of communication processes, and how science is defined [25]. While the deficit model has limitations, it still plays a necessary, though not sufficient, role in science communication research and practice [25]. While these models are often seen as an evolutionary progression, they can coexist as policy instruments [23]. The shift towards dialogic and participatory models emphasizes two-way communication and audience engagement. However, the effectiveness of participatory approaches has been questioned. Some argue that so-called participatory efforts may not differ significantly from top-down models in terms of community involvement [26]. Despite this critique, there is a growing emphasis on dialogue and participation in science communication, with social media facilitating public engagement in hybrid forums [23]. All three models are to be considered to find approaches to specific engagement goals and audience comprehension.

In Nepal, where science communication plays a crucial role in shaping public attitudes towards science, understanding the model aligning with current practices can provide valuable suggestions for linguistic biases and their impact on public perceptions of science. Despite efforts to promote scientific literacy, gaps in science education persist, leading to scientific illiteracy that hinders overall progress and development in the country. So, by exploring how these challenges intersect with different models of science communication, researchers can gain a deeper understanding of how linguistic choices and communication strategies impact public engagement with science in Nepal.

2.2. Linguistic features and comprehension

According to Bailin and Grafstein [27], sentence structure complexity and vocabulary familiarity are two factors that affect a text's readability, which is a measurement of how simple it is to read a passage. In other words, readability is influenced by both lexical and syntactic complexity [28]. Willoughby et al. [29] developed an R script to assess the level of technical language in written content and tailor it to specific audiences. They established different thresholds for jargon use based on the intended readership. For material intended for children, the recommended average jargon score should be under 0.015. When communicating with the public, keeping the jargon-ness score below 0.030 is advisable. Those with undergraduate-level knowledge in a scientific field can typically comprehend content with an average jargon score of up to 0.300. At the same time, individuals with graduate-level expertise may comfortably understand the material with a jargon score extending up to 0.500 [29].

A study conducted by Baram et al. [30] suggests that science communication has moved further away from everyday language in the eyes of the public, even though it may still be understandable to the academic community. In another similar study conducted by Bullock et al. [31], findings strongly suggest that minimizing jargon in science communication can alleviate resistance to persuasion and lower risk perceptions, ultimately boosting support. They also emphasized how jargon can hinder informing and persuading the public. This hindrance is attributed to a cognitive process known as metacognition. The key takeaway is that trust in science is paramount for its long-term impact, as trust allows scientists to influence public perception and decisions effectively.

Research on communication challenges in Nepal highlights various issues, including linguistic barriers in climate change discourse [32] and AIDS education [33]. While English is recognized as crucial for professional communication in engineering [34], significant obstacles exist in disseminating complex scientific information, particularly in flood early warning systems [35]. Studies emphasize the importance of considering local languages, resources, and preferences for effective communication [32, 33]. However, the existing literature primarily focuses on general communication challenges without exploring specific linguistic factors such as sentence structure, vocabulary choice, or the interplay between English and Nepali in scientific texts. Additionally, there is a lack of research examining how linguistic stylistics, including technical jargon and complex sentence structures, affect the accessibility of scientific information, particularly in the context of natural disasters like earthquakes. Likewise, the specific linguistic challenges in translating and disseminating earthquake-related scientific information to diverse audiences remain largely unaddressed.

3. Methodology

The potential impact of a study on linguistic problems related to the use of jargon, English words, and passive and complex structures in science communication through the Nepali language can be significant for Nepali society. This study attempts to identify specific linguistic problems faced by science communicators in Nepal and helps develop strategies to address these linguistic issues.

Our perspective acknowledges an external reality independent of human perception, emphasizing that underlying structures and mechanisms influence linguistic patterns in science communication. This study assumes that language issues in communicating earthquake science and engineering knowledge to society exist objectively, and the attempt is to uncover these underlying structures through empirical investigation. We recognize the need for numerical data and their in-depth understanding to explore the

linguistic intricacies in science communication. It employed an approach combining a survey and quantitative content analysis to explore linguistic challenges in earthquake-related communication in Nepal. The survey gathered perspectives from house owners and construction workers, key groups in the preparedness work for earthquake risks. At the same time, the content analysis examined linguistic features in earthquake-related newspaper articles. This mixed approach allowed for a comprehensive understanding of language-induced communication gaps between experts and lay audiences.

In the first stage, primary data were collected through a structured survey with 241 participants directly and indirectly involved in construction work and living in Kathmandu Valley. Participants were selected using purposive sampling to ensure the representation of individuals directly involved in building and construction activities. Even though Kathmandu was the site of the data collection, the participants came from a variety of districts around Nepal. The study was able to record a range of viewpoints and experiences related to earthquake communication because of the deliberate selection of this community of different origins. The results are not limited to the Kathmandu Valley but rather provide insightful information that may be applied to larger national contexts for planning and policymaking. However, without on-site data collecting, the study admits that some region-specific challenges—especially those in isolated rural areas—might not be properly represented. The survey was designed to explore the depth of the communication gap between earthquake experts and the public regarding earthquake-related information and practices. A structured questionnaire was used as the primary data collection tool. The questions covered five themes: exposure to earthquake knowledge and information, the participants' difficulty in understanding earthquake-related information, use of difficult words, preferred communication challenges, engagement with information, and perceived effort by communicators. This survey was administered through face-to-face interviews, with questions presented in Nepali to ensure that participants could clarify any ambiguities, particularly among house owners and construction workers, who had varying literacy levels. Responses were recorded and anonymized to maintain confidentiality.

In the second phase, newspaper articles and information on earthquake science and engineering were analyzed quantitatively to determine the frequency of specific linguistic choices - jargon, English words, passive voice, and complex structures. This design allows for exploration of linguistic patterns through quantitative analysis demanding in the next sequential research a deeper understanding of their effects on comprehension through qualitative investigation. In this phase, quantitative data were collected through the content analysis of communicated articles published in the newspaper. This phase enhances the study's external validity by examining a media source that has national circulation and effect. This is because it reflects the kinds of language and communication that the Nepali community most frequently encounters in various locations and periods. The analysis's eight-year duration provides more comprehensive perspectives about recurrent language hurdles in science communication with the public. Consequently, the results help to develop recommendations that may be used across the country to enhance the clarity and accessibility of expert-to-public communications.

By reducing the impact of researchers' subjective judgements, quantitative approaches seek to be impartial and objective [36]. To provide an overview of the replies, descriptive statistics, such as frequencies and percentages, was used to provide an overview of the replies. To find patterns and trends, key variables such as communication medium preferences and comprehension challenges were examined.

The dataset's patterns were compared in the content analysis data, and the frequency and distribution of linguistic characteristics were measured. The results were compared with survey results to establish links between audience understanding issues and language choices. All survey respondents provided informed consent after being reassured of their privacy and the voluntary nature of their involvement. Likewise, authorization was obtained to use the chosen newspaper articles for scholarly research.

The study complied with ethical research standards regarding data confidentiality and results reporting integrity.

The descriptive and analytical research aims to describe the frequency of linguistic elements, namely jargon, foreign words, passive structures, and complex structures, and analyze their contextual meanings in the communication process. The exploratory nature of my research is justified by the limited existing literature on linguistic challenges in the context of earthquake science communication in Nepal. This approach allows for identifying novel linguistic patterns, contributing to the broader field of science communication research. So, data collected from the time between the Gorkha earthquake in 2072 B.S. and 2080 B. S. is justifiable due to the significant seismic event's impact on science communication. Several earthquakes are still frequently hitting different locations of the country at different times since then. This time horizon allows for an in-depth analysis of post-earthquake science communication, capturing the evolution and persistence of linguistic challenges in the field. Purposive sampling was employed to select articles from 2015 AD (2072 B.S.) This ensures relevance to the seismic context and provides a focused dataset for analysis.

Daily newspapers are a primary source of information for the public in Nepal, and they play a crucial role in shaping public opinion and understanding of scientific issues. They represent diverse perspectives and opinions on scientific issues, providing insights into the linguistic challenges faced by science communicators in Nepal and the potential impact of these challenges on the clarity and accessibility of scientific information. Daily newspapers have a wide readership and are accessible to a broad audience, making them an effective tool for disseminating scientific information and raising awareness about scientific issues. By surveying daily newspapers, a researcher can compare complex linguistic features, such as English words, jargon, passive voice, and complex sentences in publications, and identify patterns and trends in their use. Daily newspapers can provide insights into the linguistic challenges science communicators face in Nepal. The Gorkhapatra Daily has been a prominent contributor to earthquake information news reporting in Nepali newspapers. Newspapers serve as a rich source of data for linguistic analysis.

The Gorkhapatra Daily was chosen to study linguistic challenges in science communication in Nepal due to its historical significance, readership, and coverage of scientific and social topics. It covers various scientific and social topics, including health, environment, and disaster management. This broad coverage makes it suitable for studying the linguistic challenges in earthquake communication.

Content analysis allows for an objective and systematic examination of textual data. It provides a structured method to identify, analyze, and quantify linguistic elements without introducing subjective biases with the quantification of linguistic patterns and challenges. According to Neuendorf and Kumar [37], content analysis enables a quantitative and objective examination of message attributes despite the importance of qualitative methods.

4. Results

In the first phase of data collection, the numbers of participants were selected in the ratio, as shown in Fig. 1, from the three

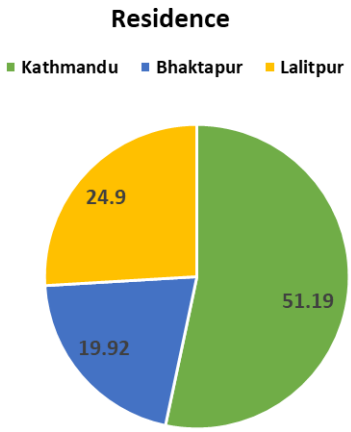

Figure 1: Proportion of respondents from the three districts of Kathmandu Valley - Kathmandu, Lalitpur and Bhaktapur.

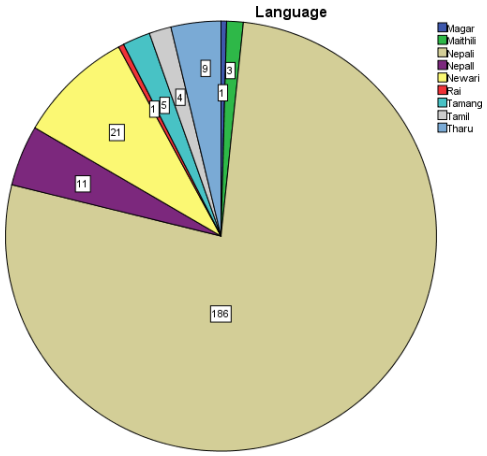

Figure 2: Distribution of respondents by their mother languages which illustrates the range of first languages spoken by participants, reflecting the linguistic diversity of the study population and supporting broader relevance of the findings.

districts of Kathmandu Valley, namely Kathmandu, Lalitpur, and Bhaktapur. The most significant percentage of the respondents were under SEE by their education, as illustrated in Fig. 2. Similarly, Fig. 3 indicates that most respondents speak Nepali as their mother tongue.

The research of Nepali house owners and construction workers revealed significant barriers and constraints in the spread of earthquake knowledge and information.

As demonstrated in Table 1, only 32.8% of those asked said they have sometimes come across knowledge and awareness regarding earthquakes. Some participants (5.4%) even reported that they had never come across this kind of content before, whereas 6.2% rarely did so although all respondents are living in Kathmandu valley.

Table 1: Availability of materials to read and listen showing the participants' access to written and audio resources to indicate how easily they were able to obtain information.

Response	Frequency	Percent
Always got to read and listen	32	13.3
Often got to read and listen	102	42.3
Sometimes got to read and listen	79	32.8
Rarely got to read and listen	15	6.2
Never got to read and listen	13	5.4
Total	241	100.0

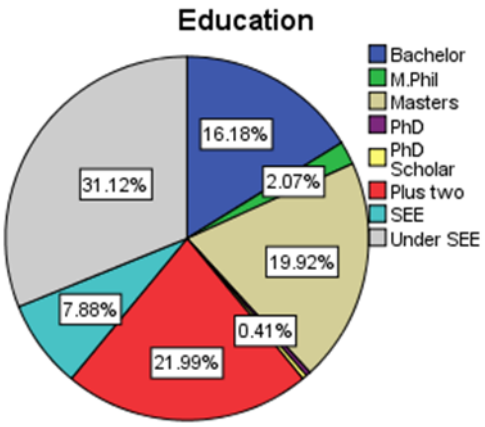

Figure 3: Distribution of respondents by their academic qualifications which shows the respondents' distribution by highest academic qualification, from under SEE to a doctorate.

Table 2: Understanding of the text about earthquake given to them, which provides insights into how well important material is received by a broad audience by displaying participants' comprehension levels of a text on earthquakes.

Response	Frequency	Percent
Always understood	46	19.1
Often understood	116	48.1
Sometimes understood	55	22.8
Rarely understood	18	7.5
Never understood	6	2.5
Total	241	100.0

The information provided to participants concerning earthquakes was always understood by minority (19.1%) of them as shown in Table 2. Most of them attributed their issues of comprehension to the jargon, technical terminology, and communication style of the communicators.

As illustrated in Table 3, 30.3% found that communicators used difficult-to-understand language and style. During the poll, 42.3% of respondents admitted sometimes ignoring or ceasing to read about earthquakes. Similarly, 36.5% of the respondents reported that they sometimes misunderstood the information they were provided. Thirty-nine percent of respondents said that there wasn't enough knowledge and information on earthquakes provided by knowledgeable communicators. In contrast, 12.5% said there had been no earthquake communication effectiveness. Nevertheless, 65.1 % of those surveyed suggested that mass media (newspapers, radio, and television) can become a very effective means of learning about earthquakes.

All published earthquake-related articles were collected from the Gorkhapatra after the 2015 Gorkha earthquake in the second data collection phase. So far as Nepali print media are concerned, such articles were discovered to be published almost daily in the month of Baisakh after the 12th of this month in 2072. Then, the frequency of publication decreased by months. In the years following 2072, earthquake-related matters were published twice, sometimes only once a year. It was either on the 12th of Baisakh or on the 2nd of Magh. Magh 2 is the commemoration of the 1990 Magh earthquake, and Baisakh 12 is the commemoration of the Gorkha earthquake of 2072 B. S. There were, in total, 31 earthquake-related science articles published in the Gorkhapatra written by earthquake experts to communicate earthquake-related knowledge to ordinary people from Baisakh 12, 2072 to Falgun 28, 2080.

Table 3: Perception of language difficulty, which illustrates possible obstacles to successful comprehension by showing respondents' perceptions of the intricacy of the language used in texts on earthquakes.

Response	Frequency	Percent
Always feel language and style difficulty	27	11.2
Often feel language and style difficulty	62	25.7
Sometimes feel language and style difficulty	73	30.3
Rarely feel language and style difficulty	45	18.7
Never feel language and style difficulty	34	14.1
Total	241	100.0

Table 4: Correlations.

		NOS	NPOV
NOS	Pearson Correlation	1	.511**
	Sig.(2-tailed)		.004
	N	30	30
NOPV	Pearson Correlation	.511**	1
	Sig.(2-tailed)	.004	
	N	30	30

**Correlation is significant at the 0.01 level (2-tailed).

In Nepal, the frequency of publication in English was found to be very low. In contrast, earthquake experts rarely used other local languages to communicate earthquake-related knowledge to the public.

As shown in Table 4, the Karl Pearson correlation coefficient between NOW in the text and the jargon used in the text is 0.581 with a p-value of .001, which indicates that the correlation is significant at a 1% significance level. Similarly, the correlation coefficient between NOS in the text and the number of complicated sentences is found to be 0.443 with a p-value of .014, which indicates the correlation is significant at the 5% level. Furthermore, the correlation coefficient between NOS in the text and the number of passive voice sentences is 0.511 with a p-value of .004, which indicates that the correlation is significant at the 1% level of significance.

4.1. Lexical findings

As displayed in Table 5, the number of words (NOW) in the biggest article was 1810, whereas the smallest article on earthquake communication contained 527 words. The average number of words was 894± 304.2. The total sum of difficult words—Number of General English Words (NOGEW), Number of Technical Words (NOTW) in Nepali, and Number of English Science Jargons (NOESJ)) was, on average, found to be 36. Half of the articles have less than 895 words, and the other half have more than 895 words. The use of general English words in the surveyed articles was low. The average number of general English words was 3.5. However, the use of English words was much higher in their interviews in broadcast media (oral).

4.2. Syntactic findings

The average Number of Sentences (NOS) in the sample articles was 48, as indicated in Table 4. On average, a sentence was found to be consisting of 19 words. Several difficult sentences are considered to be the sum of Number of Compound Sentences (NOCS) and Number of Complex Sentences (NOClS). An average number of difficult sentences is 21, which is 43.75%. On average, the ratio of Number of Passive Voices (NOPV) to Number of Active Voices (kartri vachya)(NOAV) was found to be 0.45.

5. Discussions

The results revealed significant issues with disseminating information about earthquakes among Nepali lay people. A communication outreach gap may be seen in the fact that most respondents did not regularly get enough earthquake information. This implies that current information activities have not sufficiently reached the populations directly engaged in earthquake-resilient building techniques. The high frequency of understanding issues draws attention to the frequent use of technical jargon and complicated communication styles in expert resources. These obstacles turn off non-expert audiences, emphasizing the need for ordinary people to receive clear messages pertinent to their context. The fact that 20% of respondents frequently misinterpreted the content and 30% of respondents disregarded or abandoned it in the middle suggests that the audience was not adequately engaged in line with the finding many communicators primarily target individuals already interested in science, neglecting broader public engagement [38]. Works that are too technical or don't speak to the needs and experiences of the audience might be to blame for this. Half of the respondents perceived that expert communicators have not provided sufficient earthquake knowledge. This perception underscores the need for experts to adopt a more audience-centric approach and increase their engagement with construction workers and house owners. Half of the respondents say expert communicators have not offered sufficient earthquake knowledge. The necessity for specialists to take a more audience-centric approach and interact with ordinary people more is highlighted by this finding. Various actions can be taken to increase the efficacy of communication regarding earthquakes. Research in science communication underscores excessive jargon, particularly among lay audiences, which reduces reader interest and comprehension. Dayton & Dragojevic [39] observed that jargon reduces information-seeking intentions and perceived credibility. Key recommendations can include using plain language, reducing jargon, teaching communicators and experts how to engage audiences, and simplifying the language used in science communication publications.

Mass media, which may reach wide audiences, is the main way most adults are exposed to science [40]. In the same vein, mass media are still preferred as efficient channels in Nepal, so mass media can help close the communication gap in the country. It is important to use these platforms to deliver clear, interesting, and intelligible information on earthquakes. Communicators can help builders adopt earthquake-resilient practices by tackling linguistic problems.

Furthermore, the study highlights the dominance of the Nepali language in earthquake-related communication, with few English-language publications and negligible use of other regional languages. This linguistic landscape reflects Nepal's historical and cultural context, where Nepali is the official language and lingua franca. However, the limited use of other regional languages may hinder the access of earthquake-related knowledge to diverse communities, including those more comfortable with other local languages. The study also reveals a months-long drop in publishing frequency after the initial surge in earthquake-related communication. This pattern may be attributed to the cultural context of Nepal, where traditional communication channels might not reach marginalized communities with limited access to formal education

Table 5: Analysis of linguistic features of published earthquake communication texts in Nepali which summarizes the findings of the content analysis identifying important linguistic components-like English words, technical words and sentence structure - in published Nepali earthquake-related information.

Statistics	NOW	NOTW	NOGEW	NOESJ	NOS	NOSS	NOCS	NOClS	NOAV	NOPV
Average	894.6	20.5	3.4	13.9	47.5	25.9	11.4	9.7	32.8	14.6
Maximum	1810	35	10	26	87	48	20	20	60	27
Min	527	8	0	2	30	5	3	3	12	6
Sd	304.2	8.1	2.6	7	12.6	11.4	3.9	4.7	10.1	6
Median	843	20	3	13.5	45	25.5	11.5	9.5	33.5	14

or technology. The historical context of Nepal, with its resistance to colonization and the acceptance of English as a national and international language, has shaped the country's linguistic landscape. The study's findings suggest that the historical context has led to a preference for Nepali in earthquake-related communication, with limited use of English and other regional languages.

The ratio of passive voice to active voice in Nepali science communication documents is an important linguistic aspect that can impact the effectiveness of knowledge dissemination. The finding of a 0.45 ratio of passive voice to active voice in Nepali text suggests a relatively high prevalence of passive voice constructions. This result should be analyzed in the context of science communication in Nepal, considering the linguistic and cultural factors that may influence the use of passive voice. Research has indicated that the use of the passive voice has traditionally been common in scientific writings, accounting for about 30% of clauses [41]. The use of passive voice in scientific writing is a topic of interest in the international scientific community. While the passive voice is sometimes considered more appropriate in scientific writing, its overuse can compromise the quality of the writing.

In the context of Nepal, where there is a rich linguistic diversity and a dominant use of Nepali in communication, the prevalence of passive voice constructions may pose challenges for effective science communication. The high ratio of passive to active voice in Nepali science communication articles may indicate a writing style that prioritizes the object or action being described over the agent acting. This emphasis on the action or object rather than the agent can lead to less direct and clear communication. Furthermore, as highlighted in a Scientific American blog post, the societal challenges to science communication in Nepal emphasize the need for clear and concise scientific communication. Additionally, the lack of dedicated space for science communication in Nepali media and the sensationalization of non-scientific topics further underscore the importance of clear and engaging relevant scientific knowledge coverage.

Science communicators and writers in Nepal should be mindful of the potential impact of linguistic choices on the clarity and effectiveness of their communication. Balancing passive and active voices to ensure clear and engaging scientific writing is essential for overcoming the linguistic challenges in science communication in Nepal. The analysis of the 0.45 ratio of passive to active voice in Nepali science communication documents should be viewed in Nepal's unique linguistic and cultural landscape.

The data also revealed that the average number of difficult words, including general English words, Nepali technical words, and English science jargon, was 36. This finding highlights the linguistic challenges of science communication in Nepal, where technical language and jargon can alienate non-specialist audiences. The use of general English words in such articles, with an average of 3.5, further underscores the need for clear and accessible language in science communication. Nepal's linguistic diversity and cultural traditions, combined with the technical nature of earthquake-related information, make it challenging to communicate scientific information effectively to diverse audiences. To address these challenges, science communicators in Nepal must prioritize clear and accessible language while respecting the country's linguistic and cultural diversity.

Compared to the survey results conducted among house owners and construction workers, the quantitative content analysis of Nepali newspaper articles reveals recurring communication patterns and linguistic barriers to spreading information about earthquakes. Their objections regarding the difficulty of professional communication are reflected in the frequent usage of English terminology and technical jargon in Nepali newspaper articles. This overlap draws attention to a structural problem: specialized vocabulary in written and spoken communication alienates audiences who are not experts. Such terminology risks excluding people without extensive education or technical competence, such as construction workers, even though it may reflect a wish to uphold professional legitimacy or replicate worldwide standards. Newspaper articles remarkably use the passive voice and complex/compound sentences, corresponding with construction workers' challenges in comprehending information about earthquakes. Although frequently used in academic and professional writing, complex sentence forms can make important ideas difficult to understand and make writing less accessible to a wider audience. This stylistic decision further marginalizes people who depend on clear-cut, approachable communication.

The combined findings indicate a substantial gap between the demands of the target audience and the way expert knowledge is conveyed. Although newspaper articles are meant to educate the public, construction workers and other lay audiences cannot understand them due to their language and structure. Given that they probably faced comparable linguistic obstacles in other media, this dissonance could help to explain why 20% of construction workers misinterpreted information, and 30% ignored it. Using complicated writing styles and difficult vocabulary in expert communication and newspaper stories points to the need for systemic change in sharing information about earthquakes.

6. Conclusion

The examination of genuine newspaper articles written by actual scientists and scientific communicators addressing actual audiences, rather than subjects' writings in a lab, provides ecological validity of this research. It investigated the linguistic problems of earthquake-related communication and science communication at large. The findings indicate that Nepali is the language that is primarily used for earthquake-related communication, reflecting its status as the official language and lingua franca in Nepal. This kind of dominance is limiting the accessibility of information for communities that are more comfortable with other regional languages. The limited use of other regional languages in science communication and the historical context of language preferences highlight the need for an approach that balances linguistic diversity with clear and engaging communication strategies. Likewise, the preva-

lence of passive voice, with a 0.45 ratio, in Nepali science communication articles raises concerns about clarity and effectiveness. The high ratio of passive to active voice challenges clarity and directness in conveying scientific information to the society. This emphasizes the importance of mindful linguistic choices to effectively disseminate knowledge to diverse audiences. This, coupled with the societal challenges in science communication, necessitates a conscious effort towards using a clear and active voice for impactful knowledge dissemination.

Additionally, the variability in article lengths, technical language, and jargon accentuates the need for accessible and engaging science communication practices to reach diverse audiences with varying levels of literacy and scientific background. To overcome these challenges, science communicators in Nepal must prioritize clear and concise language while considering the country's linguistic diversity and cultural connections. By striking a balance between linguistic complexity and accessibility, science communicators can enhance the reach and impact of earthquake-related information among diverse communities in Nepal.

Hence, this study highlights important linguistic problems in Nepal's earthquake-related knowledge dissemination. The problem of inaccessible science communication is associated with using English terminology, technical jargon, and complicated sentence structures in newspaper articles and expert communications. According to the study results, due to these language difficulties construction workers and house owners misunderstand the message, get disengaged, and lack practical knowledge. To overcome these obstacles, communicators should reduce jargon and technical phrases and simplify the language. Using basic phrase forms and the active voice helps improve readability.

By putting these tactics into practice, Nepal can increase the sharing of information about earthquakes among lay people. Media outlets should collaborate with academic institutions and research centers to bridge the gap between technological knowledge and its real-world implementation. Academic studies in science, engineering and journalism should also incorporate science communication and public engagement strategies prioritizing local languages.

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