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Using Plain Language for more effective interdisciplinary science communication

by

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ABSTRACT

Globalization, rapid technological advances and complex problems require scientists to cross-collaborate to solve problems, and to compete for funding in an interdisciplinary arena. This involves communication across disciplines, often also across national, cultural and linguistic borders. Such communication is mainly in English, currently the global language of science, but a second language for many scientists. One important area of interdisciplinary peer-to-peer science communication is writing and reviewing funding proposals, formulated in terms of discipline-specific details, terminology and concepts. However, panels reviewing funding proposals seldom consist only of experts from the same field of expertise as the proposers. This thesis posits that one way to enhance the chances that proposals are not misunderstood, and to assist the reviewing process, is to apply Plain Language strategies.

This exploratory, mixed methods study investigates the use of Plain Language principles in interdisciplinary peer-to-peer science communication and how it can help to clarify funding proposals. It thus adds to previous Plain Language research conducted on consumer needs around finance, law and the medical sciences, and on how Plain Language benefits science communication with the general public and applications in science education.

Based on an extensive literature review on science communication and Plain Language definitions, a definition of Plain Language for funding proposals and eight Plain Language guidelines were developed to guide the analysis of two funding proposals. From these two texts, sample texts were selected and rewritten in Plain Language for testing in a survey, which also probed participants' writing experiences, their perceptions on Plain Language and collaboration with language practitioners in science communication. The survey provided some quantitative and some qualitative data, which were expanded by two rounds of interviews with engineers and other scientists.

Survey respondents confirmed the frequent need for written peer-to-peer communication. They predominantly preferred the Plain Language versions of the sample texts, confirming the relevance of the eight guidelines relating to the macro-level (organisation) and micro-level (vocabulary, conciseness, vertical listing, sentence length, active/passive voice, reduction of cross-references and sequencing). The scientists in the sample seemed aware of the concept of Plain Language, but were unsure of the value of the guidelines beyond simplification, which some resisted. Overall, participants were positive about Plain Language and collaboration with language practitioners, although they mentioned practical obstacles to collaboration. Many equated language services with checking spelling and grammar, which implies a need for the language services industry to educate scientists on the value of language-related services. Instead of document-based collaboration, interviewees showed a keen interest in training on Plain Language guidelines and associated strategies to ensure that reviewers of proposal are able to judge the merit of research on first reading.

KEY WORDS

English as dominant language of science
Funding proposal
Interdisciplinary science communication
Plain Language
Plain Language definition
Plain Language guideline
Reviewers
Telling the science story

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INTRODUCTION

"We should not write so that it is possible for the reader to understand us,
but so that it is impossible for him to misunderstand us."
(Marcus Fabius Quintilianus, quoted in Bulaon, 2018:5)

1.1 BACKGROUND

Rapid technological advances and complex global problems often require scientists to collaborate on projects (Phillip, 2012:1-4) and to draw on the findings of colleagues across disciplines. However, even when all the scientists concerned communicate in English, as the current *lingua franca* of science, and appear to use a shared set of technical terms, several factors can hamper communication. One problem arises from the degree of specialisation required in the sciences and in the application of scientific findings and inventions. Other factors include a limited vocabulary, uncertainty around idiomatic usage, or the kinds of "code-mixing and code-switching [that…] establish identity and belonging to a speech community" (Kirkpatrick & McLellan, 2012:654) in different "Englishes" around the world, and differences in how a specific term might be used in each specialisation. Therefore, when cross-collaboration is necessary, it can be difficult for scientists, including those in the applied sciences, such as engineering, to communicate seamlessly with one another.

One important area of interdisciplinary science communication is the writing and reviewing of funding proposals, often in competition with several other applicants. The larger the funding, the stricter the review process. What makes a given funding proposal unique is what it offers and requires, formulated in terms of discipline-specific details, using the terminology and concepts of a particular specialisation. However, the panel reviewing a funding proposal seldom consists only of experts from the same field of expertise as the person or team writing the proposal. This implies that the content needs to be communicated to a group of educated peers, but usually from various fields.

Hence, a funding proposal needs to be clear enough for reviewers to be able to grasp the merit of the proposed research message. Ideally, for all proposals to be evaluated on their merits, without distractions, it is important that the information be presented as clearly as possible. The proposal should not lead to misconceptions or omit crucial information which may seem self-evident to those who write the proposal, but which may not be so to the reviewers. To help address the need for an equal platform, funding panels often institute templates to be used by the applicants, but templates are inadequate to solve the problem.

Communication is regarded as a “soft skill” in terms of the sciences. Nevertheless, there is a definite need to develop this skill for science communication in general, and in the engineering sector in particular (Taylor, 2016:9-10). Some effort to promote more effective science communication is being made in the form of training programmes focusing on this skill: several universities already include technical communication in their prescribed coursework for scientists and engineers (Baldauf, 2011; Grady & Davis, 1998; Jameson, 2009). However, according to a survey done by PPS[1] in 2013, most engineers and scientists still struggle with the writing and communication process (PPS, 2013:1-2).

Carefully applying appropriate Plain Language principles to funding proposals is one possible solution to ensure clear and unambiguous communication across disciplines. I investigate the possibilities of using selected Plain Language principles, going beyond a purely vocabulary-focused approach, to determine whether there is room for collaboration between scientists and language practitioners in this regard. I also look at which principles are the most applicable for peer-to-peer communication. For instance, the use of Plain Language principles should not be construed as undermining the specificity of scientific vocabulary, but as bridging areas of scientific communication where misunderstanding might arise, so that the principle of a plainer vocabulary in Plain Language may have to be adapted or applied in a very nuanced way. The use of Plain Language principles should aid in making a text accessible in ways that highlight the meaning in the most effective manner possible. The epigraph to this chapter, taken from Quintilian(us) (quoted in Bulaon, 2018:5), calls for “being impossible to misunderstand”, and this would be the aim for good interdisciplinary communication between peers from different scientific backgrounds and disciplines.

Most prior research on Plain Language and science communication has focused on rewriting science for the general public, including school learners, and ensuring that an outside audience (often not scientifically literate) can understand the science that is presented. By contrast, in this study, I focus on interdisciplinary communication with *peers*, where all the parties

[1] According to its website, https://www.pps.co.za/our-story, PPS is a financial services company that focuses exclusively on graduate professionals.

concerned are educated in highly specialised fields, but do not necessarily share the same specialisation, and where the readers need to grasp complex information in a limited time (the review period), without risking misunderstanding.

My exploratory research focuses on funding proposals as a specific instance of interdisciplinary science communication. The purpose of this study is to probe the proposition that Plain Language can be useful in interdisciplinary science communication. It also considers the argument that given the combination of high-level language expertise and scientific or technical expertise required to communicate clearly in such specialised documents, it may be more effective for scientists and engineers to work alongside a language practitioner familiar with Plain Language principles rather than to try to and teach scientists and engineers another "soft" skillset. I investigate how the fields of sciences/engineering and languages can work collaboratively through the use of Plain Language principles and the challenges that both parties would face in such a collaboration.

1.2 PROBLEM STATEMENT

To ensure funding for research and projects, scientists and engineers frequently need to communicate their ideas to a panel of reviewers in the form of written proposals. This is a highly competitive environment, where academics and industry, the private and public sector all have to vie for limited funding pools, sometimes nationally, and sometimes internationally, adding to challenges in communicating in a second language for many scientists. Without funding, expensive projects cannot be undertaken and completed, and complex research may have to be shelved. Proposers are under immense pressure, because the reviewing process is competitive, and scientists and engineers do not often get a chance to re-submit or even explain the research that they propose to do. Reviewers are under pressure because reviews are time-consuming, with the added pressure of needing to make hard decisions regarding limited funding. The reviewing process can also be extremely strenuous for reviewers because they rarely deal with only one proposal. If they have to review several proposals on a tight deadline, reviewers can often only read (if not merely skim) a proposal once (see Section 2.6.4 for more on the reading process). The merit of the concept proposed should ideally be the focus, but if a proposal is unclear, the funding application may be rejected without due consideration, and its merit may not be recognised.

Funding proposals are reviewed by other scientists and engineers. The proposal applicants usually assume that these peers will be able to understand the content of proposals. In practice, however, communication is complicated by the fact that the reviewers on a panel may not necessarily work in the same field as a particular applicant. A panel may consist of physicists, chemists, mathematicians (working in both pure and applied mathematics) and engineers. Aside from the many branches of science and mathematics, engineering is a blanket term covering mechanical, electronic, civil, and industrial engineering, information and communications technology, and many more sub-specialisations. Despite some overlap, each field has its own jargon, theory and abstract concepts. Effective intra- and interdisciplinary communication is thus crucial in the writing and reviewing of funding proposals.

In South Africa, proposals are submitted in English as the *lingua franca* of science communication (see Section 2.2), although the proposers and/or the reviewers may not be English first-language speakers. However, it may be assumed that scientists and engineers that receive training in South Africa are likely to have had most textbooks and tuition in English.

I posit that one way to enhance the chances for proposals not to be misunderstood, and to assist the reviewing process, is to apply specific Plain Language strategies. Martin Cutts[2] (2004:iv) defines Plain Language as follows, in the second edition of his widely used publication, *The Oxford Guide to Plain English*:

> The *writing and setting out* of essential information in a way that gives a cooperative, motivated person a good chance of understanding it at *first reading*, and in the *same sense that the writer meant it to be understood*. (my emphases)[3]

This definition is revisited in detail in Section 2.9.4, where I explore various definitions of Plain Language that might apply in the context of funding proposals. I also investigate how Plain Language guidelines could contribute to a better understanding of how scientists and engineers might communicate more effectively across disciplinary boundaries in the wider engineering and science-related fields.

To cover new ground from most prior research on Plain Language, which tends to concentrate on how it benefits science communication with the general public, this study investigates

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[2] Martin Cutts is the founder and Director of the Plain Language Commission in the United Kingdom. He has been working in the Plain English movement since the 1970s. He is a world-renowned expert on Plain Language principles (Plain Language Commission, 2022).

[3] I used the second edition of 2004. According to Noomé (2015:135-136), Cutts used the same definition in the first version of the book in 1999, and in the third edition of 2009, but opted for a different definition in subsequent editions.

interdisciplinary peer-to-peer science communication and the possible benefits of Plain Language principles for peer-to-peer communication in funding proposals. This is the original contribution of this study, and it is important because effective communication in funding proposals could potentially increase the chances of receiving funding for a project because the project's merits are clear to the reviewers.

1.3 AIM OF THIS STUDY AND RESEARCH QUESTIONS

The aim of this study is to explore whether and how applying Plain Language guidelines to funding proposals can help scientists to communicate their work more effectively to an interdisciplinary panel of reviewers.

The main research question is thus the following:

> **Can Plain Language guidelines be applied to interdisciplinary science and engineering communication, such as funding proposals, to improve clarity and understanding? If so, how can this be done?**

In order to answer the main question, I address the following sub-questions:

- What obstacles do *science experts* face when they read proposals, especially in the context of trying to decipher highly scientific and technical information?
- What obstacles do *language practitioners* face when they read highly scientific and technical content in funding proposals?
- Which Plain Language guidelines (and associated) strategies would be appropriate in addressing the fact that science writing contains technical terminology and abstract concepts, affecting the clarity of proposals at a micro-level?
- If science is, according to several experts, a "language" different from English, how can guidelines for Plain Language be adapted to fit different kinds of scientific or technical communication?
- What are the limitations on the use of Plain Language in the context of fixed templates for such documents?
- How do scientists perceive Plain Language and language practitioners? How do their perceptions inform their willingness to work collaboratively on projects with a language practitioner as part of the team?

1.4 WHY CONSIDER PLAIN LANGUAGE?

The Plain Language movement has gained popularity in recent years, but the ideals that the movement promotes are not new (Cutts, 2004:xiv-xv). They are connected to the notion of a *lingua franca* in the sense that Plain Language, like a *lingua franca*, is about wider (and thus global) access to information. Both the concept of a *lingua franca* and Plain language have interesting interfaces with the realm of science communication, which is admittedly an elite form of communication, but has long had international reach, and also calls for real-world application, which implies communication with a wider public. Before English became the dominant language of science, top-level scientists were expected to be well-versed in more than one language and scientific research was conducted in an array of different languages. According to Gordin (2015:2), "most of humanity for most of its existence has been to a greater or lesser degree multilingual" but in the twentieth century, English came to be the preferred language for science globally. (I expand more on English as the *lingua franca* for science in Section 2.2.)

The notion of using a *lingua franca* as a bridge to make ideas accessible goes back thousands of years, and the issues related to language access were a consideration even in religious texts, as is suggested, for example, by the choice of Koine Greek for the New Testament and the Septuagint, and popular Latin for the Vulgate. According to Firth (1996:240), English as a *lingua franca* is "a contact language between persons who share neither a common native tongue nor a common (national) culture and for whom English is the chosen foreign language of communication". Kirkpatrick and McLellan (2012:662) point out that, globally, there are more speakers using English as a *lingua franca* today than mother-tongue speakers.

Cutts's (2004:iv) definition (cited above in Section 1.2) indicates that Plain Language contains elements of both "writing" and "setting out", taking Plain Language into the realm of the written word, although many of its communicative strategies are drawn from public speaking or oratory, which is a more structured and deliberate practice than ordinary conversational speech. According to James (2008:3-4), the principles of rhetoric (communication in practice) are comparable to those of Plain Language. Like Plain Language, rhetoric has always focused on the effect on the audience to accomplish specific practical objectives. Early examples of Plain Language show that the principles were also included in the spoken word. Greece's democracy used rhetoric as a way for citizens to argue for a certain idea or action publicly.

Clear communication allowed citizens to gain power and influence. Hence, the first teachers of public speaking made their mark on Greek citizens.

The Greek philosopher Aristotle developed the "techne", or craft of rhetoric (James, 2008:3). Cicero, the Roman statesman, lawyer, scholar, and writer, divided the discipline of rhetoric into five canons (James, 2008:4) - the canons of invention, arrangement, style, delivery, and memory. Of these, arrangement and style are arguably the most applicable in applying Plain Language techniques and guidelines, but other aspects also have some modern equivalents. Table 1.1 provides a summary of these canons and their modern-day Plain Language equivalents, some of which are explored for their applicability to science and engineering communication in subsequent chapters.

Table 1.1: Cicero's canons and their modern-day equivalents

Traditional canon	**Traditional application**	**Modern equivalent and Plain Language application**
Inventio	Discovery of arguments	Content: accuracy, completeness, and logic
Dispositio	Arrangement of a speech	Structure: effective sequencing of a document structure for its purpose
Elocutio	Setting the style to a level appropriate to audience and context	Expression: elements such as word choice, syntax, sentence length, efficiency, and tone
Pronunciatio	Delivery of a speech	Document design: typography, layout, and other visual elements
Memoria	Memorising techniques for long passages of text	Databases, manuals, help files, and content management systems

Source: Adapted from James (2008:4)

In 1946, George Orwell wrote his well-known essay "Politics and the English Language", in which he discusses the connection between words and actions. For language to be clear, Orwell (1946:111) insists that a writer should "let the meaning choose the word and not the other way around". He suggests a set of rules for clear language which influenced Cutts, and which are still used, in some form, today:

(i) Never use a metaphor, simile or other figure of speech which you are used to seeing in print.
(ii) Never use a long word where a short one will do.
(iii) If it is possible to cut a word, always cut it out.
(iv) Never use the passive where you can use the active.

> (v) Never use a foreign phrase, a scientific word or a jargon word if you can think of an everyday English equivalent.
> (vi) Break any of these rules sooner than say anything outright barbarous. (Orwell, 1946:111)

Sir Ernest Gower published *Plain Words* in 1948, his *ABC of Plain Words* in 1951 and then a compilation of the first two publications in 1954 as *The Complete Plain Words*. In the prologue to this combined volume, Gower ([1954] 1966:9) states: "Writing is an instrument for conveying ideas from one mind to another; the writer's job is to make his [or her] reader apprehend his [or her] meaning readily and precisely." Gower's statement seems obvious in its simplicity, but how should a writer convey this message? Exactly how should a writer support the reader and ensure that the reader understands the meaning easily? What is plain to one set of readers could be confusing to another. The different Englishes around the world also affect understanding, and, as English develops, what might be plain in meaning today might not be understandable in future (Cutts, 2013:13). In the case of science, a specialist term might mean one thing to one specialisation and another thing to other disciplines.

As early as 1953, Stuart Chase (cited in Mazur, 2000:204) published *The Power of Words* in the United States of America. Several American presidents also saw the merit of Plain Language in the years following. Most scholars agree that the Plain Language movement gained traction in the 1960s. In 1972, President Richard Nixon decreed that the Federal Register had to be written in "layman's terms" (Mazur, 2000:205). In 1998, President Bill Clinton urged government officials to use Plain Language for all government documents (Thrush, 2001:292). In several other countries, such as Australia, Canada, Sweden, New Zealand and South Africa, there is also increased interest in the Plain Language movement (Mazur, 2000:206).

In the South African context, the writing of the *National Credit Act, 34 of 2005* (RSA, 2005) and Article 22 of the *Consumer Protection Act, 68 of 2008* (RSA, 2008) in Plain Language, and calling for greater transparency in financial documentation has helped to promote the public's access to fair contracts and increased transparency from financial institutions providing credit to consumers. These Acts define "plain language" as follows:

> A document is in plain language if it is reasonable to conclude that an ordinary consumer of the class of persons for whom the document is intended, with average literacy skills and minimal credit experience, could be expected to understand the content, significance, and import of the document without undue effort, having regard to—
> (a) the context, comprehensiveness and consistency of the document;
> (b) the organisation, form and style of the document;

> (c) the vocabulary, usage and sentence structure of the text; and
> (d) the use of any illustrations, examples, headings, or other aids to reading and understanding. (RSA 2005, 2008, also cited in Noomé, 2015:137)

The importance of Plain Language and how it applies to the field of law is investigated by Feldman (2009) in the article "Plain Language for patents", by Garner (2013) in his textbook *Legal Writing in Plain English*, and for South Africa by Van der Walt and Nienaber (1997) in Chapter 9 of their textbook *English for Law Students*. Cornelius (2015, 2016, 2017) has done extensive work on Plain Language in South Africa, including its applications in the banking sector (Cornelius, 2016), and the importance of Plain Language in the South African milieu (Cornelius, 2017). Cornelius's work on defining Plain Language in the South African context was part of what inspired this study, but her focus is on Plain Language in the context of the law and finance, which, like science, have specialist vocabularies. The law is not my focus, although I draw on the same principles. Nor do I look at the well-trodden field of communication with the general public, or at science communication with learners at school level discussed by Fouché (2018) or even at tertiary level, as explored by Fouché and Müller (2021). The focus of this study is whether or not Plain Language can aid in more effective interdisciplinary science communication, and if so, to look at how to apply selected Plain Language principles to achieve more effective science communication.

In a South African context, we face the challenge that South Africa is a multicultural and multilingual society with 11 official languages.[4] Many discussions and investigations to date around Plain Language principles and guidelines have taken place in societies where it assumed that a single language is spoken by most citizens, such as the United Kingdom and the United States. Because South Africa is a multilingual society, the Plain Language guidelines and principles that would be effective in South Africa may need to differ slightly from those for a more homogeneous society. The cultural differences in South Africa will also have an impact on how Plain Language develops in future (Viljoen-Smook, 2020:14).

Despite its manifest popularity and success where it has been applied, there is considerable resistance to Plain Language among professionals, including the legal, medical and scientific community, even when expert language practitioners have been involved.

[4] Sign language is set to become South Africa's twelfth official language (Thomas, 2022:n.p.), but is concerned mainly with interpersonal and in-person communication, rather than with scientific communication in written form, so it is not discussed here.

1.5 "TECHNICAL CANNOT BE PLAIN"

The pitfalls of collaboration between language practitioners and experts in other fields have been noted in a number of prior studies. One of these highly specialised fields is law. In South Africa, there have been efforts by legal experts and language practitioners to work together, albeit mostly with the intention of communicating with the general public. Cornelius (2016:26) states in her article "An appraisal of Plain Language in the South African banking sector" that there are two main concerns that pertain to how Plain Language principles are applied to legal documents and collaboration. I argue that these concerns are equally applicable to engineers working with language practitioners. Where Cornelius uses the term "legal practitioners", it can easily be replaced with "engineer/scientists". She asks whether "language practitioners have the required knowledge, skills and expertise to accurately convey complex legal [engineering/scientific] concepts and ideas in plain and understandable language without risk to legal status and legal consequence [scientific accuracy]" (Cornelius, 2016:26).

This raises questions about the discipline-specific expertise of language practitioners, who are trained in language and communication-related fields. The inverse might also be asked: "Conversely, do legal practitioners [engineers/scientists] have the required (text) linguistic and other related knowledge and skills to enhance consumers' understanding of the content and significance of a complex legal [scientific] text...?" (Cornelius, 2016:26).

Critics of Plain Language argue that it is not always easy to focus just on writing documents plainly. In this regard, Bekink and Botha (2007:34) point out that there are several considerations in the field of law when it comes to Plain Language. One of these considerations, according to Assy (2011:379), is that the complexities of law cannot be reduced to mere elements of language and style. Assy argues (2011:379) that complexity is what makes legalese necessary in the field: "By suggesting this [the use of Plain Language], it presumes that persons who are not legally trained are capable of fully understanding the law and availing themselves of its protections without a lawyer, if only the language is stripped of its unnecessary complexity." The scope of the current study precludes a more detailed dissection of Assy's somewhat defensive claim, which focuses on the legal *vocabulary*, whereas Plain Language principles go beyond just looking at vocabulary.

Where scientific communication is concerned, Halliday and Martin (1993:70) believe that the nature of science does not make it viable, or even desirable, to present scientific or technical information in any other way than how the research is done: "...you cannot separate science from how it is written or rewrite scientific discourse in any other way". They claim that the highly technical vocabulary of scientific writing is not just a set of impressive-sounding words that replace everyday words, but contains complex scientific concepts that have been developed over many years and have come to represent abstract ideas and processes. (This is broadly true, but should not preclude the possibility of explaining those concepts.) According to Halliday (1989:14), learning science is about more than just these abstract ideas and processes – it is also about learning the *language* of science. And the difficulty with the "language" of science is not just a result of the words themselves but the inherent nature of science and, therefore, the subject matter is the source of the problem and not the language. I discuss the language of science and mathematics in more detail in Section 2.3, taking issue with some of these assumptions.

Theoretically, if scientists (and engineers) work alongside language practitioners to follow Plain Language guidelines, this could ensure that the purpose of research is communicated as clearly as possible in documents such as funding proposals, while still making room for the vocabulary of the relevant disciplines. Using that vocabulary more mindfully should enhance the final product when the scientific expert and the language expert form a team. However, Halliday and Martin (1993:2) caution against this type of collaborative work because they claim that "the language of science" differs too much from ordinary English. This is similar to the issue raised by Cornelius (2016:26), cited above. I do not refute the part of their argument that relates to the vocabulary of science, but contend that Plain Language does more than change vocabulary. Halliday and Martin (1993:2) describe some of the difficulties of communicating science and suggest that these can be challenging to a non-scientifically trained language practitioner.

I took these caveats seriously, and have therefore probed the challenges that a language practitioner might face in my survey and interviews, as discussed in this thesis, because it is important to explore whether scientific language and "engineerese" can be deciphered, as legalese and academese can often be, and can be "translated" or at least made clearer and easier to review for scientists in other fields.

1.6 PRIOR PLAIN LANGUAGE AWARENESS IN THE SCIENCES

There are currently several fields that have already investigated the value of Plain Language. Although there is an awareness amongst scientists of the benefits of using Plain Language to communicate important scientific information to the general public, there has been no assessment yet on the possible value that Plain Language can have when applied to funding proposals as a form of interdisciplinary peer-to-peer communication.

Applications of Plain Language are often consumer-driven (Cutts, 2004:xxvi; Burger, 2018:1, 41), especially in the fields of legal documents relating to consumer needs. In several countries, legal documents, contracts, and public health announcements have been reviewed and then rewritten into Plain Language (Cutts, 2004:x-xi). Medicine, as a scientific field, has also had to grapple with Plain Language to communicate essential information to patients and users of medications. In an article on Canada's health information brochures, LeBrun, DiMuzio, Beauchamp, Reid and Hogan (2013) highlight the importance of health literacy to educate the public, because members of the public may need to grasp complex scientific concepts to understand what medicine to take and what is happening to their bodies while they are being treated.

The use of Plain Language principles to motivate a reader to process complex information is obvious here – pharmacies, clinics and doctors' offices are often lined with public information pamphlets and brochures. Recent communication about medical findings around Covid-19 and vaccines (including information to allay fears caused by misinformation) are another case in point. Bala, Keniston, and Burden (2019:2) found that patients prefer Plain Language medical notes. In response to patients' need for clearer information, Fulton, Kaley, and Gardner (2019) have published an article describing tumours in Plain Language. Whether or not such attempts at Plain Language versions of complex information are successful fall beyond the scope of this study – although the medical sciences fall within the wider ambit of the "sciences", I do not look at this field.

Scientists from all fields are increasingly made aware of Plain Language to communicate with a wider public. For example, several journals publishing scientific research from various specialties require researchers to submit their articles along with a Plain Language summary. One of these is *PLOS* (2021:n.p.), a non-profit, open access journal, which publishes research in science and medicine, and which encourages journal article submissions to include a Plain Language summary of the work.

Kerwer, Chasiotis, Stricker, Günther and Rosman (2021) and Locke, Whiteman, and Mitrany (2001) have discussed the importance of Plain Language summaries in the scientific community. They believe that Plain Language summaries have the potential to communicate complex (critical) scientific concepts to a wider audience that might otherwise not have had access to this information. According to Gudi (2021:n.p.), one of the benefits of writing Plain Language summaries is that it helps to promote "knowledge transfer" to everyone, from the general public to the expert. With regard to the writing of Plain Language summaries, Gledhill, Martikainen, Mestivier and Zimina (2019) have investigated the editorial guidelines of the Cochrane Organisation, which specialises in communicating specialised medical knowledge to both professionals and the general public. They comment on the vagueness of Plain Language summary guidelines to scientists and the issues that these scientists encounter in trying to communicate this specialised knowledge in a more simplified manner. Dormer, Schindler, Williams, Lobban, Khawaja, Hunn, Ubilla, Sargeant and Hamoir (2022) attempt to provide scientists with a practical "how-to" guide on how to draft Plain Language summaries.

One example of a Plain Language summary in a field similar to that from which I took the documents I explore is the abstract by Zampieri, Goessling, and Jung (2018), in their article "Bright prospects for arctic sea ice prediction on subseasonal time scales":

> With retreating sea ice and increasing human activities in the Arctic come a growing need for reliable sea ice forecasts up to months ahead. We exploit the subseasonal-to-seasonal prediction database and provide the first thorough assessment of the skill of operational forecast systems in predicting the location of the Arctic sea ice edge on these time scales. We find large differences in skill between the systems, with some showing a lack of predictive skill even at short weather time scales and the best producing skillful forecasts more than 1.5 months ahead. This highlights that the area of subseasonal prediction in the Arctic is in an early stage but also that the prospects are bright, especially for late summer forecasts. To fully exploit this potential, it is argued that it will be imperative to reduce systematic model errors and develop advanced data assimilation capacity.

In this summary the authors attempt to summarise their key findings regarding the use of Computational Fluid Dynamics (CFD) in terms of predicting the formation of sea ice, but this aim is hidden in this paragraph. The vocabulary is not particularly specialised, and only one sentence is longer than 26 words, but the abstract is far from clear at first reading, suggesting that other Plain Language principles should come into play. This particular summary demonstrates my contention that although they often agree with the principle and merit of Plain Language summaries, few scientists are sufficiently trained on all the nuances of good Plain Language writing – technical vocabulary is often, as in this case, not the main difficulty. The authors fail to present the information in a structured way that is easy to follow and then miss out on an opportunity to tell the science "story". I elaborate on this aspect in Section 2.6.

A detailed exploration of Plain Language summaries, as well as whether or not the summaries are effective, falls outside the scope of this thesis. For the purposes of this study, it is important to note that some scientists seem to be at least aware of Plain Language, albeit only in summaries or abstracts. This perceived awareness was something I wanted to investigate. In the survey and interviews, I felt it was important to ask the respondents about Plain Language to test whether scientists in South Africa are indeed aware of Plain Language. (The results of the survey and interviews are discussed in Chapter 5 and Chapter 6.)

1.7 METHODOLOGICAL APPROACH

This is an exploratory study examining the possibility of employing Plain Language for more effective science communication in six phases (these are discussed in detail in Chapter 3).

In the first phase, I undertook a literature review on Plain Language and the sciences, and whether Plain Language principles are already being promoted in science communication. This literature review also included a preliminary identification of Plain Language principles to establish guidelines that could be useful in the writing of more effective funding proposals, which originally piqued my interest in the potential for the application of Plain Language in interdisciplinary science communication. I also explored various definitions of Plain Language to draft a definition to guide this study.

In the second phase, I analysed two rejected funding proposals obtained (with permission) from scientists and engineers working at a leading research institution in South Africa. Institutions have different types of funding proposals for different types of projects. The two proposals that I used were

- a Technology Demonstrator entitled "A black-box coupling tool for partitioned, multi-physics simulations"; and
- an Expression of Interest entitled "Leakage detection of gas in a 3D space using CFD and IIoT".

These texts were used as case studies, in which I identified complex language as examples of "engineerese". I identified which of my preliminary Plain Language guidelines could be applied to clarify the communication, and then rewrote parts of these documents as sample texts to use in the third phase of my study.

In the third phase, I engaged with the realities in the field, by means of a survey and interviews. The survey was first pilot-tested and then sent out to a sample of scientists (including some engineers) via the South African Council for Natural Scientific Professions (SACNASP). The aim was to gauge writing involvement, awareness of Plain Language, and test responses to the sample texts (original and rewritten) in this diverse readership, as well as prior engagement with a language practitioner, and willingness to engage with a language practitioner in future. The survey development, pilot test and roll-out are described in detail in Section 3.5, including the ethical implications of conducting the survey (see Section 3.7).

In combination with the survey, I also conducted two rounds of semi-structured interviews with scientists and engineers from different fields. The first round was conducted in the third phase with a small engineering consulting firm by means of purposeful sampling. The third phase ended with a preliminary inspection of themes emerging from the first round of interview results and the survey results. In the fourth phase, I conducted a second round of semi-structured interviews to clarify some of the responses from the first round. For the second round of interviews, interviewees were recruited by asking respondents to the survey whether they would be willing to be interviewed for further clarification on some areas of the survey to add more qualitative data. The interview process and the ethical implications are discussed in detail in Sections 3.6 and 3.7.

A special focus of the survey and the interviews was to determine the understandability of the Plain Language sample texts from Phase 2. The interview questions also provided me with an opportunity to explore to what extent the concept of Plain Language is already known in technical fields, and whether scientists are of the opinion that there is a place for Plain Language in science communication.

After conducting the interviews and the survey, I completed a detailed data analysis and using ATLAS.ti in Phase 5, I was able to present the data visually. I then proceeded to Phase 6, the drafting of a final set of Plain Language guidelines.

1.8 OUTLINE OF THE THESIS

In the first chapter, I have provided background on the problem of science communication, aiming to explore interdisciplinary science communication in engineering funding proposals as a specific form of peer-to-peer communication where clarity is crucial. I consider the Plain Language movement and current applications of Plain Language. Defining science communication is important in the context of how scientists, including engineers, need to communicate their work to either the public or to other stakeholders (in this study, the relevant stakeholders are peer reviewers and funders). I also briefly discuss my methodology and provide an outline of the different stages of the study.

In the second chapter, I focus on how English came to be the dominant language of science. As part of the discussion, I also investigate how "storytelling" can help scientists and engineers to ensure that their funding proposals can be reviewed on merit. I discuss the use of Plain Language in science communication and a few key differences between the language of science and mathematics. I conclude the chapter with an investigation into different definitions of Plain Language and then define Plain Language for the purposes of this study, before selecting eight guidelines for this study.

In the third chapter, I give a detailed explanation of the methodology I used to conduct this study. I discuss the various phases in detail, provide a rationale for the survey and interview questions, discuss the development of the survey (including pilot testing) and interview schedule, the data analysis, as well as the ethical implications of this study.

In the fourth chapter, I report on my analysis of the two funding proposals as case studies to determine the pitfalls to consider when I proposed Plain Language sample sets for the surveys and the interviews. I needed this analysis to inform the sample texts that I included in the survey and interview questions.

The fifth chapter presents and discusses the data from the survey. Using SurveyMonkey, I gathered demographic information about the participants. Their perceptions of the sample texts were also tested. This chapter shows that using Plain Language principles can help to improve comprehensibility in proposals to help reviewing panels (composed of members from various disciplines) to judge proposed research on merit, rather than being distracted by a lack of clear communication. Data were also gathered on the participants' perceptions of language practitioners and their willingness to collaborate on projects to discern whether applying Plain

Language and working with language practitioners are viable solutions for more effective interdisciplinary peer-to-peer communication.

In the sixth chapter, I focus on the results from the follow-up interviews that I conducted after the respondents had completed the survey. I analyse interview respondents' data and visually represent the findings using ATLAS.ti.

In the last chapter, Chapter 7, I summarise my findings, explore possible recommendations for future research, present the final Plain Language guidelines, and reflect on the strengths and limitations of the research.

CHAPTER 2:
LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, I review the literature that provides the necessary background on science communication and Plain Language to provide a starting point for the next phases of the study. This is in line with my focus on whether language practitioners can apply Plain Language guidelines to interdisciplinary science communication, such as funding proposals, to improve clarity and understanding. This chapter starts by looking at English as the *lingua franca* of science, its role in intra- and interdisciplinary science communication, and how it came to be that most science is published mainly in English today. In the context of this development, I discuss Plain Language and its current application to scientific documents and science communication, including teaching the rudiments of Plain Language principles as part of teaching science communication at university. The purpose of this discussion is to help give context to my research questions and show gaps in the literature which my research is intended to address.

I continue the discussion by considering how to tell, and read, the "science story". As part of this discussion, I look at what a story is and how familiar sequencing can help to create a schema for readers. I also investigate the reading process and important elements to consider when thinking about applying Plain Language guidelines to funding proposals. Before looking at the different approaches to defining Plain Language, I consider the difficulties with scientific vocabulary and how words could potentially mean different things in different specialisations. In writing funding proposals, it is important to ensure that a reviewer cannot interpret what is being said any other way than how the author(s) (applicants) intend the research to be interpreted.

I conclude the literature review with a discussion on three different approaches to defining Plain Language. I draw on various definitions of Plain Language to build a working definition of Plain Language for the purposes of this study, containing the most relevant elements of these three approaches. My proposed definition of Plain Language is then applied in the choice of eight guidelines that I used to analyse and rewrite funding proposals in the second phase of this study.

2.2 ENGLISH AS THE *LINGUA FRANCA* OF THE SCIENCES

Scientists require a shared language for peer-to-peer communication, often across disciplines. Therefore, I discuss the *lingua franca* of science in relation to Plain Language, as my thesis specifically focuses on interdisciplinary science communication. The choice of a shared language is the first step to intra- and interdisciplinary communication, and Plain Language versions of that shared language is one solution to improving clarity and removing ambiguity.

English has not always been the language that scientists preferred to use when communicating their discoveries. For almost two millennia, until the nineteenth century, scientists in the West used Latin, as indicated in Section 1.4. Indeed, Latin terminology can still be found in legal, botanical, zoological, and medical texts. By the start of the twentieth century, three languages other than Latin were commonly used in publishing scientific research – French, German, and English – in line with the political dominance of England, France and Germany in Europe (Baldauf, 2011:141-142). Scientists were also publishing in Italian, Dutch, Russian, Polish, and Czech (Baldauf, 2011:141-142). The spread of English due to British and later American imperialism, as well as key events of the twentieth century, altered this situation. After the end of World War II, German in particular was no longer favoured for the publication of scientific research, and the Russian-dominated sphere became less willing to share scientific findings with the West.

Since then, English has become the preferred language in which to publish research (Skapinker, 2015). This was partly because after 1945, the United States of America, a predominantly English-speaking nation, was the key Western industrialised nation with an intact educational and industrial infrastructure. Post-war immigration resulted in a need to establish one language for education. The Cold War led to rapid technological advances, and most research was published in English (Baldauf, 2011:142).[5] More research findings were available to more people, because most had access to English, at least as a second or other language.

Baldauf (2011), in his chapter in Ammon's collection of essays, *The Dominance of English as a Language of Science: Effects on Other Languages and Language Communities*, cites a number of surveys that reveal the shift to English as the dominant language in scientific publications. In 1967, a survey showed that half of the scientific research published in chemistry, mathematics, and medicine was still in a language other than English. In biology,

[5] Research was published in Russian, but this was not made available globally.

physics, and engineering, only 15% to 20% of scientific research was not published in English (Baldauf, 2011:143). Another survey, conducted in 1981, showed a significant increase in the preference for English as the language in which to publish scientific findings. Looking at the trends from 1965 to 1988, English thus became the dominant language for scientific research, followed closely by Russian during the Cold War, given the influence of the Union of Soviet Socialist Republics (USSR) at that time (Baldauf, 2011:144). However, in the wake of the collapse of Russian dominance in Eastern Europe at the end of the twentieth century, English gained in influence, even if the number of English second-language speakers today far outnumbers mother-tongue speakers (Baldauf, 2011:145).

Science is a cumulative process. Scientists make discoveries; these discoveries are then explored further by others in the scientific community. Most of the global technical information is now available in English (Baldauf, 2011:142-143). If countries do not have access to this technical information (if their scientists are not competent users of English) they are less economically competitive. In South Africa, scientists face the same challenges as in many other countries: scientists, whether they are first-language English speakers or not, have to conduct research drawing on the scientific literature in English, and publish their findings in English. Aside from dealing with complex concepts in a language not their own, the equivalent terms for some scientific concepts might not exist in the scientist's mother tongue (Chetty, 2013:2). The issue of inequality in terms of language is a topic that is widely debated in South Africa, especially since 1994.

The *Constitution of the Republic of South Africa Act, 108 of 1996* (RSA, 1996:1245) explicitly states that all 11 official languages are equal, and no language is subordinate to another. It mandates the Pan South African Language Board to promote developing and using all 11 official South African languages. This need for including and accepting multilingualism in South Africa has led to the drafting of the South African Language Policy and Plan. According to Wright (2015:187), the South African Language Policy and Plan

> is an instrument for protecting and nurturing the nation's linguistic heritage in an equitable manner. It aims to address the linguistic consequences of colonial and apartheid language policy in the past and to foster effective national and international communication for the future.

The Language Policy and Plan seeks to develop a system where all 11 official South African languages are used in "every domain of a modern economy for every ordinary and specialised function" (Wright, 2015:190). However, although science is an area of fundamental importance for South Africa's development, it is unlikely that any real changes will be made regarding science communication (Wright, 2015:189). The reality is that English will remain the dominant language of science in South Africa. As Titlestad (1996:165) rightly notes, "South Africa must be able to communicate with the rest of the world". It is crucial for South African scientists to be in touch with international scientific work, and to communicate their own work to each other across the country and to a global audience if they are to stay on the world stage of scientific research.

Although scientists are thus required to communicate in English (as a first, second or other language), matters are complicated by the fact that the vocabularies of different specialisations also differ both from "ordinary" English, and from each other. Taking note of how the languages of mathematics and other disciplines differ from "ordinary" English is important, as scientists (especially second language speakers) are not only working in a new language, but also have to master a new way of communicating complex information.

2.3 THE LANGUAGE OF SCIENCE AND MATHEMATICS

According to several experts, the languages of science and mathematics should be viewed as languages in their own right (Halliday, 1989; Halliday & Martin, 1993:2). Gordin (2015:4) states that "scientific activity is communicated in a language. I do not simply mean 'in words'; I mean in a particular, specific language, shared by a community of speakers". Although there will be often some overlaps in this "language" that scientists speak, each discipline has its own unique traits. This may require a combination of "languages" in one document, complicating the reading process; for example, the two funding proposals that I used as a case study for my document analysis (see Chapter 4), focused on mathematical modelling, but in combination with other disciplines. The reason that the language is important in this discussion is that although there is a belief that "science" should be a universal language, this is not entirely true. Gordin (2015:11) explains that there is an assumption that

> scientists can simply read the equations and figure out what is going on. This might be true in certain cases, but it is hardly true generally. Even for an ostensibly 'hard' science like chemistry, papers contain more than isolated chemical formulae and mathematical equations. You read descriptions of the reaction, analyses of colors and odors, detailed explanations of method.

Keeping this in mind, I think it is important in a given document to investigate not only English as the dominant language of science, but also how this "English" would differ between the two (or more) different disciplines relevant to the document.

2.3.1 The language of mathematics

The original funding proposals that I used as sample texts draw on mathematical modelling. Mathematical modelling is a field of study that uses mathematical equations to conduct research in fields where hypotheses are either too difficult or too expensive to prove using experiments, and are therefore not viable to explore using traditional experimental methods.[6]

According to Orr and Schutte (1992:185), mathematics is a complex, precise language with its own vocabulary and communication structure. Mathematical language is read from left to right, like English, but that does not mean that these two languages work the same way. Every sign, symbol and connection can be read in words. In mathematics, the symbols convey generality, communicate clearly, are easy to manipulate, and convey a large amount of information in a very compact, precise, and elegant way. However, “there are only a limited number of symbols in print fonts” that mathematicians can use (Orr & Schutte, 1992:199). As a result, the same symbols are used for a variety of purposes, which could lead to confusion. Orr and Schutte (1992:188) comment:

> Mathematics places great emphasis on the ability to write clearly and concisely, and above all, unambiguously. For this purpose the elaborate and precise language of mathematics was developed… The language of the mathematician in this respect is just the opposite to the language of the poet; yet, the most elegant and sublime thoughts can be expressed by both.

To enable this clear, concise and unambiguous writing, the symbols in mathematics all help to convey its message. The use of brackets (referred to as a bracket pair) in mathematics, is a useful example of a different use than the use of brackets in “ordinary” English. In English, if you use brackets, the reader is given some extra (optional) information, but in mathematics all the information in brackets is important and nothing in brackets can be discarded. Every symbol in mathematics is important and nothing can be disregarded, or seen as less important, or as just extra information. In the language of mathematics, brackets indicate the sequence in which a complicated formula should be read and the predefined sequence of actions that the reader will need to focus on (Orr & Schutte, 1992:200). The brackets in mathematics can also help to define a specific concept or symbol. The bracket pair is also used “to collect similar groups of physical and other constants or variables together” (Orr & Schutte, 1992:201).

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[6] The arctic ice study mentioned in Section 1.6 is a case in point.

The verb "to be" and the related symbols have very exact meanings. It appears in mathematical texts in five different ways (Orr & Schutte, 1992:203-204), to

- indicate identity;
- connect, as a linking word, what is written on the left and right of equations;
- indicate a state, condition, property of an object on the left and how this is modified by what is written on the right;
- act as an auxiliary verb; and
- to act as the passive of other verbs.

One of the symbols for the verb to be is the equal sign (=), and there are very particular conventions that dictate how information is presented to the left and the right of this symbol. Including the symbol = in any equation means that whatever is on the left and on the right match exactly. When in mathematics we say A=B, we cannot mean merely that they have similar characteristics, it means that they are exactly the same in all respects. Mathematics places very carefully defined constraints on every use of a specific word, term, or symbol (Orr & Schutte, 1992:206).

Most language practitioners have very limited experience with mathematics and may not be able to understand complex mathematical equations. However, being aware of the differences between mathematics and English offers the definite advantage that the editor can be trained to be alert to certain areas that might need clarification within the abstract conventions of communicating technical information.

2.3.2 The language of science

Scientific English has a specific functional grammar that relates to scientific research and all the fields of expertise that fall under the blanket term "science". Halliday (1989:27), who sees the language of science as a unique language in its own right, explains:

> In a certain sense, [science] presents a different view of the world. As we grew up, using our language to learn with and to think with, we have come to expect (unconsciously, until our teachers started to give us lessons in grammar) that nouns were for people and things, verbs for actions and events. Now we find that almost everything has been turned into a noun. We have to reconstruct our mental image of the world so that it becomes a world made out of things, rather than the world of happening—events with things taking part in them—that we were accustomed to.

Starting from this idea that science turns everything into nouns, I briefly discuss the characteristics of the language of science that can be challenging to a reader.

According to Halliday (1989:15), scientific English has seven characteristics that can make it difficult to understand and that pose challenges for "translating" its vocabulary into Plain Language:

- interlocking definitions;
- technical taxonomies;
- special expressions;
- lexical density;
- syntactic ambiguity;
- grammatical metaphor; and
- semantic discontinuity.

The first of these characteristics is interlocking definitions, which use various words that depend on each other to create meaning. Although the words in themselves may not be complex words, the fact that they are all used to define each other can make it difficult to keep track of what is being defined. The more terms are added to the definition, the more complicated things can become. Halliday (1989:16) uses the following example to illustrate why interlocking definitions are difficult to follow – in this example the words circle, radius, and centre are all used to define each other through the two concepts of distance and plane curve that is already known (Halliday, 1989:16-17):

> A circle is a plane curve with the special property that every point on it is at the same distance from a particular point called the centre. This distance is called the radius of the circle. The diameter of the circle is twice the radius. The length of the circle is called its circumference.

The second characteristic is technical taxonomies, which are "not simply groups of related terms; they are highly ordered constructions in which every term has a definite functional value" (Halliday, 1989:18). This implies that a scientific concept may have many parts to it, and that these may be hierarchically structured to ensure that specialised terms have a specific meaning based on the context of the taxonomy. For example, the concept "climate" may refer to both different kinds of climate, and different parts of climate. This is illustrated in Figure 2.1.

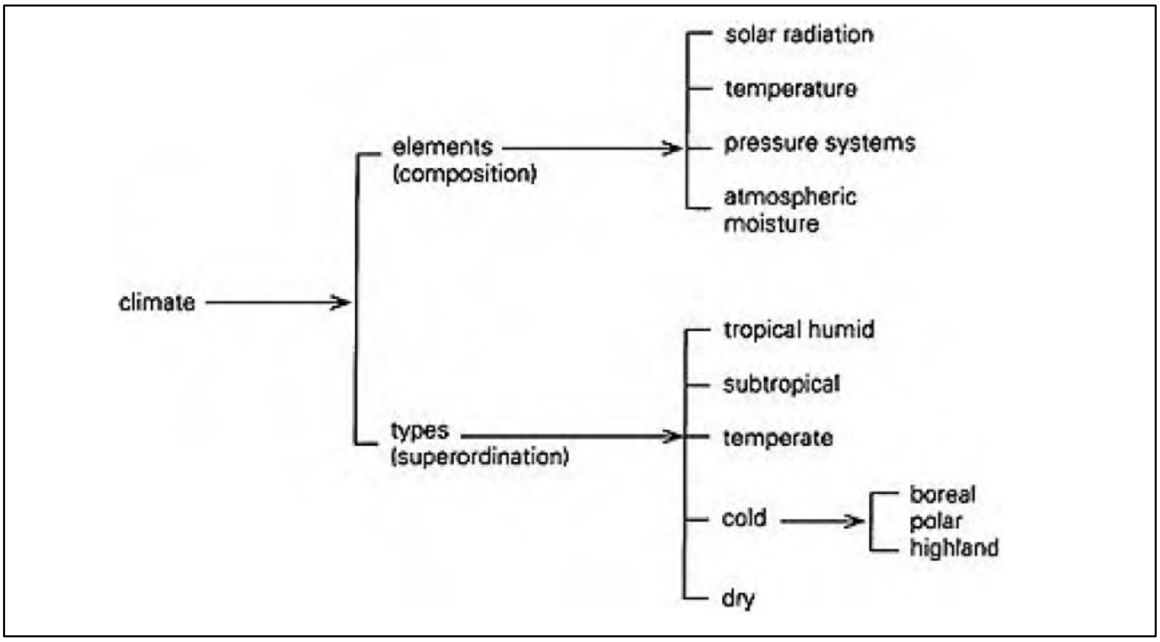


Figure 2.1: The taxonomy of climate as an example of the importance of context

Source: Wignell, Martin, and Eggins (1989:367)

The third characteristic of scientific language is that it uses special expressions which, in any other context, would not make any sense, or not the same sense as in "ordinary" conversation. These special expressions can be ambiguous and difficult to decipher because the "doer" in the sentence is often removed (passives abound in science writing) and abstract concepts may be given "special" properties. The simplified example that Halliday (1989:20) gives states that

> (y)our completed table should tell you what happens to the risk of getting lung cancer as smoking increases. The table is, of course, a table of figures; that is understood. But how does a table tell you something? – tables do not talk, even tables of figures. And what kind of an object is a risk, such that we can ask what happens to it? And what does smoking increases mean: that more smoke is put out by some combustion process? What kind of relationship is being expressed by the as: does it mean 'while' (time), 'because' (cause), or 'in the same way that' (manner)?

Even where words themselves are simple, these special expressions can be very difficult to understand. Here, again, all the concepts are interrelated and words depend on each other to create meaning and context.

A fourth complication of these special expressions is that they can be very lexically dense. In this context the lexical density of scientific language refers to the number of words in a clause that give critical information. Halliday (1989:20) uses the following example:

"A *parallelogram* is a *four-sided figure* with its *opposite sides parallel*" (my emphases)". In this sentence there are six words that are critical to meaning. The more concepts are described in a sentence, the more difficult it would be to keep track of what the writer is describing.

The fifth characteristic that adds to the complexity of scientific English is syntactic ambiguity. Relational words such as "as" can mean time, cause, or manner, which could lead to misunderstanding. Verbal expressions such as "reflected in" and "associated with" may be problematic because it is difficult to distinguish whether they indicate relationship or cause. In the example "lung cancer death rates are clearly associated with increased smoking", the words "associated with" could mean that the more one smokes, the higher one's chances of dying of lung cancer, but in this particular sentence, the meaning can also be that the higher cancer death rates are, the more people smoke. What does the term "rates" in "lung cancer death rates mean"? Is it how *many* people die from lung cancer or how *quickly* people die after getting cancer? "Increased smoking" may mean more people smoke, or it may mean individual people smoke more. In this example, the writer does not commit to a specific meaning statement (Halliday, 1989:22). Usually, a sentence would not be analysed in isolation without its context, but it remains important for an editor to be aware of such potential ambiguities. I expand on these obstacles in Chapter 4.

According to Halliday (1989:20), lexical density and syntactic ambiguity are the result of grammatical metaphor when one grammatical class is substituted for another. For example, "the glass crack growth rate" in essence means how quickly cracks in glass grow. How quickly is also replaced by rate. In scientific English, the traditional functions of nouns (used to signify people and things) and verbs (used to signify actions) may be overturned (or not).

The last characteristic that presents a challenge for language practitioners embarking on the process of translating scientific English is semantic discontinuity. Writers often make semantic leaps where one event causes another event. The challenge is that scientists writing documents such as funding proposals often assume that the reader already has a particular item of information – taking for granted shared knowledge – and then presents new information without indicating that the information is new or that critical pieces of information will follow from this. Halliday (1989:28) provides an example of three paragraphs that focus on the pepper moth:

> In the years since 1850, more and more factories were built in northern England. The soot from the factory smokestacks gradually blackened the light-coloured stones and tree trunks.
>
> Scientists continued to study the pepper moth during this time. They noticed the dark-coloured moth was becoming more common. By 1950, the dark moths were much more common than the light-coloured ones.
>
> However, strong anti-pollution laws over the last twenty years have resulted in cleaner factories, cleaner countryside and an increase in the number of light-coloured pepper moths.

In the last paragraph, there is no link between anti-pollution laws and the paragraph that came before detailing more dark moths in the 1950s. The link between anti-pollution laws having an impact on the environment of the light-coloured moth, and how a cleaner environment helped it to thrive is a semantic leap. The reader here has to discover that this is now new information, understand what the implied meaning is and then use this new information to understand the rest of the information to follow. This places undue effort on the reader to connect the proverbial science dots.

If it is unlikely that scientists will be required to communicate their research in any other language than English, and scientific English is generally not clear, this then suggests that Plain (or plainer) Language may offer at least part of the solution. If English is to remain the dominant language of science, and it needs to be more effective in communicating across disciplines, even in a peer-to-peer context, does science communication already include Plain Language principles, or awareness of them, at the moment? This question may be answered by evaluating science communication whether Plain Language principles are already being used.

2.4 PLAIN LANGUAGE AND SCIENCE COMMUNICATION TO THE PUBLIC IN SOUTH AFRICA

The fact that scientists are sharing information with the public suggests an awareness of the need for science to be simplified for non-scientists. Gastell (1983:ix), a medical doctor, in the preface to *Presenting Science to the Public*, explains why it is important to educate the public on the sciences:

> ... science is an integral part of our culture. We would not tolerate locking the musically untrained out of concert halls; we would not banish all but art historians from art museums; nor would we restrict Shakespeare and Dickens to scholars of drama and literature. Rather, we have program notes, gallery tours, popular lectures, and more. The public deserves similar help in understanding and appreciating science.

Ground-breaking research is being done in the sciences in South Africa, and institutions such as the Council for Scientific and Industrial Research (CSIR), the various universities and Creamer Media communicate scientific research and big projects to the public. They do this via social media and publications such as *ScienceScope*, UP's *Innovate* and commercial media such as *Engineering News*.

ScienceScope is a magazine-style publication that focuses on specific themes related to different aspects of research at the CSIR, according to the CSIR website (n.d.). The readers of this publication are "varied and include decision- and policy-makers, leadership in appropriate government departments, peer-researchers locally and abroad and the informed public with an interest in science" (Sabinet African Journals, 2022:n.p.). The University of Pretoria's *Innovate* focuses on technological advancements from the Faculty of Engineering, the Built Environment and Information Technology. It is published annually, and the mission of the magazine is to "promote the understanding of new and emerging technologies in engineering, the built environment and information technology" (University of Pretoria, 2022:n.p.). Although the audience is not explicitly stated as the public, or scientifically less literate, I interpret the mission statement as aiming the publication at a wider public that includes non-scientists.

ScienceScope and *Innovate* are published by academic and research institutes, whereas Creamer Media's *Engineering News* is a commercial publication focusing on a wide range of topics on various industries including, but not limited to, agriculture, economics, mining, and construction. According to their website, they have a readership of 61 424 people, and their target readers can be specialists or more general readers with an interest in the topics discussed. They have printed copies of their weekly magazine, as well as an online platform (Creamer Media's Engineering News, n.d.). These are by no means the only publications communicating science to the general public, but are typical, and show that South Africans do have access to science in the media. However, Joubert and Mkansi (2020:786) lament that the number of specialist science reporters has declined in South Africa, which may result in "haphazard science reporting by untrained journalists". Journalists may even misinterpret or misunderstand complicated scientific information (Goggin, 2017). According to Hartz and Chappel (1997:27), scientists often feel that journalists do not understand the basics of the methods that scientists use and often oversimplify complicated science in order to pander to a largely scientifically illiterate audience. (I expand more on how scientists regard language services in general in Sections 5.4 and 6.3.)

"Understanding and appreciating science" is the aim of science journalists such as Sarah Emily Wild (n.d.:n.p.), a freelance journalist with a background in physics, electronics and journalism. She reports on science policy, astronomy, forensics, and physics. Her articles aim to make complex science information more accessible to a general public and focuses primarily on issues that affect the science communities in South Africa.

In terms of the Plain Language principles that I could identify from all these publications, the focus seems to be a general attempt to use everyday language and easy-to-understand vocabulary. Several articles are still relatively technical, especially if one considers that the aim is to communicate with a possibly "scientifically illiterate" audience. In an undated online article, Lily Whiteman posits that "Plain Language is one of our best tools for improving scientific literacy and encouraging wise decision-making by the public on science-based issues". I agree with this statement and appreciate the importance of this, but I believe that Plain Language principles can also be valuable for peer-to-peer science communication. Whiteman also claims that "scientific information conveyed in Plain Language invariably reaches bigger scientific audiences than information conveyed in technical language". In terms of whom this science is communicated to, and how Plain Language is already being applied in this context on the website ScienceLink.co.za, collaborating with a communication specialist to "make research relevant" seems to support my suggestion that scientists need to collaborate with a Plain Language specialist to be able to communicate to the general public.

If Plain Language can benefit this type of communication, the question remains to what extent these principles are then explicitly part of science communication teaching, to those with limited (but growing) scientific knowledge, and writing for peers, who may be experts (albeit not in the same discipline).

2.5 PLAIN LANGUAGE AND TEACHING SCIENCE

According to Huttner-Koros (2015:n.p.), teaching science in English creates a disadvantage for those who are not first-language speakers. She argues that learning science in a second language can result in less confident learners that need to invest considerable time and energy into absorbing and understanding the content. This then could also impede the communication process later when such scientists attempt to present their findings either to peers, or to a more general audience. This has wide implications for South Africa, where English first-language speakers are in the minority. A census conducted in 2011 showed that only 9.6% of South Africa spoke English as a first language (Statistics South Africa, 2012:24). Although this number is low, most South African universities require that instruction be given in English; and some offer science communication courses in English as well.

The aim of university communication modules for scientists and engineers is not only to train them adequately on the technical requirements of the qualification, but also to prepare them for working in their respective industries, where "soft" skills such as communication are just as important as technical expertise (Fouché & Müller, 2021:38). According to Nudelman and English (2016:17), most professional communication courses that universities offer focus on

> … a wide range of skills, including research methodologies, referencing, report-writing, executive summaries, business proposals, business correspondence, curriculum vitae, letters of application for work, presentation skills, visual literacy, graphics, posters and team work and negotiation skills. Courses to post-graduates also focus on writing proposals and theses. This content includes research methods, creating hypotheses, reviewing the literature, writing academic text, and, overall, managing the thesis writing process from first draft to final submission.

Nudelman and English (2016:18) explain that writing is one of the most important activities that engineers complete in their day-to-day tasks. Perhaps surprisingly, the teaching of Plain Language Principles is often absent from these communication courses. Thus, although scientists and engineers do receive communication training, there still seems to be a need for support in this regard. The need is reflected in a number of self-help titles; for example, in an early text of this kind, *Effective Communication for Engineers* (Woodson, 1974), chapter headings such as "Are You Being Heard", "Watch Your Words", and "The Jargon Jungle" implore engineers to be clearer in their communication.

To help the public in "understanding and appreciating" science (Gastell, 1983:ix), the application of Plain Language makes sense. However, I believe that in the same sense if the public can benefit from Plain Language principles, it follows that funding proposal reviewers, both as part of that public and as experts in different disciplines, will also be able to derive some benefit from the advantages of Plain Language, depending on how one defines Plain Language. Plain Language principles can help scientists to tell their research and proposal story clearly to ensure that their funding proposals' message is as clear as it can possibly be.

2.6 TELLING THE SCIENCE (TECHNICAL) STORY

Several sources directed at scientists and considering the "how" of Plain Language communication refer to the concept of telling the "science story" (Greene, 2013:12). This can be a daunting task for scientists, as this might not be the traditional way that they think they are trained to communicate (Turbek, Chock, Donahue, Havrilla, Oliverio, Polutchko, Shoemaker, & Vimercati, 2016:418), because they tend to think of "stories" as imaginative fictions that have nothing to do with science, that narratives imply "fantasy" or imaginary "facts" (Greene, 2013:12-13). However, in the sense that the research process has a beginning, middle and end, and follows a sequence, the process follows a storyline, which the Western mind has long been socialised to expect. Therefore, I argue that storytelling elements can help scientists to convey complex information in a manner that might tap into the story pattern, thus creating a schema for the reader to follow. In this regard, Greene (2013:12) states:

> [W]riting stories about science doesn't mean making it up or dumbing it down. Rather we can hang complex ideas on the scaffolding of good, simple stories and make our science as exciting to our audience as it is to us.

I start this section then with what can be classified as a "story" and what the elements of a "good, simple story" is.

2.6.1 What is a story?

Nathanson (2006:2) says the following about stories:

> Story, or narrative, is a powerful – perhaps the most powerful – tool for teaching and learning because of its ability to hook audiences, activate the pleasure principle, and facilitate retention.

Bamberg (1987:v) considers the ability to narrate (tell) a story as a skill: the skill of being able to combine words, lexical knowledge, with grammatical structures, syntactical knowledge to create meaning. The word "narrative" is derived from the Latin *gnarare,* which means "to know" (Nathanson, 2006:2). According to Thornbarrow (2012:51), "storytelling is integral to the way we structure, account for, and display our understanding of our human condition and experience". Although narrative analysis is a broad field with various theories and applications, for the purpose of this study, I am mainly concerned with the purpose of clearly defining what a "story" is, what I mean by "storytelling", and how it can function in the context of funding proposals.

A story has a recognisable structure of a beginning, middle and end. The order or sequence of the events that a writer describes in a story creates the context and has a definite impact on what the story means. As a story continues, the more relevant detail is revealed, the reader is oriented in respect of the importance of the who, what and where of the story. Although not all stories contain an abstract (or story preface), when telling the science story, it can help the reader to know what to look out for, and what it will take for the story to be completed. It creates expectation. It helps a reader to have a summary of the events of the story, the purpose of the telling, and what makes it a "tellable" story. This also helps the reader to know why the story is important (Thornbarrow, 2012:52).

Stories are shaped by "the local, situated context in which they occur" (Thornbarrow, 2012:55). The way one tells a story largely depends on what the story is. If a story lacks that element of "tellability" and a clear reason why the story is important or relevant, the reader is left with a sense of "so what?" When it comes to funding proposals, that sense would result in a rejection of the proposal and failure to assess the value of the research properly.

According to Nathanson (2006:4), there are four main advantages to writing in a more narrative style: stories are universally enjoyed; it is easier to understand stories than random details; narrative structure provides a familiar organisational structure that allows readers to know what to expect of the text; and stories create interest by involving a reader or listener. Stories could thus allow scientists to convey complex scientific ideas by scaffolding the information in a structure that will feel familiar. Olson (2009:6) admits that most scientists are not great storytellers, but suggests that a story is

> … an enormously powerful means of communication. With good storytelling you end up both arousing and fulfilling at the same time, which allows you to sustain interest over much larger amounts of material.

I argue that new scientific breakthroughs often require new vocabulary and descriptions of ideas that are not yet familiar. If complex information is presented in a narrative form, it gives reviewers familiarity, involves and interests them, and invites them to continue reading to find out what happens next.

2.6.2 Familiar sequencing in scientific writing

Kelsky (2011:n.p.) has summarised the familiar sequence that a funding proposal follows. She suggests that the story should start with a statement on the topic that is of interest to a wide audience. As part of this brief introduction in order to provide the reader with some context to the topic, there should be a short reference to the literature on what has already been done (a form of brief narrative flashback with some foreshadowing in the form of which gaps in the literature will be addressed). It is crucial that the essence of what the research is proposing should then be included as close to the start of the proposal as possible (the what and why). This is what journalists also refer to as "the hook" (Hartz & Chappel, 1997:92). This gives the reviewer a sense of what to expect from the rest of the text as early on in the proposal (story) as possible (see Figure 2.2)

The detailed literature review gives the fuller narrative capitulation of the past, again reinforcing the need for what is being done (what Kelsky entertainingly refers to as the "hero narrative", see Figure 2.2). The methodology (the "how") helps the reader to follow the remainder of the events, which unfold in the results and discussion sections, culminating in the conclusion and possible recommendations.

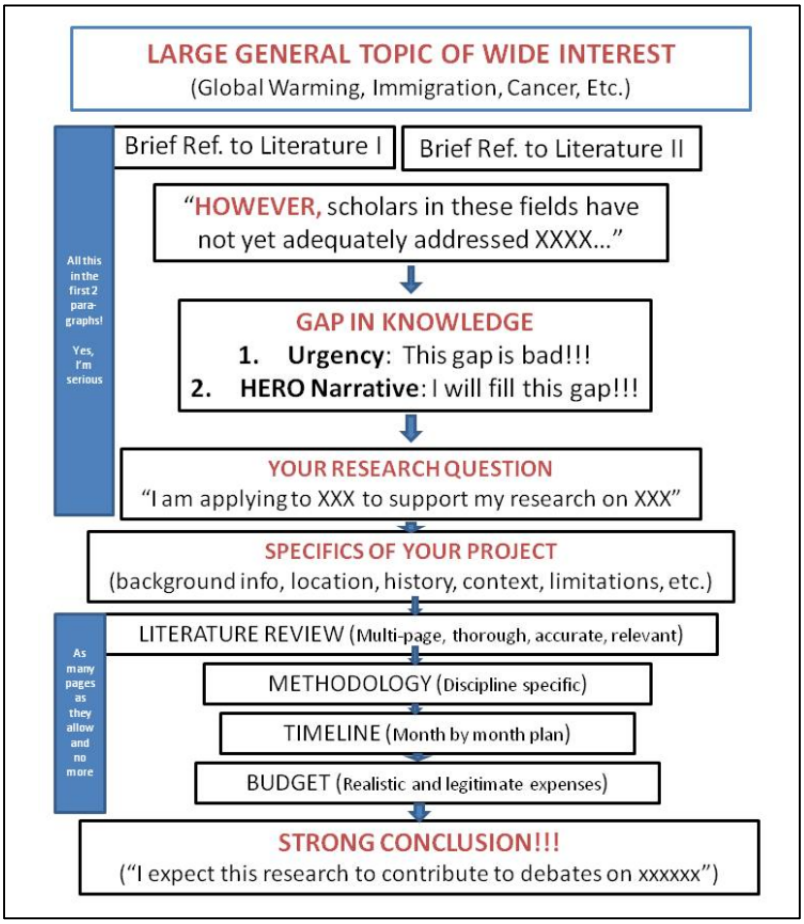


Figure 2.2: Karen Kelsky's research proposal template

Source: Kelsky (2011:n.p.)

If scientists follow this approach to telling their science story, it provides reviewers with a familiar order to follow when they need to evaluate new information. This is called a schema. Understanding how a schema works and how to use this to the benefit of the audience in funding proposals are key elements to consider when writing a funding proposal.

2.6.3 The schema

A schema is activating the knowledge already stored in memory. The individual schemata help reviewers to process new information encountered during the reading process. How is a schema activated? How can funding applicants use this to follow a more reader-centric approach to writing funding proposals?

2.6.3.1 Activating the schema

A schema is an abstract knowledge structure. It reflects what is known about a variety of cases that differ in many particulars and the relationship between different components and parts.

A schema is everything that is already known about a specific concept or topic. The different components or parts are called variables. The variables are instantiated with specific information, and each variable has its own set of information attached to it, including the information attached to the concept and excluding information that is not relevant. Words have specific meanings and infer specific images and ideas based on the reader's own values and experience. This also results in exclusions, as all concepts not related to a specific schema are discarded by the reader and will not be part of the overall recall. Certain words help the reader to recall stored knowledge (Anderson & Pearson, 1984:13-17).

2.6.3.2 Stored knowledge

If a text does not provide enough information, readers are forced to do a lack-of-knowledge inference (Anderson & Pearson, 1984:21). For the correct schema to be activated, the temporal, causal, spatial, part-whole and member-set relations need to be clear to the reader (Anderson & Pearson, 1984:22-23). Knowledge embodied in schemata will cause certain knowledge of particular scenes, happenings or messages to be recalled. The challenge in this regard is anticipating what all the sciences have in common and what would be general knowledge for the reviewers of a funding proposal, and what needs to be seen as "new", adding to the schema. Templates provide reviewers with a familiar sequence of the research events and prepares them for what to expect in each section. If the proposal does not clearly show what has been done, what the research is proposing to do and what makes a particular proposal unique, then the reviewer (who is possibly not knowledgeable on the specific topic) will only be left with a general impression. If the reader knows more about a specific topic, the reader's mind will automatically be able to access more details (Anderson & Pearson, 1984:24-25).

To ensure that the correct knowledge is recalled in the reader's mind, it is crucial to provide the correct perspective. Anderson and Pearson (1984:54) give the example of readers' different schemata, activated in an exercise by assigning each reader a different "character" and instructing each to read the exact same text from the various perspectives. This resulted in readers' remembering different parts of the same text, based on what they were inherently told to focus on by being assigned different perspectives (Anderson & Pearson, 1984:55-56). This suggests that ensuring that reviewers of funding proposals are "assigned" the most useful aspects to focus on in the text from the start will aid their understanding of difficult information and unknown concepts.

2.6.3.3 Schemata and inference

The goal of any form of discourse is for the receiver to understand the message that the sender has sent. An inference is implied knowledge that the writer does not explicitly state. According to Goetz (1977:1), it is impossible to make all the possible inferences when you are reading a document. Inferences allow the sender to communicate more information than is explicitly stated on the page, because it is also difficult to state everything explicitly. The example Goetz (1977:2) uses, "I saw John driving down the road", relies on the reader's knowing what a road is, and the most plausible inference is that John is driving a car. The question then is how, if people only make some inferences but do not consider all the possible variations, the writer (or editor) would ensure that the reader will make the correct inferences.

According to Goetz (1977:26-30), the key to readers' understanding of a text is to ensure that one gives readers a specific context and a point of view from which to read a text. This helps them to pay attention to what is deemed "important information". Giving clear instructions also aids the readers' recall, as can organising a text in such a way that information can be inferred from what has already been stated. This is called a hierarchical structure. Goetz (1977:11) points out that "it is often the case that an implication is the joint product of several sentences rather than the derivative of a single sentence". According to Goetz (1977:12), there are four types of inferences:

- deciding what schema among many should be activated;
- instantiating different variables in the schema and assigning default values in the absence of any specifically substantiating information;
- assuming that readers have some pre-knowledge, some concepts that are likely to be inferred accurately do not need to be stated (for example, the colour of blood); and
- drawing conclusions based on a lack of knowledge.

A schema is often based on inference. According to Adams and Collins (1977:4), a schema is important because

> … spoken or written text does not in itself carry meaning. Rather, a text only provides directions for the listener or reader as to how he [or she] should retrieve or construct the intended meaning from his [her] own, previously acquired knowledge. The words of a text evoke in the reader, associated concepts, their past interrelationships and their potential interrelationships. The organization of the text helps him [her] to select among these conceptual complexes… to specify the interface between the reader and the text – to specify how the reader's knowledge interacts and shapes the information on the page and to specify how that knowledge must be organized to support the interaction.

The inference of "drawing conclusions based on a lack of knowledge" is problematic where funding proposals are concerned and should be a form of inference that should not be encouraged by the text.

With ambiguous texts, readers make inferences based on their own knowledge, expertise and preferences. These are called specialised schemata. The schema that is selected influences the amount and nature of recall. Once a schema has been activated, it will drive other inferences. If something is so vague that the reader cannot give meaning to it, giving readers a title or perspective could help. Once a schema is properly activated, even vague or ambiguous terms can actually help the reader to "slot" the unknown words or concepts into the correct variable (Anderson & Pearson, 1984:32-39). Providing adequate context will help a reviewer more readily and easily to activate the schema that is applicable to the specific content on which a funding proposal is focused.

As part of a schema, it is important to consider to what extent the reviewers of funding proposals are literate in a specific specialisation. I briefly mention some of the aspects related to technical literacy below.

2.6.3.4 Technical literacy

To be successful in a professional career such as the sciences, literacy and numeracy skills are not sufficient. Individuals now also need so-called soft skills such as the ability to communicate effectively, work in a team, and think critically to complement hard skills that require deliberate instruction and training (Nudelman & English, 2016:17). This study focuses on interdisciplinary science communication, and this assumes a high level of functional literacy, because most professional scientists and engineers would have needed to complete some form of tertiary qualification to enter the workforce. In this context, however, I should also consider technical and scientific literacies.

Technical literacy goes beyond the ability to read, write, and functionally use a language. It is fair to say that the literacy to understand, read, and play music is different to the literacy needed for mathematics, even if the two fields overlap in certain areas. Gee (2012:373-374) argues that it goes further than merely being able to recognise words on a page. In this definition of literacy, "reading" is a transitive verb, so Gee (2012:373) defines reading as not "just the action of focusing on letters that forms words and the grammar of a language". He argues that, in fact, anything can be read. A "text", from this viewpoint, can range from anything in the media (visuals) to poems and advertisements. A reader needs different skills for each of these texts and may need to activate different schemata to access prior knowledge. A text might become inaccessible to a reader (now rendering the reader illiterate where that text is concerned) if the reader does not know how the text works, or the type of text is unknown. This links back to providing schemata for reviewers by focusing on telling the science "story".

Understanding the reading process is also crucial for translating documents into Plain Language. For this, I draw on Strang (1978:61-81), Anderson and Pearson (1984:90-91), and Wolfe and Nevills (2004:3-5). The reading process is centred around an understanding of how a schema is activated and how readers comprehend information.

2.6.4 The reading process

There is not a single profession today that does not need and use reading skills. Strang (1978:63) describes the process of reading as "a creative act. As the writer creates a structure of thought, so the reader re-creating the pattern of words, discovers for himself [or herself] the essence of the author's idea". To enable a reader to recreate meaning from words, the writer must take the reader into account. Reading is more than just being able to recognise words and pronounce them. It is more than just merely understanding words in isolation. Reading requires thinking, feeling, and using imagination. For reading to be effective, there must be a purpose to the reading. Why should a reviewer be reading a proposal? This links back to telling the science story and ensuring that the purpose of the research in a funding proposal is mentioned as soon as possible, at the start of the document. Understanding the heart of the proposal is critical for a reviewer to be able to understand what the research is proposing in all its complexities. Strang (1978:71) describes the reading process as "intake" and "output". The process starts when readers are confronted with a text (the input) and then responds (the output), either through thoughts or mental images of what they are reading.

Ultimately in a funding proposal, there is a need to increase the effectiveness of the output in the reading process. To increase the effectiveness of the output, the proposal needs to be as unambiguous as possible, and the purpose of the proposal must be clear. For the purpose of this study, there is definitely a focus on the action. The purpose of any funding proposal is to convince panellists of the merit of the research. And the better a reader responds to a funding proposal, the more successful proposals could potentially be.

The reading process happens in four steps (Strang, 1978:72):

- Step 1: Visual reception;
- Step 2: Perception;
- Step 3: Conceptualization; and
- Step 4: Higher levels of association.

During the visual reception step, the eye physically moves along a text and registers the words and their possible meanings (Strang, 1978:73). During the perception step, the visual impressions become more meaningful. During this step, the reader comprehends and organises the visual impressions. How easily a reader perceives a text depends on the quality of the text, the purpose of the reading, and the reader's needs and expectations of the text. The third step of the process happens after the reader has seen the text and starts to conceptualise it. When perceptions are grouped together into patterns and association, the mind can mentally visualise the concept that is being described. This leads to the fourth step in the process. There is a relationship between perception and conceptualisation. Concepts filter impressions that form in the mind while the reading process is happening. This helps the reader to form only images related to the specific concept presented by the words, as opposed to being completely overwhelmed with each perception in isolation. This conceptualisation can also be called decoding. With all fluent readers the process of conceptualisation, or decoding, happens automatically. This automatic processing is called unconscious or implicit memory, and this enables a reader to concentrate on the meaning of the words rather than on deciphering the words (Wolfe & Neville, 2004:3-4).

The last step in the process is when higher levels of association happen. Here there are patterns, schemata, and interrelated memory subsystems. The memory activated at this level is not just focused on storing impressions over a lifetime, but also on being able to retrieve what is relevant when the information is needed.

While telling the science story, it is also critical to consider that technical terminology can have different meanings, depending on the specialisation. While writing the science story, it is also important to ensure that the context surrounding the technical terminology is clear enough so that the reader cannot interpret it in any other way than how it appears on the page. In the next section I consider the ambiguity of vocabulary and how to ensure that the message of a funding proposal is as clear as it can be.

2.7 IMPLIED MEANING AND WHAT IS ON THE PAGE

According to Grice (1975:45), also cited by Baker (2011:237), the implied meaning of what the author writes in the text also has to be taken into account when constructing a text. Particular care should be taken to make sure that the relevance of all information and the intended message are properly reviewed so that there can be no other interpretation of the words than what is explicitly written. Originally Grice's four maxims of quality, quantity, relation (relevance) and manner referred to oral communication, but if they are adapted to writing they can be used to present information purposefully (White, 2001:63). The first maxim of quality prescribes that when you communicate, you should make it as meaningful and true as possible. The second maxim of quantity prescribes that the contribution needs to contain only as much information as is needed to clearly communicate the intended message, but enough information to do so. The third maxim of relation says that the communication should be relevant to the context in which the communication is taking place (Baker, 2011:236). Baker (2011:237) explains that the last maxim has four instructions:

- Avoid being obscure;
- Avoid being ambiguous;

- Be brief; and
- Be orderly.

The last instruction of "being orderly" is more aimed towards verbal communication, but I read this instruction as one that links up with Cutts's Plain Language principle of organising a text properly so that readers can easily find what they need (Cutts, 2013:165-166).

Another aspect related to meaning that I thought important to investigate was Halliday's Systemic Functional Linguistics (SFL). SFL views language from a functional perspective to discern how language is organised to achieve social functions. Halliday's systemic functional description is concerned with how language works and "views language as a meaning-making resource, i.e., language as 'meaning-potential'. To learn how a language works is to learn how to mean" (Neddar, 2017:58).

Language is seen as a resource and not just as a set of rules. The term "metafunction" was used by Halliday and Matthiessen (2004:31) to suggest that function is an integral part of any language. A language must be "used" to fulfil a purpose. The three metafunctions of language interweave with each other to create meaning. These metafunctions are (Neddar. 2017:60) ideational (referring to experiences and logic); interpersonal (relating to the opinions of and interactions with others); and textual (a combination of the ideational and interpersonal metafunctions that create a sequence of discourse).

Texts involve a series of choices by both author and reader. Texts have a potential meaning that can be expressed using endless choices of semantic options considering the clauses as theme, mood, and transitivity. The clause as theme is concerned with what is mentioned at the start and gives the message or alerts the reader to the message by indicating what the clause is about. The clause as mood focuses on three types of mood: the declarative, the interrogative, and the imperative. Lastly, the clause as transitivity answers the question of who does what, where, when and how (Neddar, 2017:62-64).

According to Halliday and Matthiessen (2004:24), language can be divided into seven microfunctions:

- instrumental: accomplishing tasks and satisfying material needs;
- regulatory: rules and instructions;
- interactional: to include or exclude;

- personal: expressing language concerned with an individual;
- heuristic: exploring environment, seeking, and learning;
- imaginative: creating stories, new words and new concepts; and
- representational: conveying messages concerned with specific reference to processes, persons, objects, abstractions, qualities states, and relations to the real world.

The purpose of these microfunctions is to provide a particular context of use. Keeping the context of each function in mind helped me to analyse the original documents. With many of the discoveries that scientists are making today, there is a need to find new ways to describe abstract concepts. The three microfunctions that are applicable for the purposes of this study are the heuristic, imaginative, and representational functions. The heuristic metafunction is relevant because funding proposals often suggest exploring "environments" that do not exist yet. I suggest that scientists present their research in funding proposals as stories for the reviewers to follow, and scientists often present new concepts in funding proposals. Therefore, the imaginative metafunction applies as it relates to funding proposals. The representational metafunction applies because the funding proposals I used as case studies in this thesis present specific processes that were used to simulate events happening in the real world but cannot be detected with the naked eye.

Another way to view SFL is also that it helps to answer the question: *How does this text mean what it does?* Differences in meaning emerge from different choices in grammar and the choices represent different meanings in different contexts (Schleppegrell, 2012:22). It is important to note that there are two types of meaning: an utterance-type meaning and an utterance-token meaning. Words, phrases or structures have a range of meanings. This is called the utterance-type meaning. Utterance-token meaning is also called situated meaning, where in different situations, a word will have a different meaning. The situation, or context, of a specific piece of information will determine the meaning (Gee & Handford, 2012:1).

In science communication, the context, or the situation, is crucial. I discuss more of the contextual difficulties I encountered in the document analysis in Chapter 4.

2.8 TEMPLATES AS TOOLS TO STRUCTURE A SCHEMA

Many funding proposals require applicants to use specific templates, which, like structured abstracts in scientific journals, imply that the science "story" should be told in a specific sequence. Part of the intention is to elicit specific information, and structure that information.

The aim is also to level the playing field, as all the documents reviewed have to meet the same formal requirements and follow the same pattern. This makes comparisons easier.

The advantage of using a template is that it creates familiarity and helps the reader to navigate the information. This activates a schema, enabling the story pattern to help reviewers navigate towards new information. Reviewers rely on what they already know to judge and interpret new information. The headings create an expectation in the reviewer and assist the applicants to structure their material to aid comprehension. The risk is that, if the template is unclear, or the information in a template field does not match the requirement, the schema can be disrupted, frustrating the reviewers.

A disadvantage of using templates is that the information might not naturally fit the template, as every project is unique. Another drawback is the limited space, which constricts an applicant's writing. The constraints of space and word limits can lead to abstract and vague descriptions that may confuse a reviewer unfamiliar with the specific field of research. Electronic templates may also prevent applicants from using some layout choices to optimise readability.

2.9 APPROACHES TO DEFINING AND IDENTIFYING PLAIN LANGUAGE

The concept of Plain Language can be difficult to define. There are three approaches to defining Plain Language, each focusing on a different aspect of the process:

- the numerical or formula-based approach;
- the element-focused approach; and
- the outcomes-focused approach.

2.9.1 Numerical or formula-based approaches

A numerical or formula-based approach to Plain Language focuses on measuring the readability of a text, based on quantifiable elements. These elements are font size, word and sentence length, the number of syllables in a word, and the average length of a paragraph. There are more than 200 readability formulas that are used in this approach (Viljoen-Smook, 2020:7-8). For the purposes of this study, I used an online automatic readability checker which allows users to post texts of up to 3000 words and then the checker gives results based on the following seven formulas:

- the Flesch Reading Ease Formula;

- the Flesch-Kincaid Grade Level;
- the Gunning Fog Index (FOG) Formula;
- the Smog Index;
- the Coleman-Liau Index;
- the Automated Readability Index; and
- the Linsear Write Formula.

I have added a detailed description of how each readability test works as Appendix K.

There are a few advantages to focusing on a numerical or formula-based definition. The first is that the readability formulas are relatively easy to use and accessible through various software programs. The second is that users do not need any writing expertise or experience to use the formulas. The last is that the formulas provide users with an objective result, indicating whether the document is readable or not.

The disadvantages of using this approach are that

- the formulas tend to focus only on a few elements of language, with a strong focus on sentence and word length;
- the results only indicate whether a document is easy to read in theory or not, and does not take all the nuances of language into account;
- the results can be wrong or misleading;
- the formulas do not provide guidance on how to improve the writing, but rely on the author to improve the score; and
- the formulas only group readers overall in terms of grade levels.

2.9.2 An elements-based approach

A second approach to defining Plain Language is an elements-based approach, which focuses on elements of the writing process to improve the clarity, readability and comprehensibility of the document. This approach encourages users to ask questions relating to all the elements of the writing process.

The Plain Language Commission (2011, cited in Cornelius, 2015:6) in the United Kingdom uses the guidelines in Table 2.2 in an elements-focused approach to Plain Language.

Table 2.1: Guidelines for an elements-based approach

Examples of questions used in an elements-focused definition	
Content	Is the purpose of the writing clearly stated? Is the information what the reader needs? Is the content helpful or entertaining? Is there information that the reader might not need? Is the information accurate, relevant, and complete? Are the technical terms explained or defined? Are there instructions on how readers can get further information if they need it?
Style and grammar	Is the style appropriate for the intended reader? Is the register appropriate for the intended reader? Is the text grammatically correct with clear punctuation? Is capitalisation consistent? Are the headings on the contents page consistent with the headings in the text? Is the text in active rather than the passive voice?
Vocabulary	Do the words in the text reflect the intended meaning accurately? Are the terms correct and used consistently? Will the intended readers understand the words? Are the technical terms explained or defined? Is the text free of officialese, legalese, etc?
Structure	Has the information been arranged in a logical and reader-friendly manner? Are the sentences and paragraphs well-constructed? Are the paragraphs, sentences, and words short? Does the sentence length vary? Is the information accessible? Is the information easy to follow, with headings and subheadings? Has information been clarified by using tables, diagrams, and illustrations?
Design	Does the document look good? Is the typeface and type size consistent and easy to read? Is there sufficient use of colour, tables, graphs, white space and other methods to improve readability? Is the use of colour, tables, graphs and white space functional?

This approach also has several advantages and disadvantages. The advantages include that users can customise the approach for different reader groups, and that this approach is more likely to allow a more accurate determination of the readability of a text than readability formulas and readability test results. This approach also provides guidance on how to improve writing, and is much broader than the formula-based approach.

Some disadvantages of this approach are that it can be difficult for a user to decide on the relevant techniques and which techniques are most suited to a specific document, and it takes more time than simply applying some software. This approach requires some writing expertise to be able to judge a document accurately. It also does not give a numerical measure of whether the document is indeed in Plain Language or not (Cheek, 2010:6), which some users might want.

2.9.3 The outcomes-focused approach

The third approach is outcomes-focused. This approach aims to determine how usable a text is and how well readers understand the text. Unlike the previous two approaches, this approach focuses more strongly on visual elements, as well as linguistic elements. This approach also prescribes how visual elements might influence the readability and understandability of a document (Viljoen-Smook, 2020:12).

An outcomes-focused definition has four advantages. As with the elements-focused definition, the first is that users can customise it to suit the needs of various reader groups. The second advantage is that this type of definition is most likely to produce a usable document. The third advantage is that it is possible to get a quantified result, depending on how Plain Language practitioners test the document. The last advantage is that the testing results could give very specific guidance on how the document can be improved.

The three disadvantages of this definition are that it is the most difficult approach to use, that it can be complex, time-consuming, and expensive to measure. Testing a document with actual readers is often impractical (Cheek, 2010:6).

After investigating these three different approaches to defining Plain Language, I now discuss various definitions before constructing my own definition to guide this study.

2.9.4 Various definitions of Plain Language

Defining Plain Language is no easy task. I start by looking at what experts say Plain Language is *not*. Butt and Castle (1997, quoted in Cheek 2010:12) state:

> Plain English is not just about words. It means using plain language to express ideas so that they make sense to the reader and designing documents so that information is easy to find and understand … Using plain English does not mean sacrificing precision.

This negatively framed definition is relevant because scientists do fear that they may be misinterpreted and that they will need to sacrifice precision, as the concerns reported in Section 1.5, "Technical cannot be plain", show.

Garner (2013:xiv) notes that Plain Language is not language that is “drab and dreary” but that Plain Language is “the opposite of gaudy, pretentious language”. He maintains that a call for Plain Language merely proposes that a writer should use everyday words that express the ideas of the author in the “most straightforward way”. This is a consideration especially where technical information in science communication is concerned.

For the purposes of this study, I also considered definitions that combine elements of all three approaches, framing the term in positives, rather as what it is not. One international definition of Plain Language, according to the United States of America’s *Plain Writing Act of 2010*, quoted on the website of the Plain Language Action and Information Network (PLAIN), states:

> Writing that is clear, concise, well-organized, and follows other best practices appropriate to the subject or field and intended audience.

In this definition, the emphasis is on the vocabulary, the layout of the information and the users of the document. In my study, the audience is a key component of funding proposals. This approach to audience-centric writing is present in most of the definitions that I looked at for this study. Another international definition that supports this, and also expands on the instruction to ensure that all the components in a document work together states that

> communication is in plain language if it meets the needs of its audience— by using language, structure, and design so clearly and effectively that the audience has the best possible chance of readily finding what they need, understanding it, and using it. (Cheek, 2010:9)

In this definition, for a document to be considered as being written in Plain Language, the audience should be able to find what they need, understand what they find and then be able to use the information that they find. This definition instructs the author of a document to combine elements of language (micro-structure: vocabulary, sentence structure), structure (micro- and macro-structure: hierarchically scaffolding information, clear signposting), and design (macro-structure: the look, layout, typesetting) to ensure that the document as a whole provides a reader with the best possible chance of accessing the information. Many funding proposals require specific templates, which implies that this last element of design poses a challenge to language practitioners, as a template’s layout, especially if it is an online template, often does not permit any changes in design.

The already quoted definition by Martin Cutts (2004:iv) also combines elements from all three approaches. He defines Plain Language as follows:

> The writing [elements of language] and setting out [structure and design] of essential information in a way that gives a cooperative, motivated person a good chance of

> understanding it at first reading, and in the same sense that the writer meant it to be understood. (my insertions)

Another way of saying this is that Plain Language focuses on the author's intention, the message and ease of access for the reader, and if all of these aspects work together then a document can be considered as effectively Plain Language. This means that the purpose of a document is clear, with the emphasis on clarity "at first reading" and the absence of ambiguity. In this definition, however, the purpose of the document and what the readers need to do with it is not included, unlike in the PLAIN definition quoted below.

One interesting aspect of this definition by Cutts is the reference to a "motivated reader", which suggests that communication in a written format requires reciprocity from a reader, rather than being a purely unidirectional process. In the case of funding proposals, reviewers might be assumed to be "motivated" in the sense that they have to read the document, regardless of personal motivation, as this forms part of their responsibilities in the reviewing panel.

A key aspect of this definition that is highly applicable to funding proposals is the instruction for the reader to be able to understand a proposal *at first reading*, given the time pressures on reviewers. How readers process new information is based on schemata. These are created through the use of signposts and key words. While reading a funding proposal, reviewers will often decipher a paragraph based on the first sentence, key words that repeat through the paragraph and concepts that relate to each other (Strang, 1978:69). This then also aids the reader with "objectives" for evaluating a document.

PLAIN defines Plain Language as follows:

> A communication is in plain language if its wording, structure, and design are so clear that the intended audience can easily find what they need, understand what they find, and use that information.

This definition closely resembles the second definition from this discussion by Cheek (2010:9) and again incorporates all the elements of a document to consider when drafting a Plain Language document, but foregrounds the functionality of the text.

In South Africa, as already indicated, section 64(2) of the *National Credit Act, 34 of 2005* (RSA, 2005) and section 22(2) of the *Consumer Protection Act, 68 of 2008* (RSA, 2008), both refer to the "ordinary consumer", someone "with average literacy skills and minimal experience as a consumer of the relevant goods and services", who should be able to

> understand the content, significance and import of the notice, document or visual representation without undue effort, having regard to –
>
> (a) the context, comprehensiveness and consistency of the notice […];
> (b) the organisation, form and style of the notice […];
> (c) the vocabulary, usage and sentence structure of the notice […]; and
> (d) the use of any illustrations, examples, headings or other aids to reading and understanding.

Noomé (2015:149) suggests that "without undue effort" here links to Cutts's statement that readers should be able to understand what they read "at first reading". She notes that this definition breaks down the components of Plain Language into four areas, which might also be usefully considered in accessible peer-to-peer communication. If the four areas of context, organisation, vocabulary and clarifying visuals are correctly applied, then Plain Language can be used effectively as a means for clarifying technical information in funding proposals.

In her effort to define Plain Language for South Africa, Cornelius (2015:13) warns that the local definition does not take factors such as multilingualism and literacy in South Africa into account. As mentioned earlier, literacy at its most basic level is not a consideration for this study, but multilingualism is indeed an important factor to consider.

Considering all the elements from various definitions, I drafted my own definition of Plain Language to guide this study.

2.10 DEFINING PLAIN LANGUAGE FOR THIS STUDY

Considering that the audience for funding proposals consists of reviewers under pressure in terms of time and the number of proposals to review, the definition I propose for this study combines elements from the definitions that I discussed in Section 2.9.4.

The aspect that I consider the most important in writing for the reviewers of funding proposals is that the reviewers understand the proposal at "first reading" and also "in the same way the author meant the information to be understood". An aspect regarding scientific writing that I have already discussed is that different jargon will have different meanings in various specialisations. Therefore, I propose the following definition of Plain Language for this study:

> A funding proposal is in Plain Language if it presents essential research in such a way that elements of storytelling, organisation and structuring work together to give a reviewer a good chance of understanding the funding proposal at first reading. A funding proposal's language is clear and concise to ensure that a reviewer also understands the content in the same sense that the writer meant it to be understood.

This definition combines all the elements that I consider important for writing funding proposals in Plain Language.

The guidelines for documents to meet this definition are discussed in the next section. I apply these guidelines in Chapter 4, where I undertake the document analysis of two funding proposals.

2.11 PLAIN LANGUAGE GUIDELINES

In this section, I discuss the key guidelines that I selected to inform my document analysis and work toward a final set of Plain Language guidelines for writing funding proposals. The basic guidelines are selected from those that Cutts (2013, 2020) proposes, adjusted for my purposes, and considering their relevance based on the wider Plain Language literature. I also briefly investigate what other guidelines might apply to this study, as proposed by Greene (2013) and Viljoen-Smook (2020). I use Greene for her perspective on Plain Language as it applies to science writing and Viljoen-Smook for her South African perspective. I refer back to the elements-focused approach in the guidelines Cornelius (2015) proposes as well. These guidelines helped me with the document analysis and guided the rewriting of the original text extracts into Plain Language. For an international perspective on Plain Language guidelines, I also look at PLAIN's guidelines.

A popular online resource with a focus on engineering writing is Grammarly. This resource can help determine whether information is "pitched" at the right level. It is a tool that "can help you replace complex words with simpler ones that appeal to a wider audience" (Romanyshyn, 2020: n.p.). Although this tool generally focuses more on vocabulary, it can also help to indicate where sentences might be unclear and give suggestions of how to reword a sentence. A disadvantage of an online tool such as this is that if the vocabulary is unknown to the tool's database, it can provide incorrect alternatives or flag words that are crucial for the interpretation of the particular science content in a proposal. There are not many online tools that can help funding proposal applicants to work through the minutiae of the writing and determine at a syntactical level where there might be ways to improve the clarity of the content of the proposal. Most resources offer course or guidelines, suggesting that being able to apply Plain Language principles might be a skill that scientists need to acquire.

The overarching intention is to make the science "story" as clear as possible, bearing in mind the definition of Plain Language above. If the purpose of a funding proposal is to tell reviewers this story, then organising the content in a way that makes this clear is crucial.

2.11.1 Guideline 1: Organise your material so that readers can grasp the important information early and navigate through the document easily

Cutts (2020:10) acknowledges that most readers only skim documents in haste and that "they'll be asking two questions about everything they read: "'So what?' and 'How does this affect me?'" He warns that merely answering these questions in the text might not be enough. It is important to follow a hierarchical structure, to provide a context (building a schema) so that readers can access unknown, complicated information easily. The science "story" can then also become clearer if readers have a clear storyline to follow. Ness (2007:n.p.) encourages funding applicants to consider what will make reviewers excited about the research and then present the content in such a way that it gives reviewers a chance at understanding the research and getting excited along with the applicants.

Although many templates guide the authors to build a schema by forcing the authors to include an introduction, if the authors do not understand the schema-building function of an introduction, or the information in the introduction is unclear and overly complicated, readers will have to read it several times or even go back to it while struggling through the rest of the document.

Viljoen-Smook (2020:83) states that the purpose of a document should be clear from the start and suggests writing a document in a way that achieves the intended goal of the documentation. Cornelius (2015:6) also notes that as part of an elements-focused approach (see Section 2.9.2), the content should be organised in a way that answers the following two questions:

- Is the purpose of the writing clearly stated?
- Has the information been arranged in a logical and reader-friendly manner?

Keeping these two questions in mind will help with the sequencing and logical order of the content. Viljoen-Smook (2020:69) emphasises logical flow as a way for readers to follow from sentence to sentence and from paragraph to paragraph.

PLAIN (2011:6) concur. They also regard organisation as the most important aspect to start with in a document. They suggest that a document should start with the purpose and "the bottom line". They also propose thinking about the questions that readers might ask and then answering these questions in a chronological way throughout the documents.

In addition to this, Viljoen-Smook (2020:68) suggests that a document should start with the "general picture and then move to the specifics". This is in line with the inverse pyramid writing structure (Nel, 1999:55), which suggests that the most important ideas should come first in a paragraph. When organising information, it is also important to ensure that paragraphs only address one topic at a time and that clear transitions connect sentences as well as paragraphs. This will help to eliminate the semantic discontinuity that Halliday (1989:28) noted as a characteristic of scientific content.

Greene (2013:79-80) gives similar advice, suggesting (a little more specifically) that scientists should "present a problem or paradox early in the document and proceed to solve it or show a novel approach to it". PLAIN (2011:7) also suggests that information that would be known to the readers (in this case, the reviewers) should be first.

For the purpose of this study, it can be difficult to determine what reviewers might already know, therefore I suggest that information should be structured in a way that gives the reviewers the purpose of the proposal as soon as possible. This will also aid the reviewers in reading the science story and ensuring that the merit of proposed research is as clear as possible.

2.11.2 Guideline 2: Use words your readers are likely to understand

As already stated, funding proposals are usually aimed at a panel of reviewers and contain field-specific vocabulary that might not be clear to reviewers who are not in the same field. Some jargon terms can have different meanings in different fields, so technical terms should be clearly defined and consistently used throughout the proposal.

As a general guideline, PLAIN (2011:41) cautions against using definitions explicitly and suggests rewriting text so that the meaning is clear, but this would not necessarily apply for peer-to-peer communication. With the specialised vocabulary that funding proposals will inevitably include, and word limits, brief clarification may be needed upon first use. It can be tempting to try to define each term, but it is important rather to ensure that words around the jargon are clear enough so that readers can infer accurate meaning. PLAIN (2011:42) suggests that if one needs to define a term, it is important to define it where one uses it, and to avoid cross-referencing where possible. (This links to Guideline 7, discussed in more detail below).

This aligns with Green's (2013:36-37) point that it is important to define the terms, or rather leave them out if possible.

Cutts (2013:12) suggests using only words that will ensure that "busy readers" do not miss the point. This is valid in respect of the general descriptions, but does not fully address the fact that some jargon or technical terms can form part of a "shorthand" between scientists. An important consideration where technical words are concerned is that everyday words can have completely different meanings in certain contexts. In the scientific context, specific words (jargon) are better than using general words, but only if the audience knows the vocabulary.

PLAIN (2011:45) defines jargon as "unnecessarily complicated, technical language used to impress, rather than to inform". By this they do not mean that all *necessary* technical terms should be removed but rather that the words around the term should be as clear as possible. Specialised vocabulary "may be the clearest way to communicate inside the group" (PLAIN, 2011:45) but going beyond using the necessary terms to write only in "technospeak" can "cause misunderstanding or alienation, even if your only readers are specialists" (PLAIN, 2011:45).

In a more nuanced argument, Cutts (2013:14) argues that where technical terms are essential, "clear explanations are vital" and states that in

> a technical document, technical words will usually be clear enough to technical people… (S)ometimes an unusual word is perfect for the job, expressing just what you want to say; then you should use it and either give an explanation or trust the context to explain.

What Cutts terms "trust the context" links to the first guideline in the sense that you can only create this necessary context by organising your information properly.

2.11.3 Guideline 3: Write concisely

The third guideline supports the first two in the sense that once the content has been organised, the essential terminology explained, within the context of a funding proposal, scientists and engineers are often limited in the number of words that they will be allowed to use. It is crucial then that information is presented in as simple a manner as possible for reviewers to grasp the importance of the proposal as early in the document as possible, and to follow the essential points without repetition.

For this guideline, Cutts (2020:57) again emphasises that busy readers want to access the main points of a document as quickly as possible. This principle states that information should be kept simple. Cutts (2020:60) points out that "(w)ordiness often comes from trying to make a simple procedure sound impressive". PLAIN (2011:38) agrees that there is "(n)othing more confusing to the user than long, complex sentences containing multiples phrases and clauses" and that it is important to look at the content in a document from the reader's perspective. They suggest critically evaluating a document and then to remove all redundant words and words that, in context, might be nonsensical. However, Cutts (2020:57) issues the caveat that the writing should not be so concise that "you exclude essential points" and sometimes it is important to expand a text slightly to ensure that the argument is clear. Although scientific processes are often complicated, it is important to ensure that these processes are presented in a clear, concise manner.

All the funding proposals that I analysed for this study used specific templates. Therefore, it is crucial to remove all unnecessary words that does not enhance the understanding of the proposed research. Cutts (2020:58) suggests the following:

- remove useless words (overly descriptive words that have a single word equivalent or straight repetition);
- remove words that do not show the action; and
- shorten prepositional phrases (phrases that start with prepositions such as "for", "to", "by", "with", "from", "in", and "of").

If one has worked through a document and the writing is still "wordy", then the only other option is to rewrite it completely (Cutts, 2020:64).

2.11.4 Guideline 4: Use vertical lists to break up complicated text

Vertical lists refer to bullet or numbered lists, instead of horizontal lists where elements of the list are simply strung into a sentence in a text chunk or paragraph. According to Viljoen-Smook (2020:43) the purpose of using bullet points in a document is to make information-dense documents easier to read and to follow. She states that "we use bullet points to simplify the accessibility of the information" (Viljoen-Smook, 2020:49). Vertical lists allow readers to get to the essence of the information at first glance and without a need to reread a document several times.

PLAIN (2011:71) gives the following advantages for using vertical lists. A vertical list

- highlights levels of importance;

- helps the user to understand the order in which things happen;
- makes it easy for the user to identify all necessary steps in a process; and
- adds blank space for easy reading.

As already mentioned in the first guideline, for the steps of the process, it is important to organise this information chronologically. PLAIN (2011: 72) also suggests that a vertical list is an ideal way to do this.

Cutts (2013:81) confirms that vertical lists make information “easier” to grasp, but adds the important caution that it is important to ensure that a list follows a parallel structure with consistent punctuation. Parallel structures as consistent grammatical constructions are often missed by scientists, who tend to focus on the content rather than the grammatical form (for example, they might switch confusingly between leading with nouns and with verbs in the infinitive form, or with participles, or might make some bullet points a full sentence and others a sentence fragment).

PLAIN’s guidelines (2011:72) add that vertical lists should always include a lead-in (platform) sentence, and that the bullets in lists should be kept as simple as possible. Large bullets with “creative” shapes and sizes distract readers from the content. Cutts (2020:89) adds that the punctuation in a vertical list should also be used consistently.

Vertical lists would be a simple method for writers to follow, provided that the document template interface allows for the insertion of bullets, if it is not a basic MS Word document.

2.11.5 Guideline 5: Over the whole document, make the average sentence length 15 to 20 words

Complex ideas are often written in long, overly complicated sentences. Cutts (2013:2; 2020:22) recommends variation in sentence length. He asks what length of a sentence is too long and suggests that sentences between 15 and 20 words are easiest to read. He emphasises that the focus should be on the average, so it is not necessary to rewrite every sentence in a document to fit between 15 and 20 words.

Although PLAIN (2011:50) does not suggest an explicit number of words to define a “short” sentence, they do suggest presenting “only one idea in each sentence”. Cutts (2020:23) maintains that “(s)entences of just a few words can add punch, though too many of them in succession will make your writing staccato” and that the reason for sticking to the 15 to 20 word range is that readers are used to it. One way to keeping sentences short, according to Cutts (2013:5), is to create a vertical list (see Guideline 4).

According to Greene (2013:63), "(s)cientific writers can hardly be accused of writing too many short sentences; instead, they tend to write medium to long sentences and to maintain the same sentence length throughout a whole document". She advises that sentences should vary in length to ensure that the reader does not get bored, because "short sentences have punch and serve to emphasise the important points, while longer sentences add rhythm" (Greene, 2013:63). Although she does not give a specific number, she echoes Cutts's instruction to vary sentence lengths.

2.11.6 Guideline 6: Prefer the active voice unless there is a good reason for using the passive

Scientific breakthroughs are often communicated using abstract nouns and the passive form. The preference for the passive voice is diminishing, however. Using the active voice in a proposal ensures that the value of the research is clearer. Although the process is usually the key to any scientific research, and is sometimes conveyed more effectively in the passive, texts should be written in the active unless it changes the context of what the researcher is trying to say. For science, the "doer" is often irrelevant, and scientists prefer to write in the passive form (Greene, 2013:22). One advantage of using the active voice is that it helps to write more concisely (see Section 2.11.3) and that the passive voice can add up to 30% to a document. I include one of the examples that Greene (2013:23-24) gives to compare the passive to the active form in Table 2.3, showing how much clearer it is in showing who needs to do what and why. The passive and active constructions are underlined. The replacement of unnecessarily "elegant" but vague words is marked in italics. Words that can be omitted without loss of meaning are marked with strikethrough.

Table 2.2: Example of passive vs. active form in scientific writing

Passive voice	Active voice
Dramatic improvements in *policy* and technology are needed to ~~*reconfigure agriculture and land use*~~ to ~~gracefully~~ meet global demand for both food and biofuel feedstocks.	The Department of Agriculture must help farmers with *new legislation* and technology to meet global demand for biofuels and food.

Source: Adapted from Greene (2013:23-24)

It is important to keep in mind with rewriting passive sentences into the active voice that the meaning remains clear and that no information goes missing or is added. In the example by Greene, the words “agriculture and land use” are left out in the active form and is replaced by “farmers” in the active form. It is important to ensure that the word does indeed have exactly the same meaning, and in this example, farmers might not give enough context. I agree that “gracefully” can be eliminated but omitting feedstocks from biofuel might sacrifice precision. In order to produce biofuel, one needs to use crops (the feedstocks) and omitting that from the active form can force the reviewer to need to make an inference that if there are not enough crops, then there will be no biofuel. If the reviewer is not familiar with biofuel, then there is a chance that the reviewer will not link it to crops at all. Greene (2013:23) continues that besides helping to make writing more concise, the active voice also helps to tell the science “story”.

However, there are some advantages to using the passive voice. Cutts (2013:63) again offers nuanced advice, suggesting that documents should prefer the active voice “unless there’s a good reason for using the passive”. As already mentioned, the “doer” is often irrelevant in science writing and where this is the case, the passive voice is acceptable. Cutts (2020:77) gives the following example of where the passive form might be preferable:

> Concern has been raised about arrangements for gaining immediate access to the chimney. Winch failure or the presence of debris between the platform edge and the chimney internal wall may necessitate access.

Cutts explains that in the first sentence, the focus is on gaining access, although it has been placed towards the end of the first sentence. Because the second sentence is in active, it seems to take the focus away from gaining access, so in this instance rewriting the second sentence in the passive form will ensure that the focus stays on gaining access. He suggests the following reformulation (Cutts, 2020:77):

> Concern has been raised about arrangements for gaining immediate access to the chimney. Access *may be needed* if the winch fails or there is debris between the platform edge and the chimney internal wall. (Cutts’s emphasis).

The passive can also be used if the intention is “(t)o focus attention on the receiver of the action by putting it first”, as in the example taken from Greene. The passive can also help to place already known information at the start of a sentence or clause.

2.11.7 Guideline 7: Reduce cross-references to a minimum

The documents on which I focus for the purposes of this study almost all have to be presented in fixed templates. The risk is then that authors keep referring the reader to later sections of the document. The challenge is to ensure that all relevant information is kept together and explained where it is first mentioned as far as possible. Cutts (2020:161) warns that "(c)ross-references mean cross readers" and that if the point (purpose) of a document is not clear, then it might not be worth making the point at all.

PLAIN (2011:83) concurs that "(m)ost users consider [cross-references] a bother, and just skip over them". This can be a problem if the information being referred to is critical to the argument that the author is trying to convey at a given point. However, PLAIN also warns against repeating content again and again because this "can be equally annoying to users" (PLAIN, 2011:83). The best way they suggest for minimising cross-references is by carefully organising the content in a way that will "eliminate the need for cross-references" and to keep information that belongs together in the same sections. This can be challenging, especially considering the prescribed templates that funding proposals often use. Therefore, where it might be impossible to remove all the cross-references, PLAIN (2011:84) gives the following instruction:

> Be sure that the reference you insert clearly describes the referenced material. That way, users can decide if they need to read it to know how the rule [or section] affects them. Sometimes just including the title of the referenced section is enough.

PLAIN's (2011:84) guidance on using cross-references states that if they are necessary, it is best rather to include them at the end of a text so that it does not disrupt a reader. Including the cross-reference at the end of the text also gives readers "a chance to absorb your main message before your references elaborate on it" (PLAIN, 2011:84).

2.11.8 Guideline 8: Sequence process steps for clarity

Scientific research often focuses on processes. If the research is based on optimising a certain process, the correct sequencing of events can help to tell the science story clearly (see Section 2.6.2).

I derived this guideline from Cutts's (2020:230) instruction to "(d)evote special effort to producing lucid and well-organised instructions". Although a process is not, strictly speaking, a set of instructions, it follows the same kind of structuring, because one step leads to the next.

According to Cutts (2020:232-235), technical vocabulary is only one element that makes instructions (in this case processes) unclear, and he gives the following principles to ensure that sequencing is clear:

- remember the readers;
- split the information into chunks;
- favour a basic style of language; and
- use separate, headed sections.

For this last point, I needed to consider an alternative, as funding proposals often use templates with prescribed headings. Although templates may provide different sections with questions that they specifically want answers to, PLAIN (2011:6) suggests addressing a process in a chronological order and clearly indicating the steps that the process follows.

Sequencing steps clearly will help a reviewer to follow what the scientists did, clearly and without any misunderstandings.

2.12 GUIDELINES CONSIDERED BUT NOT APPLICABLE TO THIS STUDY

PLAIN's (2011:1) first guideline suggests that the first rule of Plain Language is to "write for your audience". This guideline states that in writing funding proposals, it is important to be sure who it is that one will be writing for. For this study, it can be difficult to determine exactly who the readers will be, in terms of their specialisations. Although reviewers will have tertiary qualifications, they are often from various fields with various specialisations. I did not include this as a specific guideline for this study, because determining the target audience is too vague as a consideration. Instead, I preferred to use this notion of purpose as a thread throughout all the guidelines.

As Noomé (2015:36-37), who reads Plain Language as a form of translation, points out, the notion of purpose can be tied to Vermeer's ([1989] 2004:227-239) *Skopos* theory, which addresses the interaction with a client who commissions or calls for a text and the brief provided by a client on the purpose or aim of the action (Vermeer, [1989] 2004:227). The *Skopos* determines the purpose of a text, as there is a reason the text is written. The person who asks for a text to be drafted also has a say in the content and determines the purpose of a text. In this case, funders are the "client" calling for the text, with the panel of reviewers as the target readers. The brief includes the template. The purpose (*Skopos*) of funding proposals is to convince a panel of reviewers to award funding for a specific project. Because the reviewers are the most important variable in this use of the document, my guidelines focused on the potential reviewers (readers). My objective with each guideline was to ensure that a funding proposal can be as clear and concise as possible to ensure that reviewers under pressure will only need to read a proposal once to get the essence of the research.

Another guideline that I initially considered but did not include in my list was what Cutts (2013:178) terms "using alternatives to words, words, words", such as lists, tables and diagrams. Templates would usually allow for using lists, but not always diagrams. Where they are allowed, it is more important for peer-to-peer communication to use my Guidelines 1, 2, 3, and 7, to ensure that the caption of the diagram is as clear as possible.

PLAIN (2011:iv) lists the following as "alternatives" to consider in order to aid clarity:

- use examples;
- use lists (my Guideline 4);
- use tables to make complex material easier to understand;
- consider using illustrations;
- use emphasis to highlight important concepts;
- minimise cross-reference; and
- design your document for easy reading.

The funding proposal templates were already in table format and from these suggestions, the two guidelines most applicable to this study were to use lists and to minimise cross-reference. The funding proposals I analysed for this study already included examples and I decided to focus on making these examples as clear as possible by using lists.

2.13 CONCLUSION

In this chapter, I investigated how English has come to be the dominant language for scientific research, even though English is not the home language for most scientists. English is likely to remain the *lingua franca* of the science community, including that community in multilingual countries such as South Africa. Finding ways for scientists to communicate more effectively across disciplines will become even more of a priority in future. Having to work in English while also needing to understand difficult information can be seen as a notable obstacle when reading funding proposals, so this discussion of English as the language of science addresses part of my first research sub-question, which focuses on the obstacles that science experts face when they read funding proposals, especially in the context of trying to decipher highly scientific and technical information.

I also looked at how the languages of mathematics and science differ from "ordinary" English and how these differences can influence the understanding of complex scientific content. This discussion highlighted obstacles that scientists from different fields as well as language practitioners face when they need to work on highly scientific and technical content in funding proposals. According to the literature (Halliday, 1989; Orr & Schutte, 1992), the language of science differs from English and although some experts are of the opinion that science should be a universal language in its own right, unfortunately it is seldom possible for scientists just to read equations in isolation to determine the merits of the scientific content. The language of science and mathematics contains technical terminology and abstract concepts, which affects the clarity of the content in documents such as funding proposals at a micro-level. For the scientific vocabulary to have meaning, the context within which it is included in funding proposals becomes crucial. These are important considerations when suggesting Plain Language guidelines for funding proposals to enable reviewers to grasp the content accurately without sacrificing critical information.

After investigating the obstacles that scientists and language practitioners face in science communication, it was important to determine whether Plain Language is already being applied in science communication and science teaching. Although science communication with the public uses some Plain Language principles, there does not seem to be any application yet for peer-to-peer communication, apart from Plain Language summaries or abstracts. As part of this investigation, I also looked at telling the science story and how familiar sequencing can help create a schema for readers. This discussion also included an important section on the reading process and how this process would influence the understanding of funding proposals. Moreover, templates are briefly considered as schema-building tools.

I also included a short discussion on the vocabulary of funding proposals and why it would be important to ensure that the meaning on the page cannot be misinterpreted by reviewers by providing the necessary context to enable readers to make the correct inferences. I concluded the literature review by investigating the various approaches to defining Plain Language and defining Plain Language for the purposes of this study, selecting and discussing a set of eight preliminary guidelines which I apply in the document analysis set out in Chapter 4. In the next chapter I focus on the methodology that I used to conduct my research.

CHAPTER 3:
METHODOLOGY

3.1 INTRODUCTION

This chapter sets out the research design and methodology in detail, exploring the design choice and six phases of the research process. The document analysis, survey and interview processes are explained fully, including ethical considerations relevant to each phase and process.

I opted for an exploratory design to gather information regarding Plain Language and how it can be applied for more effective interdisciplinary science communication. I chose a mixed methods design to enable me to combine a quantitative data collection method with a qualitative data collection method, with the various phases informing each other.

After deciding on an appropriate research design (see Section 3.2), I started the first phase of my research, which consisted of a literature review to gain insight into the language of science and mathematics, science communication to the public, three different approaches to defining Plain Language. The chapter concludes with eight appropriate Plain Language guidelines for this study. Phase 2 consisted of a detailed document analysis and rewriting of sections to use as sample texts in the survey. Phase 3 focused on designing and distributing a survey as the quantitative data collection method. Concurrently, I also designed a semi-structured interview to probe willing respondents' opinions on the value of Plain Language for their respective fields, their current writing experiences and why they preferred one text sample (either the original sample or the rewritten one in Plain Language) over another. The interviews formed part of the qualitative data collection method. After finalising Phase 3, the results from the survey and first round of interviews informed the questions for the second round of interviews in Phase 4. Phase 5 only commenced after the quantitative and qualitative data collection had been completed. The data were analysed using a combination of quantitative data analysis methods and qualitative data analysis methods, such as a form of discourse and content analysis. After the data analysis phase, I used the insights that I gained from Phase 5 to choose a final set of Plain Language guidelines to inform the final document sample texts in Phase 6. The final phase of the research ended with conclusions and recommendations.

An essential component of this study was considering the ethical implications of conducting the survey and interviews. I end the chapter with a discussion of the ethical considerations and the steps I took to ensure the anonymity and confidentiality of the participants.

The phases of the study are set out in Figure 3.1.

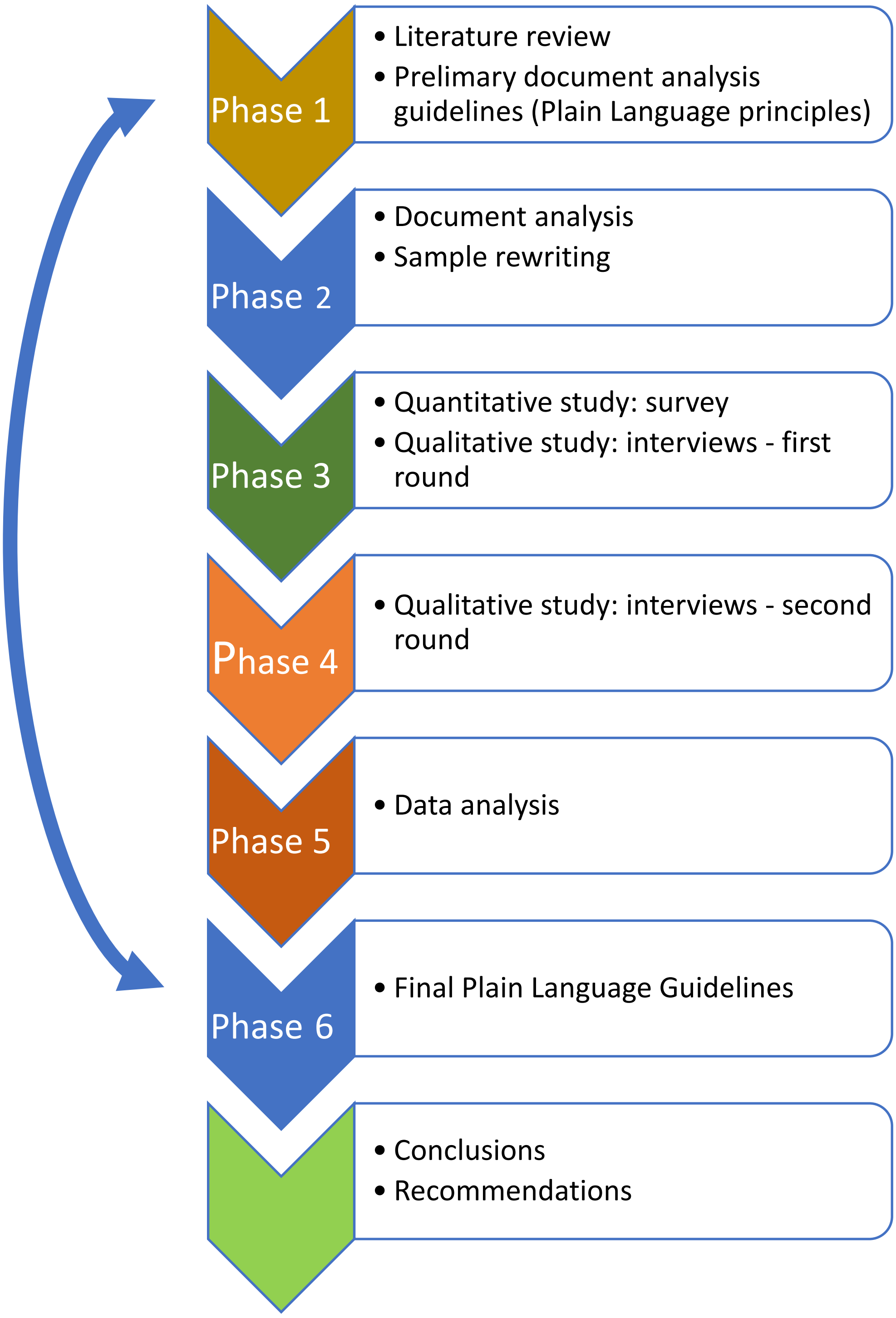


Figure 3.1: Summary of the research sequence

3.2 RESEARCH DESIGN

As indicated in Chapter 2, the lack of research into Plain Language and how it can benefit interdisciplinary science communication necessitated an exploratory study. This kind of design is used when exploration is needed for several reasons, such as that measures or instruments are not available, variables are unknown, or there is no guiding framework or theory (Creswell, Shope, Plano Clark & Green, 2006:75). In this case, the absence of theoretical positions on Plain Language (despite a plethora of guidelines on how to use Plain Language) and on information on how it has been applied to interdisciplinary science communication between peers suggested that an exploratory design was appropriate. Therefore, for the purposes of this study, I decided on an exploratory mixed methods design, because that would enable me to combine a quantitative data collection method with a qualitative data collection method to elicit as much information as possible, with the qualitative data illuminating the quantitative data, and vice versa.

This kind of design often starts with a qualitative aspect where results are then used to develop an instrument, identify variables or make assumptions based on a theory or framework that can be tested. Because this design starts with the qualitative component, there is usually a strong emphasis on these results; the quantitative data are used to confirm or complement the qualitative results from the first phase (Creswell *et al*., 2006:76-77). The purpose of a two-phase exploratory design is to obtain results of the first method (qualitative) and these results then help inform the second method (quantitative), which in my case informed the next qualitative phase, which implies a multi-phase exploratory design.

In my study, the literature review formed this initial qualitative aspect, which informed the document analysis, but also the development of a survey, which was designed to elicit both quantitative information and some qualitative responses. Because of the complexity of the information that I wished to explore, my study had six, rather than only two, phases.

The advantages of an exploratory design are that data are collected in separate phases; this results in the data being more straightforward to describe, implement and report on (Hannington & Martin, 2012:84). Although exploratory designs emphasise the qualitative aspect, including quantitative data can help support the assumptions that were made in the qualitative phase (Creswell *et al*., 2006:78). The first challenge to using this design is that it can take longer to implement several phases. The researcher also needs to decide whether or not to use the same respondents for both (or more) sets of data collection (Creswell *et al*., 2006:74-75). In my case, I conducted a first round of interviews with a set of interviewees from a consulting firm and a second round of interviews with interviewees who volunteered at the end of the survey. For the survey, the same set of interviewees for both rounds of interviews also completed the survey.

After deciding on an appropriate research design, I started with the first phase of my research, a literature review. The purpose of this literature review was to gain insight into the languages of science and mathematics and science communication with the public. I also investigated whether, and how, Plain Language principles are already being applied in science communication. As part of the literature review, I looked at the three different approaches to defining Plain Language with the purpose of selecting elements that would be the most appropriate for this study. I concluded the literature review with a discussion on various Plain Language guidelines and selected the eight guidelines that I deemed to be the most appropriate for this study.

After completing Phase 1, I focused on a detailed document analysis and applying my Plain Language guidelines to selected sample texts to include in the survey in Phase 2. In Phase 3 of my research design, I focused on designing and distributing a survey (quantitative data collection method) and designing a semi-structured interview to probe willing respondents' opinions on the value of Plain Language for their respective fields, their current writing experiences, and why they preferred a certain sample text over another (qualitative data collection method).

After concluding Phase 3, I conducted a second round of interviews in Phase 4. Phase 5 consisted of the data analysis and Phase 6 led to the conclusions of the study and recommendations for future research.

The various phases are discussed in more detail in the sections that follow.

3.3 PHASE 1: LITERATURE REVIEW AND CHOICE OF PRELIMINARY DOCUMENT ANALYSIS CRITERIA

The purpose of a literature review is to identify what has already been investigated and where there is a gap in the knowledge on a specific topic (Hannington & Martin, 2012:112). My literature review started with searching for research relating to science communication.

My focus was on whether Plain Language principles would be beneficial to the science community. I was aware that institutions such as the University of Pretoria and the Council for Scientific and Industrial Research communicate science to the wider public, as mentioned in Section 2.4. I had previous experience working with engineers who were very critical of science journalism, which is designed to simplify science for a wider audience that might not have scientific expertise. Through various informal discussions, I formulated some initial ideas and questions regarding ways in which scientists could possibly communicate their own research more clearly to an audience that might not have the same level of expertise, but I widened the enquiry to communication with a readership that might have the same *level* of expertise but not in the same *discipline*.

The literature review enabled me to answer the following questions:

- How does the languages of science and mathematics pose difficulties for language practitioners and other science experts?
- What has already been researched and published regarding Plain Language and science communication?
- How is Plain Language defined and used?
- Can Plain Language be used for interdisciplinary (peer-to-peer) science communication?
- What would be a possible way forward for Plain Language and interdisciplinary science communication?

To expand on this, I started by investigating other fields where Plain Language principles have been applied, namely law and medicine (see Section 1.4). The literature review (see Chapter 2) enabled me to draw up a working definition of Plain Language, refine my research questions and decide on a research design. The reading also led me to review Plain Language guidelines, in both published and online forms, from which I could select eight applicable guidelines (see Section 2.11) to inform my document analysis in Phase 2.

3.4 PHASE 2: DOCUMENT ANALYSIS AND REWRITING

The second phase of my research entailed a detailed document analysis of two funding proposals. The results of these two analyses are discussed in Chapter 4, but I discuss the methods used here.

3.4.1 Choosing documents to analyse

An obvious gap in the literature is peer-to-peer interdisciplinary science communication, for example, in funding proposals. Therefore, I focused on exploring such documents, as I wanted to investigate how Plain Language principles can help improve the clarity of these documents for reviewers.

A major obstacle that I faced at the start of this study was finding appropriate documents to use. There are many such documents, but, because one important aspect of engineering is creating new technology, with large financial implications, confidentiality of such documents is crucial. Competition for funding is fierce. Most engineers that I approached were supportive of the study, but cited intellectual property as a concern around providing me with documents.

I approached a leading science research council in South Africa for permission to use a proposal. The first funding proposal I was granted permission to work on focused on technology development. This type of funding proposal is called a Technology Demonstrator, and the purpose of this type of proposal is for scientists to prove that the type of research proposed will result in the development of new technology. The research council then makes funding available for the research to continue and ultimately develop this new technology. Although intellectual property was still a concern, I was allowed to use sections from the proposals for the sample texts and document analysis, provided that all identifying information was removed.

The version I was permitted to use was originally rejected by a panel of reviewers, but the proposal did eventually go ahead after the applicants lodged an appeal, indicating that the research did indeed have merit, but that the original written proposal that the applicants submitted was not clear enough to convince the panel of reviewers of the merit without additional explanation and author input. Therefore, I wanted to investigate elements of the proposal that were unclear, and where I would be able to apply my chosen Plain Language guidelines. The content, discipline and details are discussed in Chapter 4.

The second funding proposal I looked at is called an Expression of Interest (EoI). This type of proposal's purpose is to apply for a predetermined amount of funding and the research needs to be adapted to fit within the constraints of this amount. For the second funding proposal, I became involved in the proposal process for a unit focused on mining engineering. As part of my agreement with this unit, I would review their proposal document before it was submitted for approval and, in turn, I would then be able to use the *initial* draft of the submission document for my study, again removing identifying information. I was involved in meetings from the conceptual phase until the submission stage. The content, discipline and details are discussed in Chapter 4.

Both of these funding proposals needed to use exacting templates provided by the research council. All the ethical permissions and clearances are discussed in Section 3.9.

3.4.2 Document analysis process – tools and method

Part of selecting appropriate documents for this study and to use as samples in the survey and interviews relied on a preliminary and more detailed document analysis to determine whether it would even be possible to apply Plain Language principles to aid interdisciplinary science communication between scientists and engineers working in different fields with different specialities. Therefore the process involved an initial reading phase and then a process of rewriting the text by applying Plain Language guidelines. The initial analysis started with a readability test to give an indication of how difficult the texts were to read before I applied my chosen Plain Language guidelines. The individual document analyses are discussed in more detail in Chapter 4, but I provide a broad overview of the process I followed here.

3.4.2.1 Readability tests for the original documents

As indicated in Section 2.9.1, a readability test or formula can be used to determine how readable a text is by counting items such as syllables, words, and sentences. The aim of using readability formulas, according to Cutts (2013:121), is to measure the readability of a document.

To get a rough idea of the initial readability of my selected proposals, I used the online "Automatic Readability Checker". This online platform allows users to post texts of up to 3000 words and then the checker gives results based on seven different formulas, as listed in Section 2.9.1. These formulas all have different algorithms that give an indication of which age level or United States grade level would find the text easy to read. It is important to note the tests are based on the American schooling system, and on the assumption that all readers are home-language English speakers. I briefly mention the seven readability tests in Section 2.9.1, and I have included a more detailed description of these tests in Appendix M. The results of the seven different formulas on my proposals are discussed in Chapter 4. With any readability test, it is important to remember that the score is just an initial indication, so I used the scores only as a starting point to gauge which guidelines might be most applicable.

The intended readers of the text (see Sections 2.10 and 2.11) were more important for the purpose of my study than the readability scores, which can only give a broad indication of readability. Since the assumption is that the intended readers of these funding proposals are all scientists or engineers, and have expertise at an advanced tertiary level, and since the texts deal with highly technical information, the readability score might be expected to be aligned with such readers. However, general readability levels may still not guarantee full understanding at first reading, as is desirable in a Plain Language scenario. If a reader is skilled and competent in the subject, a reader might find the text easier to read.

For the purposes of this study, I could not assume intradisciplinary knowledge and expertise for all reviewers, as reviewers might come from different backgrounds. Readability formulas cannot take the author's skill, the background or motivation of the reviewer into account. Cutts (2013:122-123) acknowledges that, regarding readability tests,

> [t]he formulas are blunt tools. They ignore the way the text is organised, how it looks on the page, and the reader's motivation and level of prior knowledge. They only hint at how to write a text better, [even if] they encourage the idea that a clear document is one that scores well on the formula.

I discuss the results for each test and the initial scores in Chapter 4.

3.4.2.2 Strategies for the document analysis: manual process

After using the readability tests to determine how difficult the documents were to read and flagging initial challenges to focus on, I then asked the following questions before starting with the rewriting process:

- What is the purpose of the document?
- Who is the intended reader?
- When reading each document, what are my questions/major concerns after a first reading?

The documents that I wanted to analyse were very technical. As I do not have an engineering or mathematical modelling background, I used this to my advantage to flag areas in the abstract and introductions that did not give enough contextual information for an outside reviewer to understand the significance of the proposal easily. One big challenge, and the most time-consuming. was understanding the content sufficiently to propose Plain Language sample texts. In the course of working on the two proposals some of the comments from participants reflect some of the difficulties that I faced in collaborating with the authors (the applicants):[7]

> *The content was too complicated to simplify and in simplifying the information the science was being watered down or inaccurately presented.*
>
> *We support the idea of Plain Language, but some information cannot be written in any other way.*
>
> *Because of your language background, the information cannot be explained in any other way, and you would not be able to understand it even if we tried explaining.*

I perceived a general mistrust from the scientific community because of previous experiences that they had had with science journalists and editors. To probe this mistrust further, I included a question relating to language practitioners in the survey and one in the interviews. These questions help me to ascertain if it was just the few engineers I was collaborating with that had this mistrust and if it was an opinion shared by more authors in the sciences.

Rewriting technical information is an iterative process, so every rewritten version should be checked several times before readers are asked to review the information. Here I followed a process where I put aside the Plain Language sample texts for a few days and then reread them with fresh eyes to see if there were any questions. As I researched the technical fields and became more familiar with the content of the documents, I found it more difficult to ascertain which information was obvious and which would be difficult to understand. To help me check my Plain Language sample texts, I referred to my original document analyses, and relied heavily on the initial questions I identified as gaps in the original. The document analyses phase is discussed in detail in Chapter 4, where I give examples of the iterative process.

As part of this rewriting process, although editors and language practitioners often do rely on intuition, I wanted to quantify the vocabulary problems beyond the readability test results. Guideline 2 of my chosen Plain Language guidelines instructs applicants to use everyday words that readers are more likely to know. To quantify whether a word is more known than another word, I used the GSE (Global Scale of English) Teacher Toolkit. This is an online source and rates vocabulary on a scale from A1 to C2, where A1 is the level of vocabulary suited to a beginner level English speaker and C2 that suited to a proficient speaker, close to mother-tongue ability. The tool is shown in Figure 3.2. I discuss examples of how the toolkit works in Chapter 4.

[7] Where I quote the participants, they are quoted *verbatim*, and their comments are printed in italics.

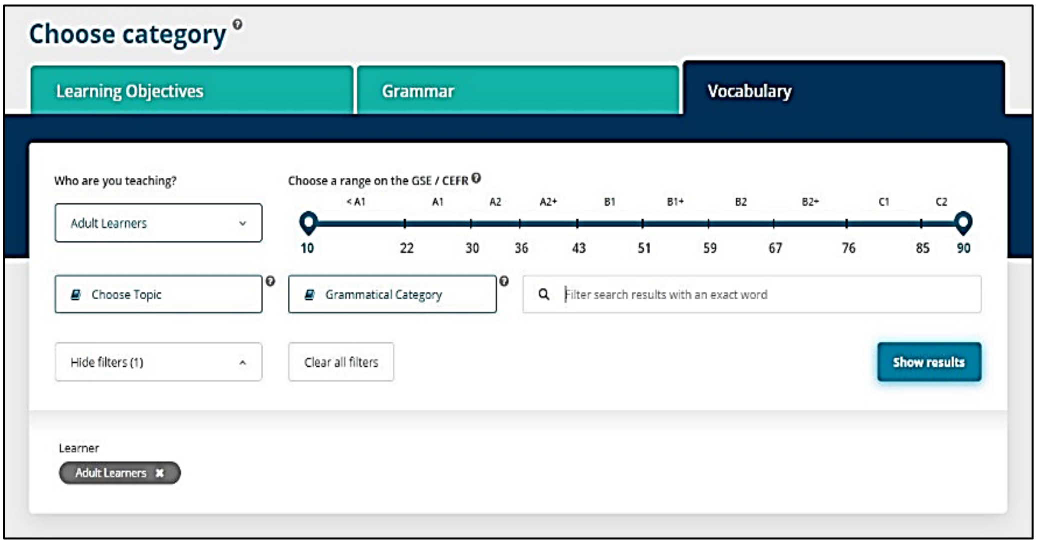


Figure 3.2: GSE Teacher Toolkit homepage

Source: https://www.english.com/gse/teacher-toolkit/user/lo

3.4.3 Selecting sample texts to be included in the survey

After completing the document analyses, I needed to select sample texts to which I could apply Plain Language guidelines and then include in the survey. For detailed descriptions of all seven sample sets that I used for the survey, refer to Sections 4.4.5 and 4.5.6. I have included a short discussion on both proposals here, and included a table with two examples for each proposal.

3.4.3.1 Sample texts from the Technology Demonstrator

The first document I analysed was a Technology Demonstrator. This is a funding proposal specifically to fund the development of new technology. The complete analysis of the document is discussed in Chapter 4, but Table 3.1 gives two examples of the original texts, the questions that I noted down at first reading and then my proposed Plain Language version.

3.4.3.2 Sample texts from the Expression of Interest

For the survey sample texts, I decided that sections from the abstract would be the most applicable. At first, I attempted to read the document sentence for sentence and analyse each sentence separately, but it is very difficult to infer meaning without the context of the information that comes before or after each individual sentence. I expand on this process in Section 4.4.3. To give a sense of the process, Table 3.2 shows two examples from the rewriting of the abstract that was used for the survey.

Table 3.1: Two examples of sample texts to be included in the survey

Original Text	Questions/Queries	Lack of Plain Language	First Plain Language Rewrite
A black-box coupling tool for partitioned, multi-physics simulations.	What does "tool" refer to? Generally speaking, could it be a physical device? What are partitioned multi-physics simulations?	Technical terminology could confuse readers. Title not used to build schema.	A tool for coupling software to enable multi-physics simulations.
Consider the following example of blood flow through an artery. A pressure pulse (from the heart), causes the artery walls to expand, which in turn causes the pressure pulse to propagate through the artery. This pressure pulse propagates through the arterial system at enormous speeds (close to 500cm/s) which in turn slowly forces the blood to circulate. The very nature of the blood flow problem is a strongly coupled system between fluid flow and structural deformations. The blood flow is a direct result of the artery wall displacements, where these displacement again depends on the fluid flow. To solve problems of this nature requires accounting for highly non-linear, strongly coupled interactions between these multiple physical domains.	The process of blood flow through an artery is difficult to follow. The information between brackets is difficult to follow. The reason this example is important should be mentioned first, to provide the reader with context for the process that follows.	Break up complicated text with vertical lists. Hierarchical structure of information will help the reader to follow the process of blood flow. The process of blood flow should be broken up into each separate step.	Blood flow through an artery is an example of a coupled system between fluid flow and structural deformations. This example helps to explain the kinds of problems fluid structure interactions (FSI) typically tries to solve: • When the heart pumps, it sends out a pressure pulse that travels along the length of an artery. This happens at speeds close to 500cm/s. • The pressure pulse travels and gathers momentum (a propagating wave). This is a direct result of the strong coupling between the fluid flow and structural deformation. • This high pressure causes the artery walls (solid) to expand outwards.

Original Text	Questions/Queries	Lack of Plain Language	First Plain Language Rewrite
			• When the artery walls expand outwards, this changes the way that the blood (fluid) behaves. The pressure on the artery wall increases, and the force from the wall disperses the fluid. • This cycle of pressure and force is repeated. As a result, blood continues to flow through the arterial system. To model how blood flows through the arterial system accurately, one has to take into account the non-linear, coupled interactions between the fluid flow and the solid structure.

Table 3.2: Two examples of Plain Language sample from the Expression of Interest to be included in the survey

Original Text	Questions/Queries	Lack of Plain Language	First Plain Language Version
Leakage detection of gas in a 3D space using CFD and IIoT.	What is meant by "leakage detection"? Does it refer to a system, software package or automated robots? Is a 3D space the physical space or within a modelling world? What is CFD? What is IIOT?	The acronyms make it difficult for the reviewer to create a schema for the rest of the document to follow.	A detection system for the earlier identification of gas leaks for implementation in mining and refinery environments.
The accidental release or leakage of hazardous gasses is a serious health and environmental concern, with potentially deadly consequences. The ability to rapidly detect the source of such a leak will reduce or manage these risks.	It is just assumed that the reviewers will know what these deadly consequences are. Is there any system available already detecting gas leaks and if so, is it too slow, is it too general, does it only detect gas after people have already died? What is the current system doing? What is the improvement offered by this new proposed system? Better situational awareness is vague, and how can we know if it is better without knowing what is currently available?	Longest sentence 23 words. The reviewer is not provided with background to why this technology is important. Tentative and vague language causes confusion.	Hazardous gasses are sometimes accidentally released. If this is not detected quickly, it could potentially have deadly consequences (e.g. explosions or illnesses caused by long-term exposure). Leaks can also harm the environment. A method to detect gas leaks from a few dispersed data sources is currently widely applied, but faster detection with pinpoint accuracy will save money, time and lives.

3.5 PHASE 3: QUANTITATIVE AND QUALITATIVE RESEARCH – SURVEY

Quantitative research produces results that can be depicted numerically. It is concerned with answering questions of how often, how many, and how much. This type of research often aims to establish general laws of behaviour across different settings and in different contexts (Kraska, 2012:1167), or, as in this exploratory study, to identify some broad trends and set a baseline to which the findings of similar subsequent studies can be compared.

The numerical data that quantitative research delivers can be used to test a theory (McLeod, 2019, n.p.), in this case, whether applying Plain Language principles to funding proposals can aid interdisciplinary science communication to ensure that a panel of reviewers are able to judge proposals on merit, rather than being distracted by complications in understanding that arise from problem language. Three popular designs for quantitative methods are experimental designs, quasi-experimental designs, or non-experimental designs (Kraska, 2012:1167).

For the purpose of my study, I needed insight into the following:

- engineers' and scientists' demographic information;
- the writing that they need to do in various fields of specialization;
- the primary language that they work in; and
- which sample texts they found easier to understand at first reading.

None of this data could be elicited by means of an experiment, so, for this study, I chose a non-experimental survey design, because such designs are the best way to test opinions and perceptions (Lobmeier, 2012:911), and to gain basic demographic information. However, the survey also contained some open-ended questions, adding a qualitative element.

3.5.1 Non-experimental designs

The three most popular methods for non-experimental designs are causal comparative methods, surveys and correlation. To enable me to gain the insight mentioned above, surveys were the most appropriate design for this study. Surveys allow researchers to ask specific questions to elicit answers on particular topics or questions. I used a survey to elicit information on the specialisations of scientists, the type of writing they need to do, whether or not they are aware of Plain Language, whether they perceive Plain Language to have a possible benefit for their respective fields, and test readers' preferences regarding the understanding at their first reading of seven sample texts. Previous studies focusing on testing Plain Language either used a questionnaire, as in the study by Fouché (2018), or focus groups, as in the study by Burger (2018), to test the Plain Language sample texts.

With the survey, there was the potential risk that I would have a low response rate, but even a low response rate would be higher than the information I could glean from interviews alone. In informal discussions, several engineers and scientists warned me that it would be difficult to find participants who would be willing to give me the time needed to run a focus group or do extended interviews. Hence, a short survey was the most viable option for the purpose of gaining answers to some of my research questions. I therefore opted for a survey, using a questionnaire with 28 questions that was expected to take respondents an average of 7 to 10 minutes to complete. I distributed my survey online between March 2020 and April 2020.

Even with a survey that took no more than 10 minutes to complete, the response rate was low: more than 10 000 survey links were sent out, and only 66 answers were returned (0.0066%). According to Punch (2011:42) the average response rate to expect with the survey method distribution that I opted for is between 30% and 40%. My response rate was significantly lower, which implies that my results cannot be statistically significant or generalisable. In part, this low rate could be attributed to the South African national lockdown that started on 26 March 2020 due to Covid-19, when everyone had to switch to a digital mode, and people felt overwhelmed. I discuss the response rate in more detail in Sections 3.5.6.

3.5.2 Population and sample

The survey was sent to the South African Council for Natural Scientific Professions (SACNASP), who agreed to distribute the survey to its members on my behalf. For ethical reasons, I could not access the member database directly. The council has more than 10 000 registered members and members are part of various fields and subspecialisations.

The inclusion criterion was that the respondents had to be scientists or engineers (in other words, graduates) who write funding proposals. I did not exclude the one respondent who indicated that he/she worked in an administrative role within his/her company, as there are often graduates who work as support staff in such companies. One interviewee, for example, commented that although he/she is in an administrative role, he/she is often asked to read through technical reports and proposals before submission.

3.5.3 Compilation of and rationale for questions for the survey "Better technical communication for scientists/engineers"

To ensure that the data that I gained from the survey would provide insights into my research questions, it was important to consider carefully the questions and type of information that I wanted respondents to provide. According to Punch (2011:42-44), the first step in drafting a survey is to develop clear objectives. This exploratory study focuses on whether applying Plain Language principles can help a panel of reviewers to judge more accurately the funding proposals with technical content that the reviewers might not be very familiar with. Keeping this main objective in mind, I carefully considered each question included in the survey. To ensure that I asked relevant questions to answer my research questions, I divided my survey into four sections, with a main objective for each section.

The survey was designed online using SurveyMonkey. This is a platform where responses can be completely anonymised, and the layout of the survey could also be customised. The link generated by SurveyMonkey enabled respondents to complete the survey using either a laptop, personal computer, tablet, or mobile phone.

In the design phase of the survey, it was important to take into account the time to complete the survey, because time is a contributing factor in response rates. A survey that is too long and difficult to complete on multiple platforms could potentially result in respondents' not completing the survey. SurveyMonkey has an algorithm built into the software that allowed me to determine an average completion time of 10 minutes. In the pilot phase, the four respondents took between 7 and 14 minutes to complete the survey. Although the follow-up interviews were used to probe some of the comments from the survey data, the survey information was appropriate for an exploratory study of this nature.

The survey started with a permission page, where respondents had to indicate that they accepted the terms of the survey before they continued. The remainder was divided into four sections.

The first section focused on questions relating to the demographics of the respondents to establish that they were indeed from different fields, with various qualifications, and speaking different home languages. Little personal or categorical information was asked – categorical variables include categories such as age, gender or race (Lee & Schuele, 2012:2). However, for the purposes of my study it was irrelevant to collect this type of information. The only categorical information that I wanted to collect related to the respondents' field of specialisation, highest qualification, and home language. In South Africa, English is mostly used as the language of science and research. It was important to ask these demographics questions to establish that the survey respondents were indeed a representative sample for the purpose of this study. To align with the *Protection of Personal Information Act, 4 of 2013* (RSA, 2013) and given the time factor, I also did not want to ask highly personal information that was not relevant to the research interest.

The second section in the survey focused on the writing process. Here it was important to gather data on how often respondents are required to write funding proposals, work on projects in teams, whether scientists write funding proposals in groups and whether they need to write funding proposals in a specific template in their everyday working environment. I also asked respondents to rate their template experience using a Likert-scale, from “very easy” to “almost impossible” to complete. This provided insight into how respondents experience different templates and was directly linked to the third section of the survey.

The third section of the survey related to language skills, and the language in which respondents have to submit their work. This section was important to enable me to gain insight into a possible disparity between respondents’ home language and the primary language they have to work in. This section also asked questions related to the writing process and how comfortable respondents feel with their own writing skills. One of the research questions this study aims to answer is whether scientists have the necessary skills to be able to communicate their research clearly. I also wanted to probe how comfortable scientists are with their own writing skills and this section provided data on this topic and enabled me to give a possible answer to this question. I concluded the third section with a question related to using a language practitioner to help respondents with language-related services when they write funding proposals.

The last section of the survey consisted of eight questions with seven example sets, each providing a short original text and the Plain Language equivalent of that text. The survey respondents were asked to choose between a randomised order of original technical texts and Plain Language sample texts of the same samples. Respondents were asked to choose the text they preferred based on how easily they understood the text *at first reading*. According to my working definition of Plain Language, this is a key requirement for a document to be classified as being in Plain Language. A detailed discussion of these examples and the writing process is included in Chapter 4. The detailed rationale for asking the survey questions is shown in Table 3.3, except for the Plain Language examples, which are discussed in detail in Chapter 4.

Table 3.3: Summary of rationale for survey questions

Section	Rationale
Section 1: Demographic information	
1. What is your field of specialisation?	Questions relating to demographics provide the characteristics of the group of respondents that completed the survey. The focus of the thesis is on interdisciplinary science communication and the purpose of this question was to determine that the respondents were indeed from different fields.
2. Highest qualification: • Bachelors • Honours • Doctorate • Master's • Other	The focus of this study is not on communicating highly technical or scientific information to the general public, but for such information to be communicated between peers, but from different specialisations. Therefore, I assumed tertiary education as a given. This question in the survey was to determine that this assumption was correct.
3. Home language: • English • Afrikaans • isiZulu • isiXhosa • Sepedi • Sesotho • Xitsonga • Siswati • Tshivenda • IsiNdebele • Other	English is the language of science but about 90% of South Africans do not speak English as their home language (Statistics South Africa, 2012). The purpose of this question was to determine how many of the respondents are in fact writing in English as their second language.

Section	Rationale
Section 2: Writing in field of specialisation	
4. How often do you need to write reports? • Never • Once a month • Every three months • Twice per year • Once per year • Other If other, please specify.	The purpose of this question was to confirm how frequently scientists and engineers have to write reports and funding proposals. If scientists and engineers do not frequently engage in the writing process, then there would not be a strong case for using Plain Language guidelines. Assy (2011:380) caution against the Plain Language movement and that the movement seeks to find simple solutions to overly complex language problems. In his criticism of the movement, he explicitly states that the complexity of legal and technical language cannot be reduced to issues with grammar and vocabulary.
5. Is your work dependent on outside company funding? • Yes • No	This question provides context for the follow-up question. If respondents need to rely on outside funding, clearly written funding proposals are crucial. If survey respondents do not need to rely on outside company funding for projects, then this follow-up question does not apply and the respondents do not need to complete the questions that follow.
6. If yes, how often (on average) do you need to write funding proposals? • Never • Once a month • Every three months • Twice per year • Once per year • Other If other, please specify.	After determining which respondents need to rely on outside funding, the purpose of this question was to explore how often respondents need to write funding proposals.
7. Do you write funding proposals on your own?	Based on my experience of working with engineers, few scientists and engineers write proposals on their own – they work in teams. If most respondents do work in groups, this implies that several

Section	**Rationale**
• Yes • No If no, how many peers (on average) write funding proposals together?	readers and authors give input into funding proposals before they are submitted to a panel of reviewers. However, if the people working together are all working in the same field, it may be difficult for them to determine what outside reviewers would not know and might find difficult to understand.
8. How many pages long (on average) is each funding proposal?	Funding proposals are usually long, detailed documents, and reviewers are unlikely to want to read a proposal more than once. This makes the principle of making it possible to "understand[…] at first reading" crucial for funding proposals.
9. Are you provided with a template for the proposal?	The two example texts that I used for this study were taken from templates. Templates are common for most funding proposals. There are advantages and disadvantages to using templates, but before considering how to adapt Plain Language guidelines to fit templates, it was important to determine whether templates are indeed common for funding proposals.
10. How easy do you find it to navigate the template and write your specialisation into it? • Very easy • Bit of an effort • Difficult • Almost impossible	The purpose of this question was to determine whether or not respondents find templates easy to navigate or struggle to use templates.
11. Would you prefer to write according to a template?	One of the potential disadvantages of templates is that they can be limiting. On the other hand, they offer a ready-made structure. This question, therefore, verified whether applicants prefer using templates or not. If they do, then it will be necessary to keep this in mind when selecting the final set of Plain Language guidelines for this study.
Section 3: Primary language that you work in	**Rationale**
12. Primary language that you work in? • English	As English is the language of science, this question was used as a confirmatory check.

Section	Rationale
• Afrikaans • isiZulu • isiXhosa • Sepedi • Sesotho • Xitsonga • Siswati • Tshivenda • isiNdebele • Other	
13. How proficient do you feel working in this language? • Completely proficient • Fairly confident • Sometimes struggle • Not at all proficient	Given that most engineers in South Africa are working in English as their second language, this question probed how comfortable respondents are working in their second language. If respondents are comfortable working in English even if it is their second language, then they might be less open to the idea of using Plain Language guidelines.
14. How comfortable are you with your own writing skills? • I'm a good writer and know how to write clearly • I sometimes need help but overall, I am able to communicate efficiently • I know how to convey my message, even if it's not elegant • I can't write and don't enjoy writing	Although scientists need to complete communication courses at university in order to graduate, research suggest that engineers lack the necessary writing and communication skills that they need to be able to efficiently write funding proposals (Knapp, 1984:10; Nudelman & English, 2016:18). This question tested respondents' own perceptions of their writing abilities and whether they do experience writing as difficult. This question provided me with insight regarding the writing process and if scientists were comfortable with their writing, then would they still be interested in Plain Language guidelines as a way to help them clarify their writing.

Section	**Rationale**
15. In writing funding proposals, or any other writing you do for work purposes, do you ever use a language practitioner or communication specialist to review the proposal before submission? • Yes • No • Sometimes	This question and Question 16 probed whether respondents have worked with a language practitioner and provided context for the answers to the (qualitative) open-follow-up question about the reasons for using, or not using, a language practitioner.
16. Reason for using/not using a language practitioner.	

3.5.4 Piloting the survey and revision

After completing the draft survey questions, I ran a month-long pilot phase with two rounds. Two respondents were asked for their input regarding the structure and whether the questions were clear or not. After this first round of input, the survey was adapted. In the second round, the survey was sent to the original two respondents, as well as two new respondents. After this round, final adjustments were made to the survey before I sent the link to SACNASP to distribute.

The first round of the pilot survey indicated a broken link in the branching of the survey. Where respondents answered "no" to Question 5, they were then immediately redirected to the next section as Questions 6 to 11 then only related to funding proposals and the writing one needs to do for funding proposals. Respondents also noted problems with both the example texts and what they found confusing. This then resulted in one last round of rewriting before I finalised the survey and sent it for distribution.

3.5.5 Recruitment of respondents and distribution of the survey

As already mentioned, the survey was distributed from March to April 2020, with 28 April 2020 as the final completion date. To ensure confidentiality and to reach as many scientists and engineers as possible, I approached SACNASP to distribute the survey to the members on its database. The organisation also posted a link to the survey on its Facebook page, and included a paragraph on the study in its monthly newsletter. To reduce non-participation, a reminder email was sent to SACNASP on 14 April 2020 to distribute to members to remind them to complete the survey.

I also approached two other professional organisations with an exclusive focus on engineers from the various subspecialisations and professionals working in applied mechanics. The two funding proposals that I analysed for the purpose of this study worked within the fields of mechanical engineering and applied mechanics, of which mathematical modelling is a subspecialisation. Because these fields would have been known to the respondents, I wanted to determine whether they preferred the Plain Language versions or the original versions of the texts. Although I had also approached two professional engineering bodies to distribute the survey, they did not respond to my request, and I was only able to send the survey to the members of SACNASP.

As already mentioned, respondents were invited to participate in the survey via a link to SurveyMonkey that was sent to the members of SACNASP.

3.5.6 Survey response rate

The survey was aimed at scientists and engineers. A total of only 66 responses was gathered. Of these 66 responses, only 42 respondents completed the survey in full, completing all the questions from Questions 2 to 27. The other respondents completed only parts of the survey or opted out after the first page.

3.5.7 Survey limitations

One limitation of this survey is the low response rate. As a result of the low response rate, I was unable to determine statistically whether there were any correlations between the demographics and the Plain Language examples choices. A detailed explanation of the data from the survey is discussed in Chapter 5.

Another limitation of this survey is the order of the Plain Language examples in the fourth section in the survey. The examples of text to choose from are sequenced – in this case, the two examples were put immediately following each other on the same page. Where such sequencing is used, the first example might "inform" the second example (Vannette, 2015; Villar, 2011:752). Although I tried to randomise the order of the examples, and most respondents predominantly preferred the Plain Language versions, it is important to acknowledge that the sequencing could have influenced the outcome. In future studies, such potential bias might be mitigated by building in an automatic randomisation for the sequence that changes the order per respondent, if the survey tool allows this.

3.6 PHASE 4: QUALITATIVE RESEARCH – INTERVIEWS

Miles and Weitzman (1994:1) state that qualitative data are "usually in the form of words rather than numbers". According to Crouch and McKenzie (2006:484), interviewing is the primary form of this kind of research. In-depth interviews focus on respondents' perceptions and opinions, rather than the "facts" that can be captured in numbers only. The value of qualitative research is that it helps researchers to offer knowledge, provide critiques of current established methods and also to help protect sensitive information (Willis, 2007:231).

An appropriate tool for the exploratory nature of my study was interviews. Hannington and Martin (2012:102) explain that interviews are often a complementary component to questionnaires. Although I used a survey or questionnaire for my study, and, therefore, my research design included interviews to complement the survey.

Interviews revolve around asking questions and interviewees then answering these questions. Interviews can be structured, semi-structured or open. With a structured interview, interviewees are given answers by the researcher and then asked to choose the answer they prefer. An open interview consists of open-ended questions where the purpose of the questions is to elicit opinions and perceptions from interviewees. Disadvantages to using interviews include that interviewees can feel "put on the spot" or try to provide the answer they think the interviewer is looking for (Persaud, 2012:633-634). The way the interviewer behaves or responds (verbally or non-verbally) could also have an influence on responses. When conducting interviews, it is important to take all of this into account (Persaud, 2012:635-636).

For the purpose of this study, I elected to conduct follow-up semi-structured interviews with willing survey participants. All the interviewees that participated in this study also completed the survey. The purpose of conducting the interviews was to elicit insight into the process of writing funding proposals and how scientists experience this writing process. The interviews also focused on Plain Language and whether or not interviewees thought it could be beneficial to their respective industries and the challenges they perceived in collaborating with a language practitioner in practice. I also probed some of the elements that influenced interviewees' decisions in choosing one example text over another in the survey and why they preferred one example over another.

Language tends to be subjective, and knowing what influenced most interviewees' decisions informed the final selection of Plain Language guidelines. The value of these conversations was two-fold. It gave me the opportunity to ask scientists about their experiences directly and it also gave scientists the opportunity to volunteer information and concerns they might not have had a chance to voice otherwise. Although I asked questions to elicit answers, this kind of research is arguably less objective than quantitative data, because the conversation may be influenced by individual values, backgrounds and experiences (Collins, Shattel & Thomas, 2005:192).

3.6.1 Sample and recruitment

A first round of interviews was conducted face-to-face on 9 March 2020. On 26 March 2020, the South African government imposed full national lockdown due to the outbreak of Covid-19. In order to gain a higher number of interviews, a second round of interviews was conducted telephonically. I discuss the sampling, recruitment of interviewees, and process, as well as the interviews schedule in this section.

The follow-up interviews happened in two rounds. The first round of interviews was conducted with engineers from a small engineering consulting firm with nine employees. The company employs various types of engineers and allowed me 15-minute timeslots per interview. All interviewees received the link to the survey the day before the scheduled interviews and I asked that the interviewees complete the survey before the interviews. The company allowed their employees to complete the survey during working hours and eight out of the nine interviewees had completed the survey before I conducted the interviews.

The second round of interviews were conducted only after I completed the survey data collection and preliminary analysis of the survey data. I adjusted the questions for the second round of questions based on themes that emerged from the open-ended survey questions. For the second round of interviews, survey respondents were asked whether they would be willing to participate in a follow-up interview. The willing survey respondents were then asked to provide me with their email addresses, and I contacted them to schedule the second round of interviews. There were 12 survey respondents who indicated that they would be willing to participate in follow-up interviews but only seven participants responded to the email I sent to arrange a time that would suit them. Because of the national lockdown, I was unable to conduct the second round of interviews as soon after the survey as what I initially planned, and this could account for five respondents' unwillingness to go ahead with the interviews. The second round of interviews could not be conducted face-to-face, so I conducted these interviews telephonically to avoid Covid-19-related risks.

All respondents verbally agreed to being interviewed and recorded. Respondents were assigned a number and no personal details were asked for in the interview. I discuss the ethical considerations of the study in full in Section 3.9.

3.6.2 The interview schedules

The interview schedule for the first round was divided into four sections. The first section focused on the interviewees' writing experience and whether or not they were aware of the audience that they need to write for. In Section 2, I focused the interview on Plain Language and interviewees' perception regarding the benefits thereof for their respective industries. In Section 3, I asked about templates, while Section 4 focused on the survey example texts and why interviewees preferred one example of text over another. I concluded the interview by offering interviewees a chance to provide any last comments on communication. Table 3.4 summarises the detailed rationale for first round of questions.

Table 3.4: Rationale for first round of interview questions

Section	Rationale
Section 1: Writing experience and audience awareness.	
1. How often do you need to write reports or funding proposals?	The purpose of this question was to confirm whether scientists and engineers need to write reports or funding proposals frequently, and how frequently. Although this question was also in the survey, the survey limited the responses to four predetermined answers. Repeating this as an open-ended question allowed interviewees to elaborate and volunteer more details if they wanted to.
2. Who are the stakeholders you must communicate with when writing funding proposals?	In Plain Language, the audience is important. Before being able to discuss the audience, I needed to know who the readers of reports and proposals are.
3. Are the documents written in technical language that your reader might not understand?	The aim of this question was to get insight into the obstacles that even expert readers have to overcome when deciphering reports and proposals. I asked this question to establish also whether or not the authors are aware of the reader and this then led to the follow-up question, Question 4.
4. How do you usually try to accommodate the issue of someone	After confirming that scientists and engineers do write in highly technical language that might be difficult for readers

Section	Rationale
maybe not understanding your document?	to understand, I wanted to establish whether or not the writers are aware of strategies to accommodate readers in using the report or proposal.
5. What are the repercussions, if any, of a reader not understanding your document?	I wanted to confirm that the repercussions of readers' not understanding reports and proposals are a loss of income and some research developments not being funded by asking the participants about their experience of such repercussions.
Section 2: Plain Language and perceived benefits to the sciences and engineering fields	
6. The definition of Plain Language is: ***The writing and setting out of essential information in a way that gives a cooperative, motivated person a good chance of understanding it at first reading, and in the same sense that the writer meant it to be understood.*** **Have you ever heard of this before?**	Before I can discuss the applicability of Plain Language principles to technical documents, I first needed to establish whether the science and technical community is aware of Plain Language. I chose to read Cutts's (2004:iv) definition to interviewees to provide them with context for the rest of the conversation.
7. Do you think Plain Language can be beneficial to your industry?	Based on the definition, I wanted to establish whether or not scientists would even be willing to consider the use of Plain Language as an option to solving some of the understandability obstacles that they encounter in reading and writing.
8. If you think Plain Language could be beneficial, would you be willing to work with a Plain Language Practitioner on your documents?	One of my research objectives was to determine whether or not scientists would be willing to collaborate with a Plain Language practitioner on revising documents to make it more accessible to a panel of experts reviewing the suitability for funding purposes. This question allowed me to determine the attitude that scientists have towards this suggested collaboration.
9. What are the problems you foresee working with a Plain Language Practitioner?	If scientists are reluctant to work with Plain Language practitioners, it was important to probe some of the reasons to

Section	Rationale
	why they would feel this way. This provided insight and also informed future research recommendations.
Section 3: Templates	
10. For your reports and funding proposals, you use templates. What are some of the advantages and disadvantages for you using templates?	I needed to establish how scientists experience using templates. I assumed that it is cumbersome and that they would rather want the option to write freely with only a few guidelines. This question helped me to gauge the attitude within the industry towards templates. The survey question provided very limiting options in terms of answering this question; therefore, the interview afforded interviewees the opportunity to expand here if they wanted to.
Section 4: Survey feedback regarding choosing one example over another.	
11. When you completed the survey, what were some of the factors that influenced you choosing one example text over another?	This question provides insight into why respondents preferred one example of text over another example. These insights helped me to consider the final set of Plain Language guidelines.
Closing	
12. Do you have any other comments regarding communication that you would like to share with me?	This gave interviewees the opportunity to volunteer information that they thought would be important for this study. This also gave me the opportunity to probe themes that I might not have thought about in order to make future research recommendations.

The first question repeated the question about writing reports or funding proposals with the aim of establishing a rapport with the interviewees, as well as provide some context to the conversation that followed. I did not ask about the audience that scientists write for in the survey and wanted to probe whom the interviewees need to write for. While Question 2 asked about the audience, Question 3 then focused on whether or not the interviewees consider their documents to be in a technical language that the audience might not understand.

After asking interviewees about their audience, I then directed the interview to asking about the interviewees' strategies for writing in Question 4. I wanted to gain insight into the techniques used and habits of scientists when they think about writing for someone that might not understand their work. Question 5 then focused on the repercussions of interviewees' documents not being understood. This concluded Section 1 of the interview.

Section 2 of the interviews focused on Plain Language. I included Martin Cutts's definition (2004:iv) of Plain Language. After reading this as one definition of Plain Language, I asked interviewees whether they had heard that definition before in Question 6 and then followed this by asking interviewees if they thought that Plain Language can be beneficial to their industries in Question 7. Question 8 asked interviewees about their willingness to work with a Plain Language practitioner on their documents and then probed some of the challenges they foresee with such a collaboration in Question 9, concluding Section 2.

Question 10 in Section 3 asked the interviewees to comment on some of the advantages and disadvantages they experience with using templates. Although I also asked about templates in the survey, this probing question was to determine how scientists experienced using templates and gave them the opportunity to volunteer more information on their experiences using templates. I only asked this one question on templates in the interviews because the other questions related to templates were already answered in the survey.

In Section 4, I focused on the Plain Language sample texts and asked interviewees in Question 11 to expand on some of the factors that influenced their choice in preferring one text over another in the survey. In concluding the interview, I asked interviewees whether they had any other comments regarding communication in Question 12.

3.6.3 The second round

As already mentioned, the second round of interview participants were selected based on the last question in the survey. Survey respondents were asked if they would be willing to complete follow-up questions and then had to provide me with contact details. The second round of interviews was conducted with seven respondents. I sent the survey in April 2020 but was only able to conduct this round of interviews from June to August 2020. Because of the extended time that had passed between the survey and the second round of interviews, I adapted Section 1 and Section 4 from the first interview schedule. Section 2 and Section 3 were kept the same. I summarise my detailed rationale for each question in Table 3.5.

Table 3.5: Rationale for interview questions: Round 2

Section	Rationale
Section 1: Demographics	
1. In which field do you work? (establish engineering, science, research, …)	Because I was unable to complete the follow-up interviews as soon as possible after the survey, I decided to ask the participants these introductory questions to establish rapport with the interviewees.
2. How long have you been working in this field?	
3. Do you have to write reports? Y/ N or funding proposals? Y/N or tenders? Y/N	
Section 4: Language practitioner	
11. Have you ever worked with a language practitioner (editor, technical writer)? **If yes, what was that experience like?** **If no, what are some of the reasons that prevent you from working with a language practitioner?**	One of my research objectives was to determine whether or not scientists would be willing to collaborate with a Plain Language Practitioner on revising documents to make it more accessible to a panel of experts reviewing the suitability for funding purposes. This question allowed me to determine the attitude that scientists and engineers held regarding this suggested collaboration. If scientists are reluctant to work with Plain Language practitioners, it was important to understand some of the reasons to why they would feel this way. This provided insight and also informed future research recommendations.
12. How much do you think language practitioners ask for their work? Do you think that is expensive?	One of the key themes that emerged from the open-ended question in the survey as to why respondents are not willing to use the services of a language practitioner was that it is expensive. I wanted to probe what respondents meant with "expensive" and why that would prevent them from using the services of a language practitioner.
13. Currently language-related services as an industry are mostly unregulated in terms of quality and price. Would you like to retain the option of being able to negotiate fees with a practitioner, or would you rather have a fixed price set	This was an exploratory question as another theme that emerged from the survey answers for reasons why respondents have not used language practitioners was that they were ignorant of the language services industry. This

Section	Rationale
by some kind of government or industry regulation?	question in Round 2 of the interviews was designed to probe this theme further.
Closing	
14. Do you have any other comments regarding communication that you would like to share with me?	This gave interviewees the opportunity to volunteer information that they thought would be important for the study. This also gave me the opportunity to probe themes that I might not have thought about in order to make future research recommendations.

The information in Section 1 of the second round of interviews repeated the demographic questions from the survey to establish rapport and also to provide me with context while talking to the interviewees. As stated previously, the questions for Section 2 and Section 3 stayed the same. I adapted Section 4 of the second round of interviews to probe statements that survey respondents made regarding language practitioners. Question 12 started with the question of whether or not interviewees had worked with a language practitioner previously and although this question was repeated from the survey, I needed to repeat it as a starting point to ask the interviewees to respond to the yes/no that I had received from the survey results. If an interviewee answered yes, I asked him/her to comment on how the person experienced working with a language practitioner. If an interviewee answered no, I then asked him/her to provide some of the reasons that prevented him/her from working with a language practitioner. Although I had asked the same question in the survey, the interview offered a chance for interviewees to give a more detailed explanation of their reasons. From the survey, one of the reasons interviewees gave for not using a language practitioner was cost. In the second round of interviews, I wanted to probe this further. Question 13 then asked interviewees how much they think language practitioners charge for their services. A follow-up to this question was then to ask interviewees whether they thought whatever amount they mentioned was expensive or not.

I viewed the second round of interviews as the perfect opportunity to further ask interviewees for their opinion regarding language-related services. With Question 14 I asked interviewees about the fact that the industry is mostly unregulated and then asked if they would prefer to retain the option to bargain for the price of these services and if they preferred having it regulated with fixed prices. In concluding the second round of interviews, I then asked interviewees if they had any other comments to share regarding communication.

3.7 PHASE 5: DATA ANALYSIS

I discuss the results of the data analysis in Chapter 5 and in Chapter 6. For the purpose of the discussion that follows here, I discuss the only methods and tools that I used for the data analysis.

3.7.1 Survey data

As already mentioned, the survey was divided into four sections, containing some closed-ended questions and some open-ended questions.

3.7.1.1 Closed-ended questions

Originally, I approached Professor Sonali Das, a statistician associated with the Department of Economic Management Sciences, at the University of Pretoria, to gain further insight into the quantitative data. After a detailed analysis of the data that I collected, she indicated that the data were not sufficient to make any statistically significant observations. However, I still wanted to investigate, on average, how often respondents with specific demographic traits chose the Plain Language version of the sample text. To compute this overall percentage, or preference for plain language, I used weighted averages, based on the number of times that respondents with, as an example, a doctorate preferred the Plain Language version of the text. In other words, the weighted average serves to find the average of how often a respondent preferred the plain language version, on the basis of the demographic subcategory. I expand more on this in Section 5.7.

3.7.1.2 Open-ended questions

The survey included a number of open-ended questions. In order to engage with these questions, I joined a course on ATLAS.ti to learn how to use this software, and then employed ATLAS.ti to help me interpret the comments that respondents made. I briefly discuss what the software does and how it relates to the data I presented in Chapter 5 and Chapter 6.

ATLAS.ti is a computer-assisted qualitative data analysis software program that can help researchers to evaluate qualitative data. The software provides a means of quantifying results through coding, cross-tabulations and networks, showing the links between text-based data, survey results, or transcripts (Scales, 2013:134). Smit (2002:66) states that analysis

> literally means to take apart, words, sentences, and paragraphs, which is an important act in the research project to make sense of, interpret, and theorise such data. This is done by organising, reducing, and describing the data.

ATLAS.ti helped me to divide the open-ended survey questions into segments, attach codes to these segments and then display all these connected codes as a network. As I worked through the data, the analysis happened as I named (coded) the various patterns in the data and then also connected these codes to determine how they affect each other, as described by Miles and Weitzman (1994:311). Scales (2013:138) outlines the following principles that underpin computer-assisted analysis:

- Analysis happens as you read the data and divide it into smaller segments.
- How the data is organized is determined by the content of the data.
- The meaning of the data is contrasted and compared which then reveals relationships between different codes.
- The analysis of the data reflects the respondents' perceptions.

Scales (2012:138) explains that "by naming or coding properties of the text to be analysed, the researcher enters into the realm of counting and the data becomes 'quantitative'". Friese (n.d.) recommends that the coding stage (naming the various segments of data) happen in three stages. In the first stage, I therefore did an initial coding where I worked through all the open-ended questions in the survey, reading each response and deciding which of the responses were relevant for this study. As I evaluated the texts, I did an initial coding where I used open coding to assign specific characteristics to each response. These codes were very general and tentative. An example of this was the reasons survey respondents provided for using or not using a language practitioner. For this initial coding, I used *in vivo* coding to label each response according to a specific set of words that described why respondents did or did not use a language practitioner.

In the second round of coding, I then evaluated each code again and grouped comments that related to themes that emerged from the data together. This reduced the number of codes and also helped me to reflect on which codes were the most relevant and actively organise my data in a way that would help me present this in its clearest possible form. After this evaluation in the second stage, I renamed my codes where necessary, merged codes where there were overlaps, and then created networks for the different groups. I demonstrate detailed labelling of one of the networks in Figure 3.3.

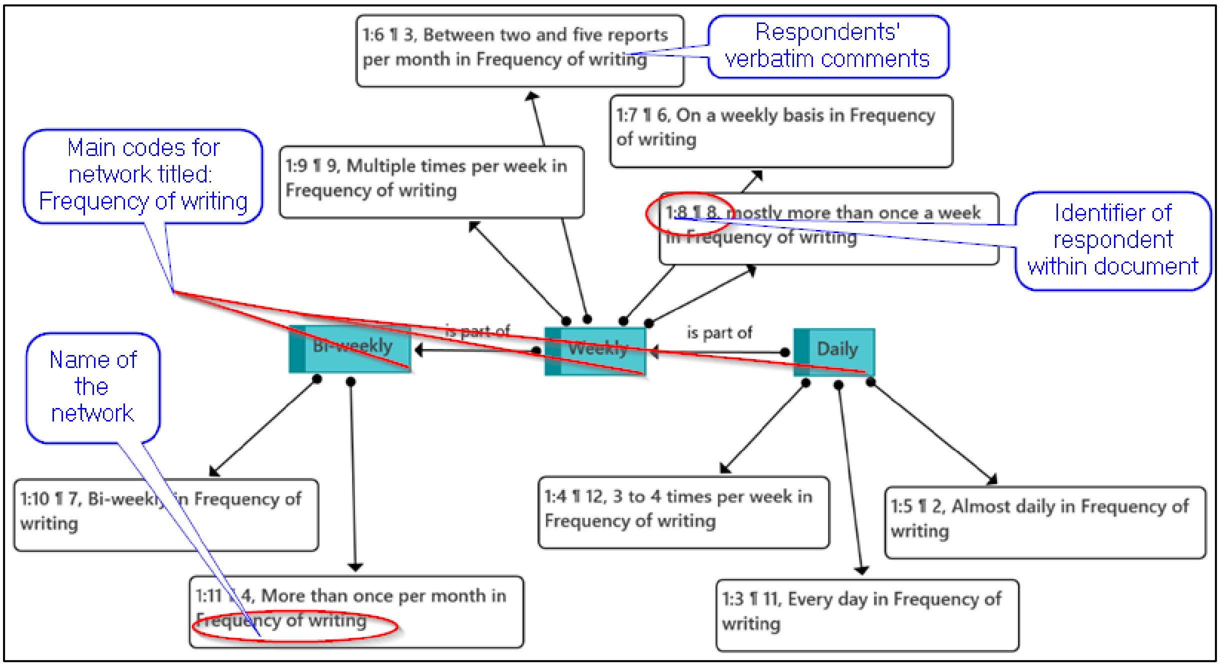


Figure 3.3: Detailed labelling of a completed network in ATLAS.ti

The network name was not always included in the results. Some of the networks were extensive and this necessitated my selection of some components to discuss separately in order to allow me to investigate each theme more easily.

3.7.2 Interview data

The interviews were recorded using otter.ai, an application on my smartphone that transcribed the interviews as interviewees spoke. The application was not perfect, so there were considerable grammar and spelling mistakes in the transcripts. Hence, before I started the data analysis, I first edited the transcripts for grammar and spelling but did not change the content in any way. The results from the interviews were individually reviewed and compiled into documents which I could then use to analyse.

The interview transcripts were analysed for both content and discourse. According to Krippendorff (2004:18), content analysis is used to make valid inferences from texts. The content analysis can be inductive or deductive (Hannington & Martin, 2012:40). For the purposes of this study, I used inductive content analysis where I systematically read through the interview transcripts, grouping responses that were similar together. I identified key phrases that were repeated throughout the interviews and then grouped these phrases together to establish themes. I again used ATLAS.ti to assist me in this process (Section 3.7.1.2). The content analysis helped me to establish the various themes that emerged from the interviews, and I present this analysis in more detail in Chapter 6.

Discourse analysis helped me to determine why a word had a specific meaning within the context that interviewees used the words. According to Gee and Handford (2012:1), there are two types of meaning: utterance-type meaning and utterance-token meaning. They add:

> (a)ny word, phrase, or structure has a general range of possible meanings, what we might call its "meaning range". This is its utterance-type meaning…However, words and phrases take on much more specific meanings in actual contexts of use. These are utterance-token meanings, or what we can also call "situated meanings."

In the context of this study, I use discourse analysis to explore interviewees' "language in use" (Gee & Handford, 2012:1). Discourse analysis is used here to refer to the meaning a word had in the specific context of the interviews. I used such discourse analysis to help infer meaning from the interviewees' opinions and specific words that they used to describe their writing experiences, their opinions on Plain Language and their willingness to work with Plain Language practitioners. I give a detailed account of the interviews and the subsequent themes in Chapter 6.

3.8 PHASE 6: FINAL PLAIN LANGUAGE GUIDELINES

After concluding the data analysis, I reviewed my Plain Language guidelines and decided on a final set of guidelines. I reflect on these final guidelines in Chapter 7.

3.9 ETHICAL CONSIDERATIONS FOR PARTICIPANTS

Terrell (2012:276) lists the following concerns regarding ethical data collection using human participants:

- participation in the study must be voluntary;
- participants must be informed what the purpose and procedure of the study are;
- participants must be informed that they have a right to a copy of the results;
- participants' anonymity should be protected; and
- data should be kept securely.

In addition to these concerns, the Research Ethics Committee of the University of Pretoria considers informed consent from participants, risks and possible disadvantages to participants, ensuring that participants are not deceived and no possible harm is done to participants, that there is no remuneration for participating in the study, that participants can retract their participation permissions at any time and that there will be no penalty for doing so, and lastly that the confidentiality of participants' responses is protected. I received conditional ethical clearance for surveys only to three organisations from the Faculty of Humanities Research Ethics Committee on 25 October 2018, but requested an amendment to replace the survey to two of these organisations (who did not respond to the request to survey their members) with semi-structured interviews in 2019. The ethics application amendment was approved on 28 October 2019, reference number GW20181013HS.

In this study, human participants were involved in both the quantitative and qualitative phases of the study. The quantitative data collection was done via an anonymous survey, whereas additional qualitative data were gathered by means of two rounds of interviews, where anonymity was not possible, but confidentiality could be maintained. Moreover, technical documents with intellectual property concerns were used as examples of funding proposals. To address all these ethical concerns, three separate letters of consent were drafted and required consent.

3.9.1 Consent to analyse funding proposals

The first letter of consent (sample in Appendix I) was signed by the authors of the documents, giving me permission to analyse and rewrite the documents based on my Plain Language guidelines and then to distribute key examples in a survey.

I confirmed that there would be no reference to the author's company and/or identity in the examples and the extracts. I also provided background information on the study and Cutts's definition (2004:iv) of Plain Language to further ensure that the authors could give fully informed consent. The letter of consent included specific reference to keeping the documents secure and confidential and I also described the purpose of the study in detail. The authors were assured that participation was voluntary and that the authors could withdraw their consent at any time during the study. Authors were not offered any compensation for participation and were offered the option to request the rewritten proposals after the study was completed.

Although I was granted permission to analyse sections of the two funding proposals, I was not given permission to replicate the proposals in their entirety, to avoid revealing proprietary information that the research council the authors worked for might want to use in future projects. These specific proposals were only reviewed by internal reviewers from the council, and, at the time when the proposals were analysed, had therefore not yet been made available for public scrutiny. While the authors of the proposals were satisfied that no intellectual property was at risk of being prematurely released, the intellectual property discussed within the proposals does still reside with the council, and may in future form the basis of a core competitive advantage. It is also important to note with the proposals that even all the reviewers in the council need to sign a non-disclosure agreement (NDA) ensuring that the information remains the property of the research council.

3.9.2 Consent to distribute the survey

The second letter of consent was sent to a representative of SACNASP asking for assistance in distributing the survey to the members of the organisation. The background to the study was given and the reason for asking for assistance was also explained (direct access to members and their contact details would violate privacy rights). The council was assured of anonymity for members completing the survey and the timeline for the distribution was also included. The letter is appended in Appendix A.

3.9.3 Informed consent for participants

I drafted a letter of informed consent to survey respondents which described the study and also promised anonymity. In this letter to ask for participants' consent, I explained the purpose of my study and confirmed to respondents that all participation was voluntary and there would be no penalty if participants did not complete the survey. The letter of consent and permission page has been included in Appendix C and Appendix E.

I sent this letter, along with the survey link to SACNASP, to distribute to their members. The signed consent letter from SACNASP has been included as Appendix B. On the landing page of the survey, I included the background to the study again and then also included a shortened version of the participation letter. Before participants could continue answering the survey, they needed to click to accept the terms of the survey (Question 1) before they started the survey with Question 2. The complete survey has been included as Appendix E.

Lastly, I also drafted a letter of informed consent for the purpose of the follow-up interviews. In this letter, I again explained the purpose of the study and confirmed that interviewees were participating voluntarily. I confirmed that the interviewees would be allowed to stop the interview at any time, and confirmed that their identity would be kept completely confidential. I have included this letter of informed consent for the follow-up interviews as Appendix F.

3.10 CONCLUSION

In this chapter, I discussed the methods, processes and tools that I used for this study. After deciding on an appropriate research design, I conducted the research in six phases. This chapter discussed each phase in detail and also included the ethical considerations that were important for the survey and interview participants.

In this chapter discussing my methodology, I show how the first phase of my research, a literature review, answers my research question regarding which Plain Language guidelines (and associated) strategies would be appropriate in addressing the fact that science writing contains technical terminology and abstract concepts, affecting the clarity of proposals at a micro-level. This chapter shows how the document analysis in Phase 2 explore the obstacles that science experts and language practitioners face in trying to decipher scientific and technical information. The methodology of Phase 3 and Phase 4 (the survey and follow-up interviews) are discussed in detail, preparing the stage for the quantitative and qualitative data collection to answer the questions relating to how scientists perceive Plain Language and whether or not they think it could benefit science communication. The data analysis in Phase 5 has been fully explained to show how it provides specific answers to the research questions, culminating in the review of the eight Plain Language guidelines in Phase 6.

In the next chapter, I discuss my detailed document analysis.

CHAPTER 4:
DOCUMENT ANALYSIS

4.1 INTRODUCTION

In this chapter, I discuss the results of the second phase of my research design: the document analysis. As mentioned in Chapter 3, finding documents to analyse for the purpose of this study was the first obstacle that I faced. I approached several engineers through a prominent South African research council for permission to use documents. As discussed in Section 3.9.1, I was granted permission to analyse and use sections of two types of funding proposals that the research council uses for internal funding purposes.

Before starting the discussion on the document analyses, I give more background on the field of research covered by the funding proposals, and discuss briefly some aspects that the two documents had in common. Then, for the convenience of the reader, I again list the Plain Language guidelines that I used to evaluate the chosen documents.

The first type of funding proposal that I analysed is called a Technology Demonstrator. The purpose of this type of proposal is for scientists and engineers to prove that the type of research they are proposing will result in the development of new technology. The research council then makes funding available for the research to continue and ultimately develop this new technology. The second funding proposal is called an Expression of Interest (EoI). This second type of proposal's purpose is for a unit in the council to apply for a predetermined funding amount. Both of these funding proposals needed to use exacting templates provided by the research council. After discussing the two documents and their templates, I focus on the Plain Language sample texts and my chosen Plain Language guidelines (see Section 2.11) to determine whether the Plain Language principles have been applied to the proposals or not. This also informed the Plain Language sample texts that I wanted to include in the survey for respondents to choose between the original text and the Plain Language version.

4.2 FIELD OF RESEARCH FOR BOTH FUNDING PROPOSALS

The documents that I analyse focus on research using two methods of mathematical modelling:

- Computational Fluid Dynamics (CFD), and
- Computational Structural Dynamics (CSD).

The field of Computational Fluid Dynamics (CFD) focuses on "the analysis of systems involving fluid flow, heat transfer and associated phenomena such as chemical reactions by means of computer-based simulation" (Versteeg & Malalasekera, 2007:1). Computer simulations offer models of problems that are too expensive to solve through experiments, or problems that cannot be experimented on in a real-life setting. There is already very specific software for doing the required calculations to solve such problems, but the existing software needs to be run on computers with vast processing power, making such research too expensive. The field has an academic application, but is also widely used in various science-based industries, such as various engineering disciplines and mining.

Scientists and engineers use CFD in the following fields (Versteeg & Malalasekera, 2007:1):

- aerodynamics of aircraft and vehicles, especially lift and drag;
- hydrodynamics of ships;
- power plants, especially combustion in internal combustion engines and gas turbines;
- turbomachinery, especially flows inside rotation passages, diffusers, etc.;
- electrical and electronic engineering, for mixing and separations, polymer moulding;
- external and internal environment of buildings, considering wind loading and heating/ventilation;
- marine engineering, especially loads on off-shore structures;
- environmental engineering, for example, the distribution of pollutants and effluents;
- hydrology and oceanography, with flows in rivers, estuaries, and oceans;
- meteorology, with applications in weather prediction; and
- biomedical engineering, considering blood flows through arteries and veins.

The field of Computational Structural Dynamics (CSD) focuses on mathematically modelling certain structures and how these structures react to external factors such as fluid flow. Baum, Luo, Mestreau, Sharov, Löhner, Pelessone, and Charman (2001:1087) list the following as examples of the types of engineering problems that use CSD:

- shock/structure interactions;
- hypersonic flight vehicles;
- aero-elasticity of flexible thin flight structures; and
- deformation of highly flexible fabrics.

In this context, fabrics refer to materials such as steel and metal, not to textiles.

CFD and CSD are often used together as combined methodologies for mathematical modelling and creating computer simulations. In the first funding proposal that I considered, the Technology Demonstrator proposed combining two software packages that separately use CFD and CSD methods in order to create mathematical models that are more effective and able to solve mathematical problems faster. The Technology Demonstrator used the example of blood flow through arteries as a difficult problem to solve that would need to use both methods.

The second funding proposal, the Expression of Interest, proposes the use of CFD in combination with computer science to develop a system that will be able to detect gas leaks in mines. This proposal suggests using CFD to create a model of how gas disperses through mine shafts. This data will then be used to indicate the optimal placement of sensors to detect the gas leaks almost instantly.

4.3 ASPECTS SHARED BY THE FUNDING PROPOSALS

The purpose of funding proposals is to convince a panel of reviewers to fund a specific type of research or project. The funding proposals I considered shared a number of attributes and conditions that I needed to take into account while I was analysing the documents:

- cross-collaboration between two different units within a leading research institute;
- templates with specific headings and layout requirements;
- review by a panel of reviewers from various fields and subspecialisations;
- tight deadlines for the panel of reviewers, with a multitude of proposals to review; and
- review according to the reviewer's considered opinion, but with only very general guidelines to help the reviewer make a decision.

These factors were important because, as I stated in Sections 2.10 and 2.11, the audience is important in considering the application of Plain Language guidelines. The fact that the proposals involved collaborations between scientists from different backgrounds and were reviewed by panels with reviewers from various fields and subspecialisations made them appropriate for this study. As already mentioned, this study focuses on peer-to-peer communication, and the proposals afforded me an opportunity to investigate some of the challenges that this would entail. Both proposals had very specific template requirements, and this was important to consider because it places a limitation on any layout changes that might be advisable in order to clarify the science story.

The panel of reviewers were especially important to consider as the audience of the proposals. Although it is not possible to know exactly from which subspecialisation reviewers might be, it was critical to ensure that the proposals would be clear enough that any reviewer would be able to judge the research on its merit. The last aspect of the proposals that is important to note is that most applicants do not have a chance to dispute the reviewers' decision or appeal a rejected proposal. This was true for the second funding proposals in this case, but the first proposal's funding structure enabled the applicants to request an oral defence and the development of the technology was eventually approved. As mentioned in Section 3.9.1, I had permission to use the first draft of both funding proposals, but needed to ensure that I remove any identifying features.

4.4 PLAIN LANGUAGE GUIDELINES FOR THIS STUDY

I selected the following eight Plain Language guidelines to help guide this study:[8]

- Guideline 1: Organise your material so that readers can grasp the important information early and navigate through the document easily.
- Guideline 2: Use words your readers are likely to understand.
- Guideline 3: Write concisely.
- Guideline 4: Use vertical lists to break up complicated text.
- Guideline 5: Over the whole document, make the average sentence length 15 to 20 words.
- Guideline 6: Prefer the active voice unless there is a good reason for using the passive.
- Guideline 7: Reduce cross-references to a minimum.
- Guideline 8: Sequence process steps for clarity.

4.5 THE FIRST FUNDING PROPOSAL: TECHNOLOGY DEMONSTRATOR

The first document that I analysed for the purpose of applying Plain Language guidelines was a Technology Demonstrator. A Technology Demonstrator is a funding proposal aimed at showing how funding will be used to develop new technology, which can be an improvement on existing technology, or a completely new technology. This is a very specific funding proposal document that a leading research council prescribes for developing new technology. The council only allows limited funding for developing new technology and very few applicants apply successfully for funding. The purpose of the Technology Demonstrator is to

[8] See Section 2.11 for a detailed discussion.

convince a panel of reviewers that the technology that the engineer(s) or scientist(s) propose will be profitable, as well as fill a specific gap in the market. The Technology Demonstrator helps to provide "knowledge solutions" by encouraging applicants to research ways to help the engineering and science industries through technologies that do not exist yet. In this case, the proposed technology combined two types of software packages to create simulations of two physically different environments. There are software packages available that create simulations for how fluids behave. Then there are software packages available that can simulate how solid structures behave when there is force or pressure applied to these solid services. This technology demonstrator proposes a type of software that can combine these two environments into one software package. The reason the software packages are developed for specific environments is that a solid (as an example) is fundamentally different from a fluid.

The Technology Demonstrator chosen for discussion was initially rejected by the panel of reviewers, but – an unusual situation – the applicants had an opportunity to appeal the rejection in an oral defence where the panel of reviewers had an opportunity to interact with the authors and ask clarifying questions. After the appeal, the funding for this project was granted, suggesting that the proposed technology had merit, but that the proposal was not written clearly enough to convince the panel of that merit. This is precisely the situation that I argue can be alleviated by the application of suitable Plain Language guidelines.

Before I analysed the document to determine whether it adhered to my chosen Plain Language guidelines, I briefly describe the characteristics of the Technology Demonstrator in more detail to provide context and demonstrate the challenges that I faced in the analysis and rewriting processes.

4.5.1 The template

As mentioned in the previous section, a Technology Demonstrator as a type of funding proposal has very specific requirements, as reflected by the very specific template. The template is divided into eight sections and uses a table format. The blank template is shown in Table 4.1, using the original formatting and spelling.

Table 4.1: Technology Demonstrator template

Title:
Executive Summary
A. Market Need 1. What approach did the technology development follow? 2. State the Research Impact Area of the technology 3. What is the user need that the technology is addressing? 3.1. Who are the users of the technology (For example: Buyers, end users, operators, manufacturers)? 3.2. Who are the other stakeholders who impact on the adoption of the technology, if any (For example: regulators)? 3.3. What are the user's needs and/or requirements (What is the problem that the user wants to be addressed)?
B. Description of the Technology Demonstrator (maximum 2 pages) 1. Describe *what* the technology *does* (i.e. what outputs/effects it generates and what inputs (components) are needed to generate outputs/effects). 2. Describe *how* the technology *works* (i.e. mechanism employed to achieve the function described above).
C. Technology Demonstration 1. Describe the environment under which the technology was demonstrated (i.e. describe the relevant and operational environment) 2. What functionality was demonstrated? (In relation to the challenge being addressed) 3. What were the expectations (i.e. expected outcome) from the demonstration? 4. Describe the actual outcome of the demonstration.
D. Maturity: Technology Readiness Level Technology must have reached TRL 6 1. What is the current TRL of the technology? Table 1. Technology Readiness Level Assessment 2. Additional Comments
E. Performance Technology must perform better than alternatives/competing technologies
F. Novelty There must be an element of newness or uniqueness *(Also indicate if this is a new technology or extension/enhancement of an existing technology. If this is an extension to an existing technology, describe the delta (change), indicating how substantial the change is.)* 1. What is new or unique about the technology that provides the better performance in one or more key performance areas as identified in the previous performance section. 2. List the most relevant patents and/or other literature (such as peer-reviewed papers) related to this technology and indicate how your technology is different compared to these. 3. Describe the IP protection steps that have been undertaken and/or IP protection strategy. (Where Applicable)
G. Technology Complexity **Degree of complexity:** Is the technology characterised by **integrated novel technology components or functions (Yes or No and explain).**

Does the technology require **high intensive R&D**? Yes or no. Please explain. Is the technology a **multi-feature/versatile product/technology** with a broad range of application and can be modified easily to fit various needs of the user? Yes or No. Please explain.
H. Potential Impact *(Provide narrative)* **Typical impact type:** Economic, Social and Environmental **Key factors:** • **Economic impact:** e.g. jobs created new company/industry, revenues, cost savings etc • **Social impact:** measurable change in human population, communities, and social relationships resulting from a implementation/deployment of technology or policy change • **Environmental Impact**: e.g. soil, water, air & land alteration, noise generation, waste generation
Appendix

Although applicants are allowed to add appendices to the template, these should not be critical to the content and may give only additional information.

The template enforces applications' providing details in the same prescribed information fields, simplifying comparisons between proposals. The template also provides engineers with prompts and guiding questions as to what information is important for each section of the template to tell a coherent "story", but also forces the applicants to fit their research into a specific box, even if all the sections are not applicable to the research that the applicants are presenting. On the one hand, the questions can be restrictive, but they can also force proposers to stretch the information to complete all, sometimes leading to repetition. The length of the document makes it important to scaffold the information in a way that provides the reviewer with the best chance of understanding the content at first reading, one of the key requirements of my Plain Language definition.

4.5.2 Readability test results

The first step was to run the text, in sections, through the online automatic readability checker (see Section 3.4.2.1) to give me a starting point for analysing the information. As discussed in Section 3.4.2.1, there are disadvantages to using readability tests, as the results are only an indication of how difficult a document is to read. Overall, the Technology Demonstrator tested as difficult to read and suited to a level of a college graduate. This was not a problem in itself, as the panel of reviewers is likely to be highly qualified.[9]

---

[9] The concern with the documents that I chose to analyse was not the level of education of the readers, but that it was aimed at an *interdisciplinary* panel of reviewers, not necessarily working in, or familiar with, the particular field of research covered by the document.

4.5.2.1 "Title" and "Executive Summary"

The Executive Summary of the Technology Demonstrator is the most important section, as it creates context and should give the reviewer enough information to be able to understand the information that follows in the rest of the Technology Demonstrator. As already stated in Section 3.9.1, I am not permitted to reproduce the Technology Demonstrator in its entirety, but give samples from each section that allows the information to stay anonymous. The Executive Summary gives an overview of the research. I have included this almost in its entirety in Table 4.2, as permitted, for the purposes of my discussion.

Table 4.2: Sample text: Executive summary

A black-box coupling tool for partitioned, multi-physics simulations.
In this technology demonstrator (TD) submission we present a novel state-of-the-art coupling tool (solver/software) that enables the mathematical modelling of multi-physics problems by coupling pre- existing, field specific, sub-domain solvers. Coupling here refers to the inter-solver communication (both in the mathematical and programming sense) between the sub-domain solvers to capture the strong, (potentially non-linear) interaction between multi-field domains.
To better explain this, consider the following example of blood flow through an artery (Figure 2, Appendix A). A pressure pulse (from the heart), causes the artery walls to expand, which in turn causes this pressure pulse to propagate through the artery. This pressure pulse propagates through the arterial system at enormous speeds (close to 500cm/s) which in turn slowly forces the blood to circulate. The very nature of the blood flow problem is a strongly coupled system between fluid flow and structural deformations. The blood flow is a direct result of the artery wall displacements, where these displacement again depends on the fluid flow. To solve problems of this nature requires accounting for the highly non-linear, strongly coupled interactions between these multiple physical domains.
The black-box coupling tool presented here facilitates the solution of these types of problems, by coupling two or more stand-alone sub-domain, field-specific solvers. For example, to allow for the simulation of blood flow, a fluid dynamics software package (eg. Fluent, OpenFOAM) can be coupled with a structural dynamics software package (eg. Abaqus, Calculix). More specifically, the coupling technology presented here is a black-box coupler which requires no access or modifications to the source code of the pre-existing, independent sub-domain solvers. The black-box coupling tool

therefore enables multi-physics simulations by allowing researchers to re-use, 'as-is', the software packages they already have at their disposal.

There are however many well known limiting issues when treating multi-physics problems via black-box coupling methods. One such limiting example exists in the analysis of blood flow, where the fluid and solid densities are closely matched (almost equal) and has been coined in literature as the "added-mass" effect. For these class of problems, the coupling between the two or more domains is too strong and non-linear for the currently available methods to solve for efficiently and reliably. To circumvent this (and other) limiting issues (with respect to black-box couplers), in our TD a host of novel numerical methods have been developed which outperform all competing black-box coupling technologies.

Using the online readability checker for each section of the Technology Demonstrator confirmed reading difficulty and a readership at graduate level. The readability scores for the title and the Executive Summary are set out in Table 4.3.

Table 4.3: Readability results for "Title" and "Executive Summary"

Flesch Reading Ease score	40.6, difficult to read	
Gunning Fog	16.3, difficult to read	
Flesch-Kincaid Grade Level	13.2, college graduate	
The Coleman-Liau Index	13, college graduate	
The SMOG Index	11.9, college graduate	
Automated Readability Index	14.8, college graduate	
Linsear Write Formula	15.6, college graduate and above	
Readability Consensus	Grade level: 14 Reading level: difficult to read Reader's age: 21-22 years old (college level)	
Average number of unique words[10]	Average number of words per sentences	Percentage of words with three or more syllables
50%	23	19%

Source: readabilityformulas.com

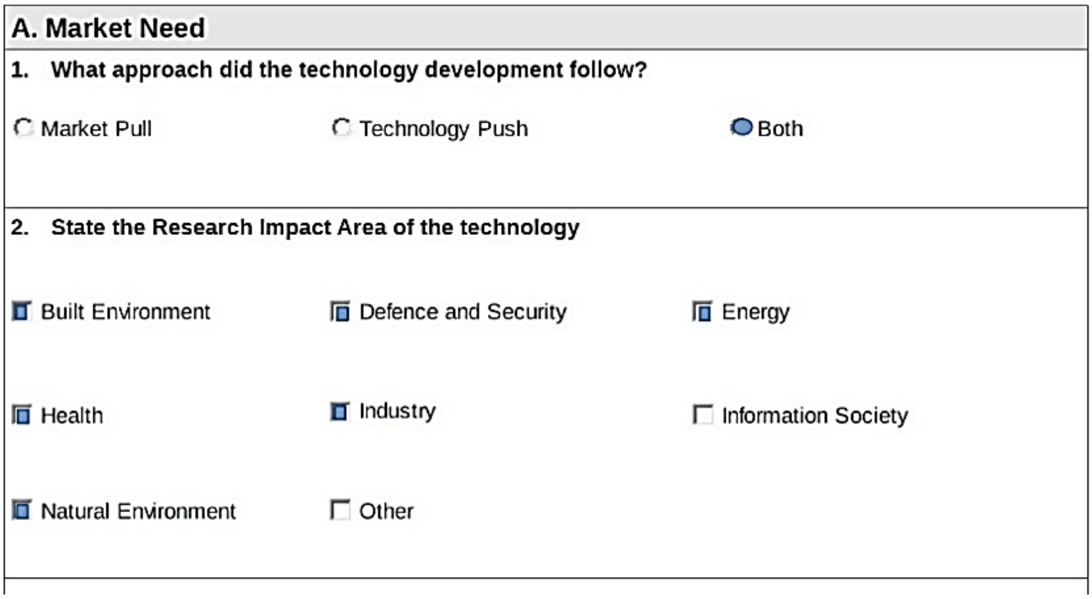
[10] "Unique words" in this context refers to words that might belong to a specialist vocabulary or need a specific context to create meaning. I will use the word "walls" as an example. Although the word might be easy to understand, within the context of the text, walls here do not refer to bricks and mortar holding a house up or dividing anything. Adding "artery" as a context changes the meaning of "walls" and gives a specialist meaning. Therefore, the readability test flags both the words "artery" and "walls" as unique words in the context of the summary,

Although words such as “tool”, “independent”, “simulation” and “fluid flow” are not considered difficult words, the concepts described in the summary are, in fact, complex. Other concepts, such as “sub-domain solvers” and “inter-solver communication”, are abstract in what Halliday (1989:20) refers to as special expressions. The authors attempt to explain some of the concepts with information in brackets, for example, “coupling tool (solver/software)” and “(a) pressure pulse (from the heart) causes the artery walls to expand”. These parentheses tended to distract from the sentence and flow of the writing.

According to the additional word statistics provided by the readability formulas website, only 19% of the summary had words with three or more syllables. This gives the impression that the text is not very complicated. However, the combined scores of the readability test indicate that 50% of the text includes unique words and that the average number of words per sentence was 23 over 19 sentences. For this first readability test, I noted a number of points to keep in mind when applying my chosen Plain Language principles. Firstly, the vocabulary had a combination of apparently familiar words, some of which had specialised meanings in the context, with half of the text containing unique words that I might need to explain or add defining information for. Secondly, the average sentence length was 23, which is not excessively long for my proposed average of between 15 and 20 words per sentence, but adds up if some sentences are longer. As Cutts (2013:123) remarks, the readability test are tools that act like a “yardstick” that gives an indication of the goals a writer should work towards. For the “Executive Summary”, the readability tests were also unable to give an indication of the structuring of the information, how many times there were cross-references, or the sequencing.

4.5.2.2 “Section A: Market need”

This section consists of five questions that the authors had to complete in the form of a fillable table with radio buttons that applicants had to select (see Figure 4.1).



A. Market Need

1. What approach did the technology development follow?

- ○ Market Pull
- ○ Technology Push
- ● Both

2. State the Research Impact Area of the technology

- ☒ Built Environment
- ☒ Defence and Security
- ☒ Energy
- ☒ Health
- ☒ Industry
- ☐ Information Society
- ☒ Natural Environment
- ☐ Other

Figure 4.1: Market Need: Answer options in template (screenshot)

The first two questions took the form of radio buttons that the authors had to select, making this easy to read for reviewers, as it automatically arranges the material in a vertical list.

- *"Question 3.1. Who are the users of the technology (For example: Buyers, end users, operators, manufacturers)?"*

> **ANSWER:**
>
> *Researchers, designers or any individual or institute who have a need to solve or analyse multi-physics systems.*
>
> *It is assumed that these individuals, or end users, have access to pre-existing solvers. It is furthermore important to note that the technology is limited to domain experts. If for example the intended use is to analyse fluid-structure interactions, the end user specifically requires access to a computational fluid dynamics (CFD) solver and a computational structural dynamics (CSD) solver. While the specific choice in solvers is arbitrary, the user is expected to be familiar with the use of these software packages.*

Table 4.4: Results for "Market Need: Question 3.1"

Flesch Reading Ease score	32.2, difficult to read
Gunning Fog	17.2, difficult to read
Flesch-Kincaid Grade Level	13.8, college graduate
The Coleman-Liau Index	13, college graduate
The SMOG Index	12.7, college graduate
Automated Readability Index	12.9, college level entry
Linsear Write Formula	14.9, college graduate
Readability Consensus	Grade level: 14

	Reading level: difficult to read Reader's age: 21-22 year's old (college level)	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
67%	20	24%

Source: readabilityformulas.com

The readability tests indicate that 67% of this answer contained unique words, with an average sentence length of 20 words per sentence. Only 24% of the text contained words with more than three or more syllables.

- "*Question 3.2. Who are the other stakeholders who impact on the adoption of the technology, if any (For example: regulators)?"*

For this question the answer was "none", therefore, I did not put this answer through the website.

- *"Question 3.3. What are the user's needs and/or requirements (What is the problem that the user wants to be addressed)?"* [11]

ANSWER:
Usually, these sub-domain solvers are commercial, and therefore there is no access to the source code. The only way to access these solvers is via input files and the results or output files. So a coupling environment is necessary that allows for black-box sub-domain solvers (solvers where no access to the source code is necessary).
These independent solvers are often based on different numerical methods (for example finite volume, finite element or finite differencing). The coupling tool therefore needs to be method independent.
Furthermore, these problems are often highly non-linear. To account for these non-linearities and guarantee a solution the system's mathematical sensitivities between the two or more physical domains need to be accounted for. This is usually done by directly accessing the source code of each of the independent sub-domain solvers/software to extract this information. Because the TD is to treat each of these solvers/software as black-boxes, access to the source code is not possible. Alternative mathematical/numerical methods are therefore necessary to account for these non-linearities.
The black-box coupling tool TD presented here not only addresses these challenges, but is far more robust and efficient than any of the comparable coupling tools.

[11] This answer contained some proprietary information, and I only included the paragraphs there that did not contain specific details that could identify this information. For the purpose of the readability test, I included the section in full, per sub question.

Table 4.5: Results for "Market Need: Question 3.3"

Flesch Reading Ease score	40.7, difficult to read	
Gunning Fog	15.5, difficult to read	
Flesch-Kincaid Grade Level	12.5, college graduate	
The Coleman-Liau Index	13, college graduate	
The SMOG Index	11.2, college graduate	
Automated Readability Index	13.3, college level entry	
Linsear Write Formula	13.7, college graduate	
Readability Consensus	Grade level: 13 Reading level: difficult to read Reader's age: 18-19 year's old (college level entry)	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
55%	20	19%

Source: readabilityformulas.com

For this answer, the tests again indicated an average sentence length of 20 words and 55% unique words. Only 19% of the words had more than three syllables, so the vocabulary was appropriate for the audience, but more than half of the words might be unfamiliar to reviewers.

4.5.2.3 "Section B: Description of the Technology Demonstrator"

This section consists of two questions and the template limits the authors to a maximum of two pages to complete the two questions.

"Question 1. Describe what *the technology* does *(i.e. what outputs/effects it generates and what inputs (components) are needed to generate outputs/effects)."*[12]

ANSWER:

The accuracy and stability of the coupled solution methods rely heavily on accurate interface information transfer (eg. forces from the fluid domain transferred to the solid domain, and vice versa).

To solve for fluid-structure interactions we have two independent domains, namely a fluid domain and a solid domain, which share a common interface (see Figure 1(a)). The coupling tool in an iterative, or successive/staggered fashion solves the two domains (see Figure 1(b) for an illustrative flow chart).

Solving for the fluid sub-domain provides an interface stress state or forces (in the form of pressures and shear stresses). The coupling tool transfers these forces to the solid sub-domain interface.

[12] I do not show this answer in full - several paragraphs repeat information already included in previous answers. I only provide a snapshot of the information and difficulties that reviewers would encounter. However, I included the full text to run the readability test.

Table 4.6: Results for "Section B: Question 1"

Flesch Reading Ease score	47.4, difficult to read	
Gunning Fog	13.5, hard to read	
Flesch-Kincaid Grade Level	11.1, eleventh grade	
The Coleman-Liau Index	13, college graduate	
The SMOG Index	9.8, tenth grade	
Automated Readability Index	12.1, 17-18 years (twelfth graders)	
Linsear Write Formula	11.9, twelfth grade	
Readability Consensus	Grade level: 12 Reading level: difficult to read Reader's age: 17-18 year's old (twelfth graders)	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
57%	18	16%

Source: readabilityformulas.com

Although this first question in Section B is pitched at an appropriate reading level for the reviewers, with an average sentence length of 18 words and only 57% of the text containing unique words, the readability tests cannot give an indication of clarity in terms of the sequencing, cross-references and whether reviewers will be able to understand the proposed processes.

- *"Question 2. Describe* how *the technology* works *(i.e. mechanism employed to achieve the function described above)*." [13]

ANSWER:

The accuracy and stability of the coupled solution methods rely heavily on accurate interface information

transfer (eg. forces from the fluid domain transferred to the solid domain, and vice versa). We however have two or more domains, each representing very different physics. The length scales present within these sub- domains typically differ sufficiently that very different discretization requirements are needed. Discretization refers to the decomposition of the domain into a number of finite elements or volumes (the triangles and squares in Figure 1(a)) which are required by the numerical techniques (in the independent solver/software packages) to approximate the relevant partial differential equations.

The biggest difficulty however with multi-physics problems is potential non-linearities. These non-linearities result in very strong coupling between the two domains. For such strongly coupled problems, simply transferring information in an iterative fashion is insufficient to guarantee convergence. Instead it becomes necessary to apply some or other coupling technique to stabilise the

[13] As with previous answers, I only give a section to demonstrate the difficulty of the text. For the purpose of the readability test, I included the section in full, per subquestion.

iterative system. Usually this is done by directly accessing the source code of the respective sub-domain solvers and acquiring the relevant mathematical system sensitivities (information relating to the cause-effect of the boundary value problem). When using a black-box sub-domain solver, we do not have access to the source code.

Table 4.7: Results for "Section B: Question 2"

Flesch Reading Ease score	22.8, very difficult to read	
Gunning Fog	17.4, difficult to read	
Flesch-Kincaid Grade Level	15, college graduate	
The Coleman-Liau Index	16, college graduate	
The SMOG Index	12.5, college graduate	
Automated Readability Index	15.7, college graduate	
Linsear Write Formula	14.7, college	
Readability Consensus	Grade level: 15 Reading level: very difficult to read Reader's age: college graduate	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
52%	20	24%

Source: readabilityformulas.com

For this section, the Flesch Reading Ease score was lower than with the previous question, which indicates that this section's answer was harder to understand than the previous sections' answers. For this answer, the average sentence length is again 20 words per sentence and 52% of the text containing unique words. For this answer, the text contained 24% of words with more than three syllables.

4.5.2.4 "Section C: Technology Demonstration"

This section consisted of four questions, guiding the authors to explain how the technology has worked in an experimental environment. The answers to the four questions were fairly short, so, to meet the minimum 100-word requirement for the checker, I decided to use all four answers in one paragraph. The four questions were:

- *"Question 1. Describe the environment under which the technology was demonstrated (i.e. describe the relevant and operational environment)"*

ANSWER:

The coupling tool has been extensively benchmarked on a host of representative mathematical models and provides sufficient confidence that the coupling tool is generically applicable.

To further demonstrate the potential functionality, the coupling tool has been used to couple a fluid flow solver and a solid dynamics solver, to enable the simulation of fluid-structure interactions (FSI). FSI is currently one of the most popular research topics in computational and applied mechanics, with many large and active international research and academic institutes. Furthermore, FSI problems where the fluid density and solid density are approximately the same (as experienced when modelling blood flow) represents a class of problems that are very difficult to solve. This particular problem has been coined as the "added-mass" effect, and is commonly used as an example of the class of problems to which black-box coupling methods are entirely ill-suited. Being able to solve these kinds of problems provides significant confidence in the general applicability of the coupling tool.

- *"Question 2. What functionality was demonstrated? (In relation to the challenge being addressed)"*

ANSWER:

Incompressible FSI, where the solid and fluid densities are closely matched represents an enormously challenging multi-physics problem (for example, the computation of blood flow through an artery). It represents the type of problem for which competing black-box coupling technologies perform very poorly (if they work at all). By demonstrating the solvability of these kinds of problems provides confidence in the general applicability of the coupling tool.

- *"Question 3. What were the expectations (i.e. expected outcome) from the demonstration?"*

ANSWER:

FSI is a very popular field. As such, there are a host of well known, well documented test problems for which the currently available black-box coupling methods perform poorly. Based on the mathematical rigour with which the new methods were developed (which form the core of the TD), expectations were that the newly developed coupling tool should be capable of solving these difficult problems, and solve them efficiently.

- *"Question 4. Describe the actual outcome of the demonstration."*

ANSWER:

The black-box coupling tool described here outperforms all other competing black-box technologies when applied to FSI problems. Not only are we now capable of solving all the well documented difficult problems, but the performance of the newly developed methods provides near Newton like behaviour (Newton's method, with quadratic convergence, is the theoretical upper limit for iterative solution methods). This is very promising, considering that quadratic convergence is only possible should the exact sensitivities be computed, and therefore limited to non-black-box methods (where direct access to the source code of the independent sub-domain solvers are available).

Table 4.8: Results for "Section C"

Flesch Reading Ease score	37.4, difficult to read	
Gunning Fog	15.1, difficult to read	
Flesch-Kincaid Grade Level	12.4, college	
The Coleman-Liau Index	14, college	
The SMOG Index	11.4, college	
Automated Readability Index	12.7, college	
Linsear Write Formula	12.6, college graduate and above	
Readability Consensus	Grade level: 13 Reading level: difficult to read Reader's age: 18-19 yrs. old (college level entry)	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
45%	17	22%

Source: readabilityformulas.com

Overall, according to the readability tests, Section C scored the best in terms of being easy to read. This could be due to the fact that I included the questions and answers in bullet form. The average sentence length for this section was also only 17 words, with 45% of the words being unique. In this section, 22% of the words had three or more syllables.

4.5.2.5 "Section D: Maturity: Technology Readiness Level – Technology must have reached TRL 6"

Section D of the Technology Demonstrator consisted of 13 yes/no questions with the option to add comments to justify the answer. The comments were short, sometimes just one word. Figure 4.2 shows the first part of this section as a screenshot.

D. Maturity: Technology Readiness Level – Technology must have reached TRL 6

1. What is the current TRL of the technology?

◉ TRL 6 ○ TRL 7 ○ TRL 8 ○ TRL 9

Table 1. Technology Readiness Level Assessment

	TRL Questions	Yes	No	Comments
Both Hardware and Software	1. Have system integration issues been addressed?	◉	○	The software described here is a systems (in the context of solvers) integrator. It couples two stand alone software packages. The coupler requires only access to input and output files of the independent solvers/software and can therefore easily be extended to any alternative software packages.
	2. Is the operational environment fully known?	◉	○	Partially. The full scope of potential applications is too large to predict upfront. Based on literature, and the performance of our methods to competing technologies we have at present a fair idea of what it can definitely be used for.
	3. Have performance characteristics been verified in a simulated operational environment?	◉	○	The solver has been extensively benchmarked on well documented difficult problems. Extensive numerical validation and verification.
	4. Has prototype been tested in a simulated operational environment?	◉	○	The problems the solver have been validated on are typical benchmark problems usually used to explain why black-box coupling is not a viable alternative. We perform better on these problems than any other competing black-box methods and compare favourably to existing commercial problem specific solvers.
	5. Has system been tested in realistic environment outside the laboratory?	◉	○	It has been used by two final year engineering students and is currently being used by a Master's student in mechanical engineering.
	6. Has an inventory of external interfaces been completed?	◉	○	Only those we are aware of. The potential application envelope is near limitless, so it would be inaccurate to state all external interfaces have been identified.
	7. Has engineering feasibility been fully demonstrated?			N/A

Figure 4.2: Sample from Section D

This section of the document relied heavily on the context of the scientific council, and the questions were very specific to the processes well known within the council. Therefore, I did not run this section through a readability test.

4.5.2.6 "Section E: Performance – Technology must perform better than alternatives/competing technologies"

This section's scores were very similar to those of the previous sections. Although the readability tests indicated that this section was easy enough for a university student to understand, this section contained very specific jargon with a table and graph that were difficult to comprehend if one is not a specialist in the field of mathematical modelling. This section also included the results of the various tests and refers the reviewers to all four of the Appendices in the Technology Demonstrator. Although I am not able to include any of the content of the answer here, because of proprietary information, the readability results indicate that this section is difficult to read. Table 4.9 shows these results.

Table 4.9: Results for "Section E"

Flesch Reading Ease score	31.2, difficult to read	
Gunning Fog	17.1, difficult to read	
Flesch-Kincaid Grade Level	14.2, college level	
The Coleman-Liau Index	14, college level	
The SMOG Index	12.6, college level	
Automated Readability Index	14.5, college graduate	
Linsear Write Formula	15.4, college level	
Readability Consensus	Grade level: 14 Reading level: difficult to read Reader's age: 21-22 year's old (college level)	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
43%	21	23%

Source: readabilityformulas.com

Although the readability test results are similar to those in the rest of the text, the test did not take into account the various equations, tables and graphs that are difficult to decipher from the descriptions in the text.

4.5.2.7 "Section F: Novelty – There must be an element of newness of uniqueness"

This section consisted of three questions. I only tested the first question for this section. The answer to this question contained three bullets with paragraphs expanding on each point. For this answer, I am not able to show the answer in full, but I give one sentence for each bullet as an example. The second question relates to a list of publications and the third question relates to intellectual property (IP) that the authors answered very briefly.

- *"Question 1. What is new or unique about the technology that provides the better performance in one or more key performance areas as identified in the previous performance section. (Also indicate if this is a new technology or extension/enhancement of an existing technology. If this is an extension to an existing technology, describe the delta (change), indicating how substantial the change is.)"*

ANSWER:

a. *A new coupling method based on a newly developed "mutli-vector iterative updating quasi-Newton" method (MVQN). The newly proposed MVQN resides within the greater field of approximate Newton methods. It is possible to demonstrate the method to be a mathematical extension of the classical rank-1 update Broyden's method (as an approximation to the generalised interface secant equations).*

b. *A proposed combination of artificial compressibility (AC) and the newly developed MVQN method, referred to hereafter as AC+MVQN.*

c. *Radial basis function (RBF) interpolation with consistent formulation to transfer interface information transfer. RBF interpolation, is a subset of the larger field of multi-variate approximation theory. Generally speaking, RBF constructs a global interpolation function of the interface information. RBF constructs this interpolation through the use of a set of interconnect splines (curvatures).*

The idea of black-box coupling is not new. However, the methods that form the core of the TD are new, and show an improvement when compared to the alternatives.

Table 4.10: Results for "Section F"

Flesch Reading Ease score	32.9, difficult to read	
Gunning Fog	15.7, difficult to read	
Flesch-Kincaid Grade Level	13.1, college level	
The Coleman-Liau Index	13, college level	
The SMOG Index	11.4, college level	
Automated Readability Index	12.5, college graduate	
Linsear Write Formula	12.7, college level	
Readability Consensus	Grade level: 13 Reading level: difficult to read Reader's age: 18-19 yrs. old (college level entry)	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
47%	18	22%

Source: readabilityformulas.com

For this section 47% of the words were unique and 22% of the text contained three or more syllables. Again, this section scored appropriately on the readability tests but the tests do not give an indication regarding the structuring and the lexical density (Halliday, 1989:20) that makes this section confusing to readers.

4.5.2.8 "Section G: Technology Complexity"

This section consisted of three bullet points where the author was asked to answer a yes/no question and then needed to explain why the author chose "yes" or "no". These answers were short explanations. Table 4.11 shows the results.

Table 4.11: Results for "Section G"

Flesch Reading Ease score	54.3, fairly difficult to read	
Gunning Fog	11.8, hard to read	
Flesch-Kincaid Grade Level	8.1, eighth grade	
The Coleman-Liau Index	11, eleventh grade	
The SMOG Index	8.2, eighth grade	
Automated Readability Index	6.9, (11-13 year's old) sixth and seventh grade	
Linsear Write Formula	5.8, sixth grade	
Readability Consensus	Grade level: 8 Reading level: fairly difficult to read Reader's age: 12-14 year's old (seventh and eighth grade)	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
64%	10	20%

Source: readabilityformulas.com

This section scored lower in terms of the difficulty of the text. One reason for this could be the shorter answers and the easy language used by the authors. Because of the short answers and bullet form of the answers, the text had an average sentence length of 10 words per sentence. Although the sentences were shorter in this section, 64% of the words in this section was unique.

4.5.2.9 "Potential impact"

In this section the template asked the authors to provide a short narrative of what the potential impact could be and then expand on each potential impact with a short comment in a table labelled "Scale of Impact". Because of the table form of the Scale of Impact, I tested it separately from the short narrative.

ANSWER:

Multi-physics simulations are an intensely competitive international research topic. As of yet, South African institutes have been largely inactive in this field.

Multi-physics simulations, and the capacity to solve such problems is an enormously important to have capability, both institutionally and nationally. The coupling tool presented here enables the simulation of multi-physics problems by allowing research units and institutes to continue to use the modelling software they already have at their disposal. This removes the need to purchase additional licenses of equivalent commercial alternatives, which may or may not be able to solve the desired problems.

Table 4.12: Results for "Potential Impact", narrative section

Flesch Reading Ease score	14.3, very difficult to read	
Gunning Fog	19.4, difficult to read	
Flesch-Kincaid Grade Level	16.8, college graduate and above	
The Coleman-Liau Index	16, graduate college	
The SMOG Index	14.8, college	
Automated Readability Index	17.2, college graduate	
Linsear Write Formula	17.8, college graduate and above	
Readability Consensus	Grade level: 17 Reading level: very difficult to read Reader's age: College graduate	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
66%	22	29%

Source: readabilityformulas.com

This narrative section describing the potential impact of the Technology Demonstrator was the most difficult section to read with the lowest score on the Flesch Reading Ease Score, indicating that the text is really difficult to read. This section also had the most unique words, with 66% of the vocabulary being unique in this section. The words in this section also had 29% words with three syllables or more.

For the second part of "Section H" of the Technology Demonstrator required authors to complete a table on the impact that they can expect from the research. I have included the table here as Table 4.13, but deleted any identifying information.

Table 4.13: Scale of Impact

Key Factors	Comment
Economic impact: e.g. jobs created, new company/industry, revenues, cost savings etc	First and foremost, the current technology bypasses the need to purchase or pay licensing fees for expensive commercial alternatives. The black-box coupling tool can be commercialised or licensed. It's main value however derives from the in-house capability it provides. Currently, we have demonstrated the ability of the tool by coupling two open-source sub-domain solvers. While this is but one example of the application envelope of the coupling tool, the FSI solver as it stands is completely free
Social Impact: measurable change in human population, communities, and social relationships resulting from a implementation/deploymen t of technology or policy change	Due to the sophisticated nature of the coupling methods introduced for the technology demonstrator, the software can be used to analyse biomechanics problems. It therefore has the ability to directly solve problems related to the cardiovascular system. Conceptually then, it is possible that the technology, coupled to imaging technologies can be used to improve decisions for complex surgeries, on patient specific models. More immediately however, the coupling tool provides students and researchers an affordable and accessible tools to catapult South African research endeavours into this highly competitive, and important international research field.
Environmental Impact: .e.g. soil, water, air & land alteration, noise generation, waste generation	The technology and routines developed here within can be used to gain a greater understanding of potential environmental problems. For example, the software can be used to model wave impact with man made coastal systems, either for disaster management or environmental protection.

Source: Technology Demonstrator

For the readability test, I was not able to include the table as it is shown above. I used the information in the left column as a platform statement and the information to the right as a separate paragraph. Table 4.14 shows the results for the "Scale of Impact".

Table 4.14: Results for the Scale of Impact

Flesch Reading Ease score	28.8, very difficult to read
Gunning Fog	16.8, difficult to read
Flesch-Kincaid Grade Level	14.2, college
The Coleman-Liau Index	15, college
The SMOG Index	12.3, twelfth grade
Automated Readability Index	14.2, 21-22 year's old (college level)
Linsear Write Formula	13.6, college
Readability Consensus	Grade level: 14 Reading level: very difficult to read Reader's age: 21-22 year's old (college level)

Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
61%	18	25%

Source: readabilityformulas.com

Although this information is presented in a table format, the results of the readability tests show that text contained 61% unique words and 25% of the words had three or more syllables. The average words per sentence was 18 words per sentence.

4.5.2.10 Overall impressions of the document after the readability tests

Although the readability test results indicated that the content of the Technology Demonstrator was suitable for the intended readers (graduates), the proposal did not achieve funding before the authors presented a verbal defence of the research and the technology that they were proposing to develop. In this instance, it was clear that although sentences were largely grammatically correct, the reader could still be confused as to what the purpose of the document was, as Baker (2011:135) warns might happen.

4.5.3 Preliminary questions before the Plain Language analysis of the Technology Demonstrator

As discussed in Section 3.4.2.3, I attempted to digest the information for myself by asking the following preliminary questions:

1. Who are the intended readers?
2. How is the information structured to help readers understand the value of the research?
3. Is the vocabulary easy to understand at first reading?

The most important question is who needs to use a document. For the Technology Demonstrator, the intended readers were a panel in the scientific council consisting of scientists from various fields, but not necessarily from the same field(s) as those who wrote the Technology Demonstrator. The Technology Demonstrator that I chose to analyse was one of 89 funding proposals of this type that were submitted to this panel. Of the 89 Technology Demonstrators, only 18 were shortlisted. After the shortlisting, the authors had to expand on the initial proposal. The panel of reviewers then reviewed all 18 shortlisted proposals and only approved two proposals for funding.

The second question that I wanted to answer before I completed the Plain Language analysis was how the information was structured to help readers understand the complex content. Because of the restrictions of the template, the layout of the document was fixed to allow reviewers access to information in a prescribed structured way. The headings were phrased in a way that ensured that the applicants knew exactly what they had to include in each subsection.

For this initial reading, I decided to note the questions I had as I read the text. The first eight sentences serve as an example of this process (see Table 4.15). These eight sentences constitute the first two paragraphs of the executive summary, which consists of 19 sentences. For each sentence (cited verbatim, but broken up to show the units I identified to work with), I highlighted the individual words that could cause confusion in purple. The only access that I had to information on words that I was not familiar with was Google. Reviewers would be in a similar situation. I therefore used Google as a preliminary search tool where this technical terminology was concerned.

I continued with the rest of the document in this manner, noting down where the content was not clear and where certain concepts raised questions that I needed to investigate further. After this initial reading and overview of the Technology Demonstrator, I then analysed the document against my chosen Plain Language principles. I have also noted in this table where my Plain Language guidelines can be used or where some of the principles were already used in the original text.

Table 4.15: Challenges with the Technology Demonstrator at first reading

Title: A black-box coupling tool for partitioned, multi-physics simulations.			
Original wording	**Questions at first reading**	**Explanations of terms**	**Plain Language guideline to apply**
A **black-box**	What does the adjective black-box refer to?	black-box: a system whose behaviour has to be observed entirely by inputs and outputs	Guideline 1: Organise your material so that readers can grasp information early and navigate through the document easily. Guideline 2: Use words your readers are likely to understand.
coupling tool for	In this context, "coupling" could refer to a device that connects part of machinery or pairs two items. The words "solver/software" in the first sentence imply that it might not be a physical device, so in this context, what are the two things that are being connected?	coupling tool: a device for connecting parts of machinery, or the pairing of two items	
partitioned, **multi-physics**	What is being divided ("partitioned")? Why is there a need to divide it? What is multi-physics?	partitioned: divide into parts multi-physics: systems involving more than one simultaneously occurring physical field	
simulations.	From my previous experience, I know that simulations imitate real-world situations.		
Overall impressions of the title: The title is vague, and the very specific technical terms do not provide enough information to understand what the Technology Demonstrator proposes.			

Sentence 1: In this Technology Demonstrator (TD) submission we present a novel state-of-the-art coupling tool (solver/software) that enables the mathematical modelling of multi-physics problems by coupling pre-existing, field specific, sub-domain solvers.			
Original wording	**Questions at first reading**	**Explanations of terms**	**Plain Language guideline to apply**
In this technology demonstrator (TD) submission we present a **novel state-of-the-art**	State-of-the-art suggest that there is already similar technology available, which contradicts the claim of novelty. So my first questions were these: What technology already exists? Why is this technology necessary?	novel: something that is new state-of-the-art: the best that technology can already offer	Guideline 1: Organise your material so that readers can grasp information early and navigate through the document easily. Guideline 2: Use words your readers are likely to understand. Guideline 3: Write concisely. Guideline 5: Over the whole document, make the average sentence length 15 to 20 words (original sentence is 30 words).
coupling tool (solver/software) that enables the	Again, in this context, “coupling” could refer to a device that connects part of machinery or pairs two items. The words “solver/software” imply that the “tool” might not be a physical device so in this context, what are the two things that are begin connected? This could be a noun or a qualifying adjective. And later in the sentence, it is a verb? This makes the term “tool” confusing, since it could be read as a physical object.	coupling: a device for connecting parts of machinery, OR the pairing of two items	
mathematical modelling of	From my experience working on engineering projects, I knew that mathematical modelling is used to create simulations of how certain materials behave under very specific predefined conditions.	mathematical modelling: a description of a system using mathematical concepts	
multi-physics problems by **coupling pre-existing, field specific, sub-domain solvers.**	What are multi-physics problems? What is a pre-existing, field specific, sub-domain solver? Missing hyphen for “field-specific”. What are multi-field domains?	multi-physics: systems involving more than one simultaneously occurring physical field solver: a piece of mathematical software, possibly in the form of a stand-alone computer	

	At the end of this sentence, it is still unclear what the "software", will be solving? .	program or as a software library, that "solves" a mathematical problem	

Overall impression of Sentence 1:
The information in the first sentence of the executive summary does not provide much context for a reviewer not in the field of mathematical modelling. At this point the reader can only access the "software" schema.

Sentence 2: Coupling here refers to the inter-solver communication (both in the mathematical and programming sense between the sub-domain solvers to capture the strong, (potentially non-linear) interaction between multi-field domains.

Original wording	**Questions at first reading**	**Explanations of terms**	**Plain Language guideline to apply**
Coupling here refers to the	Starting the sentence with the word "coupling" suggests that the topic of the sentence will be what coupling means in this context. Although the rest of the sentence attempts to explain what coupling refers to, it does not clarify the concept to the reader by the end of the sentence.		Guideline 2: Use words your readers are likely to understand. Guideline 3: Write concisely. Guideline 5: Over the whole document, make the average sentence length 15 to 20 words (original sentence 28 words).
inter-solver communication (both in the mathematical and **programming** sense) between the **sub-domain** solvers to	Inter in this context means *between*. Why will it need to be between solvers? Including information in brackets breaks the flow of information. The signalling "both" indicates that there are indeed two things to think about, but the omission of "in the" before "programming" disrupts the parallel structure, making it more difficult to see the second item in the list. The word "sense" is vague and does not clarify what the author means with the topic of the sentence, "coupling". What does the author mean with sub-domain?	inter-solver: specific jargon programming: the process of creating a set of instructions that tell a computer how to perform a task sub-domain: a subdivision of a domain; domain: location of a website	

capture the strong, (potentially non-linear) interaction between **multi-field** domains.	The last few words in this sentence do not seem difficult on their own, but together the words are not sufficient to provide enough context.	multi-field: several branches of study	
Overall impression of Sentence 2: The sentence starts with "coupling" as the ostensible topic, but, although the authors expand on what coupling means, it is still not clear at the end of the sentence what coupling is.			

Sentence 3: To better explain this, consider the following example of blood flow through an artery (Figure 2, Appendix A).			
Original wording	**Questions at first reading**	**Explanations of terms**	**Plain Language guideline to apply**
To better explain this, consider the following example of	"This" creates ambiguity, because the antecedent is unclear. Does "this" refer to the previous sentence explaining what coupling is? Will the example explain what solvers are? Will the example clarify what multi-physics is?		Guideline 7: Reduce cross-references to a minimum.
blood flow through an artery	Blood flow immediately gives the reader an image of what the author is talking about, so the example promises to be helpful.		
(Figure 2, Appendix A).	Visuals can help to explain difficult concepts. A drawback of this image is that it is on page 13 of the Technology Demonstrator but the example is mentioned on page 1. This is a drawback of using the template.		
Overall impressions of Sentence 3: An example will indeed help to illustrate the more technical content.			

Sentence 4: A pressure pulse (from the heart) causes the artery walls to expand, which in turn causes this pressure pulse to propagate through the artery.			
Original wording	**Questions at first reading**	**Explanations of terms**	**Plain Language guideline to apply**
A pressure pulse (from the heart)	Generally accepted, readers will know that for blood to flow (as stated in the previous sentence) the heart has to pump. The brackets are unnecessary, confusingly suggesting that the pressure pulse could come from something else in the human body. This image is clear enough to keep track of what the example explains.		Guideline 4: Use vertical lists to break up complicated text. Guideline 5: Over the whole document, make the average sentence length 15 to 20 words (sentence 24 words). Guideline 8: Sequence process steps for clarity.
causes the artery walls to expand, which in turn	Does the pressure build as the blood travels through the body?		
causes this pressure pulse to **propagate** through the artery.		propagate: the process by which new plants grow from a variety of sources, similar meaning is to spread	
Overall impression of Sentence 4: The image is clear enough to follow the gist of the example. In combination with the sentences to follow the example can be even clearer to the reader if the steps are presented in a vertical list. At this point the reason for this technology is still not clear.			

Sentence 5: This pressure pulse propagates through the arterial system at enormous speeds (close to 500cm/s) which in turn slowly forces the blood to circulate.			
Original wording	**Questions at first reading**	**Explanations of terms**	**Plain Language guideline to apply**
This pressure pulse **propagates** through the arterial system at enormous speeds (close to 500cm/s) which in turn	The pressure travels really quickly through the arteries. Why does the fast pressure cause the blood to circulate slowly? Why is the speed relevant here? Why is this information added in brackets?		Guideline 2: Use words your readers are likely to understand. Guideline 4: Use vertical lists to break up complicated text.

slowly forces the blood to circulate.	There should be a comma before "which", as this appears to be a non-defining relative clause, with a somewhat unclear antecedent for the "which".		Guideline 5: Over the whole document, make the average sentence length 15 to 20 words (original sentence 23 words). Guideline 8: Sequence process steps for clarity.
Overall impression of Sentence 5: The two opposing ideas of enormous speeds and slow blood flow are confusing. Combining this more logically with the previous sentence, using vertical listing, could clarify the sequence.			

Sentence 6: The very nature of the blood flow problem is a strongly coupled system between fluid flow and structural deformations.			
Original wording	**Questions at first reading**	**Explanations of technical terms**	**Plain Language guideline to apply**
The very nature of the blood flow problem is a **strongly coupled system** between **fluid flow** and **structural deformations.**	"The very nature of" implies that the authors assume that the reader will understand the example and the types of problems they are proposing to solve with this new technology. From my previous experience working with engineers, I knew that fluids flowing through objects can build up enough pressure to change the objects.	Strongly coupled system: David Tong (2011:n.p.) describes this as "stuff in physics that we don't understand very well."	Guideline 1: Organise your material so that readers can grasp information early and navigate through the document easily. Guideline 2: Use words your readers are likely to understand.
Overall impression of Sentence 6: The opening words to the sentence indicate a summative point and that this is the end of the example, but the "coupling" is not clear yet. There is an opportunity to make the leap from the example to the last statement clearer by moving this sentence earlier in the summary. This would also remove what Halliday terms (1989:28) "semantic discontinuity".			

Sentence 7: The blood flow is a direct result of the artery wall displacements, where these displacement again depends on the fluid flow.			
Original wording	**Questions at first reading**	**Explanations of terms**	**Plain Language guideline to apply**
The blood flow is a direct result of the artery wall displacements, where these displacement again depends on the fluid flow.	The return to "blood flow" confuses as the previous sentence suggests a completed example. A concord error adds confusion: "these displacement" should be plural, and the verb should be "depend". The circular system implied can be clearer.		Guideline 1: Organise your material so that readers can grasp information early and navigate through the document easily.
Overall impression of Sentence 7: The vocabulary of this sentence is not complicated, but the circular nature of the system could be clearer. However, at first glance it creates the impression that it is still part of the example above, although Sentence 6 concluded the example.			

Sentence 8: To solve problems of this nature requires accounting for the highly non-linear, strongly coupled interactions between these multiple physical domains.			
Original wording	**Questions at first reading**	**Descriptions of words**	
To solve problems of this nature requires accounting for the **highly non-linear**, **strongly coupled interactions** between these **multiple physical domains**.	At this point, is the proposed application only for medical sciences? The repetition of "nature" is unnecessary ("such problems" would do).	Repetition of technical terms already mentioned.	
Overall impression of Sentence 8: The repetition of the information is not always a disadvantage, but an explanation of the interaction between a physical domain and the fluid flow affecting this domain would work better towards the start of the summary, to activate the schema. It would also be a good place to use the microfunction of imagination so that the language can tell a story and through this story, the new concepts will be clearer to the reader.			

4.5.4 Application of chosen Plain Language guidelines

4.5.4.1 Organise your material so that readers can grasp the important information early and navigate through the document easily

Although the templates guide the authors to tell the science story, the information in the executive summary is unclear and overly complicated. Including clearer signposting can possibly help readers to answer the following three questions:

- What is the problem?
- How will it be solved?
- Why should it be solved? (Or what makes this problem more important than others?)

Cutts (2020:10) encourages writers to think about the questions that readers will have regarding a document, and then try to answer these questions for the reader. From the original text the answers to these questions are not explicit, so it was difficult to find these answers for the Plain Language example texts. Overall, it was unclear why this type of technology is important to develop, which is a crucial question for the success of the funding application.

The template requirements of all the documents restrict changes to the macro-structuring of these documents. However, at a micro-structuring level, when organising paragraphs, there is room to make sure that the information is clear in each template section. Starting the Technology Demonstrator with what the proposed new technology is (but not very clearly) does not provide enough context as to what the general problem is and why this technology is important. This Plain Language guideline suggests that the information should rather start with more context by introducing the problem this technology addresses, which is an accurate simulation of events that are not observable through traditional experimental methods. The Technology Demonstrator uses the example of blood flow as a problem to explain that the proposed software combines two opposing types of simulations into one single software package.

4.5.4.2 Use words your readers are likely to understand

To quantify how difficult individual words might be, I used the GSE (Global Scale of English) Teacher Toolkit. This is an online source that rates vocabulary on a scale from A1 to C2, where A1 is the level of vocabulary suited to a beginner level English speaker and C2 signifies vocabulary suited to a proficient speaker, close to mother-tongue ability. The tool is shown in Figure 4.3.

Before I discuss the specific jargon in the Technology Demonstrator, I first looked at words that are not technical terminology, as these offer an area where simplification could be helpful in clarifying text while leaving the technical terms intact. To demonstrate how the toolkit can be used make individual language choices, I use "discern" as an example. The result for "discern" was C1.

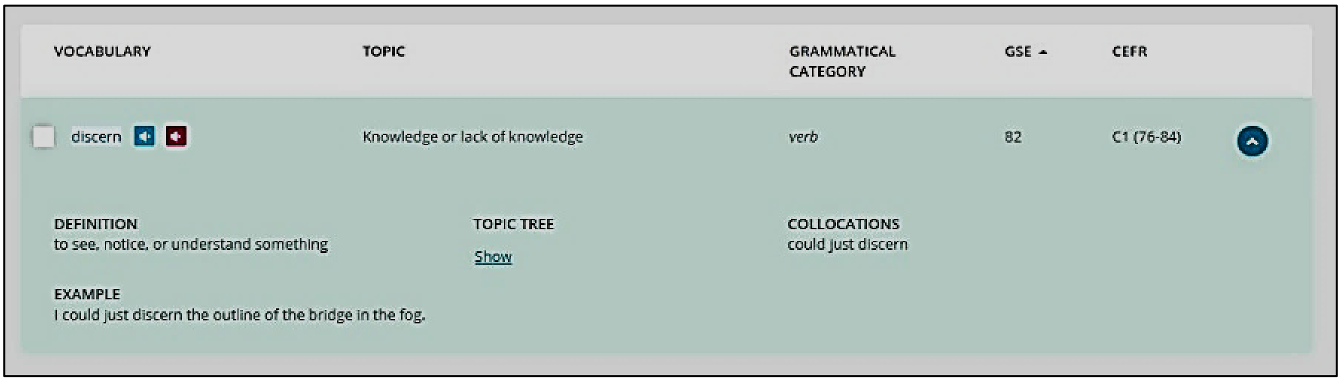


Figure 4.3: GSE Teacher Toolkit Results Page: Discern

I then tried "determine" as a possible synonym for "discern" (see Figure 4.4).

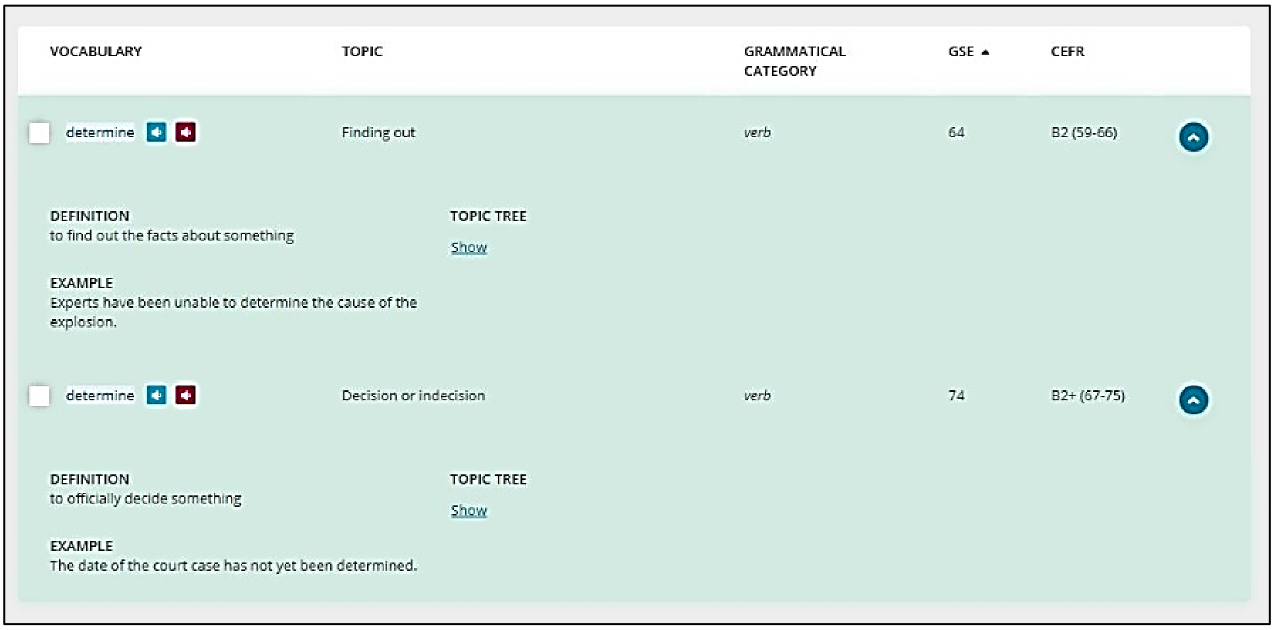


Figure 4.4: GSE Teacher Toolkit Results Page: Determine

Determine scored lower according to the toolkit, making it more likely that a wider audience will understand and know the word. The last word I tried as an example was "discover", as shown in Figure 4.5.

Figure 4.5: GSE Teacher Toolkit Results Page: Discover

"Discover" scored the lowest in respect to finding new information. This implies that the word "discover" would be more likely to be known by most readers.

I merely used this toolkit to demonstrate my point. While a tool such as this is useful, it is cumbersome to use for a large number of words, and is unlikely to be used by scientists under pressure to write a proposal. It may be used by a language practitioner, but remains time-consuming. It is more likely that word choices will remain intuitive, but awareness of the need for clear vocabulary will go some way towards better word choices.

The document uses technical terminology. Although the authors try to explain some of the technical vocabulary, there is room for applying my chosen Plain Language guidelines to enhance readability. I list some of the field-specific terminology in Table 4.16. Where a definition could be found on the internet, it is included. Items marked with an asterisk were given only as unexplained acronyms in the document. As already mentioned, for the purpose of this illustration, I thought it important to type the term into Google and then select the *first* search result as the definition. Where I struggled to find any information, the word "definition" was added to the search. In the third column, I also quoted directly from the source document to indicate how the authors of the original document explained the technical information, where they did so at all.

Table 4.16: Technical terms with possible explanations for the Technology Demonstrator

Terms	Google definition	Explanation in the original text
Multi-physics (applicants' spelling)	Multiphysics is defined as *the coupled processes or systems involving more than one simultaneously occurring physical fields and the studies of and knowledge about these processes and systems. As an interdisciplinary study area, multiphysics spans over many science and engineering disciplines.*	From text referred to as *multiple physical domains.* After reading the definition on Google this became slightly clearer.
Fluid Structure Interactions (FSI)	***Fluid-structure interaction*** *(FSI) is a multiphysics coupling between the laws that describe* ***fluid*** *dynamics and structural mechanics. This phenomenon is characterized by* ***interactions*** *– which can be stable or oscillatory – between a deformable or moving* ***structure*** *and a surrounding or internal* ***fluid*** *flow.*	*FSI is one example of the possible multi-physics simulation the coupling environment facilitates and the ability to solve FSI problems in isolation represents a distinct achievement.*
Black-box coupling tool (applicants' spelling)	With this Google search the first result was an image:  Adding the term *meaning* did not help. The second result led to a journal paper entitled *A Parallel, Black-Box Coupling Algorithm for Fluid-Structure Interaction.* The abstract of this article did not provide more clarity.	*… we present a state-of-the-art coupling (solver/software) that enables the mathematical modelling of multi-physics problems by coupling pre-existing, field specific, sub-domain solvers.*
Fluid dynamics software package	First result lead to the website ansys.com. On this website the following was said: *Computational fluid dynamics (CFD) is a tool with amazing flexibility, accuracy and breadth of application. But serious CFD, the kind that provides insights to help you optimize your designs, can be out of reach unless you choose your software carefully. To get serious CFD results, you need serious software.*	*For example, to allow for the simulation of blood flow a fluid dynamics software package (eg. Fluent, OpenFOAM)…*

Terms	Google definition	Explanation in the original text
Computational fluid dynamics (CFD)	***Computational fluid dynamics*** *(**CFD**) is a branch of **fluid mechanics** that uses numerical analysis and data structures to analyze and solve problems that involve **fluid** flows.* Typing in the acronym CFD did not yield any results relating to engineering but I was directed to a site stating that CFD stands for "contract for difference", which would have been entirely incorrect. If the author did not provide the acronym written out, the reader would have been confused.	*For example, CFD (fluid) packages usually employ the finite volume method…*
Computational structural dynamics (CSD)	Just searching on Google for the acronym CSD directs the reader to the following website https://secure.csd.gov.za. A search for the definition provided in the document leads to textbooks and various scholarly articles. Adding "definition", the first result on Wikipedia was ***Structural dynamics****, is a type of **structural analysis** which covers the behavior of a **structure** subjected to **dynamic** (actions having high acceleration) loading. **Dynamic** loads include people, wind, waves, traffic, earthquakes, and blasts.*[14]	*…where CSD (structure) packages usually use the finite element method.*
NRE*	The google search resulted in various different explanations: • National Real Estate property; • NRE property practitioners; • Non-recurring engineering; and • New relationship energy. After adding the word "department" to the search the result is: *Natural Resources and the Environment.*	*As an example, NRE currently make use of Delft3D, an integrated modelling suite which can be used to model ocean currents and waves.* It is assumed that NRE in this context might refer to another unit within the scientific council, which reviewers might know, but this should not be taken for granted.
Field-specific sub-domain solvers	https://www.comsol.com/blogs/using-the-domain-decomposition-solver-in-comsol-multiphysics/	The original text does not explain the term where it is used for the first time:

[14] Although I am using definitions from Wikipedia for the purpose of illustrating the difficulties in translating technical information without the help of an engineer, I am fully aware that Wikipedia does not constitute a proper academic source, as anybody can create a Wikipedia page, add information to a page or edit a page. This is just used for the purpose of demonstrating that the technical terms could potentially hamper a reviewer's interpretation of a text if terms are not properly contextualised.

Terms	Google definition	Explanation in the original text
	This blogpost discusses a very specific type of software. It is a very technical discussion and is meant as a set of instructions. For a person outside of the field of mathematical modelling the blogpost was not much help in understanding this term. By adding "definition" to the search I found: https://books.google.co.za/books?id=QSvyBwAAQBAJ&pg=PA27&lpg=PA27&dq=field-specific+sub-domain+%22solvers%22+definition&source=bl&ots=fU8fksKzqD&sig=ACfU3U2SVuiWwMfaLVhwCMiSD5jKuTsY9g&hl=en&sa=X&ved=2ahUKEwi-7_jAqLDnAhUVHMAKHU2BCwcQ6AEwAHoECAkQAQ. This redirects to a section of a textbook for engineers.	*The black-box coupling tool presented here facilitates the solution of these types of problems, by coupling two or more stand-alone sub-domain, field-specific solvers.*
Multi-vector iteratively updated Quasi-Newton method (MVQN)	In trying to find any sort of explanation for this term I was only redirected to scholarly articles without any further explanations.	*Instead, we approximate these sensitivities using a newly developed 'multi-vector iteratively updated quasi-Newton' (MVQN) method. The method constructs an approximation of these necessary mathematical properties/sensitivities by using only the iteratively obtained results from the two sub-domain solvers. The MVQN method outperforms all other similar methods, and is primarily responsible for the competitiveness of the current coupling tool (software).* Adding the word software at the end gives some context and at least activates the software schema.
Random access memory (RAM)	Just searching the acronym RAM leads to websites about couriers. Searching for random access memory led to this definition: *Random-access memory is a form of computer memory that can be read and changed in any order, typically used to store working data and machine code. A*	*To remove this overhead cost of repeatedly reading and writing files to the hard drive, the coupling tool pipes these input and output files to RAM (random access memory).*

Terms	Google definition	Explanation in the original text
	random-access memory device allows data items to be read or written in almost the same amount of time irrespective of the physical location of data inside the memory.	
Technology Readiness Level (TRL)	The first google search provided me with this definition: *Technology readiness levels are a method for estimating the maturity of technologies during the acquisition phase of a program, developed at NASA during the 1970s. The use of TRLs enables consistent, uniform discussions of technical maturity across different types of technology.*	***Technology Readiness Level – Technology must have reached TRL 6*** This is used as one of the headings in the template. Reviewers working within the scientific council would understand what this is. It is assumed that they would be familiar with the term.
CPU*	From the initial google search: *A **central processing unit** (**CPU**), also called a **central processor** or **main processor**, is the electronic circuitry within a computer that executes instructions that make up a computer program.*	*In the CPU column we outline the relative computational times taken by each of the methods…*
Radial basis function interpolation (RBF)	From first search: *Radial basis function interpolation is an advanced method in approximation theory for constructing high-order accurate interpolants of unstructured data, possibly in high-dimensional spaces. The interpolant takes the form of a weighted sum of radial basis functions.*	*Since we strictly require the ability to transfer information not only across a non-matching interface, but also between non-conforming methods, we make use of radial basis function (RBF) interpolation.*
Finite element method (FEM)	*The finite element method is the most widely used method for solving problems of engineering and mathematical models. Typical problem areas of interest include the traditional fields of structural analysis, heat transfer, fluid flow, mass transport, and electromagnetic potential.*	From the original text: *The pressure error results for transferring information across distinctly mismatched meshes compares favourably to the errors introduced by a linear and quadratic finite element method (FEM).*
IBQN-LS (or IQN-LS)*	For the initial search google the results did not recognise IBQN-LS. Instead the search was changed to IQN-LS because this was the term that Google recognised. This resulted in more scholarly articles and images of graphs. Adding the words “method” and “definition” did not yield more favourable results.	*The IBQN- LS (or IQN-LS) method can be demonstrated to be a specialised case of the MVQN method for steady state problems. In essence, the MVQN method constructs approximations of the coupled system*

Terms	Google definition	Explanation in the original text
		Jacobians (system sensitivities, for example effect of forces on displacement in the FSI context).
Artificial compressibility (AC)	In an **artificial compressibility method**, a fictitious time derivative of pressure is added to the continuity equation so that the set of equations modified from the incompressible Navier-Stokes equations can be solved implicitly by marching in pseudo time. From the abstract at: https://link.springer.com/chapter/10.1007/978-94-007-0193-9_4	*A proposed combination of artificial compressibility (AC) and the newly developed MVQN method, referred to hereafter as AC+MVQN. AC is a well adopted, well published method to stabilise the fluid-structure interactions problem.* In the original source document, the extra information for AC helps give a bit more context.
Solid interface meshes	The first Google search only resulted in links to scholarly articles. Adding the word “definition” did not yield more useful results.	*The method is not provably conservative, but the energy error made does reduce with simultaneous refinement of both the fluid and solid interface meshes (See Figure 12, Appendix C)***.** The visuals referred to are discussed in the next section. One of my chosen Plain Language guidelines discusses cross-references and how it is preferable to rather discuss (or in this case show) the information where you first mention it.

Interdisciplinary scientific research is becoming very important for future technological advancements. Engineers are working with computer scientists on artificial intelligence, and bio-medical engineers need to have a very clear understanding of the medical sciences. Every scientific field has its own particular vocabulary that could be confusing for outside readers. It is thus crucial to explain specific terminology. One example is the word "solve". In mathematics one solves equations, but in the context of mathematical modelling, one physically builds the environments virtually; "solve" here would then mean to depict accurately how a specific surface would then react based on particular events. To aid the reader in deciphering complicated information, it is also vital to be consistent when using technical terms. Although some of these can be searched for on the internet, to determine whether the information is correct would be nearly impossible if the choices are not verified by the authors of the original document.[15]

4.5.4.3 Write concisely

The template restricted the authors in terms of space and the authors needed to present their information fairly concisely. For the Plain Language versions of the text, however, I considered expanding some of the concepts, because in the original they were not clear. In expanding on some of the concepts, it was vital to ensure that I used only as many words as I needed to be brief but still include the necessary information, without unnecessary elaboration.

4.5.4.4 Use vertical lists to break up complicated text

The Technology Demonstrator explains several processes, but does not use vertical lists to help the readers follow the steps that the scientists are proposing. As already stated, lists could be helpful to the readers in accessing essential information at first reading. A case in point is the sequencing of the blood flow process used in the example discussed above.

[15] The discussion on this guideline is by far the longest. However, I disagree with several critics of Plain Language for science communication claim that Plain Language focuses only on the vocabulary and eliminating difficult words. Nevertheless, for the purpose of this study and showcasing the difficulties and challenges that I faced, vocabulary was by far the easiest to investigate. Although this is not the only challenge, it is a starting point, as a lack of understanding will create a lack of knowledge inference, which in turn can lead to a misrepresentation or misunderstanding of the information.

4.5.4.5 Over the whole document, make the average sentence length 15-20 words

Complex ideas are often written in long, overly complicated ways. In rewriting the example texts for the purposes of the survey, I broke up sentences to keep to one idea per sentence and to keep the sentences between 15 and 20 words.

I started by counting the number of sentences per section manually. Then, using Microsoft Word's word count function, I tallied the total words per section. The total word count of each section was then divided by the number of sentences in the section to get an average sentence length. To determine the average sentence length, I excluded "Section D: Maturity". As I explained in 4.5.2.5, this part of the template is in a table format where the author only ticks a yes or no box and then briefly comments on the chosen answer. These comment boxes have at most three sentences and only provide authors' justifications. The information repeats what has already been discussed in "Section A: Market Need" in the template. I decided to focus on the sections where long explanations appear. The sentence length averages are set out in Table 4.17.

Table 4.17: Average sentence length throughout the Technology Demonstrator

Section	Number of sentences	Average sentence length	Longest sentence
Executive Summary	19 sentences	25 words	53 words
Market Need	22 sentences	18 words	35 words
Description of Technology	34 sentences	19 words	42 words
Technology Demonstration	23 sentences	26 words	39 words
Performance	27 sentences	24 words	52 words
Novelty	58 sentences	19. words	36 words
Technology Complexity	8 sentences	12 words	33 words
Potential Impact	21 sentences	20 words	33 words
Appendix A	30 sentences	21 words	40 words
Appendix B	19 sentences	24 words	49 words
Appendix C	12 sentences	21 words	32 words
Appendix D	8 sentences	18 words	27 words

Although the *average* sentence length is close to Cutts's (2013:1-10) suggested word count of 15 to 20 words, one section's longest sentence was as long as 53 words, so there was definitely room for improvement. I briefly discuss some of these long sentences and how they could be broken up into shorter sentences. I present the sentence in its original form and then the changes made according to the Plain Language guideline.

Example sentence 1

> The coupling tool therefore requires a means to accurately transfer information across a non-matching interface, with several potential geometric discrepancies and differing numerical techniques (typically this can be defined as a mathematically/numerically incompatible problem). (34 words)

The parenthesis adds information that relates to the numerical techniques. This can be rewritten as a separate sentence. The first clause ends with "non-matching interface". The prepositional phrase that follows contains information about the interface. The sentence can be broken up as follows:

> The coupling tool therefore requires a means to transfer information accurately across a non-matching interface. (15 words) The interface has several potential geometric discrepancies and differing numerical techniques. (11 words) These techniques can typically be defined as a mathematically/numerically incompatible problem. (10 words) [Total 42 words]

Example sentence 2

> Not only are we now capable of solving all the well documented difficult problems, but the performance of the newly developed methods provides near Newton like behaviour (Newton's method with quadratic [functions] is the theoretical upper limit for iterative solution methods). (40 words)

As with the previous example, the clause in brackets can be written as an individual sentence. "The not only, …but also" construction shows that the author wants to convey two ideas. The explanation of what Newton-like behaviour is should be moved to the start of the sentence so that the reader already knows what it is before reading it for the first time later in the sentence. The clause in brackets also has a missing noun after "quadratic". The sentence can be broken up as follows:

Newton's method with a quadratic function is the theoretical upper limit for iterative solution methods. (14 words) We are now capable of solving all the well-documented difficult problems because the performance of the newly developed methods provides near Newton-like behaviour. (25 words) [Total 39 words]

Although Cutts suggests a shorter sentence length, in doing the Plain Language sample texts, the idea was not to make the writing "choppy". Shorter sentences make it easier for readers to understand technical information, but if the writing is too staccato it does not motivate readers to continue reading.

4.5.4.6 Use active voice unless there is good reason for using the passive

Although scientific breakthroughs are often communicated using abstract nouns and the passive form, the Technology Demonstrator was written mostly in the active and approached the content without using the passive form.

4.5.4.7 Reduce cross-references to a minimum

Because the documents use very strict templates, there are several places where the documents refer the reviewers to sections later on in the Technology Demonstrator. The challenge in applying Plain Language Guideline 7 was to ensure that where the authors mention new information, there is sufficient context to ensure that the reader can follow what the research is about. One example is Sentence 3 of the Executive Summary, where the reviewer is referred to page 13, Appendix A, of the document, where the concept could have been clearer described by first explaining that the blood flow example looks at the interaction of fluid on a physical domain. The blood flow problem is mentioned early on in the executive summary. Adding the image of the how blood flows through an artery and the various terms that will be used in the executive summary to the section where the example was first mentioned would provide readers with a visual component to explain what the mathematical model problem is. To add to the reviewers' understanding, the model description should give context and not further confuse the point that the applicants are making. I have included the original image as Figure 4.6.

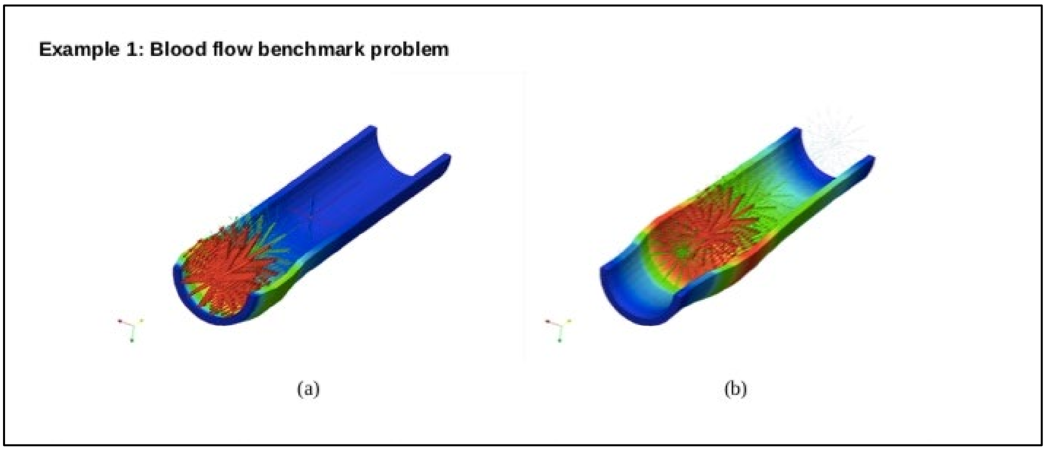


Figure 4.6: Original figure for the blood flow example

Clearer labels indicating the fluid flow, artery wall displacements and then the pressure pulse propagating would have helped the reviewers to understand the terms at first reading without needing to read the example again if they referred to the appendix. I have included my suggested labelling in Figure 4.7.

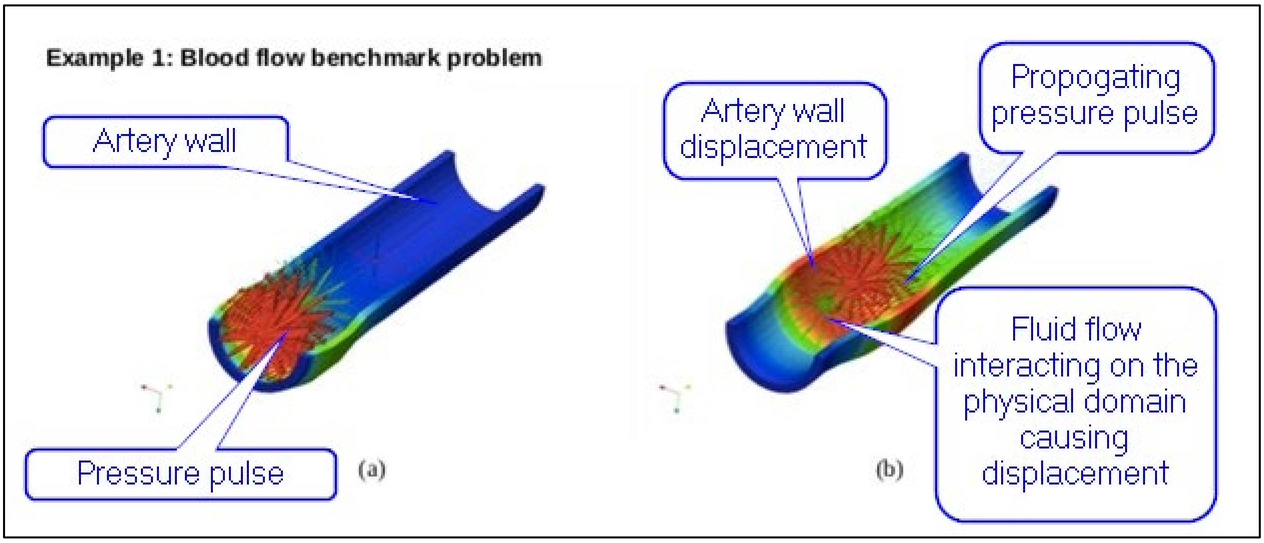


Figure 4.7: Suggested labelling for the blood flow example

The original Technology Demonstrator included this image without the labelling and only had a caption below it to explain the picture. The purpose of the caption was to explain what is happening in the picture and further explain why the problem of blood flow is a good example of how the proposed technology will be able to solve examples similar to this. I noted some concerns and questions regarding the original caption (included as a text example) in Table 4.6.

Table 4.18: Caption text and challenges for the reader/editor

Original text: Caption	Concerns and questions at first reading
Pressure pulse propagation through a section of an artery at two different time steps, where the wall displacement is amplified 10 times. It represents a popular benchmark problem and is inspired by the type of flow problems encountered in haemodynamics, and is often provided as an example of the class of problems to which black-box partitioned solvers are ill-suited.	What do "time steps" mean in this context? "Wall displacements" relate to the artery walls described in the example of the type of modelling problem. "Haemodynamics" is mentioned for the first time in this caption. Previously it was only "black-box solver" and adding the word "partitioned" here makes the reader wonder if it is still the same solver. For consistency and to ensure that there is no confusion, the author should rather consistently use the same terms. Partitioned was used in the title to refer to multiphysics problems.

The rest of the appendix has 11 pages of tables, visuals and lengthy descriptions. Although I did not explicitly choose alternatives to setting out information in a different way, there are several visuals included in the Technology Demonstrator (other visuals not included here for proprietary reasons). The document used 39 graphs, coloured model representations and tables. However, the descriptions that explain the visuals to the reader are not clear. The visuals in this document therefore do not enhance clarity. It is challenging to determine how the descriptions can be translated into Plain Language. The applicants should have rather included only a few images that enhanced the various examples mentioned throughout the document.

4.5.4.8 Sequencing process steps for clarity

Scientific research often focuses on processes. Although a process is not really instructions, it follows the same structuring. If the research is based on optimising a certain process, this process should be as clear as instructions, so that the reader can follow what the researcher did, clearly and without any misunderstandings.

4.5.5 Plain Language example sets chosen for the survey

As already mentioned, I consider the abstract (here called the "executive summary") the most important part of any funding proposal, because this is the first introduction that reviewers have to the presented information. This is also the first chance for the authors to create a schema for the readers. For the purposes of the survey example sets, I needed to choose examples that were short enough to read fairly quickly, but also contained sufficient information to be able to stand alone, separate from the rest of the text. I acknowledge that this is a limitation of the study and does provide an artificial setting for the Plain Language sample texts' evaluation. In Table 4.19, I evaluate the original texts and then give the proposed Plain Language version.

Table 4.19: Original vs. Plain Language sample texts

Original Text	Problem in terms of Plain Language	First Plain Language version
A black-box coupling tool for partitioned, multi-physics simulations.	Technical terms used that will confuse readers. Title not used to build a schema.	A tool for coupling software to enable multi-physics simulations.
Consider the following example of blood flow through an artery. A pressure pulse (from the heart), causes the artery walls to expand, which in turn causes the pressure pulse to propagate through the artery. This pressure pulse propagates through the arterial system at enormous speeds (close to 500cm/s) which in turn slowly forces the blood to circulate. The very nature of the blood flow problem is a strongly coupled system between fluid flow and structural deformations. The blood flow is a direct result of the artery wall displacements, where these displacement again depends on the fluid flow. To solve problems of this nature requires accounting for highly non-linear, strongly coupled interactions between these multiple physical domains.	Break up text with vertical lists to break up complicated text. Hierarchical structure of information will help the reader to follow the process of blood flow. The process of blood flow should be broken up into each separate step.	Blood flow through an artery is an example of a coupled system between fluid flow and structural deformations. This example helps to explain the kinds of problems fluid structure interactions (FSI) typically tries to solve: • When the heart pumps, it sends out a pressure pulse that travels along the length of an artery. This happens at speeds close to 500cm/s. • The pressure pulse travels and gathers momentum (a propagating wave). This is a direct result of the strong coupling between the fluid flow and structural deformation. • This high pressure causes the artery walls (solid) to expand outwards. • When the artery walls expand outwards, this changes the way that the blood (fluid) behaves. The pressure on the artery wall increases, and the force from the wall disperses the fluid. This cycle of pressure and force is repeated. As a result, blood continues to flow through the arterial system. To model how blood flows through the arterial system accurately, you have to take into account the non-linear, coupled interactions between the fluid flow and the solid structure.
Pressure pulse propagation through a section of an artery at two different time steps, where the wall displacement is amplified 10 times. It represents a popular benchmark	Hierarchical structure of information will help the	When the heart pumps, a pressure pulse is sent through the arteries. As this pulse moves through the arteries, the blood flow increases like a wave. This pressure wave causes the artery walls to expand

Original Text	Problem in terms of Plain Language	First Plain Language version
problem and is inspired by the type of flow problems encountered in haemodynamics, and is often provided as an example of the class of problems to which black-box partitioned solvers are ill-suited.	reader to follow the process of blood flow. Add explanations and signposts to help the reader follow the story.	(this is called an artery wall displacement). This image shows how the blood (fluid) causes the artery walls (solid surface) to expand at two different points in the process. Blood flow is a common fluid structure interaction (FSI) benchmark problem. Because these kinds of problems are numerically challenging, it is used as an example of the type of problem that conventional software struggles to solve.
To solve for fluid-structure interactions we have two independent domains, namely a fluid domain and a solid domain, which share a common interface. The coupling tool in an iterative, or successive/staggered fashion solves the two domains. Solving for the fluid sub-domain provides an interface stress state or forces (in the form of pressures and shear stresses). The coupling tool transfers these forces to the solid sub-domain interface. Solving for the solid sub-domain (with these forces as boundary conditions), provides a new interface displacement which is once again transferred to the fluid domain. This iterative cycling is repeated until convergence is achieved (i.e. the relative change in the primary variables fall below some required tolerance). Once convergence has been achieved the time step is advanced and the same process is repeated.	Break up text with vertical lists to break up complicated text. Hierarchical structure of information will help the reader to follow the process of blood flow. The process of blood flow should be broken up into each separate step.	Fluid structure interactions rely on two independent domains: a fluid domain and a solid domain. These two domains share a common interface. An interface is the boundary where the fluid domain and the solid domain meet. Our tool solves the two domains in successive steps:· • First, the tool models the fluid domain. This results in pressures and shear stresses along the shared interface boundary. The coupling tool then transfers this data to the solid domain's interface. • These pressures and shear stresses are applied as boundary conditions. The data from the solid domain then give the interface the displacements in the boundary and are once again transferred to the fluid domain.· • This cycle is repeated until the programme achieves convergence. In this context, convergence is the change in the primary variables between the successive steps.

4.6 THE SECOND FUNDING PROPOSAL: EXPRESSION OF INTEREST

The second funding proposal, the Expression of Interest, focused on using CFD to develop a system that is able to detect gas leaks in mines. This proposal consisted of 18 pages, single-sided, with ten pages detailing the qualifications and experience of the various applicants who would work on the project.

4.6.1 Prescribed template for the second funding proposal

The second funding proposal template's headings and requirements are set out in Table 4.20.

Table 4.20: Expression of Interest template

Title:	
1. Summary Information: Expression of Interest for Long-term Intervention, 2018/2021	
Proposal title	
Principal Investigator	
Lead Operating Unit/Centre	
Other Operating Units/Centres	
Ethics Approval Required (Yes/No)	
Investment Requested 1	
2. Abstract	
3. Background and Motivation	
4. Objectives	
5. Implementation Plan	
6. Outputs	
7. Probability of technical success and Key Risks	
8. References	
9. CVs	

The key difference between the Technology Demonstrator and the Expression of Interest is that the first template provided guidance to the applicants by giving detailed descriptions of what was expected per section. For the Expression of Interest, there are only nine short headings without any indication of what should be included in each section or the required length of each section. However, applicants were provided with the judging criteria that the reviewers would use to determine whether the project would be funded:

- Novelty and Innovation
- Clarity and Quality
- Technical Feasibility
- External Collaboration
- Impact Potential
- New Capabilities and Human Capital Development (HCD)
- Intellectual Property and Science, Engineering and Technology outputs.

Although the aim in providing the judging criteria was to provide applicants with guidance on what the reviewers would look for, it was not made explicit how these elements would be judged in the Expression of Interest. This is an important consideration, because the final outcome is based on the reviewers' opinion of the information that the applicants provide in the proposal. Hence, it is the task of the applicant to convince the reviewer that the research is worth funding, so it is imperative that the message be as clear as possible. In the case of this document, one reviewer stated that it was not clear from the proposal why the research was important enough to fund.[16] Because of this comment, I focused on answering that question when applying my Plain Language guidelines to the sample texts for the survey.

Because the Expression of Interest also had to fit within a predetermined template, it was not possible to change the layout of the document on a macro level, so it was vital to ensure that the organisation of the information at a micro-level was as effective as possible.

4.6.2 Readability test results

Overall, the expression of interest tested on the online tool as difficult to read and as suited to the level of a college graduate. This was not a problem in itself, as the panel of reviewers was likely to be highly qualified, albeit not necessarily in the same field of research as the proposers.

[16] This comment by the reviewer vindicated my reading of the initial document. The team all worked together on a google doc where they all wrote it together online at the same time. I was only granted access offline two days before they had to submit. I raised all my questions (as I discussed here) and the head of the team responded to all my questions that the reviewers would understand, rejecting all my suggestions.

4.6.2.1 "Summary Information"

As shown in Section 4.6.1, Table 4.20, in the summary section at the start of the Expression of Interest, applicants had to complete a short table. This is just identifying information and I did not deem this table worth testing with the readability tester, as the table form is already clear.

4.6.2.2 "Abstract"

The abstract is the equivalent of the executive summary in the Technology Demonstrator. The abstract is the first section that gives reviewers an introduction into what the funding proposal will be about. It provides the context and should activate the schema for the reviewer. Therefore, the abstract should be as clear as possible. For intellectual property reasons, I have removed identifying information from the abstract.

Table 4.21: Sample text: "Abstract"

The accidental release or leakage of hazardous gasses is a serious health and environmental concern, with potentially deadly consequences. The ability to rapidly detect the source of such a leak will reduce or manage the associated risks. For this reason, we propose a gas detection system that is capable of estimating the source or location of a leak, in real-time. The aim of the system is to provide a better situational awareness which could result in huge health, environmental and economic impacts. *We intend to develop a [smart] wireless gas sensor system based on the nano gas detector. The intended approach is to use in-situ wireless gas sensors interacting with a Computational Fluid Dynamics (CFD) model and a spatial weather system (possibly augmented with in-situ airflow sensors) to pinpoint the source of the leak. CFD modelling has the potential to accurately model the gas dispersion and threats as a function of physical characteristics in the environment surrounding a plant or underground mining domain.* *Through the CFD-generated model, it will be possible to find the optimal placement, type and number of gas sensors needed to effectively negate health and environmental risks. Due to the high computational costs associated with CFD methodologies, the approach will require generating a reduced order model (ROM), trained with a large set of CFD scenarios. Combining ROMs with mathematical inverse methods allows for the creation of an intelligent system to pinpoint gas sources using a sparse set of fixed point gas concentrations and airflow measurements.* *While a method that can estimate or infer internal field values from a few sparse data sources is widely applicable, we are limiting the scope to two problems with direct commercial benefit. Our proposed system can reduce the risk of underground mining and thereby supports the government and mining industry's commitment towards zero harm. This very strongly falls under the ICT RDI Roadmap market opportunity of "sustainability and the environment" with specific reference to the industry opportunity of mining. The system can also be implemented to reduce the risk inherent in industry projects, for clients like SASOL at their fuel refineries.*

The Modelling and Digital Sciences (MDS) operating unit has expert knowledge in CFD and mathematical algorithms for inverse problems. MDS will use mathematical models to assess the physical and parameter sensitivities of the proposed system and inverse analysis associated with pinpointing a gas source. The Meraka Institute will use expert knowledge in an Industrial Internet of Things (IIoT) sensor and network design to develop a system that satisfies the transactional flows of information between sensors and a centralised control.

Table 4.22: Results for the "Abstract"

Flesch Reading Ease score	28.9, difficult to read	
Gunning Fog	17.8, difficult to read	
Flesch-Kincaid Grade Level	15.5, college	
The Coleman-Liau Index	13, college	
The SMOG Index	13.5, college level	
Automated Readability Index	16.3, college graduate	
Linsear Write Formula	18.2, college graduate and above	
Readability Consensus	Grade level: 15 Reading level: very difficult to read Reader's age: College graduate	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
53%	25	22%

Source: readabilityformulas.com

The abstract contains 53% unique words, and the sentences are longer than my Plain Language guideline of 15 to 20 words prescribes. The percentage of words with three or more syllables is 22%. As already mentioned, the tests were unable to give me insight into how the text is organised or where there might be confusion in terms of unclear processes.

4.6.2.3 "Background and Motivation"

Although the template did not require it, under the heading of background and motivation, the applicant divided the text into sub-sections, which was helpful:

- Problem
- Sub-Problem
- Key gaps
- Key research questions
- Novelty
- Alignment
- Long-term impacts

- Human Capital Development

For the purpose of this readability test, I tested this section as one. Adding the headings creates signposts for the reviewer to follow. I have included the background and motivation as is, with all identifying information removed.

Table 4.23: Sample text "Background and Motivation"

***Problem**: In IIoT applications, there is a general class of high-value problems with very broad applicability where sensor measurements are taken at sparse spatial locations within a 3D space and used to infer values at other locations of interest within that space. These values could pertain to noise, temperature, gas, etc. and are often required for some near real-time response; the technique to implement this for IIoT is the problem.*
***Sub-Problem**: Real-time 3D gas leak source detection (typically a hazardous gas) from sparse, fixed point measurements of gas concentration and airflows. (The sub-problem is of immediate commercial interest to the team and will be used to provide a generalised solution/approach to the main problem).*
Due to the high computational costs associated with CFD methodologies, the approach will require generating a reduced order model (ROM), trained with a large set of CFD scenarios. Combining ROMs with mathematical inverse methods allows for the creation of an intelligent system to pinpoint gas sources using a sparse set of fixed point gas concentrations and airflow measurements. An early gas leak detection system is proposed combining Computational Fluid Dynamics (CFD), Reduced Order Modeling (ROM) techniques, inverse methods and an Industrial Internet of Things (IIoT) network of gas and airflow sensors.
***Key gaps**: Key unknowns exists in how the physical data and CFD models should best be combined to perform direct inverse analysis under data reliability, storage, computational and IIoT network constraints.*
***Key research questions**:*
1. Determine suitable CFD modelling techniques to accurately model pollution dispersion as well as suitable low-cost reduced order models.
2. Determine suitable techniques, to construct and solve an inverse problem to estimate gas leak locations in real-time. Appropriate filtering techniques will be required to ensure robust estimation in the presence of erroneous sensor data, time delays and possible missing data.
3. Determine a suitable methodology to determine the optimal placement, quantity and mix of sensors in the 3D space for an IIoT network and CFD predicted detection-sensitivity.
4. How do you design a wireless gas sensor using nano-micro gas sensing chip (that can measure eight different gases simultaneously) to be optimal for this application while also playing well as an IIoT node with other real-time networked applications conforming to the Industrial Internet Reference Architecture?
***Novelty**:*
1. Combining IIoT sensors with CFD, appropriate ROMs, and inverse techniques for real-time gas leak detection and location estimations.
2. Training a reduced order model on a large database of CFD simulations. The actual and computational data needed to best capture the underlying physics of the systems in order to pinpoint gas leaks in a direct inverse analysis, has never been investigated.

3. Wireless gas sensor for IIoT. This will be optimised for item 1 and thus novel.
***Alignment**:*
● South African Mineral Extraction Research Development and Innovation Strategy - Real-Time Information Management System is a thematic area which will benefit from this work in early warning for hazardous gas in mining stopes.
● This very strongly falls under the ICT RDI Roadmap market opportunity of "sustainability and the environment" with specific reference to the industry opportunity of mining.
***Long-term impacts**:*
1. Improved mine stope safety and situational awareness with respect to hazardous gas as well as the potential to contribute to mine ventilation-on-demand systems which could reduce electricity consumption by the mine (potentially around 10%)
2. Improved safety of refinery and other large campuses where there is the risk of problematic gas emissions, and the early detection capability helps mitigate against long term health complications on surrounding communities.
3. Commercial product of wireless gas sensor and associated application to detect gas leaks
Human Capital Development
3 Masters and 2 PhD students

Table 4.24: Results for "Background and Motivation"

Flesch Reading Ease score	31, very difficult to read
Gunning Fog	14.9, hard to read
Flesch-Kincaid Grade Level	13.6, college
The Coleman-Liau Index	14, college
The SMOG Index	12.2, twelfth grade
Automated Readability Index	13.1, college level entry
Linsear Write Formula	13.9, college
Readability Consensus	Grade level: 13 Reading level: difficult to read Reader's age: 18-19 yrs. old (college level entry)

Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
49%	19	24%

Source: readabilityformulas.com

For this section, having the sub-headings and bulleted lists already helped to improve the readability scores compared to the "Abstract". For this section, the average sentence length also improved to 19 words per sentence, which is more aligned to my Plain Language guideline.

4.6.2.4 "Objectives"

This section consisted of fewer than 100 words and I was unable to run this section through the online readability test. This section consisted of a platform statement with three bullet points. According to my chosen Plain Language guideline, vertical lists should aid the reader in understanding difficult text at first reading. However, in this case, the bullets were not clear and precise enough in some places and the purpose (intention) of the project was lost. One example here was where the applicants stated "*... but also as a support for experimental development and proof of concept of 1*". This "1" here referred to the information discussed in the first bullet, but when the reviewers refer back to the bullet, it is unclear how this would be developed, as the bullet point refers to creating a methodology database. The question then is why one needs a proof of concept for a database.

4.6.2.5 "Implementation plan"

This section consisted of a table with specific headings and information on how the authors expected to complete the project once the panel of reviewers approved funding for the project. The implementation plan was presented in a table format, making it easier to read. However, the table was also preceded by an introductory paragraph, which was too short for the readability checker.

Table 4.25: Sample text – introductory paragraph to "Implementation plan"

The research will be conducted over a three year period and will consist of the objectives listed in the table below. The first year will be used to finalise the simulation platforms and the following two years to complete the research relating to the PhD and masters submission requirements. See the table below for work packages with tasks arranged in chronological order.

I also did not test the table, shown in the screenshot in Figure 4.8.[17] Providing the objectives in the table format allows the reviewers to access the objectives more easily and gives a better chance of understanding at first reading because the information has been organised in this way.

[17] I have edited all identifying information out of the screenshot.

Work package/ Activity	Month A→B (Duration)	Outputs
Work Package 1: Techniques for adapting CFD models for real-time determinations		
Compare different pollutant modelling techniques	1 → 8 (8)	Journal paper and conference paper
Sensitivity analysis to determine important parameters that need to be accounted for	8 → 12 (4)	Conference paper
Determine suitable low-cost ROMs	8 → 16 (8)	Journal paper and conference paper
Develop automated ROM generation procedure using high fidelity modelling techniques	13 → 16 (3)	Conference paper
Work Package 2: Inverse problem for real-time location estimation		
Inverse problems	8 → 26 (18)	Journal paper, 2 x conference
Filtering techniques to adjust for errors and missing data	26 → 32 (7)	
Increase complexity of inverse problem	26 → 33 (7)	Conference paper
Work Package 3: Placement, quantity and mix of sensors required for leak detection technique		
Formulate suitable optimisation problem accounting for physical sensor limitations	26 → 32 (7)	
Nonlinear, constrained network optimisation	26 → 32 (7)	Publications on research results
Work Package 4: Prototype Wireless Gas Sensor Development		
Investigate project requirements	1 → 3 (3)	Requirement Specification
Sensor housing	3 → 15 (12)	Concept design, 3D printed prototype, pre-production prototypes
Electronics	3 → 15 (12)	Concept design, printed circuit board
Firmware	12 → 24 (12)	Firmware application with data acquisition, data processing & communication interface
System	20 → 36 (16)	Integrated gas monitoring network with real-time flow modelling engine
Work Package 5: Integrated Testing		
Testbed	27 → 32 (6)	Publication
Proof-of-concept test in mock mine and campus	33 → 36 (4)	TRL6 Gas leakage detection application TRL6 Prototype wireless gas sensor

Figure 4.8: Screenshot of implementation plan for the Expression of Interest

The table presents the implementation plan in a way that does give a reviewer the best chance of being able to view it at once, without needing to work through dense text. A short description of what is planned with each activity would have made this plan clearer.

4.6.2.6 “Outputs”

This section listed all the possible results of this project. This section was not written with bullet points, but just listed the various academic outputs. For the sake of context, I again just include an image of what this section looked like in the expression of interest in Figure 4.9.

> **6 Outputs**
> The research will result in 2 x PhD enrolled, 3 x Masters qualifications; 4 x Journal articles; 6 x Conference papers; 4 x Full Time HCD students working on the research problems; 1 x Technology demonstrator on prototype wireless gas sensor compatible with Industrial Internet Reference Architecture and the adapted CFD technique for real-time detection. 1 x Technology demonstrator on CFD model and techniques adapted for real-time gas leakage detection. There could be IP protection on the CFD technique and wireless device.

Figure 4.9: Screenshot of the outputs section of the Expression of Interest

This paragraph is not easy to follow because of the horizontal list, numbers and acronyms. It is very difficult to see at first glance what all the expected outputs are. For reviewers who need to understand at first reading, this is too jumbled. For this section, bullets points to create a vertical list or a table would have helped the reviewer to determine the value of the outputs more easily.

4.6.2.7 “Probability of Technical Success” and “Key Risks”

This section’s two tables detail the probability of technical success and key risks.

Table 4.26: Sample texts: “Probability of Technical Success”

Success factor	***Probability of technical success***
Relevant experience of the Principal Investigator	***High.*** *(Detailing relevant information regarding education, experience and what the researcher will be responsible for.)*
Proposed approach	***High.*** *The approach is well defined and each component is well known and understood. We have experience in CFD and embedded design and IIoT. The key risk is in not in the approach per se but in the novel contribution of our real-time adaption of the CFD technique will accurately pin-point the leakage, etc (i.e. the usual research element) with the required performance and accuracy.*
Track record of team	***High.*** *Strong team of modelling and ICT experts complemented by external collaborators.* *Proven track record in the development of TRL6 embedded intelligent devices (RockPulse real-time micro-seismic monitoring*

	& early warning instrument, ultrasonic closure meter, wireless sensor networks) for harsh environments, specifically underground mining. The core team have PhD's and a proven publication track record in the field of CFD and inverse problems.
Availability of research resources	***High.***
Collaborations	***High.*** *(List of industry experts that will be contacted to collaborate.)*

In order to complete the readability test, I inserted the text as headings and paragraphs into the readability test. I am not able to provide the full text for reasons of confidentiality, but have included the main table headings and removed all identifying information from the main discussion. Where I have removed information, I gave a descriptive summary in brackets and highlighted it in blue. For the purposes of the readability test, I did include the full table. The results for the readability tests have been included as Table 4.27.

Table 4.27: Results for "Probability of Technical Success"

Flesch Reading Ease score	31.3, difficult to read	
Gunning Fog	14.1, hard to read	
Flesch-Kincaid Grade Level	12.9, twelfth grade	
The Coleman-Liau Index	15, college	
The SMOG Index	11.3, eleventh grade	
Automated Readability Index	13, 18-19 yrs. old (college level entry)	
Linsear Write Formula	11.8, twelfth grade	
Readability Consensus	Grade level: 13 Reading level: difficult to read Reader's age: 18-19 yrs. old (college level entry)	
Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
60%	16	24%

Source: readabilityformulas.com

The table again had helped to lower the readability score and the information does appear to be easier to read. The average sentence length is again appropriate in terms of my Plain Language guideline. The high number of unique words should be interpreted with caution, as it may be ascribed to all the people's names listed in this table.

The second part of this section details the key risks of the project, again in table format, showing how the risks will be mitigated. Because of IP concerns, I am not able to include the second table here, but for the purposes of the test, I again converted the table to headings and text to be able to run it through the readability test. As mentioned in Chapter 3, one of the limitations of the readability test that I used is that it does not recognise tables and is only able to view text.

Table 4.28: Results for "Key Risks"

Flesch Reading Ease score	14.2, very difficult to read
Gunning Fog	17.1, difficult to read
Flesch-Kincaid Grade Level	16.5, college graduate and above
The Coleman-Liau Index	17, college graduate
The SMOG Index	13.2, college
Automated Readability Index	16.8, college graduate
Linsear Write Formula	15.8, college graduate and above
Readability Consensus	Grade level: 15 Reading level: very difficult to read Reader's age: college graduate

Average number of unique words	Average number of words per sentences	Percentage of words with three or more syllables
64%	21	25%

Source: readabilityformulas.com

The Key Risks table score overall was very difficult to read. The various technical terms resulted in 64% of the text's containing unique words. The average sentence length was again appropriate for this study, though.

4.6.3 Preliminary questions before the Plain Language analysis

I followed a similar strategy as with the Technology Demonstrator. Before analysing the text, I did a preliminary reading and noted down all the questions that I had after the first reading. For the purposes of this discussion, I think it is sufficient to note only the questions from the "Abstract". To avoid repeating the same information as in the Technology Demonstrator discussed in Section 4.5.3, I noted the first four sentences in the "Abstract" and the overarching questions I had with each reading in Table 4.29.

Table 4.29: Challenges with the Expression of Interest at first reading

	Original wording	Questions at first reading	Plain Language guideline to be applied
Title	Leakage detection of gas in a 3D space using CFD and IIoT.	The purpose of a title is to provide a schema, helping the reader to rely on prior knowledge to process the new information. Leakage detection of gas does not necessarily say what the proposal is for. Only after reading the entire document does the reviewer know that this refers to a system integrating wireless gas sensors and a model created by a CFD software package in mines. But upon first reading the questions are whether it is a system, a software package, maybe even automated robots. As with the Technology Demonstrator, if readers are not familiar with the field, then CFD provides no context for the title. IIoT, according to a Google search is the Integrated Internet of Things. In the title, 3D space is not necessary, and "mines" might offer more context.	Guideline 1: Organise your material so that readers can grasp information early and navigate through the document easily. Guideline 2: Use words your readers are likely to understand. Guideline 3: Write concisely.
Sentence 1	The accidental release or leakage of hazardous gasses is a serious health and environmental concern, with potentially deadly consequences.	It assumed the reviewer will know what the deadly consequences are. The "deadly consequences" should be mentioned with the health concerns as this relates to the human aspect of the hazardous gasses. With the environmental concerns, although there could be deadly consequences in the long term, the environmental impact of pollution (as an example of the of hazardous gasses) is not as immediate as death to people now.	Guideline 1: Organise your material so that readers can grasp information early and navigate through the document easily.
Sentence 2	The ability to rapidly detect the source of such a leak will reduce or manage the associated risks.	Is there any system available already doing this and, if so, is it too slow, is it too general, does it only detect gas after people have died?	

	Original wording	**Questions at first reading**	**Plain Language guideline to be applied**
Sentence 3	For this reason, we propose a gas detection system that is capable of estimating the source or location of a leak, in real-time.	What does the current system do? What is the improvement from this new proposed system?	
Sentence 4	The aim of the system is to provide a better situational awareness which could result in huge health, environmental and economic impacts.	“Better situational awareness” is vague, and how can it be better without knowing what is currently available? What is “better” situational awareness being compared to, as the comparison is currently incomplete here?	

After reviewing my questions and determining what the focus for the abstract should be to aid in telling the science story, I reviewed the Expression of Interest against my chosen Plain Language principles.

4.6.4 Application of chosen Plain Language guidelines

4.6.4.1 Organise your material so that readers can grasp the important information early and navigate through the document easily

As with the Technology Demonstrator, to determine the best order in which to present the information, I asked the following questions:

- What is the problem?
- How will it be solved?
- Why should it be solved? (Or what makes this problem more important than others?)[18]

Starting with the first question, the problem is that gas tends to leak, posing a serious health and environmental threat. In reading the rest of the abstract the reader gleans the fact that it is enough of a problem for there to be government policies in place to reduce the number of people affected by the problem, but the belated mention of the human aspect of the rationale for the research, only after discussing the system that is being proposed, gives the unintended impression that the environment in which people work is not as dangerous as the applicant claims.

If I work on one idea per paragraph, the first paragraph needs to expand on the problem and include all the information relating to the problem. The information in the original document relating to what the problem that the research proposes to solve (Question 1) is highlighted in green. To answer the second question (How will it be solved?), the focus is on the information in purple. The answer to the third question has not been addressed in the original document.

[18] For the Expression of Interest, I attempted rather to focus on the abstract as a whole in an effort to tell the science story more clearly. With this funding proposal, the technical terminology was not as much of an obstacle as with the Technology Demonstrator. In this proposal I was of the opinion that the story could be clearer. Therefore I present the text with the colour-coded reference to the questions that were answered by parts of the abstract.

Table 4.30: Expression of Interest: Questions answered in original text

Original wording	**Questions answered**
TITLE: Leakage detection of gas in a 3D space using CFD and IIoT.	What is the problem? How will it be solved?
PAR 1: The accidental release or leakage of hazardous gasses is a serious health and environmental concern, with potentially deadly consequences. The ability to rapidly detect the source of such a leak will reduce or manage the associated risks. For this reason, we propose a gas detection system that is capable of estimating the source or location of a leak, in real-time. The aim of the system is to provide a better situational awareness which could result in huge health, environmental and economic impacts.	What is the problem? How will it be solved?
PAR 2: We intend to develop a [smart] wireless gas sensor system based on the nano gas detector. The intended approach is to use *in-situ* wireless gas sensors interacting with a Computational Fluid Dynamics (CFD) model and a spatial weather system (possibly augmented with *in-situ* airflow sensors) to pinpoint the source of the leak. CFD modelling has the potential to accurately model the gas dispersion and threats as a function of physical characteristics in the environment surrounding a plant or underground mining domain.	How will it be solved?
PAR 3: Through the CFD-generated model, it will be possible to find the optimal placement, type and number of gas sensors needed to effectively negate health and environmental risks. Due to the high computational costs associated with CFD methodologies, the approach will require generating a reduced order model (ROM), trained with a large set of CFD scenarios. Combining ROMs with mathematical inverse methods allows for the creation of an intelligent system to pinpoint gas sources using a sparse set of fixed point gas concentrations and airflow measurements.	How will it be solved?
PAR 4: While a method that can estimate or infer internal field values from a few sparse data sources is widely applicable, we are limiting the scope to two problems with direct commercial benefit. Our proposed system can reduce the risk of underground mining and thereby supports the government and mining industry's	What is the problem? How will it be solved?

commitment towards zero harm. This very strongly falls under the ICT RDI Roadmap market opportunity of "sustainability and the environment" with specific reference to the industry opportunity of mining. The system can also be implemented to reduce the risk inherent in industry projects, for clients like SASOL at their fuel refineries.	

From the table, it is clear that the Expression of Interest's abstract focuses on the how of the problem before supplying sufficient information regarding the what and with no mention of the why at all during the abstract. By focusing predominantly on the how, the science story is not clear.

4.6.4.2 Use words your readers are likely to understand

The vocabulary for the Expression of Interest and the Technology Demonstrator were similar because it worked within the same fields, but with different applications of CFD. I experienced similar challenges in terms of the vocabulary when attempting to define what each word means. Therefore, I have not included that information here again as the discussion in Section 4 covers most of this technical vocabulary. The readability tests show that on average the vocabulary of the Expression of Interest contains unique words 55% of the time. It is important to note that these unique words can cause confusion and words that might seem simple enough in their everyday definition might have a different implied meaning when one applies these unique words in a technical context.

In the case of the Expression of Interest, the applicants used "real-time" to mean a specific term related to simulations within the mathematical model that they are proposing. Although the term in everyday use in this sentence position, where the words serve as an adjective and a noun, would be spelled without the hyphen, a real-time simulation refers to the model's being able to give data feedback as the simulated situation unfolds in the real world. Simulation time is often slowed down in order to interpret visually events that happen at speeds that the human eye cannot interpret. Gas spreading through a mine could happen really quickly, and this model implies that the authors would like to develop the model in such a way that will show the real-time step-by-step dispersion of the gas.

4.6.4.3 Write concisely

The Expression of Interest is not particularly wordy, but some ideas and processes are expressed in a convoluted form. One example of this is the following:

> *The intended approach is to use in-situ wireless gas sensors interacting with a Computational Fluid Dynamics (CFD) model and a spatial weather system (possibly augmented with in-situ airflow sensors) to pinpoint the source of the leak.*

The information in brackets, in addition to the parentheses for acronyms, adds another idea to the sentence. To enable that reviewer to grasp the information at first reading, it is better to try to have only one idea per sentence.

4.6.4.4 Use vertical lists

The Expression of Interest used several tables, which would aid reviewers in grasping the information quickly at first reading. The Outputs section, however, contained a very difficult horizontal list that would have benefitted from using a vertical list. A series of theses ("2 x PhD enrolled, 3x Masters qualifications"), articles and other items are listed, with a jumble of numbers compounded by odd spacing ("2 x…3 x… 4 x… 6 x… 4 x… 1 x… 1 x…), acronyms (PhD, HCD, CFD) and title case punctuation complicate the reading. (See Section 4.5.2.6, Figure 4.9, for this horizontal list.)

4.6.4.5 Over the whole document, make the average sentence length 15-20 words

The Expression of Interest did not have overly long sentences. Because most of the information was presented in table format with short descriptive paragraphs in between, the average sentence length shown by the readability tests ranged between 16 and 25 words per sentence. The horizontal list in the "Outputs" section was the longest sentence, at 55 words. In the "Abstract", the sentence length ranged between 18 and 36 words. Cutts (2020:23) urges writers to remember that varying sentence length helps a document not to read as too staccato. The sentence length throughout the Expression of Interest was thus acceptable in terms of the chosen Plain Language guidelines for this study, with some exceptions.

4.6.4.6 Prefer the active voice unless there is a good reason for using the passive

Generally, the Expression of Interest did not use the passive form and preferred to focus on the "doer", explicitly stating what the applicants intended to do. It is nevertheless important to note that the passive form can be challenging where science writing is concerned (see Section 2.11.6).

4.6.4.7 Reduce cross-reference to a minimum

The applicants were able to discuss information where they mentioned it the first time and only referred to appendices for the various team member qualifications and references.

4.6.4.8 Sequencing steps for clarity

In this particular funding proposal, the steps of how the model will specifically be created were not included. Although the applicants described what they intended to develop, they did not include process examples as with the Technology Demonstrator.

4.6.5 Plain Language example sets chosen for the survey

For the purpose of Plain Language sample sets to include in the survey, it was necessary to keep length and standalone context in mind, as already discussed in Chapter 3. Therefore, I briefly list the example texts that I included from the Expression of Interest in the survey in Table 4.3. I evaluate the original texts and then give the proposed Plain Language version.

Table 4.31: Original vs. Plain Language sample texts

Original Text	Problem in terms of Plain Language	First Plain Language version
Leakage detection of gas in a 3D space using CFD and IIoT.	The acronyms make it difficult for the reader to create a schema for the rest of the document.	A detection system for the earlier identification of gas leaks for implementation in mining and refinery environments.
The accidental release or leakage of hazardous gasses is a serious health and environmental concern, with potentially deadly consequences. The ability to rapidly detect the source of such a leak will reduce or manage these risks.	Longest sentence at 23 words. The reviewer is not provided with background to why this technology is important. Tentative and vague language causes confusion: "that is capable of estimating the source of location of a leak, in real-time." What is "real-time"?	Hazardous gasses are sometimes accidentally released. If this is not detected quickly, it could potentially have deadly consequences (e.g. explosions or illnesses caused by long-term exposure). Leaks can also harm the environment. A method to detect gas leaks from a few dispersed data sources is currently widely applied, but faster detection with pinpoint accuracy will save money, time and lives.
We intend to develop a [smart] wireless gas sensor system based on the company's on-chip nano gas detector. The intended approach is to use in-situ wireless gas sensors interacting with a Computational Fluid Dynamics (CFD) model and a spatial weather system (possibly augmented with in-situ airflow sensors) to pinpoint the source of the leak. CFD modelling has the potential to accurately model the gas dispersion and threats as a function of physical characteristics in the environment surrounding a plant or underground mining domain. Through the CFD-generated model, it will be possible to find the optimal placement, type and number of gas sensors needed to effectively negate health and environmental risks. Due to the high computational costs associated with CFD	Hierarchical structure of information will help the reader to follow the story and introduce the reader to new information.	We propose a gas detection system that is capable of estimating the source and location of a leak in real-time. The ability to pinpoint the source of a leak accurately has the potential to reduce the risks associated with gas leaks significantly. Our proposed system will use wireless gas sensors, based on the company's nano-chip, interacting with a Computational Fluid Dynamics (CFD) model and a spatial weather system, to predict the source of a leak accurately. The CFD-generated model will make it possible to find the optimal placement, type and number of gas sensors needed in any specific environment. CFD modelling enables gas dispersion and the threats it poses to be modelled accurately. This will make it possible to develop an intelligent

Original Text	Problem in terms of Plain Language	First Plain Language version
methodologies, the approach will require generating a reduced order model (ROM), trained with a large set of CFD scenarios. Combining ROMs with mathematical inverse methods allows for the creation of an intelligent system to pinpoint gas sources using a sparse set of fixed-point gas concentrations and airflow measurements.		system to pinpoint gas sources using a sparse set of fixed-point gas concentrations and airflow measurements. Developing this smart system has the benefit of reducing health, environmental and economic risks associated with gas leaks in mines, and will also be commercially applicable to fuel refineries or similar environments where leaks are an everyday reality.

4.7 CONCLUSION

In this chapter, I analysed the two funding proposals for the purpose of including sample texts in the survey. I evaluated the two proposals against my set of eight preliminary Plain Language guidelines from Chapter 2 to show how the documents would benefit from applying these guidelines. As a starting point, I used a readability tool to get an initial indication of how difficult the proposals were to understand, confirming their readership level as graduate readers, and identifying preliminary areas of concern regarding the sentence length and vocabulary. After the readability test results, I then presented initial difficulties with understanding the content of the two funding proposals. These initial impressions and questions then helped me to consider how I could rewrite the texts into Plain Language. Selecting example texts to use in the survey posed a challenge, as the texts needed to be short enough to read fairly quickly but also needed to be able to stand separately from the rest of the text. Besides the purpose of the document analysis being to select example texts to include in the survey, the document analysis also helped me to answer four of my research questions.

The first research question that I aimed to answer through the document analysis was related to the obstacles that science experts as readers need to overcome when they review funding proposals, and by implication by the writers producing a text for that readership. From the document analysis it is clear that proposals can be confusing if one is not in the same field as the authors. The field-specific terminology referring to abstract concepts can create potential traps for unwary or hasty and pressurised readers. If the introductory paragraphs in a funding proposal are unclear, then it is not clear to the reviewers why the research is important and why they need to read the proposal.

The second research question focused on the obstacles that language practitioners face in reading funding proposals. Similar to the obstacles that reviewers might face, these readers look for organisation of the technical information in a way that gives the reader a chance at understanding at first reading. Although the proposals used examples of specific problems, the concepts were not clearly described. Without a specialised scientific background, it was difficult to determine the best way to approach the proposals and how to apply my selected Plain Language guidelines.

The next research question that I wanted to answer through the document analysis was how I needed to adapt my selected Plain Language guidelines to work within the constraints of the language of science and mathematics. Guideline 6 states that one should prefer the active voice unless there is a need for the passive. The document analysis reveals that although there were difficult scientific concepts in the proposals that needed clarification, the challenge was not necessarily that they were written in the passive voice. Both proposals already preferred the active voice, but failed to answer questions related to the what, how, and why regarding the importance of the research.

The last research question related to the limitations of the templates. As mentioned in Section 2.8, templates can have advantages and disadvantages. In terms of my selected Plain Language guidelines, one challenge with the templates was that reviewers were referred to other sections in the template and this created confusion. Guideline 7: Reduce cross-references to a minimum might need to be adapted also to suggest that content be organised in a way that ensures that wherever a concept or terminology is mentioned the first time, the context is clear enough so that the reviewer will not need to depend on the cross-reference to clarify the information.

In the next chapter, I discuss the survey results, including how often the survey respondents preferred the chosen Plain Language examples over the original texts in the example sets that emanated from the document analysis in this chapter.

CHAPTER 5:
RESULTS: SURVEY

5.1 INTRODUCTION

The purpose of the survey was to gain insight into engineers' and scientists' demographic information, their writing habits regarding funding proposals, the primary language they work in, and to test whether respondents understood the Plain Language versions of the sample texts at first reading.

I started the survey by establishing demographic data confirming that the survey respondents met the criteria for inclusion, and were indeed the ones I sought for the purpose of this study, namely that they were scientists or engineers. Next, in Section 2 of the survey, I probed their writing habits and how they engage with the writing process. Section 3 provided data regarding respondents' use and perceptions of language practitioners and what the reasons for using/not using the services of a language practitioner were from the respondents' perspective.

In the last section of the survey, I tested my chosen Plain Language example texts by asking respondents to choose the version (original vs. Plain Language version) that they understood at first reading in each set. This enabled me to investigate which of my chosen Plain Language guidelines could help improve comprehensibility in funding proposals, on the premise that such comprehensibility would be more convincing to a panel of reviewers.

The survey consisted of 28 questions. The first question in the survey asked the respondents to confirm that they understood the terms of the survey and wanted to continue completing the survey. I designed the survey this way to ensure that I obtained online permission from the respondents and confirmation that they understood the terms of the survey and the purpose of the study. The last question, Question 28, asked respondents to indicate whether they would be willing to participate in a follow-up interview. If respondents were willing to participate, Question 28 then asked respondents to provide an e-mail address, which I used to contact them for an interview (as discussed in Chapter 6).

This chapter reports on the survey response rate, and then looks at the data that emerged from the four sections (excluding Questions 1 and 28):

- Section 1: demographic information (Questions 2-4);

- Section 2: writing in the field of specialisation (Questions 5-15)
- Section 3: primary language that you work in (Questions 16-20); and
- Section 4: Plain Language examples (Questions 21-27).

I have included the full survey as Appendix E, and I provide a detailed rationale for each question relating to the survey in Section 3.5.3. The discussion of these results is followed by correlation analysis of some of the data.

5.2 RESPONSE RATE

The survey was sent to SACNASP members with a formal invitation and letter of informed consent via email. SACNASP then distributed the SurveyMonkey link to the members on its database. SACNASP also published the link on their Facebook page with the letter of informed consent, asking members to complete the survey.

As already discussed in Section 3.5.6, only 66 respondents replied, of which 19 indicated they would like to complete the survey (responding to Question 1) but then did not complete any of the questions. Of the remaining 47 respondents, only 42 completed the survey in full, and this resulted in a varied response rate per question. In this chapter, I therefore indicated the responses per question using *n*=....

As already mentioned, respondents to the survey did so completely voluntarily and were allowed to exit the survey at any time. Unfortunately, this resulted in a high number of non-answers as there were no compulsory questions for respondents to complete. The reasons have already been mentioned in Section 3.5.6. The response rate of 0.0066% was disappointing, making generalisation impossible, because no statistical inferences could be drawn. For statistically significant responses, one needs a response rate of 100 responses, or 10% of the population that you are focusing on (Bullen, n.d:n.p.). Although statistical analyses were done on the data with the assistance of a trained statistician,[19] the numbers were too low to consider these findings more than exploratory. Nevertheless, the results were useful in this exploratory study to provide a baseline for future studies on this topic.

[19] I am immensely grateful to Professor Sonali Das for her insights and input on the data, and suggestions on the correlations discussed in Section 5.7.

5.3 SURVEY RESULTS FOR SECTION 1: DEMOGRAPHIC INFORMATION

Section 1 starts with Question 2, which asked respondents to provide details on their respective specialisations, followed by Question 3, which probed qualifications, and Question 4, which elicited information on home language.

5.3.1 Field of specialisation

This study explores the possibility of applying Plain Language guidelines to funding proposals that have to communicate across disciplinary boundaries as one specific application of science communication. Hence, I wanted to confirm that the respondents do indeed belong to a variety of specialisations, which would complicate such communication. The Plain Language sample texts that I included in Section 4 focused on mathematical modelling. To determine whether applying my chosen Plain Language guidelines to the sample texts improved understandability at first reading for readers outside of the specialisation, it was important that I had respondents from other fields of specialisation. I was also interested in how respondents with specialised knowledge perceived the Plain Language versions, so I did not exclude respondents working in a similar field (I discuss the fields that use CFD and CSD in Section 4.2).

As Figure 5.1 shows, there were respondents from 26 different fields. Respondents came from the fields of agriculture, animal science, biochemistry, biology, the biomedical sciences, various engineering specialisations, environmental science, food science, geology, geophysics, hydrology, physics, the soil sciences and statistics. Several respondents indicated that they had more than one specialisation. For example, one respondent indicated that he/she specialised in chemical engineering, as well as metallurgical engineering. I listed this as two different fields of specialisation. Another respondent, however, indicated that his/her field was civil engineering with a specialisation in water. I grouped this answer with the other civil engineering respondents. Therefore, although there were only 47 responses, the graph totals 52 answers.

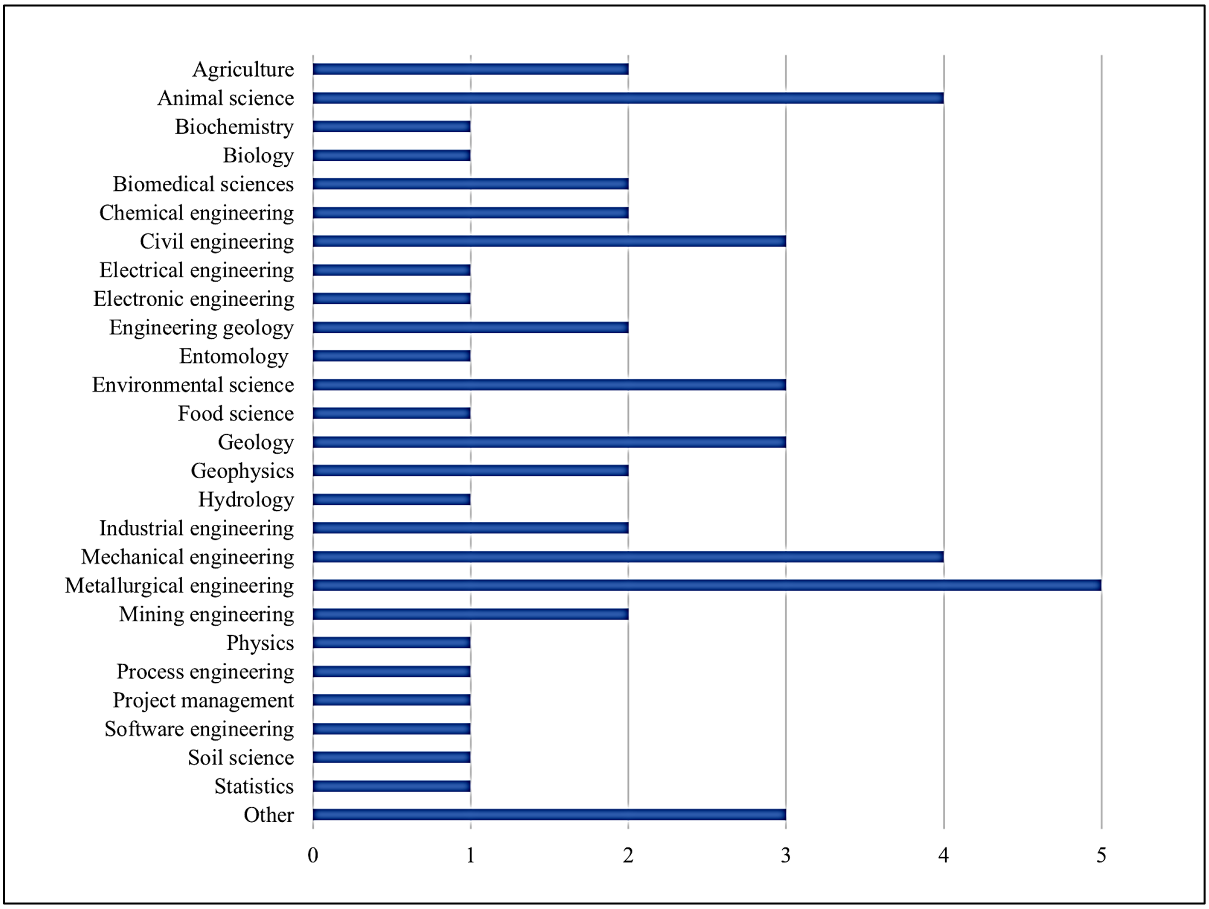


Figure 5.1: Respondents' field(s) of specialisation (n=47)

Although most of these fields use some form of mathematics or mathematical modelling, as explained in Chapter 4, CFD and CSD are specialist applications of mathematical modelling that are primarily used within mechanical engineering and applied mathematics. Three respondents answered that their fields were "scientific", "general management", and "administrative person" respectively. I have grouped these answers as "other".

5.3.2 Qualifications

In the third question to the survey, I asked respondents about the highest qualification they had obtained to confirm that the respondents were appropriate for the purposes of this study. For the purposes of this study, I assumed that the writers and reviewers of funding proposals would hold tertiary qualifications.

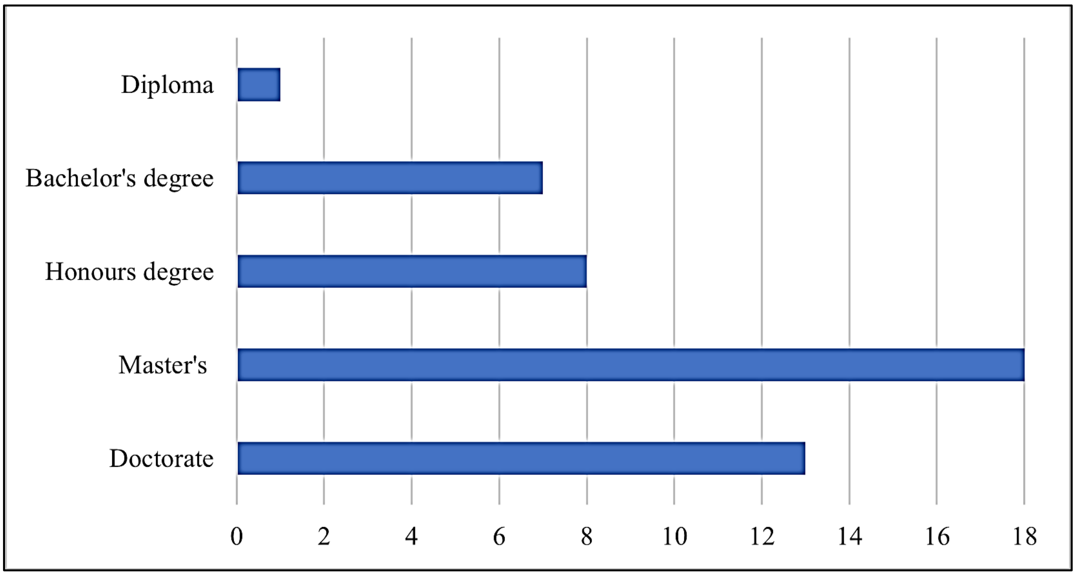


Figure 5.2: Highest qualification (n=47)

Figure 5.2 shows that all the respondents held tertiary qualifications, with 39 respondents holding further postgraduate qualifications. They are, therefore, part of an elite readership for scientific texts, since, in 2019, only 7% of all South Africans had attained a tertiary qualification, and only 1% of the South African population had completed a master's degree (Doumet & Whang, 2019:2). These responses confirmed that the respondents were the right ones for this study.

5.3.3 Home language

The fourth and final question of Section 1 focused on the respondents' home language. UNESCO (n.d.) defines a home language as "a language learned in childhood in the home environment, also referred to as mother tongue, first language…" Figure 5.3 shows the distribution of the respondents' home language.

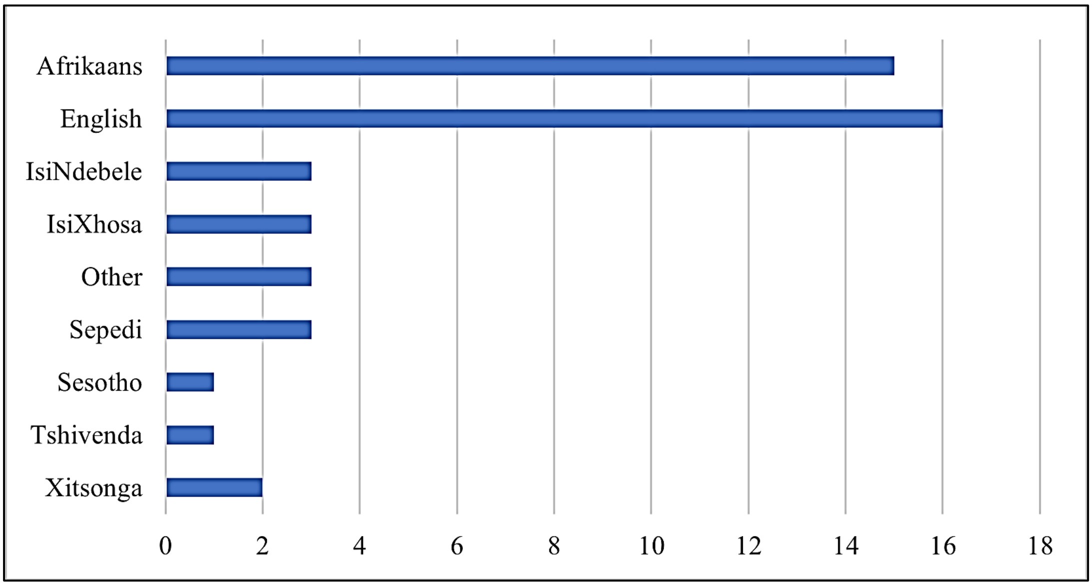


Figure 5.3: Home language of respondents (n=47)

As discussed in Section 2.5, only 9.6% of South Africans speak English as a home language (Statistics South Africa, 2012). In South Africa, 25.1% of people speak isiZulu as a common language outside of the household and 16.6% of South Africans speak English as a common language outside of the household (Galal, 2022). However, from my survey data, 16 respondents indicated that they speak English as a home language, contrary to the South African average. As further 15 respondents indicated that Afrikaans was the second most spoken home language. None of the respondents indicated that they speak isiZulu as a home language and again this is not representative of the South African statistics.

For the purposes of this graph, I only reported on the languages that respondents chose and did not include the languages that nobody spoke on the graph. Therefore isiZulu and Siswati, which were not mentioned by any respondents, were excluded from the graph.

The majority response of English as home language may be cautiously interpreted as reflecting continued inequities in the sciences in general, especially among professional engineers and other scientists, and is something that should be followed up in future studies to trace shifts in this population.

5.4 SURVEY RESULTS FOR SECTION 2: WRITING IN THE FIELD OF SPECIALISATION

The second section of the survey focused on the type of writing that respondents need to do and how frequently they need to engage in the writing process. I have included a detailed rationale for the survey questions in Section 3.5.3.

5.4.1 Frequency of writing

Question 5 included a follow-up element where respondents that answered "other" were asked to expand and provide more detail in Question 6. This open-ended element gave respondents the chance to expand on the frequency with which they write, especially if none of my choices in Question 5 fit their personal situation. Figure 5.4 shows the responses to Question 5. None of the respondents indicated that they "never" have to do any writing.

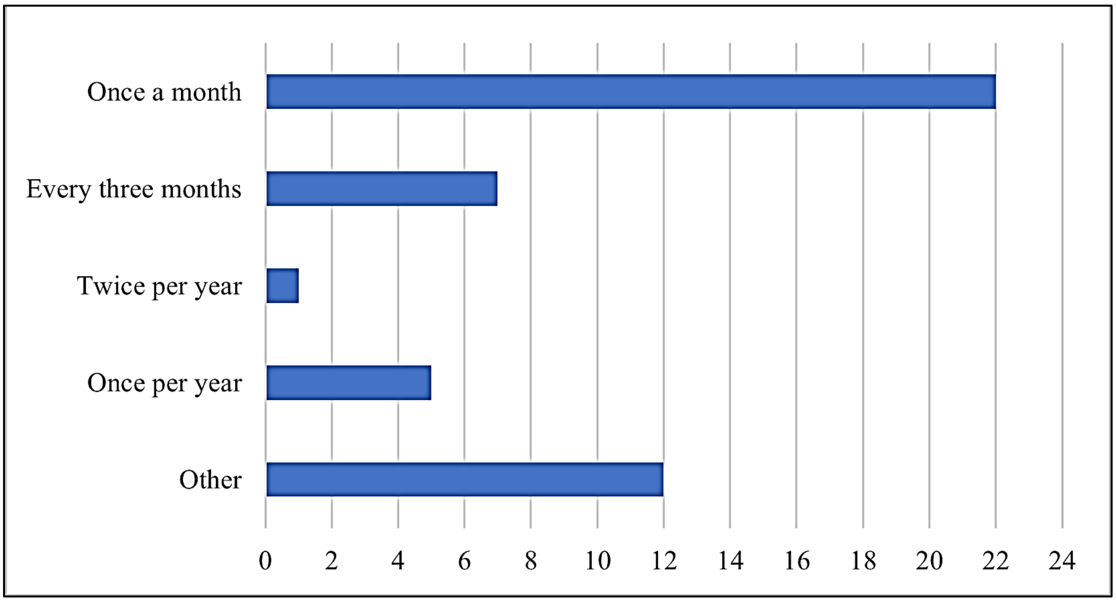


Figure 5.4: Writing frequency (n=47)

The respondents' answers confirmed that writing is an important aspect of scientists' everyday tasks, as already reported by Nudelman and English (2016:17). With the exception of one respondent that indicated he/she seldom needs to write reports, the rest of the respondents indicated that they need to write far more frequently than only once a month. One respondent indicated that he/she only needs to write a report when his/her work requires it. There was also a respondent that did not expand on his/her choice of "other", and it is not possible to comment on this respondent's frequency of writing.

The open-ended responses in Question 6 indicated that respondents write reports daily, weekly, and bi-weekly. To explore the comments that respondents made regarding the frequency with which they need to write, I used ATLAS.ti to represent the data visually. Two respondents indicated that they need to write reports daily and one respondent indicated that he/she needs to write *"3 to 4 times per week"*. Two respondents stated that they need to write reports several times a week and another stated that he/she needs to write on *"a weekly basis"*. The answers to the open-ended Question 6 indicated that respondents need to write far more frequently than only once a month. This question was important because if scientists do not frequently engage in the writing process, then there would be no point in proposing Plain Language guidelines to aid interdisciplinary science communication.

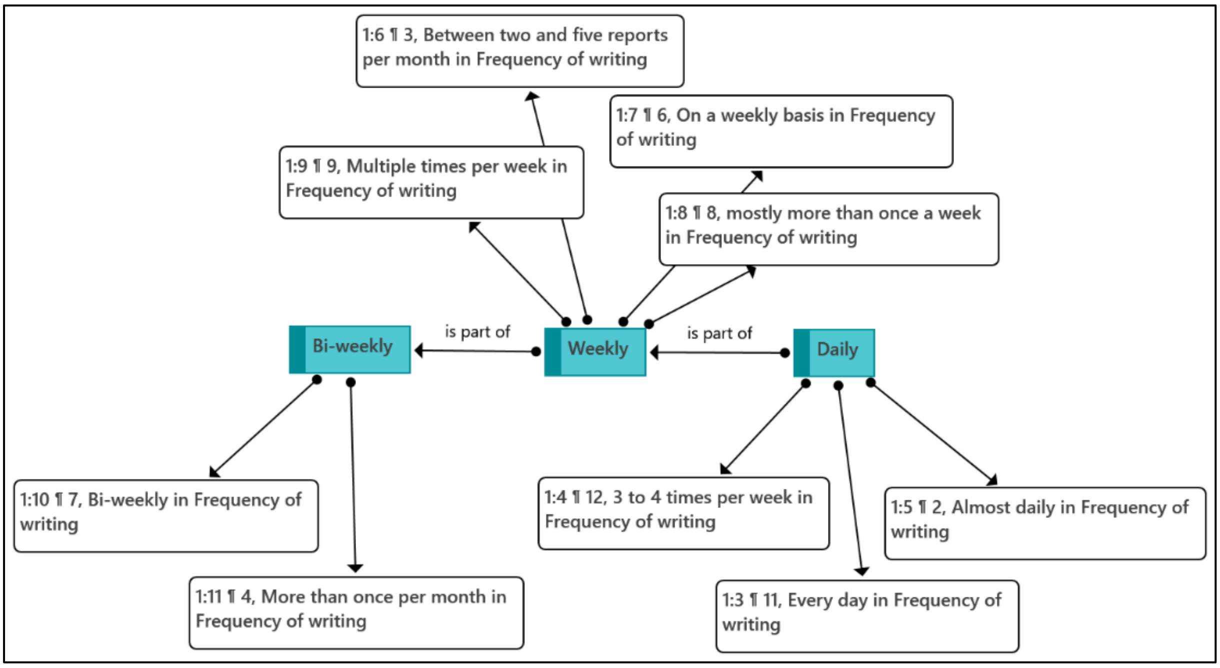


Figure 5.5: Respondents' comments on writing frequency

From the literature review, it was clear that scientists need to engage in the writing process in their everyday working environment. The purpose of this question was to confirm this for local conditions, and from the respondents' answers it was clear that they do engage in the writing process frequently.

5.4.2 Project funding

The purpose of Question 7 was to probe how many of the respondents' projects depend on outside funding. If respondents' projects rely on outside funding, then these respondents need to write funding proposals, or at least be aware of funding proposals. For this answer, of the 47 respondents (n=47), 27 respondents indicated that they would need to bid for funding from sources outside of their respective companies. If respondents answered yes to Question 7, I asked them to expand again on how often they specifically need to write funding proposals. I have included the distribution of these answers as Figure 5.6.

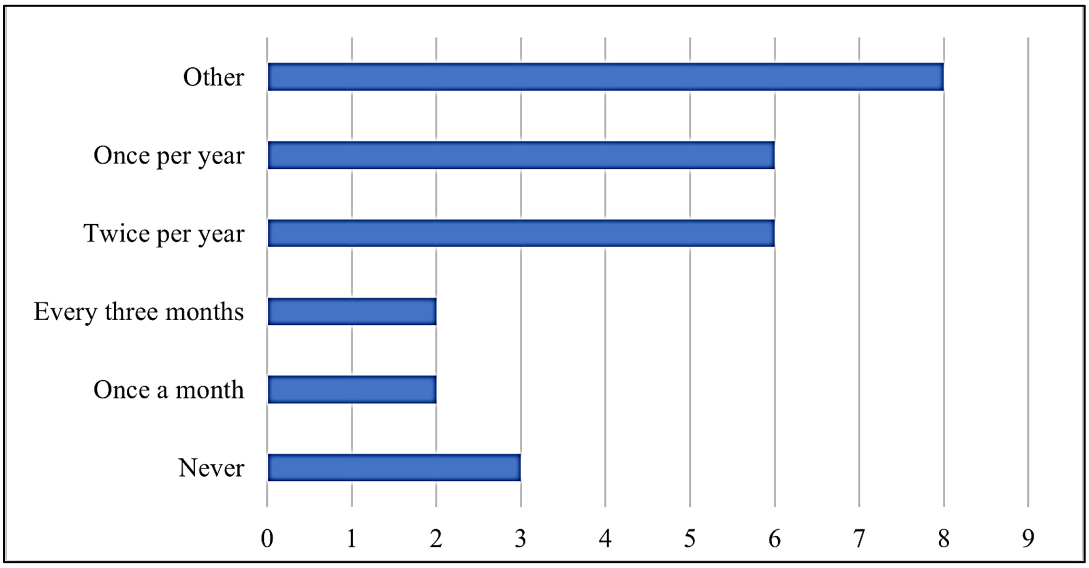


Figure 5.6: Frequency of writing funding proposals (n=27)

Respondents indicated that they need to write funding proposals less frequently than they need to write reports. According to Figure 5.6, six respondents answered that they need to write funding proposals once to twice per year. Two respondents indicated that they need to write funding proposals every three months, and two more respondents stated that they need to write proposals as frequently as once a month. Although three respondents indicated that their projects do depend on outside funding, they indicated that they never have to write funding proposals.

To give respondents another opportunity to expand on "other", I asked them to give additional information. Therefore, Question 9 asked respondents to expand on their answer if they answered "other" in Question 8. Respondents commented that writing funding proposals happens ad hoc or at least a couple of times more than only once a month. Two respondents specified that they do not write funding proposals as such, but that they do write quotations and submit documents for tenders.

Although the data already confirmed that scientists frequently engage in the writing process, this question focused on funding proposals as a specific example of interdisciplinary science communication. The data from this answer indicated that respondents do need to write funding proposals, but less frequently than they have to write reports.

5.4.3 Practicalities of writing funding proposals

The next question related to the practicalities around writing funding proposals. Although I had already asked respondents about outside funding, there is often also funding available within organisations and companies. Question 10 of the survey related to whether or not scientists write funding proposals as a group or whether respondents need to write funding proposals on their own. Most respondents indicated that they do not write funding proposals on their own, with 26 respondents indicating that they write funding proposals as part of a group.

Although I am proposing that Plain Language guidelines can benefit reviewers evaluating funding proposals, the fact that respondents indicated that they frequently need to write funding proposals as part of a group suggests that there might be merit in already applying Plain Language guidelines at the conceptualisation phase. If scientists have to work in teams on proposals, it would be vital for everyone involved in writing the proposal to be able to communicate as clearly as possible.

After confirming that respondents do need to write reports in teams, Question 11 then asked respondents to comment on how many peers would write funding proposals together. Respondents answered that they usually need to write in groups of, on average, between three and five people. To conclude the focus on the practicalities of writing funding proposals, in Question 12 the survey asked how long, on average, proposals need to be. Respondents gave a wide range of answers and the length they indicated varied from five pages up to 60 pages long. The comments regarding the length of the proposal documents confirm that reviewers might not have the time or motivation to read a proposal more than once, making the need for Plain Language even more critical. The use of Plain Language guidelines can help reviewers to understand the merit of the proposal at first reading, which could affect the outcome of the proposal negatively.

5.4.4 Funding proposal templates

The last two questions in Section 2 of the survey focused on funding proposal templates. Question 13 asked whether respondents are provided with templates to complete funding proposals. Responses were received from 40 respondents. Five respondents said that the question was not applicable to them. Of the rest of the respondents, 28 indicated that they are provided with a template when they need to write funding proposals, while seven did not use templates.

Question 14 was phrased as a follow-up to the question regarding templates; I asked respondents that answered "yes" to Question 13 to comment on how easily they were able to navigate these templates. None of the respondents indicated that they found the templates almost impossible to navigate, although 3 admitted it was difficult. The majority, 15 respondents, indicated that it takes a bit of effort to navigate templates, but 10 claimed that it was "very easy". Figure 5.7 shows the range of responses.

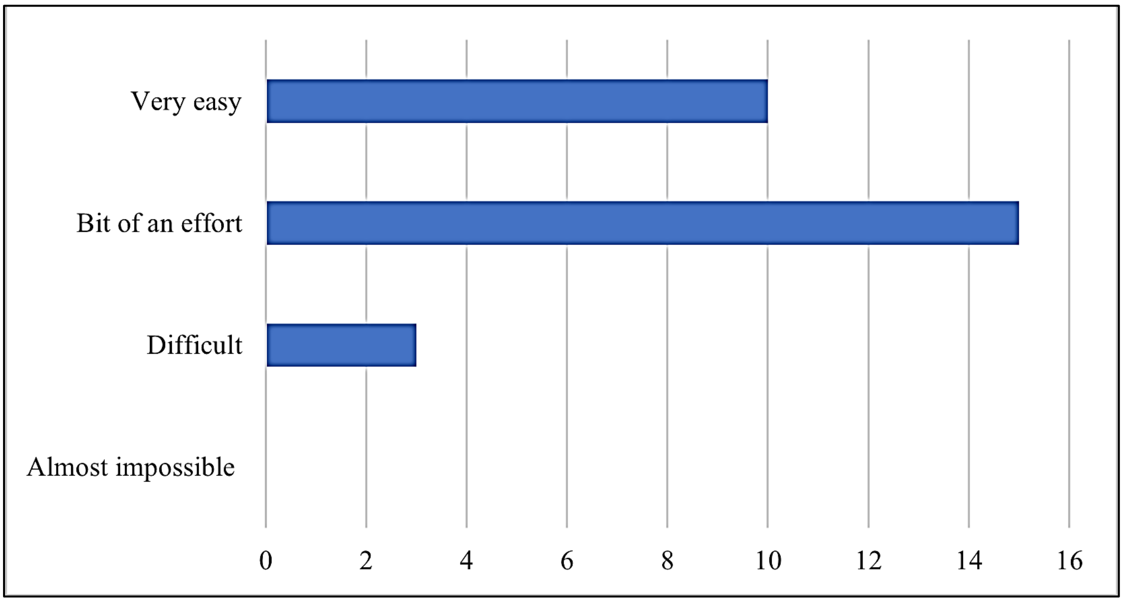


Figure 5.7: How easily respondents navigate templates (n=40)

The last question in Section 2 concluded the discussion on templates. Question 15 asked whether or not respondents prefer using templates. This question was to probe respondents' attitude towards using templates and to gauge whether they find it easier to just write or prefer the organised guidelines that a template provides. For this question, only 40 respondents (n=40) completed the answer, of whom 28 indicated that they do prefer using templates for their writing.

5.5 SURVEY RESULTS FOR SECTION 3: PRIMARY LANGUAGE SCIENTISTS WORK IN

From the Literature Review, I established that the dominant language for science communication is English (see Section 2.2). It was important for me to confirm that this was true for the respondents to this survey as well, so I asked respondents to indicate the primary language they work in.

5.5.1 Perceived language and writing skills

In the South African context, even scientists and engineers who are not home-language English speakers need to write and communicate in English. To confirm this, Question 16 asked respondents to indicate the language that they work in. The data confirms that English is used as the *lingua franca* for scientists in South Africa, as all of the respondents indicated that they primarily work in English.

The follow-up question, Question 17, probed how proficient respondents feel working in English. Figure 5.8 shows respondents' answers to this question.

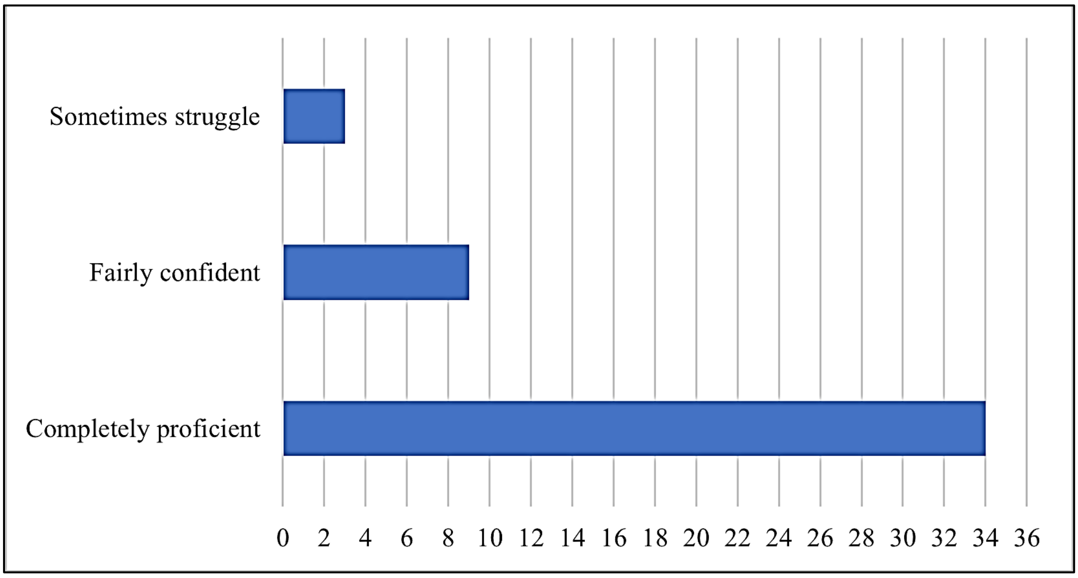


Figure 5.8: Respondents feel proficient working in English (n=46)

For this question, there were only 46 answers. Out of these, 34 respondents indicated that they feel completely proficient in English. This could be related to the fact that most respondents (16 of 47) to this survey also indicated that they speak English as a home language (see Section 5.3.3), but may suggest overconfidence in those whose home language is not English. To follow up on how comfortable respondents feel working in English, I then continued with a question related to how comfortable respondents feel with their own writing skills.

Question 18 focused on how respondents view their own writing abilities. The results for this question are set out in Figure 5.9.

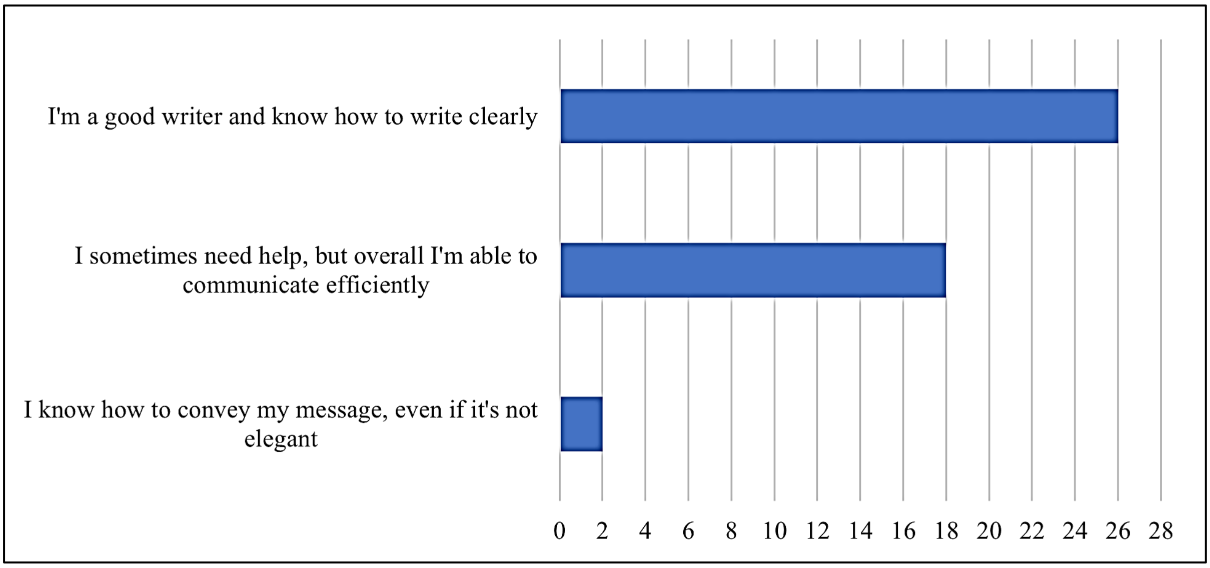


Figure 5.9: Evaluation of writing ability (n=46)

For this question, 46 respondents answered, of whom 26 indicated that they thought they were good writers and know how to communicate clearly. None of the respondents chose the option "I can't write and don't enjoy writing". However, 18 respondents admitted to sometimes needing help although they still assessed themselves as "overall… able to communicate effectively".

Other studies have shown that such self-assessments of language ability are not necessarily accurate. Defazio, Jones, Tennant, and Hook (2010:34) trace communicative difficulties from the undergraduate to the graduate levels, commenting:

> [T]he majority of students do not possess the skills necessary to effectively communicate in a written format that will enable them to become successful upon graduation. There is a significant need for students at all levels not only to be good written communicators, but also to understand the importance of good writing skills. In addition, an important facet of written communication is being able to critically assess the writing of others, particularly at the graduate level as well as in professional programs.

This concern about graduates not being able to effectively write to communicate was also raised by one of the interviewees from the first round of interviews. I expand on this in Section 6.4.4. If respondents are then of the opinion that they are good writers and communicators, there seems to be a disconnect between the survey respondents' view of their writing abilities and the opinion of industry and educators. According to Kruger and Dunning (2009:30), people struggle to assess their own abilities accurately if they are not competent in a particular field.

The reasons for the confident self-assessment cannot be ascertained from the survey alone. Although it will not be possible to determine accurately why these results are so high from my survey data set, I think there could be two possible reasons for this high number of respondents being confident in their writing abilities. This first reason could relate to the fact that almost a third of the respondents in this survey indicated that they speak English as a home language, and since this is also the *lingua franca* of science, it is possible that respondents are more likely to be comfortable with their language abilities if they can communicate in their home language. The second reason could be that all of the respondents to this survey have completed tertiary qualifications, so that through their studies they would certainly have been more exposed to writing and improving their writing skills in English. I did not probe this specific aspect of the survey in the follow-up interviews, and further studies with larger data sets could possibly investigate this aspect further.

5.5.2 Prior use of language practitioners

To conclude Section 3 of the survey, the last two questions focused on language practitioners. Question 19 asked respondents whether or not they had used language services before. Question 19 asked: *In writing funding proposals, or any other writing you do for work purposes, do you ever use a language practitioner or communication specialist to review the proposal before submission?* Respondents could choose between “yes”, “no” and “sometimes”. For this question, 46 respondents completed the question. Their responses are set out in Figure 5.10.

Of the 46 respondents, 34 indicated that they have not used the services of a language practitioner before. Only 12 respondents indicated that they use a language practitioner, of which five respondents indicated that they sometimes make use of a language practitioner’s services.

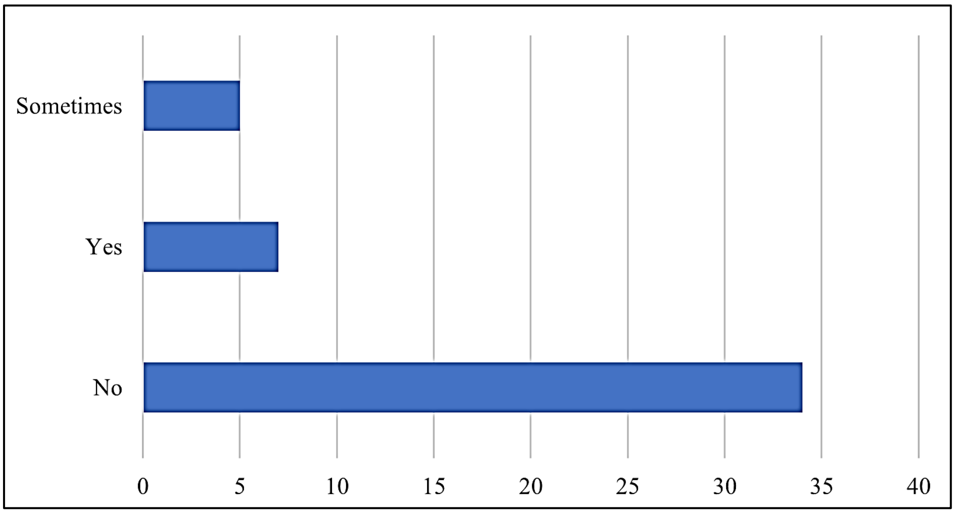


Figure 5.10: Use of a language practitioner (n=46)

The follow-up question, Question 20, then asked respondents to comment on the reasons for using or not using the services of a language practitioner. I drafted this follow-up question to probe respondents' experience collaborating with language practitioners, or provide me with comments that could provide insight into why they do not use language services. The results to Question 20 are set out in Figure 5.11.

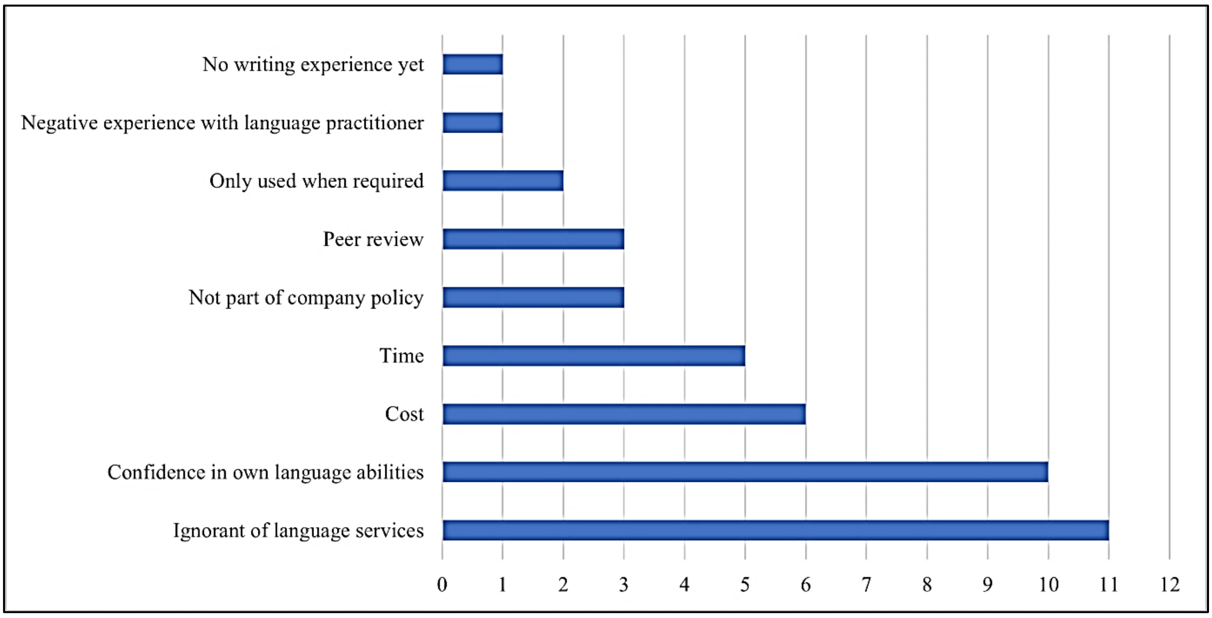


Figure 5.11: Reasons for not using a language practitioner (n=41)

For Question 20, only 41 respondents answered. However, there was an overlap on some of the themes that the respondents identified, as they mentioned more than one reason in some instances. From these open-ended responses, I identified nine themes as to why respondents have not used language-related services before or do not want to use these services. For each theme, I provide the ATLAS.ti-generated network (see Section 3.7.1.1) that shows the particular words that respondents used. The networks were generated using respondents' comments verbatim.

From the answers regarding the respondents' reasons for not using the services of a language practitioner, two themes were mentioned more than other reasons:

- confidence in own language abilities; and
- ignorance of language services.

For the first theme, 11 respondents indicated that they felt comfortable with their own language abilities and did not feel the need for a language practitioner to review funding proposals. Figure 5.12 details the comments regarding respondents' confidence in their own language ability.

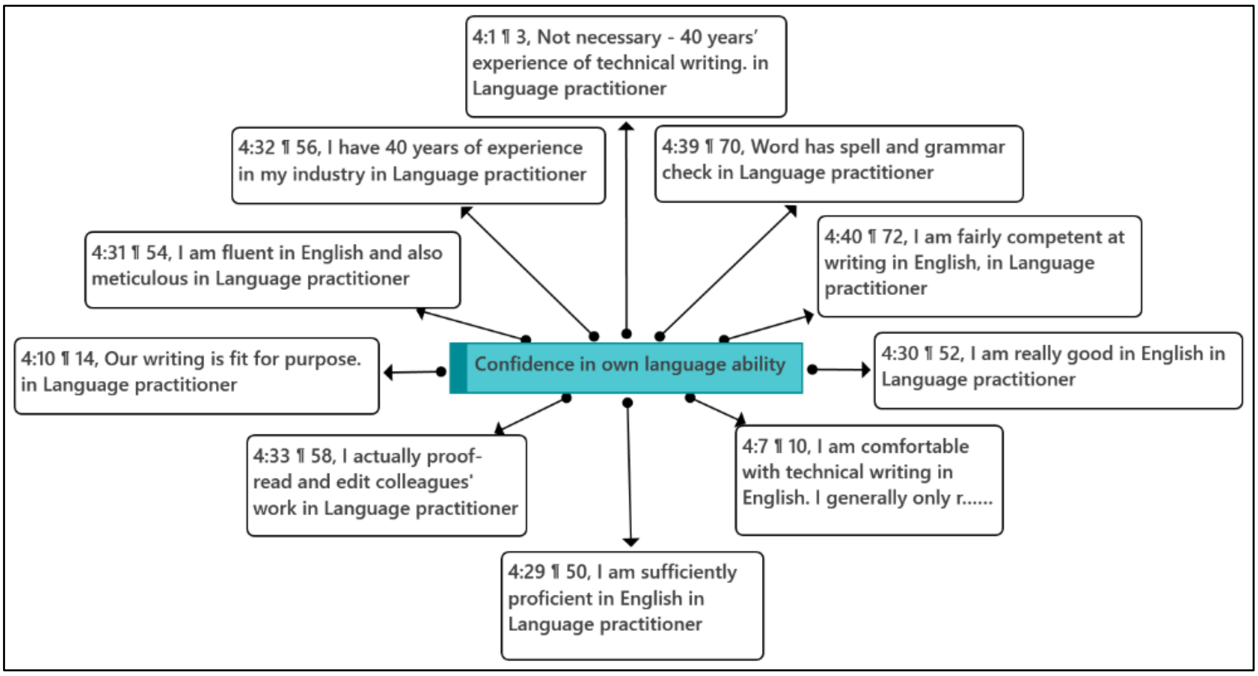


Figure 5.12: Confidence in own language ability

Two respondents stated experience as a reason to not use a language practitioner. Some explicitly mentioned feeling confident in their English proficiency. One respondent indicated that he/she "*proof-read[s] and edit[s] colleagues' work*". Another stated that the built-in spell check that Word provides is sufficient to complement his/her language abilities, while another stated that his/her *"work is quite straight forward"*. These two comments show that respondents think that language practitioners only check grammar and spelling and that a language practitioner can add no value if the words seem simple to the writer. Although these last two answers relate to the respondents' confidence in their own language abilities, these comments could also indicate ignorance on the part of the respondents regarding services that language practitioners offer. This then links to the second theme that emerged from respondents' comments regarding language practitioners, indicating that respondents are not aware of the value that a language practitioner can add.

For the second theme, ten respondents' comments indicated that they were not clear on what services a language practitioner provides. This ignorance speaks to the need for practitioners to educate people about the value of language services and that it definitely goes well beyond checking grammar and spelling. Language practitioners have been trained to evaluate a text and determine where information might be ambiguous, where the story might not be clear, and make suggestions to enhance a text to ensure that the message is conveyed exactly as the writer intended. This is another theme that also emerged from the interviews, and I discuss this in more detail in Section 6.4.2. Figure 5.13 shows the detailed comments that respondents made regarding language practitioners' services.

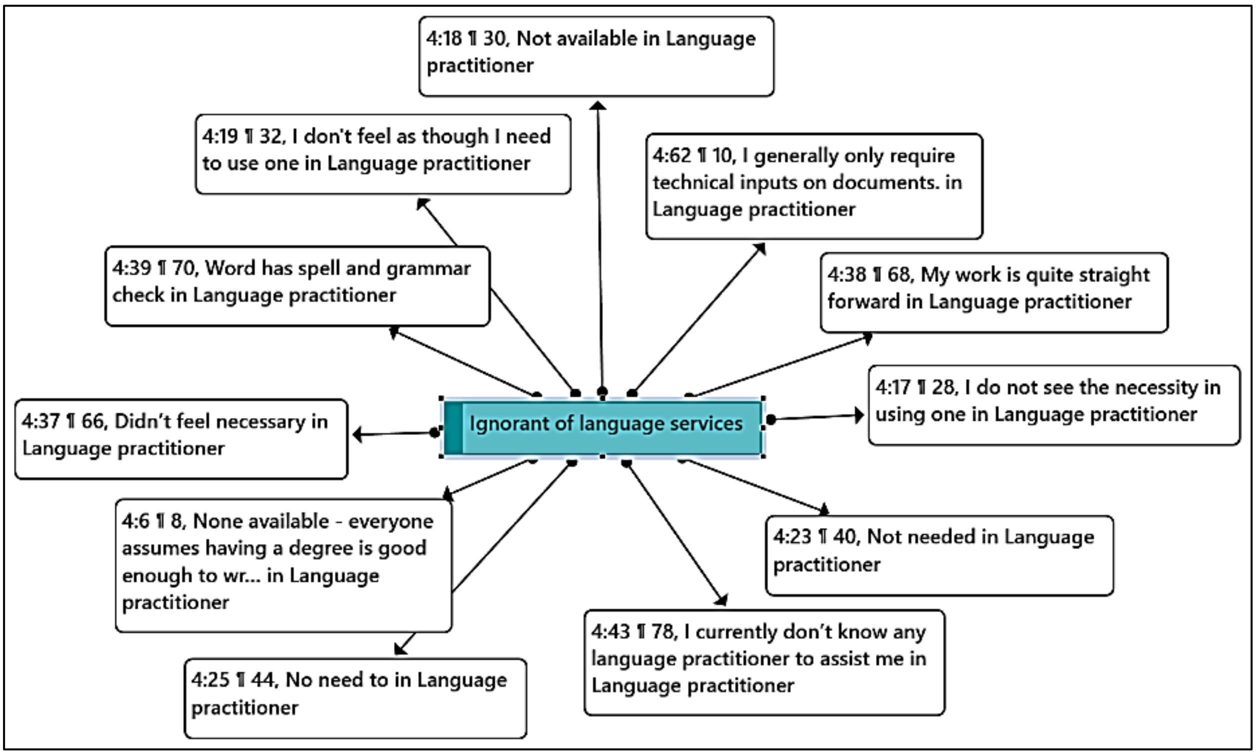


Figure 5.13: Ignorance of language services

Some respondents used words such as *"not necessary"*, *"not needed"*, or assumed that a *"degree is good enough to write"*, confirming that respondents are not fully aware of what language services entail. For the purposes of this study, probing what scientists' detailed perceptions of language practitioners are and whether or not they know what services practitioners offer fell outside of the scope of this study, but it is important to note these opinions.

Another respondent also noted that he/she only needs *"technical input"* on his/her work, showing a slight disregard for the language aspect of a document. These findings suggest that although the scientific community might be aware of language services, they do not seem to be educated on the value of these services. Some respondents claim that they do not know anyone that can help with language services and that there are no practitioners available to be of service. This shows that respondents, again, are not aware of where to find someone or do not know that you can employ someone outside of the company to provide language-related services.

The next theme that emerged from that respondents' comments was that it was not part of company policy. Three respondents claimed that the reason they have not used a language practitioner is because the company that they work for does not require them to use a language practitioner and that language services are not generally part of their work processes and procedures (see Figure 5.14).

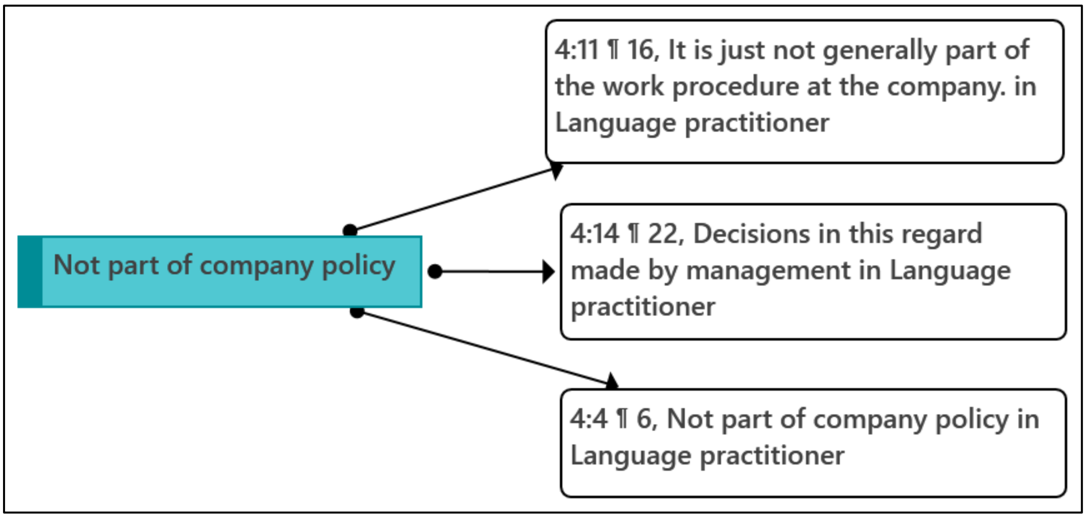


Figure 5.14: Not part of company policy

I discuss the next two themes for not using a language practitioner together, as there were overlaps between the respondents' comments. Time and cost as themes for not using a language practitioner were mentioned together 11 times. Respondents used words such as "*expensive*", "*costly*", and "*cost an arm and a leg*", implying that the respondents think language services are expensive. For the purposes of this study, I explored this further in the second round of interviews (see Section 6.3.7).

Another respondent claimed that the "*turn-around time*" was too long and that this was a reason not to use a language practitioner. In the first round of interviews, it was mentioned that deadlines are usually very tight and that there is not always time for an outside party to look at a proposal before it has to be submitted (see Section 6.2.7). Figure 5.15 details the themes of time and cost as reasons for not using a language practitioner.

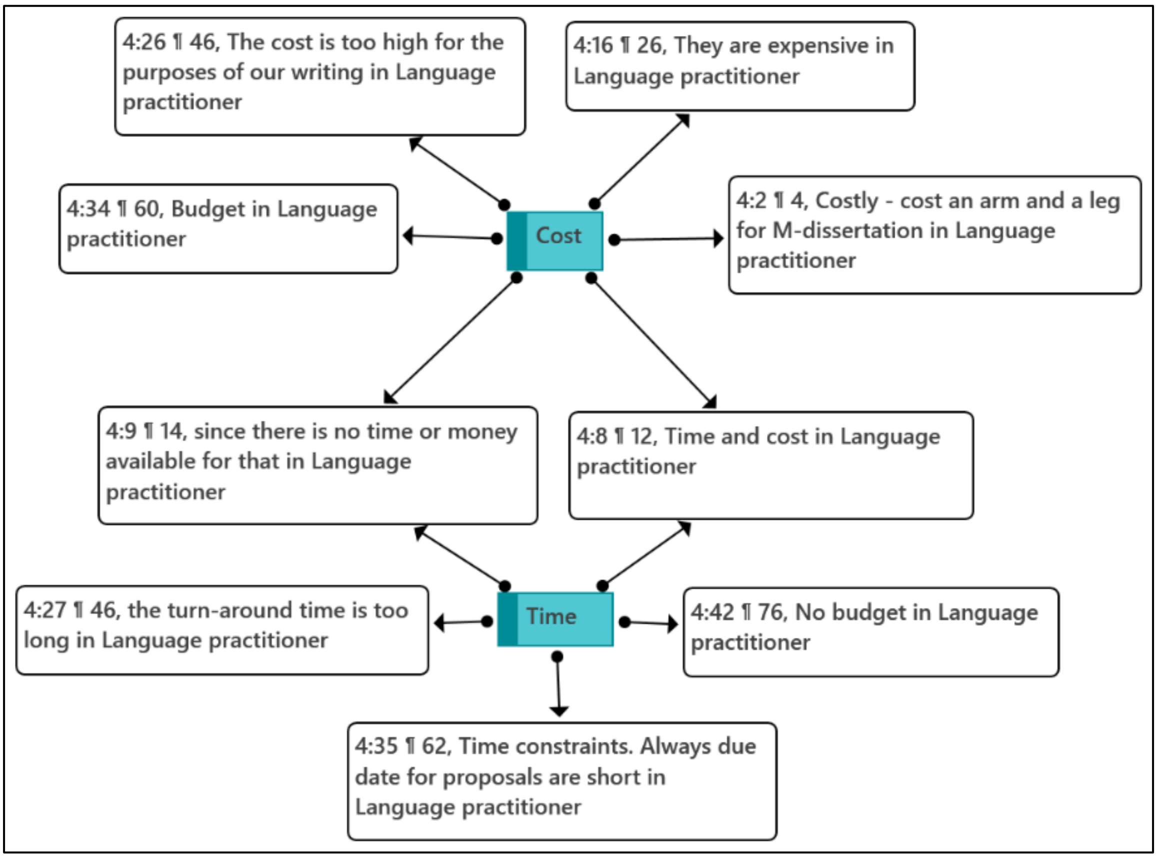


Figure 5.15: Time and cost as reasons not using the services of a language practitioner

I noted that although respondents mentioned that there is not enough time to involve a language practitioner, the previous question relating to how often respondents need to write funding proposals (Section 5.4.2) indicated that respondents only need to write funding proposals as often as once a month. This could imply that scientists might well have time to plan a language review into the process. For future research, this possibility should be investigated further.

The next theme among the reasons that respondents gave for not using a language practitioner was peer review. Figure 5.16 shows the detailed comments respondents made regarding this theme.

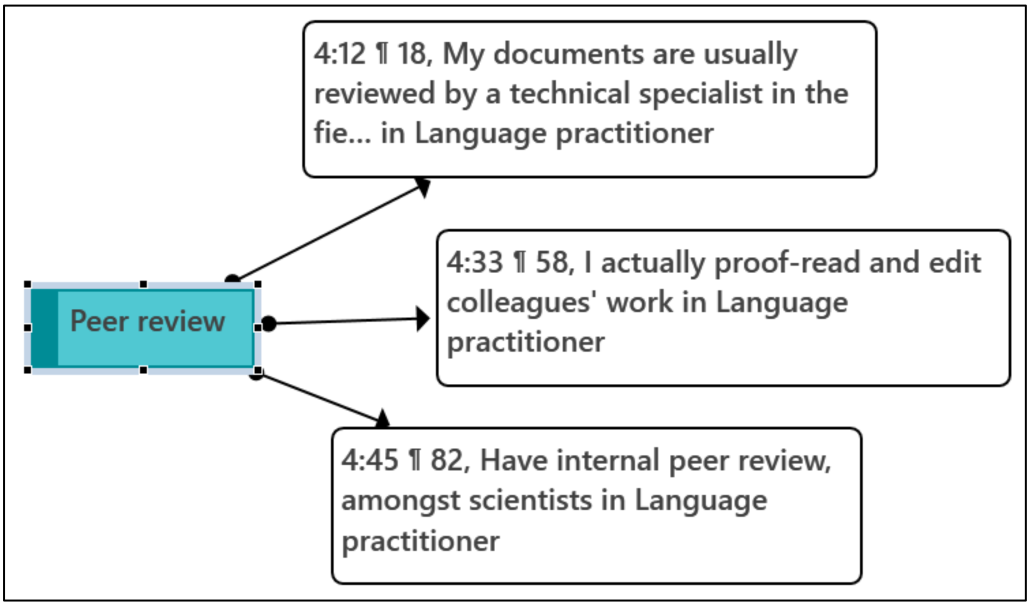


Figure 5.16: Peer review as a reason for not using the services of a language practitioner

The peer review that two respondents mention does not name language practitioners, but only that other technical specialists and scientists review their work. The third respondent mentioned that he/she "*proof-read(s) and edit(s) colleagues' work*", which also links to the first theme of having confidence in your own writing ability as a reason for not using a language practitioner.

The last three themes that emerged as reasons for not using a language practitioner were:

- No writing experience;
- Only used when required; and
- Negative experience with language practitioner.

I have presented these last three themes together in Figure 5.17.

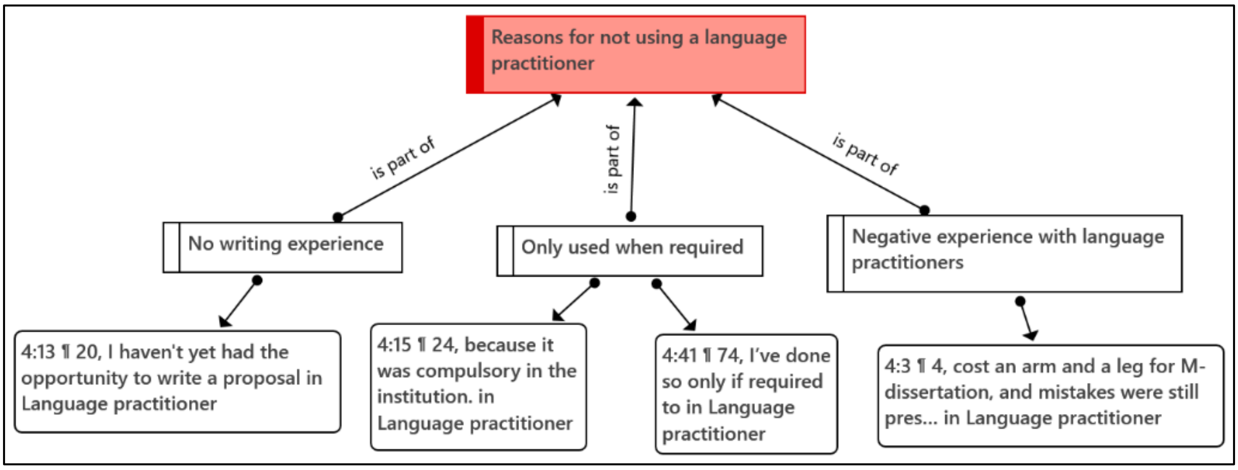


Figure 5.17: Three reasons for not using a language practitioner

Respondents mentioned that they only use a language practitioner when they are required to do so. Another respondent had not been working for that long and he/she stated that he/she has not had the opportunity to write a proposal yet. Lastly, one respondent claimed that he/she will not use a language practitioner because he/she had had a negative experience with a practitioner previously. He/she had used a language practitioner before, but since there were still mistakes in the document, he/she did not have much trust in the language services profession.

A fully interconnected diagram of all the reasons as themes for not using a Plain Language practitioner has been included as Appendix J.

Twelve respondents indicated that they had used the services of a language practitioner previously or were using the services of a language practitioner currently. Their responses are set out in Figure 5.18.

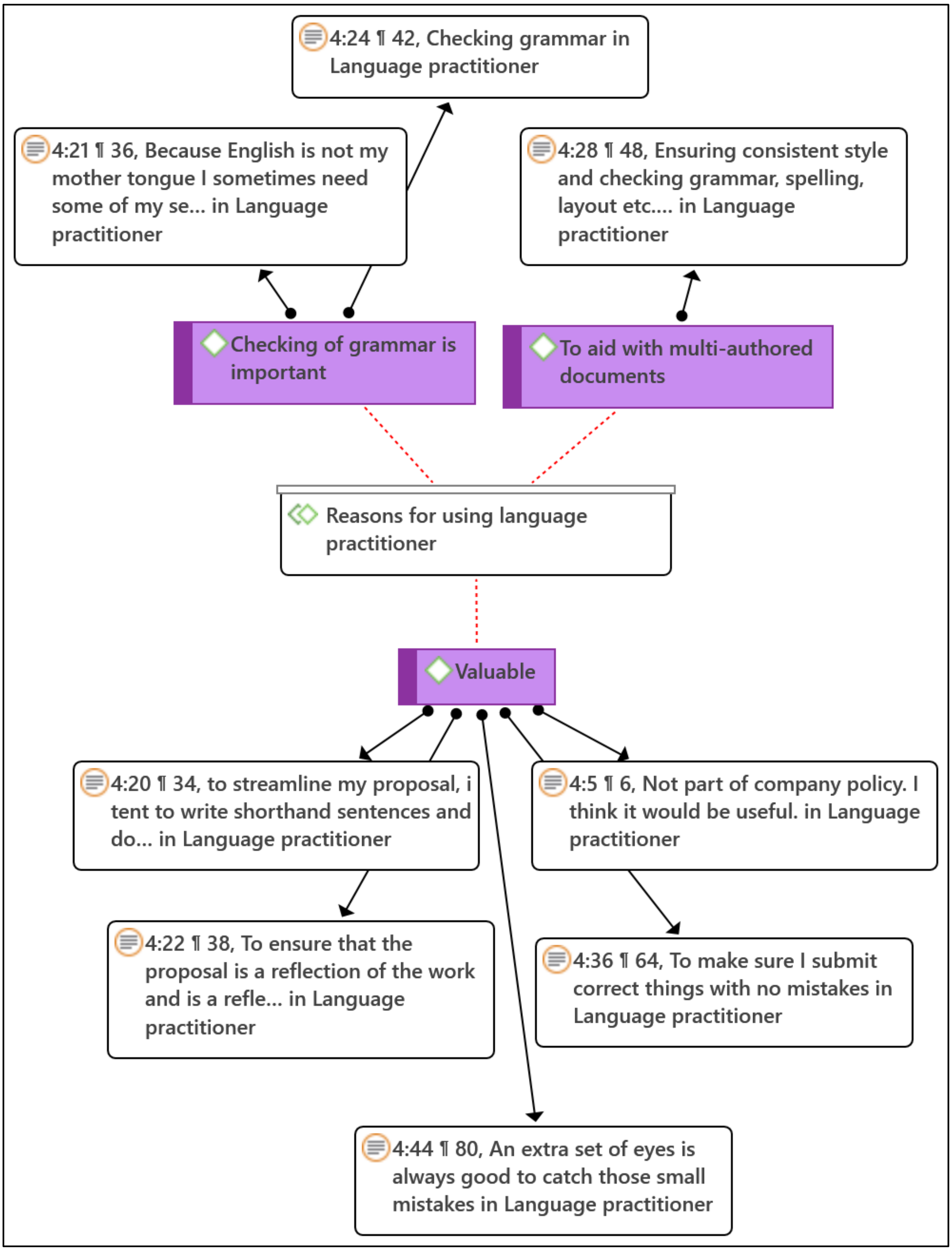


Figure 5.18: Reasons for using a language practitioner

Some respondents commented that "*an extra set of eyes is always good*" and that although it was not part of his/her company policy, one respondent thought that it "*would be useful*". Although respondents did think that language services could be valuable, the comments echoed a misconception about just what language services entail. Even where respondents had experienced working with a language practitioner, they still seemed to equate "*checking grammar and spelling*" to language services.

With Section 3 completed, respondents were asked to choose between the original text and the Plain Language version of the same text in Section 4 of the survey.

5.6 SURVEY RESULTS FOR SECTION 4: CHOOSE THE TEXT YOU FIND EASIER TO READ AT FIRST READING

The last part of the survey consisted of seven sets of examples of an original text with its Plain Language equivalent (see Sections 4.4.5 and 4.5.6, as well as Appendix E). What was critical for this last section in the survey was that I instructed respondents to choose the example they understood *at first reading*.

I have already discussed the limitations of the survey in Section 3.5.7. One important limitation to note before I discuss the results for the last section of the survey is that there is a possibility that whichever sample text was placed first in the survey could have informed the second sample text. It is not possible to say definitively that the order of the texts would have influenced the choice that the respondents made.

For the analysis of the results from this part of the survey, those respondents that did not complete the entire survey were excluded, leaving between 39 and 41 responses. I start the discussion on Section 4 of the survey by first summarising the results of which examples respondents preferred at first reading and then continue with a detailed discussion on whether or not there is any relationship between the demographic details in Section 1 that might have influenced respondents' choices of a specific text in Section 5.7.

For six of the seven sample texts, respondents predominantly preferred the Plain Language versions over the original. The only example set where the respondents preferred the original was Example Set 2. These overall results are set out in Table 5.1. The table also indicates the order in which I included the sample texts in the survey.

Table 5.1: Sample text preferences

Example set (n)	Text placed first	Plain Language Text preferred	Original preferred	No answer given
1 (n=41)	Original	35	6	6
2 (n=40)	Plain Language	5	35	7
3 (n=40)	Original	34	6	7
4 (n=40)	Plain Language	32	8	7
5 (n=40)	Original	27	13	7
6 (n=40)	Original	32	8	7
7 (n=39)	Plain Language	28	11	8

Out of the seven example sets, the original text was placed first four out of the seven times. With Example Set 2, the Plain Language version was placed first and 35 out of the 40 respondents to this question preferred the original version of the text. Although most respondents preferred the Plain Language version in most of the example sets, it is possible that the order of the texts could have informed the second text. I will now give more detail on each example set and the particulars of each example.

Example Set 1 was a title, where the original version was shorter than the Plain Language version, but contained technical abbreviations that everyone might not have been familiar with. For this set, 35 out of 41 respondents preferred the Plain Language version of the text.

For Example Set 2, the responses were anomalous, compared to the other sets, in that most respondents preferred the original version to the Plain Language version. A possible explanation is that for this set, the Plain Language version was significantly longer than the original. The Plain Language version contained more details, expanding on some of the abstract concepts in the original version.

For Example Set 3, both versions were more or less the same length, but the Plain Language version had less technical terminology and fewer abbreviations. Most respondents, 34 out of 40 respondents (85%) preferred the Plain Language version for this set. For Example Set 4, 32 out of 40 respondents (80%) preferred the Plain Language version, but two more respondents preferred the original than in Set 3. Both examples were short, and the original contained technical terms making it more difficult to read.

For Example Set 5, the Plain Language version was significantly longer, with bullet points. Most respondents still preferred the Plain Language version, but from the results it seems that length does influence a reader's choice. For this set, only 27 out of 40 respondents (67.5%) preferred the Plain Language. This is fewer than with the previous sample sets. Example Set 6's Plain Language version was longer than the original text, again using vertical lists to break up the process paragraph of the original text. For this set, 32 out of 40 respondents (80%) preferred the Plain Language version.

The last sample set consisted of two descriptions of an image. Although the two captions were more or less the same length, 28 out of 39 respondents (72%) preferred the Plain Language version for this example set as well.

These results are useful in an exploratory study, but the respondents and number of Plain Language example sets are too low to be able to prove any trend regarding the respondents' Plain Language choices. Other Plain Language sample texts compared to the original texts might produce different results. Future research might focus on including more sets for respondents to choose from, and might build randomisation of the sets into the survey tool.

Cutts (2013:xi) states that "(n)o writing can truly be regarded as clearer or better until users' performance proves it". Cutts states that he tested his own Plain Language examples on a focus group of 35 people and most users preferred the Plain Language versions of the text. Cutts tested his examples on a group of people who were presumably first-language English speakers, but, although my demographic by no means represents South Africa, it is close to Cutts's results with his focus group.

5.7 CORRELATIONS

The last step in this mainly quantitative leg of the study was to determine whether there are any correlations between the demographics (information from the first parts of the survey) and the respondents' preferences with regard to the Plain Language sample texts. In other words, is there any evidence to suggest that factors such as level of education, or home language, increases or decreases the likelihood that a reader may prefer a more technical presentation of information or the Plain Language version of the same texts.

In Tables 5.2 to 5.5, I provide a breakdown of the respondents' preferences for the rewritten Plain Language examples, based on the various demographic categories, including highest qualification, home language, and whether the respondents regularly make use of the services of language practitioners. The tables show a count of the number of respondents who preferred the Plain Language version and how often these respondents preferred the Plain Language versions. The reason for analysing the choices in this regard was to determine whether there is any noticeable difference in the distribution of the choices as a function of the demographics.

To clarify the contents, I use Table 5.2 as an example. There was a total of seven Plain Language versions of text samples that I collected from the document analysis. The respondents were given two choices and they had to indicate which text they understood at first reading. In total, there were two respondents with a doctorate who preferred the Plain Language versions three out of the seven possible times. Similarly, there was one respondent with a doctorate who preferred the Plain Language versions of the text four out of the seven possible times, three who preferred it five out of seven times, and lastly five who preferred the Plain Language versions six out of seven possible times. For the representation of the data in the tables, there is no corresponding information related to the choice once, twice or seven times out of seven, because there were no respondents who preferred all of the Plain Language versions, and there were also no respondents that preferred the Plain Language versions only once or twice.

While these numbers are interesting, in that they show the distribution of responses, they do not allow for direct comparisons, given the differing numbers of respondents in each of the categories. For this section of the analysis, it was important to get a consistent data set. Not all of the respondents completed the survey in full, so their responses had to be discarded. This resulted then in an uneven number of respondents that did not correspond to the number of responses in the first analysis of the survey responses.

To compute this overall percentage, or preference for Plain Language, I make use of weighted averages, based on the format in which the information is provided in the tables. The weighted average serves to find the average of how often a respondent preferred the Plain Language version, on the basis of the demographic sub-category. The equation for a weighted average is given by

$$W = \frac{\sum_{i=1}^{n} w_i X_i}{\sum_{i=1}^{n} w_i}, \quad \textit{Equation 1}$$

where w denotes the weights, X the data values to be averaged, and n the number of terms to be averaged. When applied to the contents of Table 5.2, the weighted average represents the global average, for each demographic sub-category, of the number of times that the Plain Language version was chosen. The weights are therefore the count or number of respondents, and the data to be averaged are the items in the header row of the respective tables.

To clarify via an example, Table 5.2 considers the *Doctorate* category. Filling in the details from this table into Equation 1, I obtained the following weighted average:

$$W_{\text{Doctorate}} = \frac{2 \times 3 \; + \; 1 \times \; 4 \; + 3 \times \; 5 \; + \; 5 \; \times \; 6}{2 + 1 + 3 + 5} = \frac{55}{11} = 5. \qquad \textit{Equation 2}$$

The weighted average for the *Doctorate* was found to be 5. This translates to the findings that, on average, respondents with a doctorate preferred the Plain Language five out of a possible seven times. Phrased slightly differently, respondents with a doctorate preferred the Plain Language version of the text 71% of the time. At this point it is important to point out that the weighted average is still just an average. It is convenient in this instance, given how the data in Tables 5.2 to 5.5 are presented. The same result could equally be obtained by summing together the total number of Plain Language choices, and dividing the sum by the total number of respondents in each category.

The preferences are discussed below with regard to educational level, home language, confidence in language ability, and prior use of a language practitioner.

5.7.1 Educational level and Plain Language preferences

I explored whether there was any correlation between the respondents' qualifications and their preferences. Table 5.2 summarises the number of times respondents preferred the Plain Language versions and the qualification that they hold. For the purpose of the tables, nobody preferred the Plain Language 7/7 times, 1/7 times or 2/7 times and, therefore, I excluded these responses. I provide responses for respondents that preferred the Plain Language versions 3/7, 4/7, 5/7, and 6/7 times.

Table 5.2: Summary of qualifications vs. Plain Language version preference

Qualification	Number of Plain Language preferences out of seven: 3	4	5	6	Weighted mean	Preferring Plain Language version
Other	-	-	1	-	5.00	71%
Bachelors	-	1	2	3	5.33	76%
Honours	1	2	-	4	5.00	71%
Masters	2	4	6	1	4.46	64%
Doctorate	2	1	3	5	5.00	71%

Table 5.2 shows that seven respondents completed a Bachelor's degree. Of these respondents, six completed the survey in full and chose the Plain Language version 76% of the time. One respondent preferred the Plain Language version 4/7 times. Two respondents preferred the Plain Language version 5/7 times, and three respondents preferred it 6/7 times.

Originally, eight respondents indicated that they held an Honours degree (see Figure 5.2). Only seven of these respondents completed the survey in full and they preferred the Plain Language version on average 71% of the time. One respondent preferred the Plain Language version 3/7 times, two respondents preferred it 4/7 times, and four respondents preferred the Plain Language version 6/7 times.

Respondents with a Master's degree preferred the Plain Language version only 64% of the time. Most of the respondents to this survey hold Master's degrees, and this is not representative of qualifications in South Africa. Two respondents preferred the Plain Language version 3/7 times. Four respondents preferred the Plain Language version 4/7 times. Although only one respondent preferred the Plain Language version 6/7 times, six respondents preferred it 5/7 times.

There were 13 respondents who had completed a doctorate (see Section 5.3.2), but only 11 respondents completed the survey in full. Of these 11 respondents, two preferred the Plain Language version 3/7 times, one respondent preferred the Plain Language version 4/7 times, three respondents preferred it 5/7 times, and five respondents preferred the Plain Language version 6/7 times. None of the respondents chose the Plain Language examples fewer than three times, but none preferred the Plain Language version for each example set. Nevertheless, respondents with a doctorate preferred the Plain Language version of the text 71% of the time.

There does not seem to be any conclusive difference regarding whether respondents preferred the Plain Language version or not, based on the highest qualification they have completed. Given the low response rate, there is no conclusive trend, and I am unable to determine with certainty that qualifications indicate whether people will prefer the Plain Language versions of texts or not. The averages do indicate that respondents preferred the Plain Language texts overall though, regardless of the qualification that a respondent held.

5.7.2 Home language and Plain Language preferences

Next, I investigated whether respondents' home language influenced their choice of either the Plain Language or the original version in the example sets.

Table 5.3: Summary of home language vs. Plain Language version preference

	Number of Plain Language preferences out of seven					
Home Language	**3**	**4**	**5**	**6**	**Weighted mean**	**Plain Language preference**
Afrikaans	-	3	5	6	5.21	74%
English	3	1	4	4	4.75	68%
Other	-	1	-	-	4.00	57%
isiNdebele	-	-	-	2	6.00	86%
isiXhosa	1	-	1	-	4.00	57%
Sepedi	-	-	1	-	5.00	81%

Originally, 15 respondents indicated that they speak Afrikaans as a home language (see Section 5.3.3, Figure 5.3), but only 14 of these respondents completed the survey in full. These respondents preferred the Plain Language version of the texts 74% of the time. Three respondents preferred the Plain Language version 4/7 times, five respondents preferred it 5/7 times, and six respondents preferred it 6/7 times.

Of the 16 respondents who indicated that they speak English as a home language (see Section 5.3.3, Figure 5.3) only 12 completed the survey in full. These respondents preferred the Plain Language version of the example texts 68% of the time, which is a lower percentage than the other groups. Three respondents preferred the Plain Language text 3/7 times and one respondent preferred it 4/7 times. Four respondents preferred the Plain Language version 5/7, and 6/7 times respectively. The English speakers preferred the Plain Language versions of the text less frequently than the Afrikaans respondents and although I am unable to identify any definitive trend, at this point it potentially indicates that second language English speakers do prefer Plain Language more frequently than English home language speakers in this context.

Originally 16 respondents in total indicated that they did not speak Afrikaans or English at home. Of these 16, only six respondents indicated that their home language was “Other”, IsiNdebele, isiXhosa, and Sepedi. No respondents that indicated that they speak Sesotho, Tshivenda and Xistonga completed the survey. The respondent who indicated “Other” preferred the Plain Language version of the texts 3/7 times, resulting in a percentage of 57%. The two respondents that indicated that they speak isiNdebele preferred the Plain Language version 6/7 times (86%). The respondent who indicated Sepedi as a home language preferred the Plain Language version 5/7 times (81%). The two respondents that indicated that they speak isiXhosa as a home language preferred the Plain Language version 2/7, and 5/7 times respectively. This resulted in these respondents preferring the Plain Language version 57%.

The low response rate unfortunately cannot help to identify a trend regarding home language and a preference for the Plain Language sample texts. This data shows that even respondents speaking English as a home language understood the Plain Language versions of the texts on average better than the original texts, albeit by a smaller margin.

5.7.3 Perceived proficiency working in English and Plain Language preferences

Respondents were asked in the second section of the survey to indicate how proficient they felt working in English. As Figure 5.8 in Section 5.5.1 shows, most respondents felt very proficient in using English as their everyday work language. Table 5.4 summarises the Plain Language preferences according to how proficient respondents feel working in English.

Table 5.4: Summary of Plain Language preferences compared with perceived English proficiency

	Number of Plain Language preferences out of seven					
Proficiency in English	**3**	**4**	**5**	**6**	**Weighted mean**	**Preferring Plain Language version**
Completely	3	6	10	10	4.93	70%
Fairly	1	1	1	3	5.00	71%
Sometimes	-	1	1	-	4.00	57%

Originally, 34 respondents indicated that they feel completely proficient working in English (see Section 5.5.1, Figure 5.8). Of these respondents, only 29 completed the survey in full and they preferred the Plain Language versions of the text 70% of the time, whereas the respondents that only sometimes felt proficient working in English preferred the Plain Language version only 57% of the time. The respondents that indicated that they deemed themselves fairly proficient in English, preferred the Plain Language version of the example texts 71% of the time. It is interesting to note that even when respondents perceived their language skills as completely proficient in English, they still preferred the Plain Language versions most of the time. The respondents that indicated that they only sometimes felt proficient working in English also preferred the Plain Language the least number of times, suggesting a difficulty in discerning the difference between versions.

5.7.4 Previous experience collaborating with language practitioners and Plain Language preferences

Lastly, I investigated whether there was any correlation between respondents' experience working with language practitioners and the frequency with which they preferred the Plain Language example texts. Table 5.5 shows the summary of these responses.

Table 5.5: Summary of Plain Language preferences compared with previous experience collaborating with language practitioners

	Number of Plain Language preferences out of seven					
Use of language practitioner	**3**	**4**	**5**	**6**	**Weighted mean**	**Preferring Plain Language version**
No	5	5	9	7	4.69	67%
Yes	-	2	2	3	5.14	73%
Sometimes	-	1	1	3	5.40	77%

Figure 5.10 (see Section 5.5.2) shows that 34 respondents indicated that they had not used the services of a language practitioner before. Of these respondents, only 26 respondents completed the survey in full. These respondents preferred the Plain Language version of the example texts only 67% of the time. The respondents that sometimes used the services of a language practitioner preferred the Plain Language versions of the texts 77% of the time and those that made use of language practitioners regularly preferred the Plain Language versions of the texts 73% of the time.

I found it interesting that the respondents that do use the services of a language practitioner most frequently preferred the Plain Language versions of the texts. It is possible that these respondents have already been educated on the value of Plain Language and are more comfortable with some of the principles such as bullet points that I used in the examples. Future research might be able to investigate this further.

5.7.5 Final impressions

Using the averages of each section, it was evident that most of the respondents preferred the Plain Language version most of the time. However, I was unable to determine any significant correlation between the demographics that respondents provided in the first part of the survey and the choices that respondents made in the second part of the survey. The low response rate, in conjunction with the number of non-answers which needed to be discarded, resulted in a data set that cannot be deemed statistically significant. Therefore, based on the survey data, it was not possible to identify conclusively any factors that determine whether a respondent would prefer the Plain Language version or not.

5.8 CONCLUSION

The purpose of the survey was to gain insight into scientists' demographic information, their writing habits as it relates to funding proposals, the primary language they work in, their experience of working with language practitioners and to test which version of a text respondents understood at first reading. I used the Plain Language texts to test whether using Plain Language principles could help improve comprehensibility in proposals on the premise that such comprehensibility would be more convincing to a panel of reviewers.

To determine whether applying Plain Language principles to funding proposals is even a viable option to consider from scientists' perspective, the survey also questions respondents' perception of language practitioners and their willingness to collaborate on projects. I propose that scientists need to collaborate with Plain Language practitioners to apply Plain Language guidelines to their writing. ScienceLink, a website that helps researchers and engineers to communicate their content to a wide audience, along with several other websites, promotes this idea of collaboration between Plain Language practitioners and scientists. I explore this concept of collaboration in more detail in the interview data analyses in Chapter 6.

In the last section of the survey, I presented respondents with seven example sets, presenting a Plain Language version of a text and an original version of a text. Although the respondents preferred the Plain Language versions of the texts most of the time, the data set was not big enough to indicate any correlation between qualifications, home language, how respondents perceived their own proficiency in English, and previous experience collaborating with language practitioners.

The purpose of the survey was to attempt to answer my research questions regarding the appropriate Plain Language guidelines and scientists' perceptions of Language practitioners and how this perception informs their willingness to collaborate on projects. Testing my Plain Language sample texts also helped me to investigate whether it would be possible to apply Plain Language guidelines to funding proposals to improve clarity and understanding.

To probe some of the comments and themes that emerged from the survey, I conducted two rounds of interviews. I explore these themes in Chapter 6.

CHAPTER 6:
RESULTS: INTERVIEWS

6.1 INTRODUCTION

In this chapter I analyse the data collected from two rounds of interviews. The first round was conducted with a group of nine interviewees from a small engineering company. The company employs various types of engineers. I had 15-minute timeslots per interview. I asked the interviewees to complete the survey before the interviews, and for the first round of interviews, eight out of the nine interviewees had completed the survey before speaking to me.

The interview questions were drafted with the following research questions in mind:

- Which Plain Language guidelines (and associated) strategies would be appropriate in addressing the fact that science writing contains technical terminology and abstract concepts, affecting the clarity of proposals at a micro-level?
- How do scientists perceive Plain Language and language practitioners? How do their perceptions inform their willingness to work collaboratively on projects with language practitioners as part of the team?

The second round of interviews were conducted only after I had completed the survey data collection and preliminary analysis of the survey data. I adjusted the questions for the second round based on themes that emerged from the open-ended survey questions. As mentioned in Section 3.6, for the second round of interviews there were 12 survey respondents who indicated that they would be willing to participate in follow-up interviews but only seven participants responded to the email I sent to arrange a date and time that would suit them.

In this chapter, I first discuss the results from the first round of interviews, noting the most prevalent themes that emerged from the content and discourse analysis. In the discussion that focuses on the second set of interviewees' answers, I only discuss the themes that emerged that differed from the themes for the first round of interviews. In the analysis of both rounds of interviews, I used discourse analysis and identified themes based on specific vocabulary that interviewees used. I inferred meaning from what the interviewees mentioned without prompting and that they volunteered when discussing other questions in the interview question set. For each round of interviews, I first discuss the answers to the interview questions and then discuss the themes that emerged from the discussions.

6.2 INTERVIEWS: ROUND 1

For the first round of interviews, I was able to conduct the interviews in person, and recorded the interviews on my mobile phone, with the informed consent of the interviewees. To help with the transcriptions, I used a cloud-based application, otter.ai, that transcribed the interviews as I was completing the interviews.[20] I described the application in more detail in Section 3.7.2. The first set of interview questions, along with the rationale for each question, has been included in Section 3.6.

6.2.1 Question 1: Frequency of writing

The first question was structured in an open-ended way to ensure that interviewees could elaborate on the writing that they have to do. Question 1 asked: *How often do you need to write reports or funding proposals?* The interviewees responded with more than one timeframe because they indicated that the frequency with which they need to do formal writing depends on the type of writing that they need to do. For the purpose of this study and my discourse analysis, formal writing refers to reports or funding proposals. For this discussion, I excluded communication such as e-mails and/or conversational writing using media such as Microsoft Teams or WhatsApp for communication. Figure 6.1 shows how often interviewees mentioned the frequency with which they need to engage in the writing process.

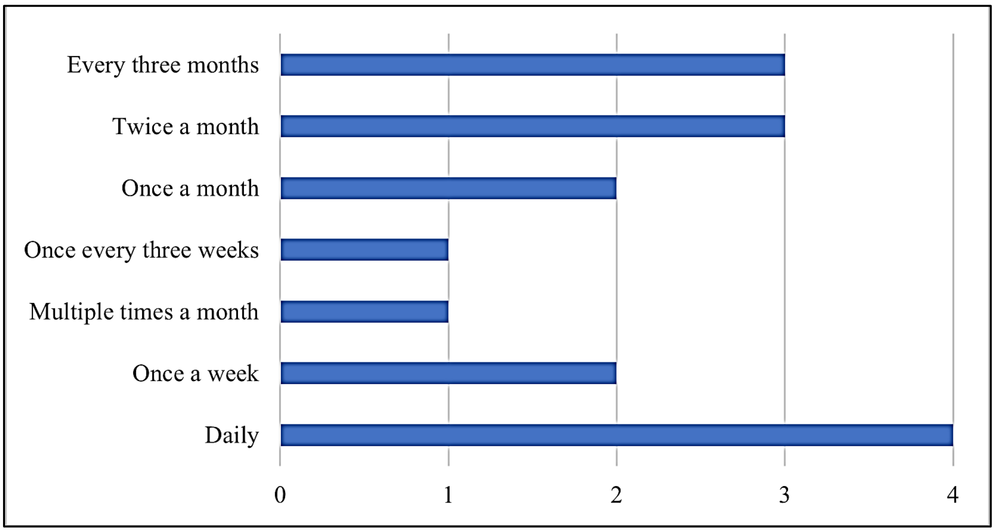


Figure 6.1: Frequency of writing as mentioned by interviewees

[20] Using this application reduced costs, and made it unnecessary to involve a transcriber, who would have had to sign a non-disclosure and confidentiality agreement, compounding the ethical challenges of the research.

According to the first round of interviewees, they need to write reports and funding proposals sporadically, as and when the company requires them to write such documents. The interviewees noted that in their company there are several different types of reports that they need to write and that these reports are not limited to funding opportunities. Some need to write funding proposals and reports as often as daily, but this varies, as some interviewees mentioned doing so only once a year. Using ATLAS.ti, I was able to generate a network of quotations relating to the frequency with which interviewees need to engage in the writing process – see Figure 6.2.

From the discussion with the interviewees, it was interesting to note that they grouped their writing of funding and research proposals into smaller groups of reports as well. With most of the interviewees, I did not need to prompt them to expand on this, as they voluntarily spoke on their writing habits and how much they write, depending on projects and reports. The majority of interviewees indicated that they write at least daily to weekly. One of the respondents indicated that he/she writes once a week but then also once every two weeks. I interpreted this response as meaning that this interviewee writes daily to weekly and also multiple times a month.

The responses confirmed that engineers need to engage in the writing process frequently. According to these responses, communication is a big part of their everyday work requirements, and they need to engage in the writing process regularly. One respondent even stated that he/she prefers writing in English to speaking because "*with writing, you have the time to review, double-checking, spellchecking these things so writing is not to be concerned. Just the effort to sit down and do it I hate*".

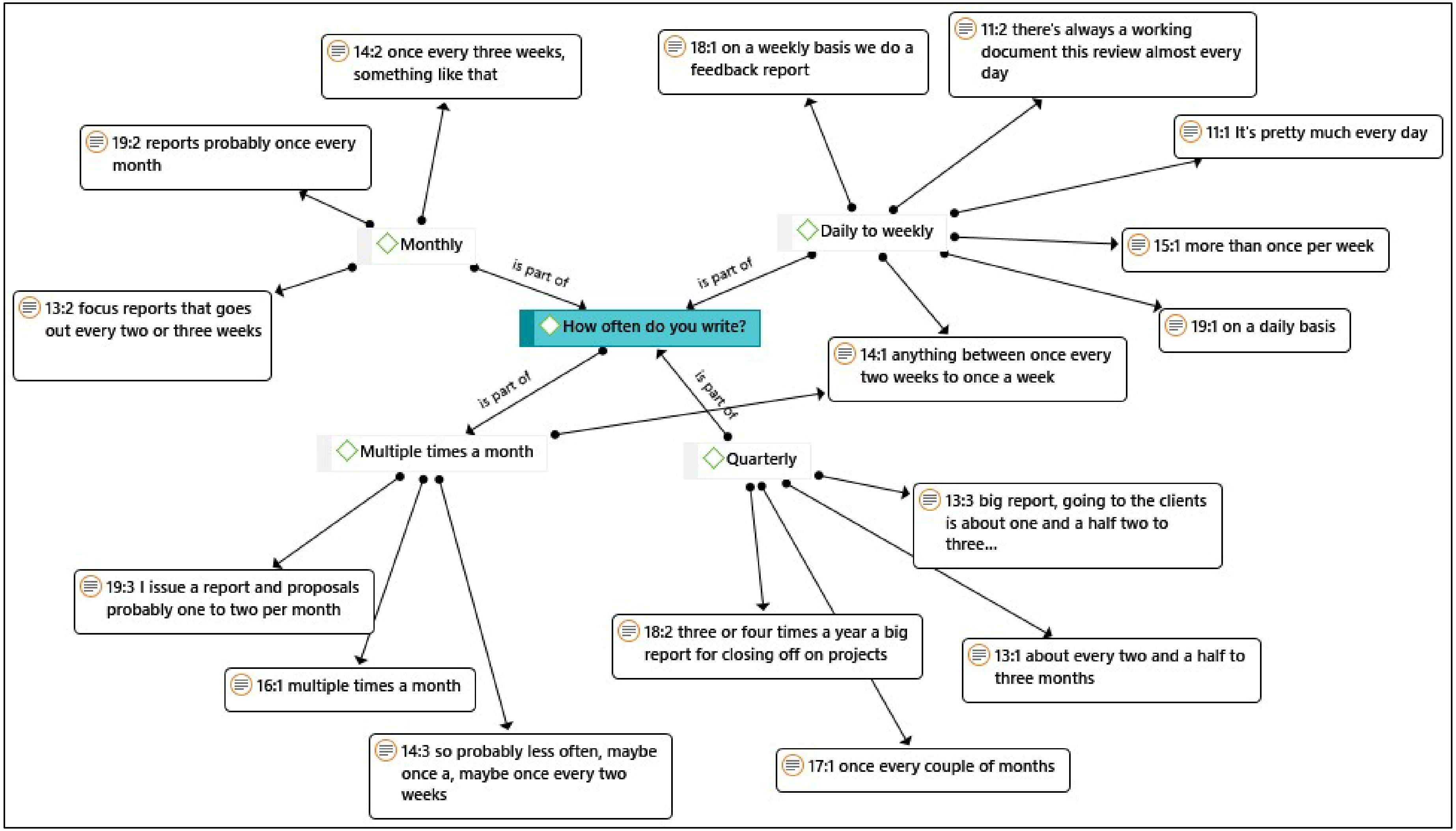


Figure 6.2: How often do you write?

6.2.2 Question 2: The audience

As explained in Chapter 2, the audience is an important consideration when deciding on the most appropriate Plain Language guidelines to use for a technical translation of a text. For the purposes of this study, it was important to establish whether the interviewees anticipate an audience of readers with the same education and background, or similar ones, or readers with a different education and background altogether. Question 2 asked: *Who are the stakeholders you must communicate with when writing funding proposals?* The second question's purpose was to probe interviewees on whom they need to write for and who they consider their audience to be. For the purpose of answering the question of whether Plain Language guidelines can be beneficial, it was first important to ask who the people are that scientists need to write for or communicate with. The interviewees' statements regarding who reads their documents are presented in Figure 6.3.

Interviewees reported that they communicate with fellow engineers within their company (the same or a similar background), as well as external clients (the same or a similar specialisation, but also completely different specialisations). The interviewees' responses revealed that the audience can be divided into three groups:

- engineers (with a technical background but not necessarily in the same field of specialisation);
- non-engineers (external clients with little to no technical knowledge or experience); and
- management (some technical background but not necessarily in the same field of specialisation).

This confirms that although the interviewees have some idea of who the audience might be, it is not always possible to determine the level at which to pitch the writing and be sure about the background of the audience. As with the first question, this question confirmed the assumption that engineers do not only communicate with other engineers that will be comfortable with the technical content of the documents.

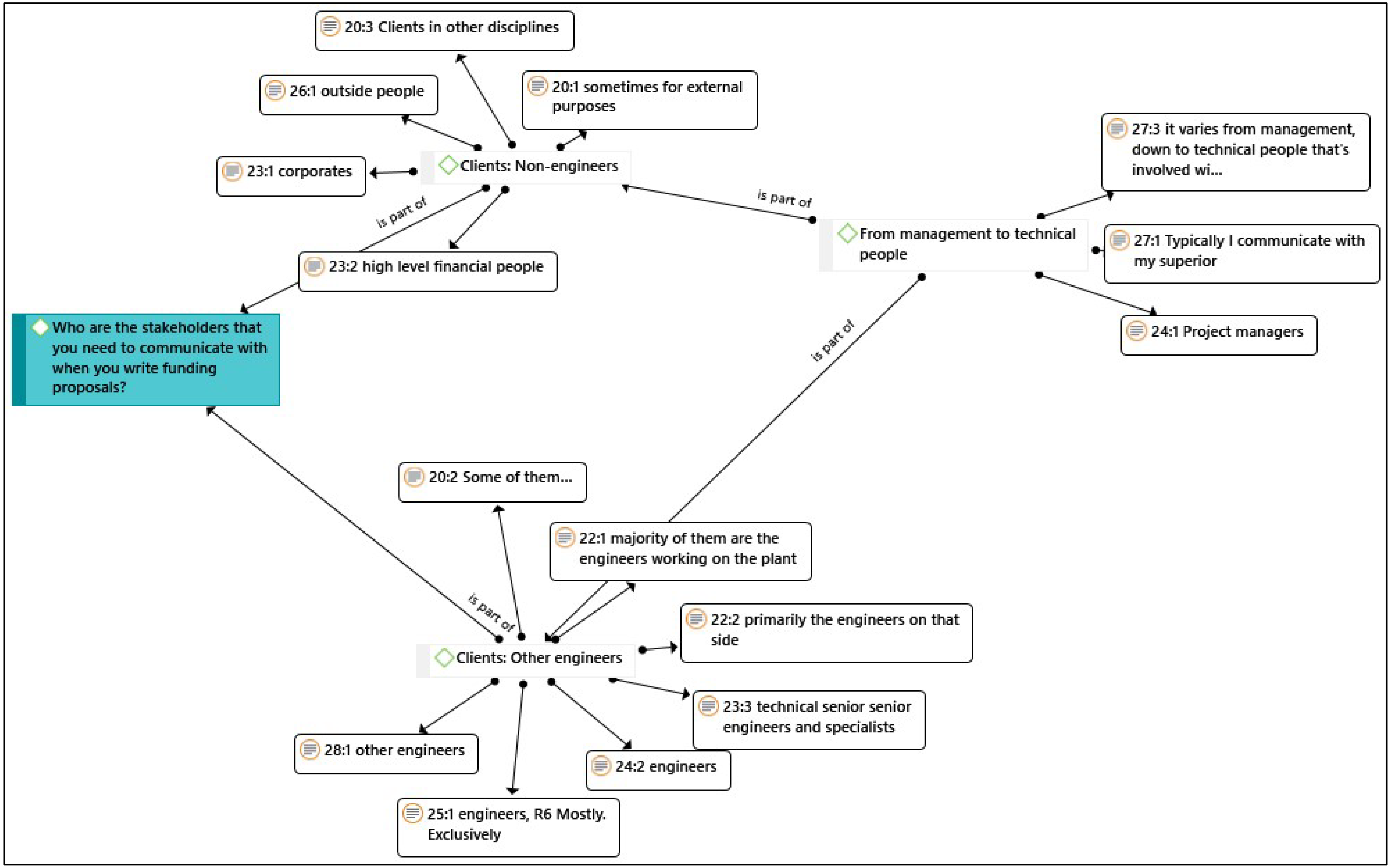


Figure 6.3: Who are the stakeholders you communicate with?

6.2.3 Question 3: Readers' understanding of technical writing

The third question related to the language that most of the interviewees use to communicate with the stakeholders that they mentioned in Question 2. Question 3 asked: *Are the documents written in technical language that your reader might not understand?* The interviewees were divided on whether readers would be able to understand the technical terminology or not. Five interviewees responded that the type of work that the company engages in necessitates specialised vocabulary. According to these interviewees, the audience tend to be more "*on the practical side*". I interpreted this to mean that the engineers that will need to read the reports are responsible for the implementation of the work that reports propose. The network of interviewees' responses to this question is set out in Figure 6.4.

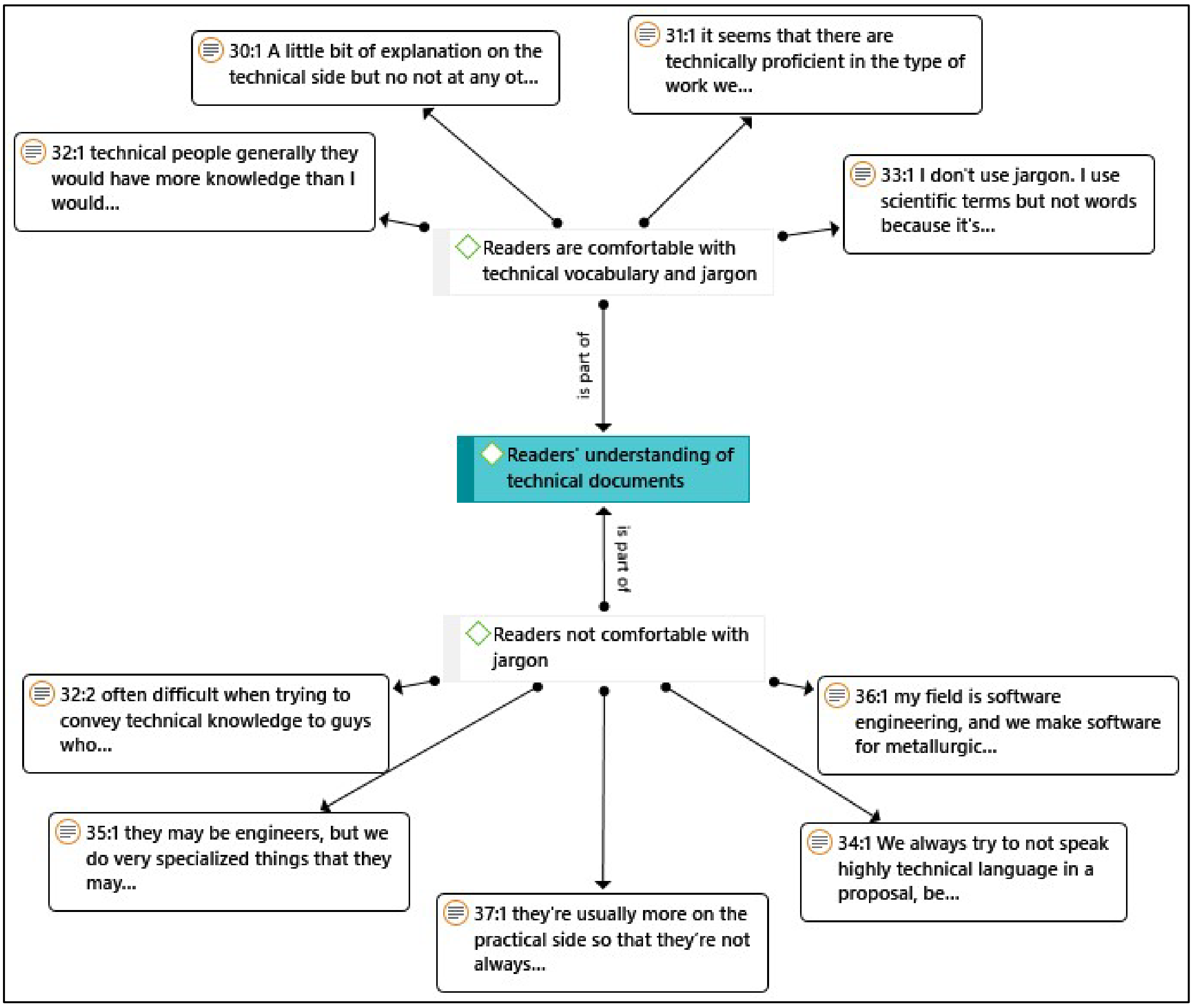


Figure 6.4: Do readers understand technical vocabulary?

Another interviewee mentioned that he/she tries not to use technical language in the proposals that he/she writes, indicating that the interviewee is aware of the difficulties related to technical vocabulary. The remaining four interviewees felt that the language in reports and proposals is not difficult to understand, and that it seems that the audience is technically proficient. Another interviewee claimed that he/she does not use jargon and therefore the audience will not have difficulties in understanding what he/she is trying to communicate. This interviewee was particularly confident in his/her writing ability, and this relates to a theme that emerged from the survey question relating to why respondents do not use the services of a language practitioner. I have already discussed this theme in Section 5.5.

6.2.4 Question 4: Strategies for clear communication

After establishing who the interviewees communicate with and whether the readers understand the technical content and technical terminology, I wanted to investigate whether engineers use specific strategies to ensure that their readers can understand them. If so, what are some of these strategies that interviewees use to clarify technical content and ensure clear communication? Therefore, Question 4 asked: *How do you usually try to accommodate the issue of someone maybe not understanding your document?* Figure 6.5 represents the four strategies that respondents use to ensure that they communicate clearly.

The interviewees' responses identified four main strategies. The first strategy that interviewees use to communicate clearly is to work with the client in face-to-face settings. The second strategy that interviewees use is that they try to get regular feedback from clients to enable them to try to understand client expectations more clearly. The third strategy that interviewees mentioned was that they ask themselves who the readers of their documents will be. This strategy shows an awareness of the Plain Language principle that urges writers always to keep the reader in mind. The last strategy that interviewees use is to communicate with clients to understand the problem that they need to investigate.

From the four themes that the interviewees mentioned, it is clear that they are aware of the communication process and actively try to mitigate any obstacles to clear communication. As the interviewees continued to discuss the strategies that they use to accommodate their readers, they showed a keen awareness of the advantages of structured writing and using macro-structuring in their documents to communicate with clients.

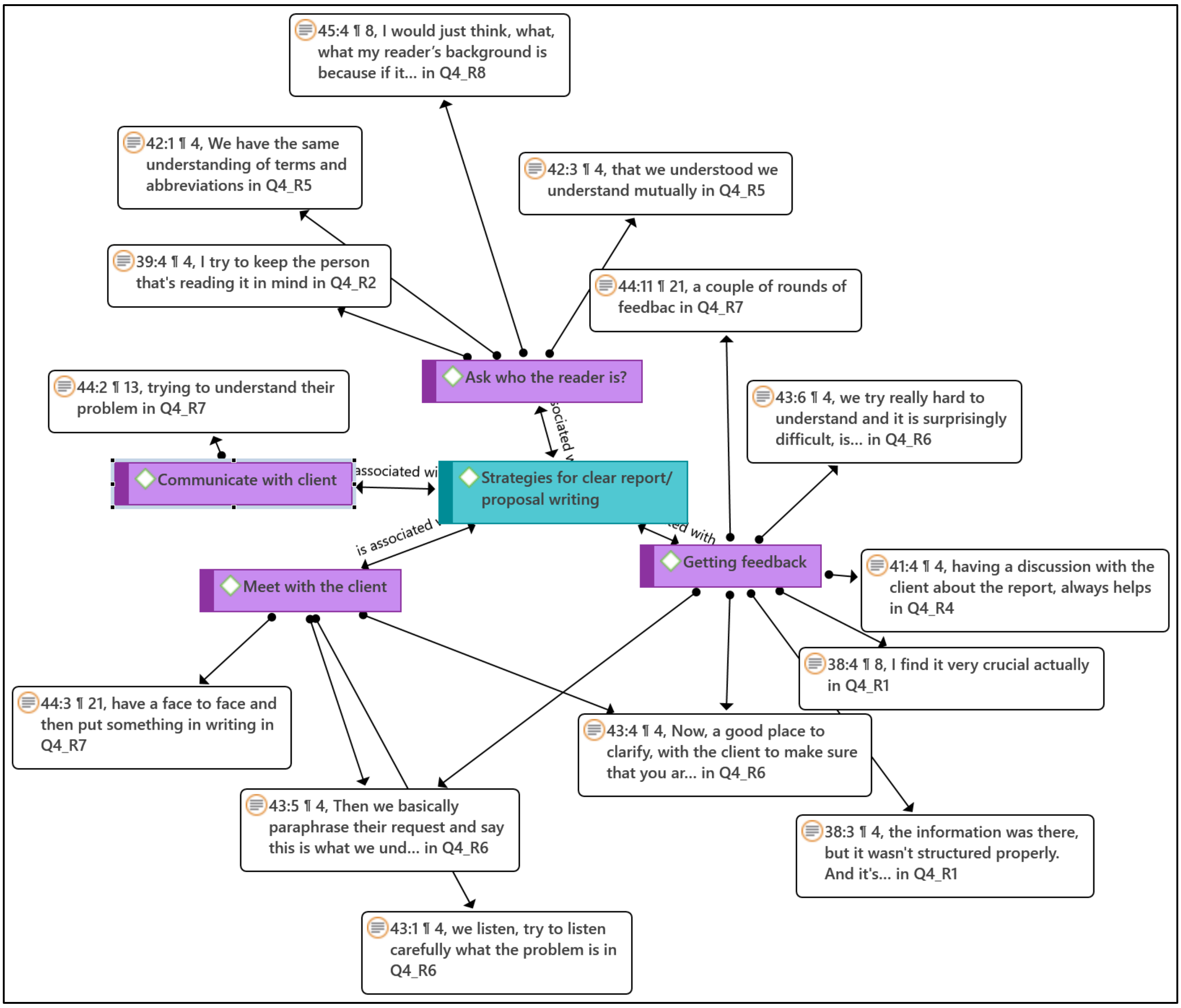


Figure 6.5: Strategies for writing clearly to accommodate readers

Besides the four strategies already discussed, another theme that emerged as a strategy to accommodate an audience was structured writing. As part of this theme, interviewees mentioned that they use visuals, add explanations, and try to structure the information with headings. They also mentioned that in their writing, they try to be specific and use bullet points where it is possible to do so. These strategies align with my Plain Language Guidelines 1, 2, and 4. Figure 6.6 shows the interconnected network of comments that specifically relate to this strategy.

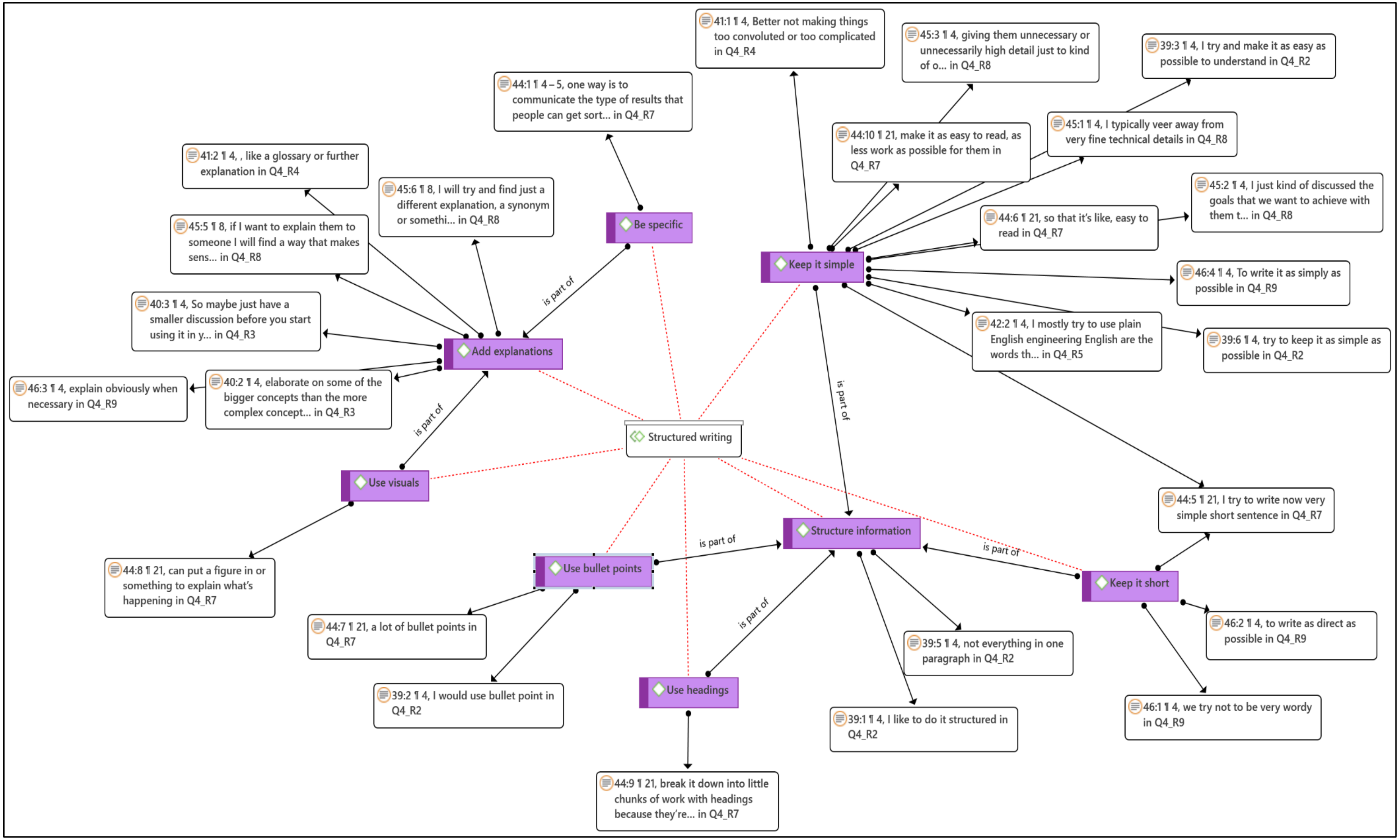


Figure 6.6: Awareness of structured writing

From the document analysis it was not evident that engineers are aware of these writing strategies, but from these interviewee responses it seemed that the assumption I made regarding engineers' not being aware of how to clearly communicate was not correct in this context. Figures 6.5 and 6.6 visually represent the extensive comments that interviewees volunteered regarding writing strategies.

6.2.5 Question 5: Repercussions of unclear writing

After discussing the interviewees' writing strategies, I wanted to probe what some of the repercussions of unclear communication in this context would be. Although the loss of funding (a monetary repercussion) seems to be obvious where funding proposals are concerned, I wanted to probe what other possible consequences there could be. Question 5 asked: *What are the repercussions, if any, of a reader not understanding your document?* The purpose of this question was to probe whether the interviewees are aware of the repercussions of unclear writing. Figure 6.7 visually represents the responses of what interviewees consider the consequences of unclear writing to be.

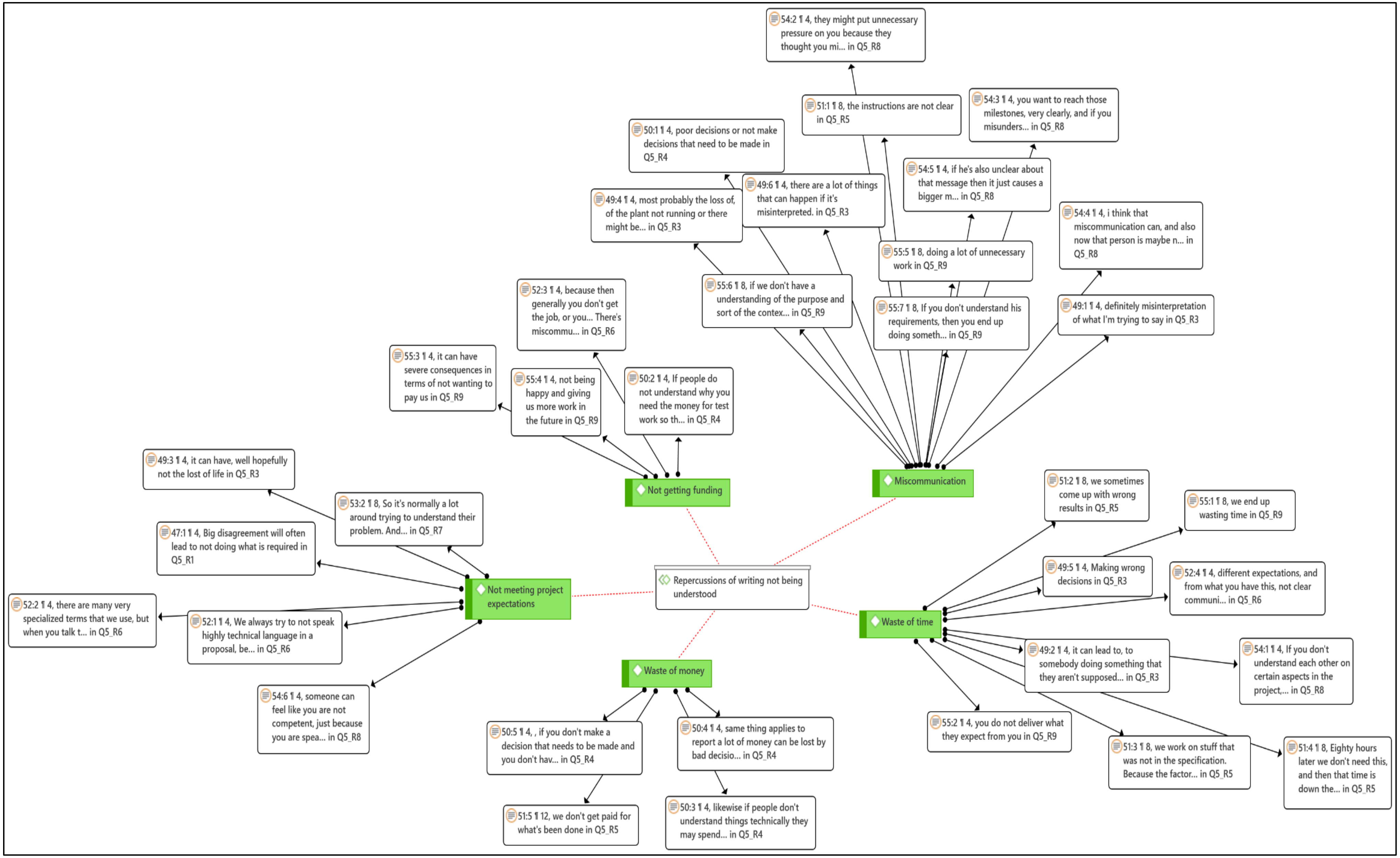


Figure 6.7: Repercussions of not being understood

From the themes that emerged from this discussion, unclear writing or any misunderstanding regarding the writing can have some consequences that goes beyond just a loss of income. My initial assumption about the repercussions of unclear writing and communication only related to monetary aspects. Although my focus is on funding proposals, in retrospect, the wording for this question might have been too broad, which resulted in interviewees' mentioning wider themes than just that which relate to funding proposals.

For this question, the five main themes that emerged from this discussion were:

- waste of time;
- waste of money;
- miscommunication;
- not getting funding; and
- not meeting project expectations.

From Figure 6.7, it is clear that there are several more repercussions to consider than just monetary,[21] but for the purposes of this discussion, these comments show an awareness that clear writing is important and that it is something that interviewees actively consider.

6.2.6 Question 6 and Question 7: Plain Language and its perceived benefits

After establishing the writing habits of interviewees, the second section of the interview focused on Plain Language and the possible benefits it could have for the interviewees' industries. Questions 6 and 7 were the following:

Question 6: *The definition of Plain Language is:*
The writing and setting out of essential information in a way that gives a cooperative, motivated person a good chance of understanding it at first reading, and in the same sense that the writer meant it to be understood.
Have you ever heard of this before?

Question 7: *Do you think Plain Language can be beneficial to your industry?*

To provide context to the interviewees for the questions that followed, I read Cutts's (2013:iv) definition of Plain Language and then asked whether or not the interviewees had heard of this

[21] It could be argued that each of these has monetary implications.

definition before. As a follow-up to the first question, my next question asked whether the interviewees believed Plain Language could benefit the industry that they worked in.

Seven out of the nine interviewees stated that they had not heard the Plain Language definition before, but all of the interviewees were of the opinion that Plain Language can benefit technical industries. Without my probing further, several interviewees elaborated on why they thought Plain Language could benefit their industry. I visually represented these opinions in Figure 6.8.

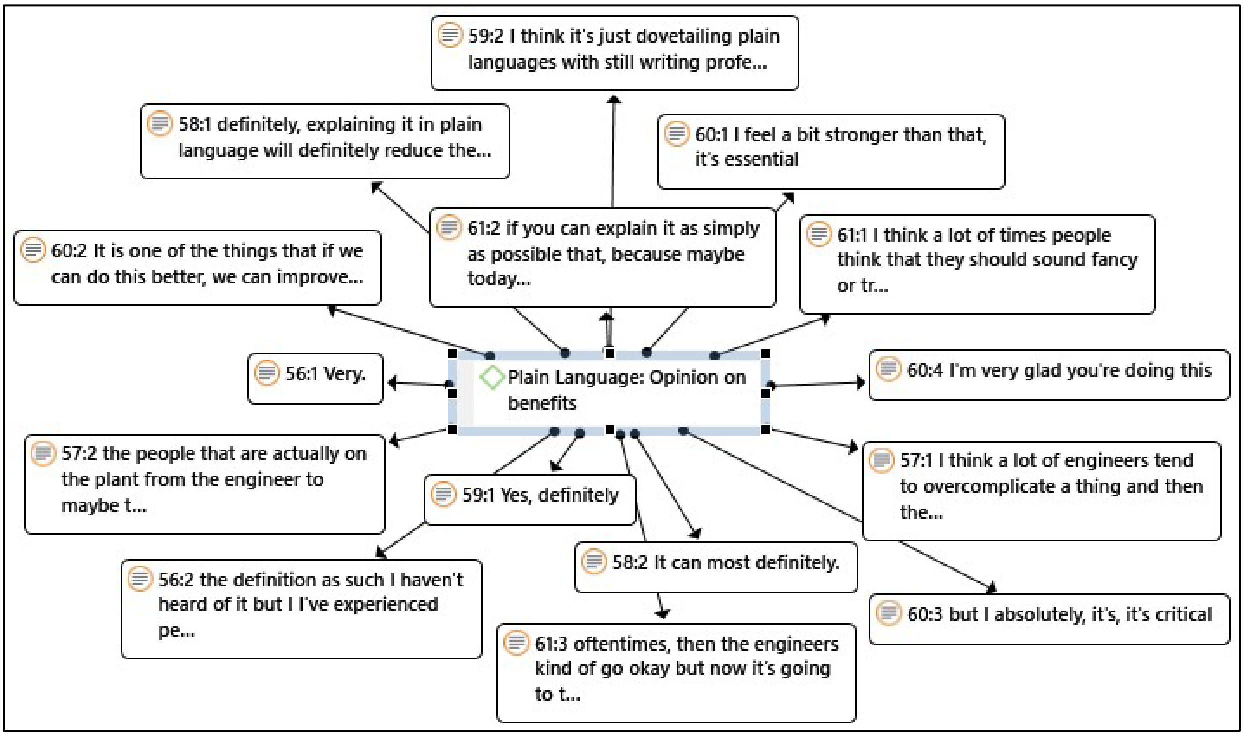


Figure 6.8: Interviewees' opinions on the benefits of Plain Language

One interviewee stated that he/she did not think it could benefit only the industry but that it was "*essential*". Another interviewee expressed the opinion that "*a lot of engineers tend to overcomplicate a thing*" and another interviewee lightly remarked that "*people think that they should sound fancy*".

Although it was promising to have interviewees express an interest in Plain Language and all reacted very positively to the idea of Plain Language, I need to note the possibility of acquiescence response bias, as described by Holbrook (2011:1). Although I ensured confidentiality for all interviewees in this study and emphasised that there is no right or wrong answer, I cannot ignore the possibility that they might have been giving me the answers I wanted to hear for the sake of social desirability, against which Collins *et al*. (2005:191) warn.

The setting of an in-person interview can lead to interviewees giving answers that they think the interviewer wants to hear (Collins *et al*., 2005:192).

The last two questions of the interview focused on the language profession and the practicalities of a collaboration between engineers and language practitioners.

6.2.7 Question 8 and Question 9: Language practitioners

In Section 2.4, I examined how scientists currently communicate complicated scientific information and to what extent they collaborate with language practitioners. As already mentioned, I reviewed the website ScienceLink, dedicated to science communication that "works with researchers and academics" to "make research relevant". As I show in Section 2.4, resources available to scientists to communicate more plainly encourage scientists to collaborate with language practitioners. To investigate this further, the last two questions asked interviewees' opinions on the language services industry. The last two questions related to my two research questions that asked:

- How do scientists perceive language practitioners?
- How does this perception inform their willingness to work collaboratively on projects?

Question 8 asked: *If you think Plain Language could be beneficial, would you be willing to work with a Plain Language Practitioner on your documents?*. All the interviewees indicated that they would be willing to work with a language practitioner and one of the interviewees commented that his/her view is that "*if you have a cold you go to a doctor, if you want to fix your sentence you give it to the language expert*". Several interviewees expressed the opinion that communication is very important and that they think language review is really important. Only two interviewees noted concern about the practicalities of such an arrangement.

Again, social desirability bias (Collins *et al*., 2005:192) might have played a role. In an attempt to mitigate bias towards me as the interviewer, as suggested by Collins *et al*. (2005:192), I designed a follow-up question to give interviewees a chance to expand on the problems that they foresaw working with a language practitioner. Question 9 asked: *What are the problems you foresee working with a Plain Language Practitioner?* The purpose of Question 9 was to gauge what the honest feelings of the interviewees were even if the first answer was an overwhelming "yes". Using discourse analysis, I was able to infer their true opinions through the specific vocabulary they used. I visually represented the interviewees' concerns in Figure 6.9.

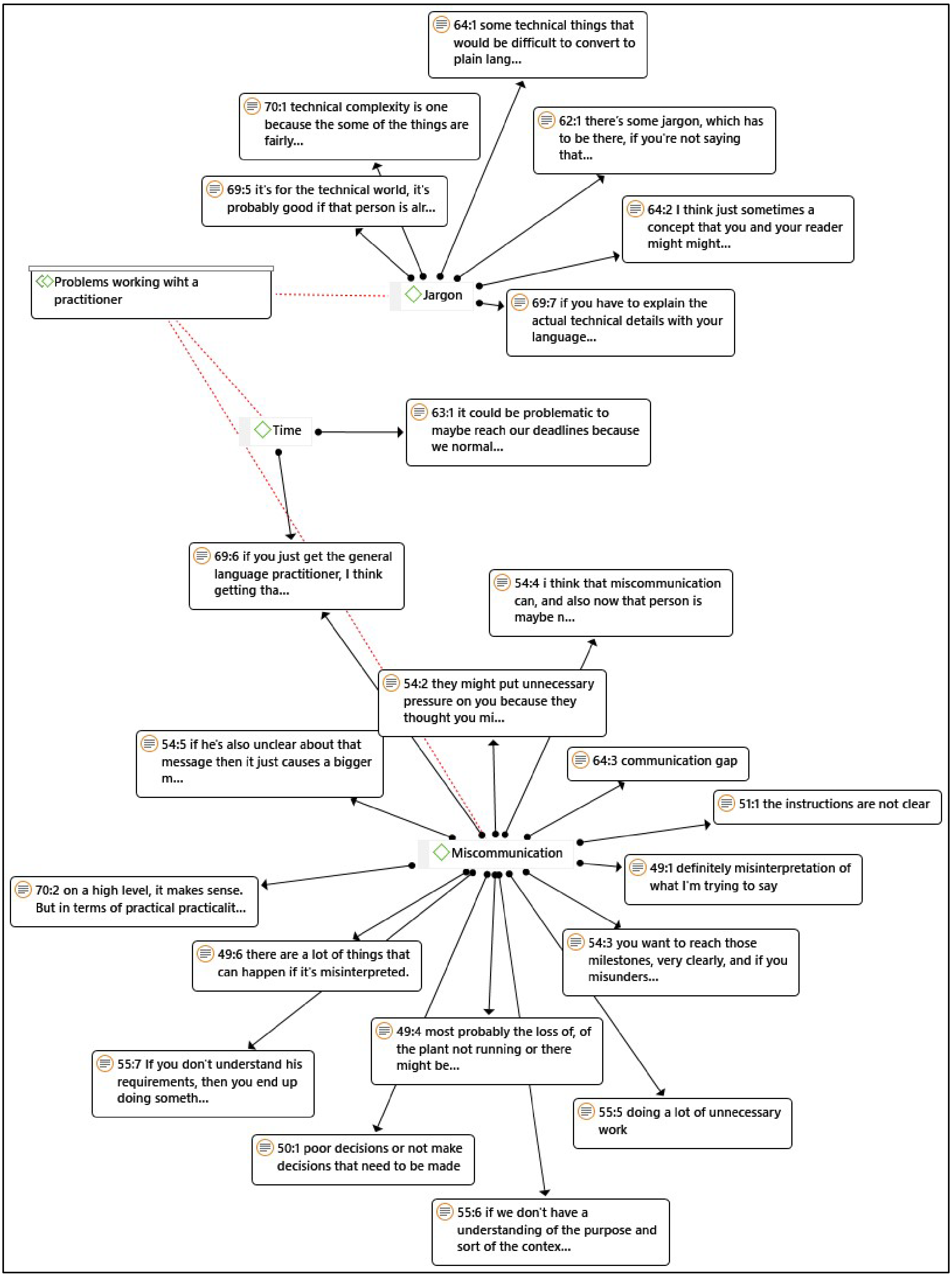


Figure 6.9: Problems working with language practitioner

The three main themes that emerged from this open-ended question were technical terminology, time, and miscommunication.

Overall, the interviewees raised the concern that a language practitioner might not understand the technical terminology that they need to use in their documents. One interviewee noted that some of the technical terminology would be very difficult to *"convert"* to Plain Language. Another interviewee pointed out that if one needs to explain all the technical terms to the language practitioner, it might not be practical to work with just any language practitioner, and it might take too much time to finish a project. This then also related to the second theme that emerged: time.

Interviewees mentioned that they work under very tight time constraints and that these tight deadlines result in not enough time for an outside person also to review documents before they submit their funding proposals. If they need to work with a general language practitioner, it will take the practitioner a long time to work through a document and this might also cause a delay in finalising the document.

The last theme was miscommunication. Interviewees had the most comments relating to this theme. One interviewee commented that "*on a high level it makes sense but practically, I think it might be difficult to transfer that knowledge to someone else who doesn't… doesn't work with it with his own daily basis*". This comment registered concern about being able to transfer very specialised knowledge to a language practitioner. Another interviewee also noted that there is a concern around a "*communication gap*" and also that there might be a "*misrepresentation*" of information on the part of the language practitioner. This reflects the concerns that Joubert and Mkansi (2020:786) also raise regarding science journalism and untrained science journalists.

The survey respondents expanded on this theme with comments related to why they do not make use of a language practitioner. I have already discussed these responses in detail in Section 5.5.2.

6.2.8 Question 10: Advantages and disadvantages of using templates

After concluding my discussion with interviewees regarding language practitioners, I wanted to probe interviewees' opinions regarding templates. From my document analyses, I experienced the templates for the funding proposals as cumbersome and restrictive. I wanted to test the interviewees' experience regarding templates. Therefore, Question 10 asked*: For your reports and funding proposals, you use templates. What are some of the advantages and disadvantages for you using templates?* All the interviewees from the first round responded very positively towards templates and they all indicated that they preferred working with templates, giving various reasons (see Figure 6.10).

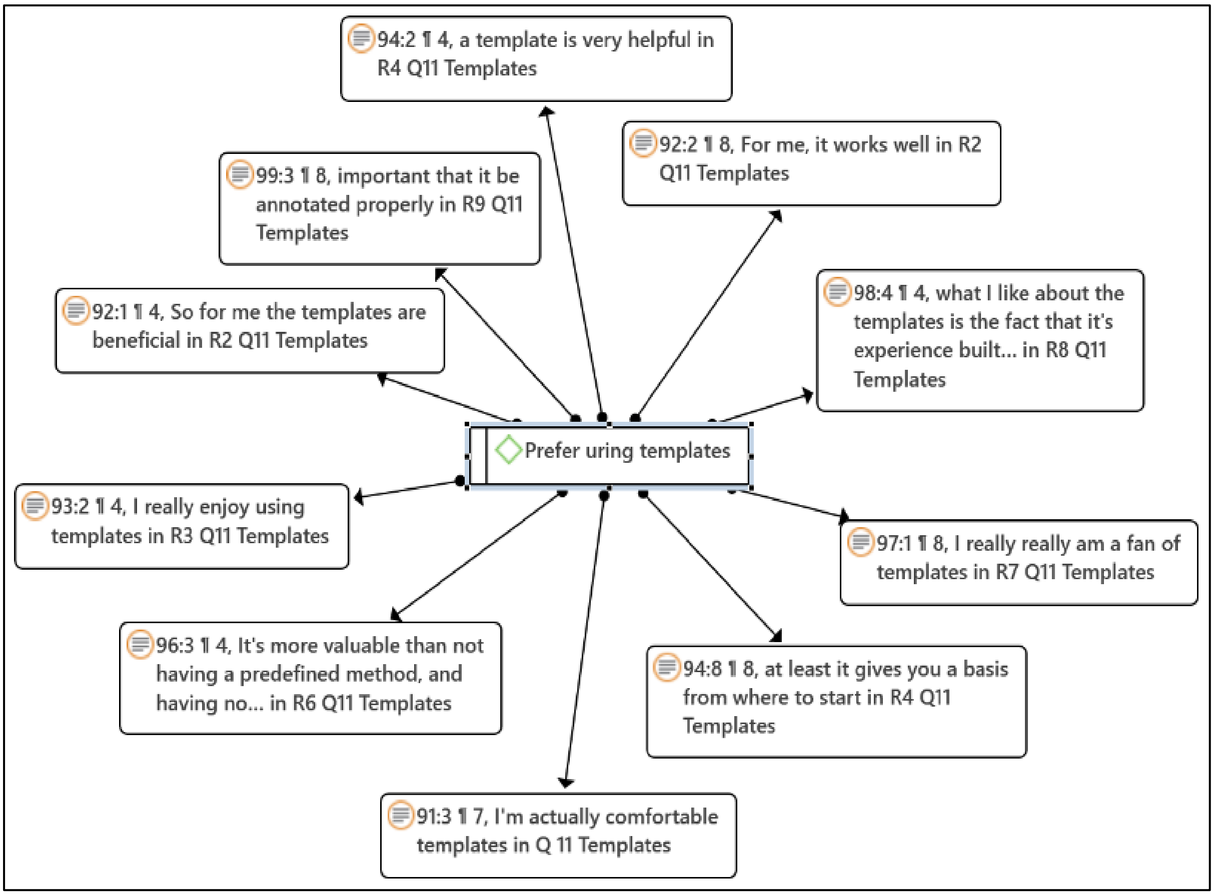


Figure 6.10: Reasons for preferring templates

Interviewees commented that they found templates "*very helpful*", "*beneficial*" and "*valuable*". One interviewee explained that he/she considers templates valuable because it is "*experience built into a document so many people have come across these certain aspects of boundaries, and they give some guidelines for you*". Another interviewee noted that it "*gives you a basis to start from*".

I asked the interviewees to expand on some of the advantages or disadvantages in the use of templates. The interviewees mentioned five main advantages to using templates – they

- clarify information;
- make for easier collaboration;
- create equality;
- save time; and
- provide structure.

Figure 6.11 represents the comments interviewees made relating to the advantages that interviewees experience working with templates.

For the first advantage, an interviewee mentioned that he/she feared being misunderstood, and felt that a template allowed him/her to get his/her information across as clearly as possible. Another interviewee mentioned that templates allow multiple people to collaborate on a document as each author knows exactly what information to include in each section of a template. This is then the second advantage of using templates. The third advantage that emerged from the comments by interviewees was that templates create equality. Templates allow various scientific methods to be judged equally and aid readers' understanding of the content because they know what to expect from a document. Another interviewee mentioned consistency and that this then makes it easier to define information. The fourth advantage that interviewees identified was that templates save time. Four interviewees mentioned that they think one advantage to using templates is that it helps them to write faster and saves time when it comes to the writing process. The last advantage that interviewees mentioned was that templates provide structure. This last advantage was the advantage interviewees identified and mentioned the most for this question. One interviewee stated that *"at least you can start"* when using a template and another interviewee also stated that *"starting with something is always a difficult, just for me personally, I think to get going"*. A third interviewee mentioned that just *"thinking about the structure of a document is often like the longest piece and it's a big hurdle to starting"*.

When I asked interviewees about some of the disadvantages to using templates, most interviewees did not feel that there were any disadvantages to using templates. They only identified two disadvantages to using a template, namely that they have to "learn" the template, and that the content does not always fit the template requirements. Figure 6.12 shows interviewees' comments relating to the two disadvantages that they experience in using templates.

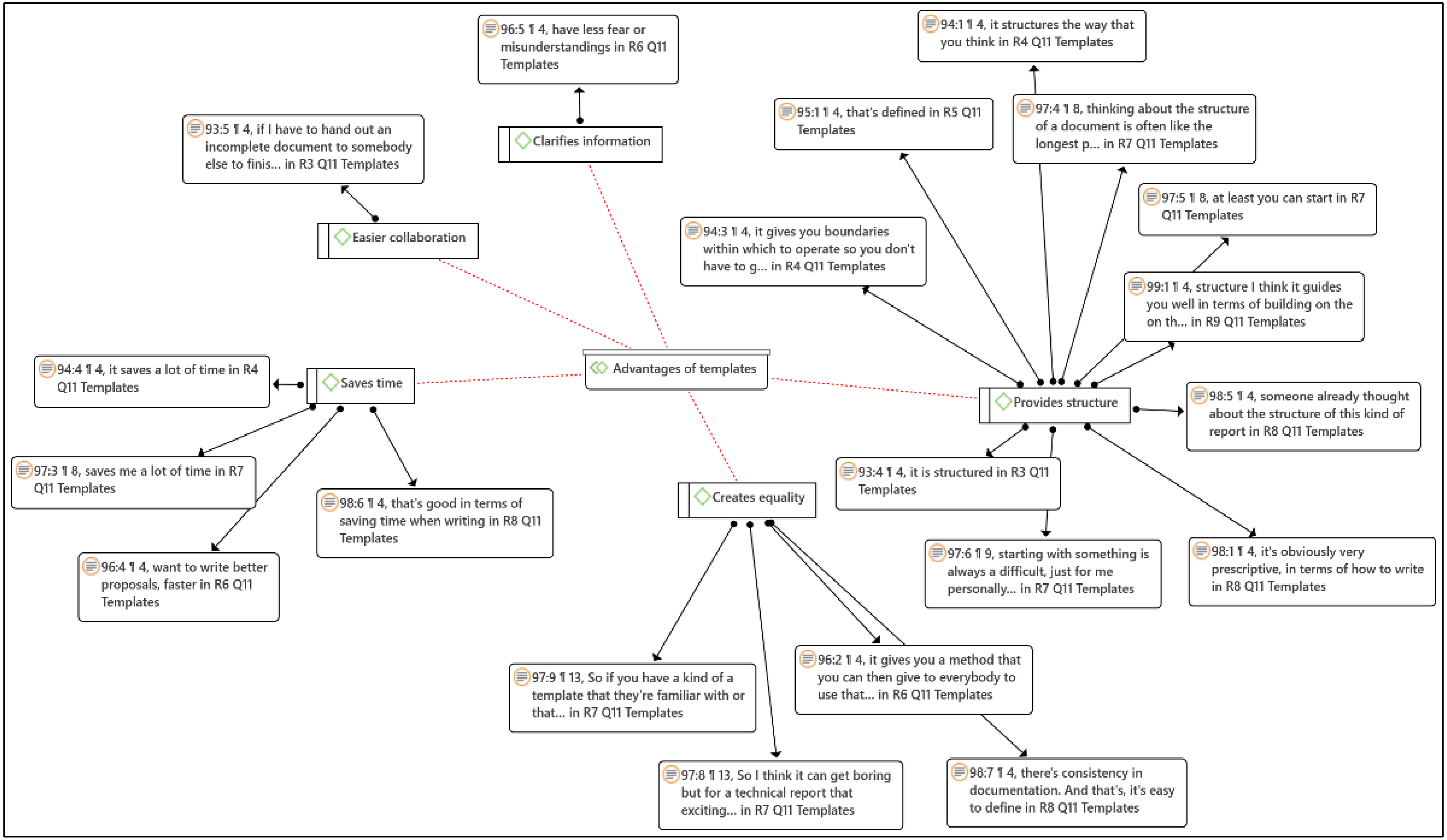


Figure 6.11: Advantages of using templates

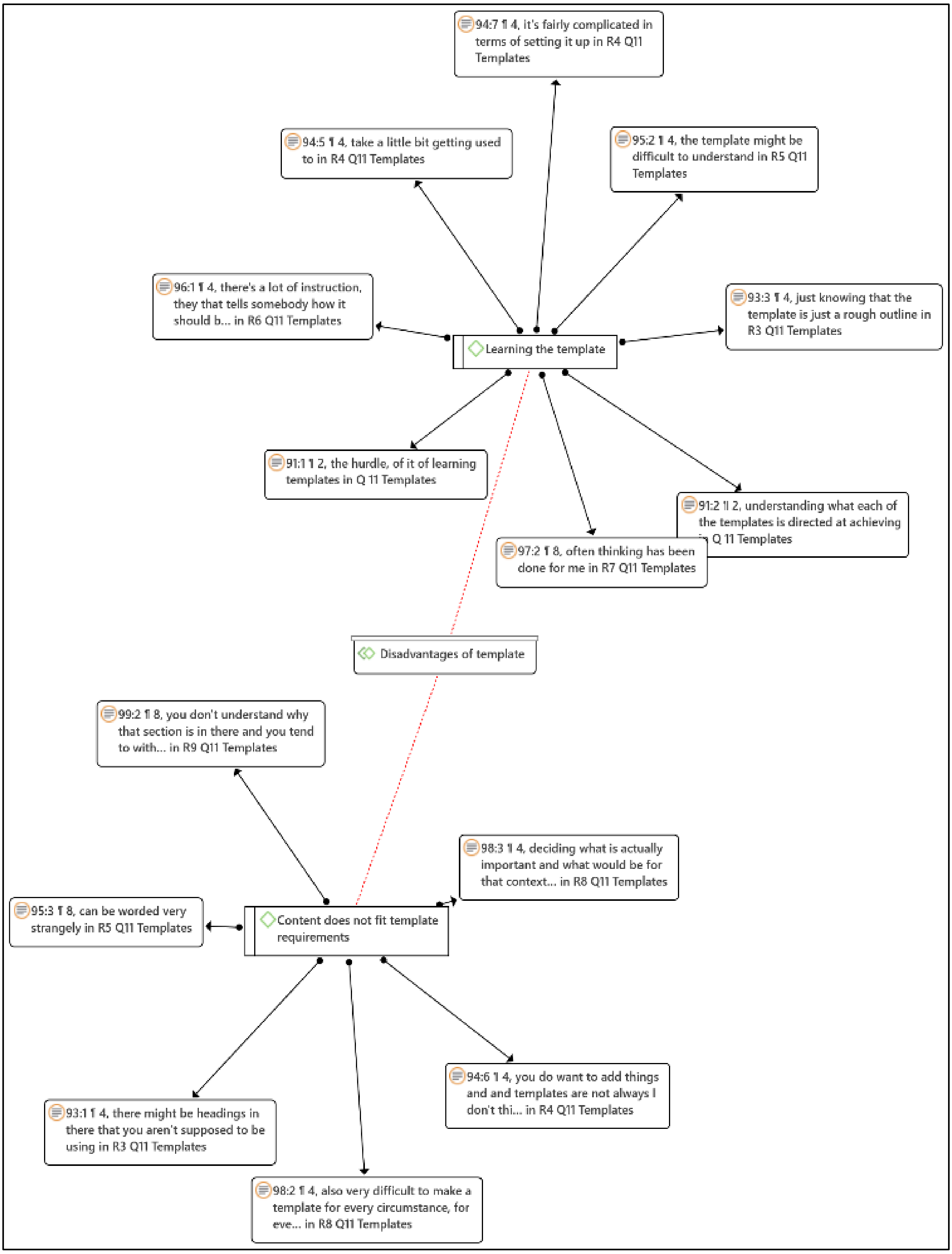


Figure 6.12: Disadvantages of using templates

The first disadvantage that interviewees experience is that it can take time to learn the template and understand what each section requires. One interviewee stated that it is "*fairly complicated in terms of setting it up*"; one interviewee said that templates can "*take a little bit getting used* *to*", and another stated that templates "*might be difficult to understand*". The second disadvantage that interviewees mentioned was that templates can be limiting in the type of content that one can add. One interviewee stated that it is "*also very difficult to make a template for every circumstance*". Another mentioned that sometimes "*you don't understand why that section is in there you tend to with your own interpretation of what you think the heading means and you write down garbage*". This last statement confirms the importance of my first Plain Language guideline, instructing funding proposal applicants to organise information in a way that enhances the likelihood that readers will grasp the information early and navigate through the document easily.

6.2.9 Question 11: When you completed the survey, what were some of the factors that influenced you choosing one example text over another?

The purpose of Question 11 was to discuss some of the factors that influenced interviewees' reasons for preferring one sample text over another in the survey example sets. Several interviewees noted that they did not have time to complete the survey and completed it as quickly as they could. For the purpose of this study, this is not necessarily a drawback as most proposal reviewers also work under time pressure to review funding proposals. The interviewees added that they chose the examples texts based on "*gut feel*" most of the time. They did, however, mention certain elements of the examples that stood out and that they still remembered the day after completing the survey. Figure 6.13 summarises the comments interviewees made regarding the factors that prompted them to choose one example text over another.

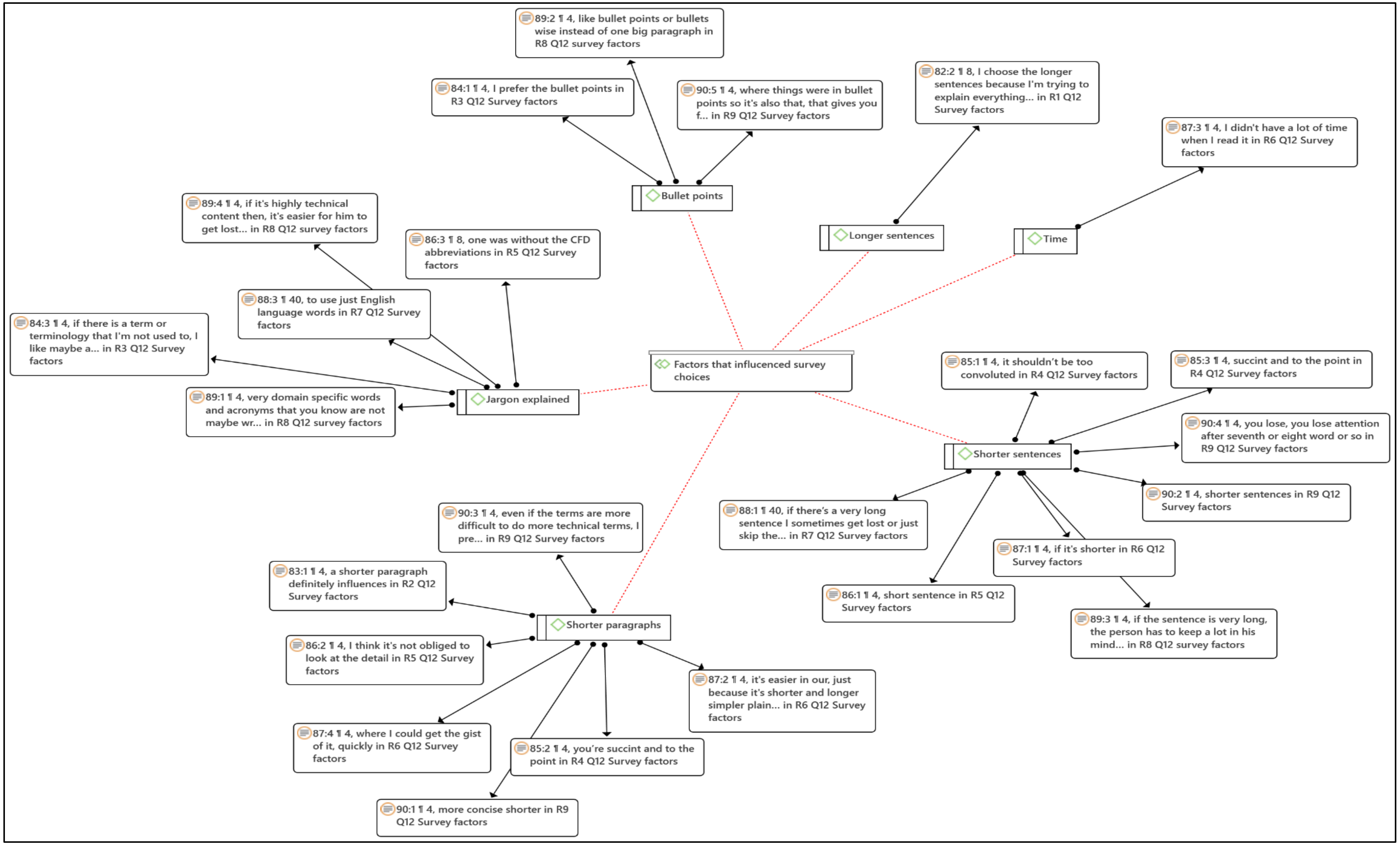


Figure 6.13: Factors that influenced survey example choices

Most interviewees expressed a preference for shorter sentences and shorter paragraphs. Interviewees also preferred the sample texts that used bullet points. Another interviewee indicated that he/she preferred the option that he/she could read the quickest. Interviewees also indicated that they preferred the examples where technical terminology was first explained or the technical language was more understandable. One interviewee stated that he/she actually preferred longer sentences and another interviewee commented that he/she thought it was still important to sound professional in the writing.

Interviewees mentioned that they preferred shorter paragraphs because it helps you to be "*succinct and to the point*", and that "*a shorter paragraph definitely influences what they're actually trying to say that is that influenced me from a layman's perspective*". Another interviewee specifically mentioned the sentence length along with the paragraph: "*So, even if the terms are more difficult to do more technical terms, I prefer shorter text, because I think you lose, you lose attention after seventh or eight word or so.*" This also relates to the Plain Language guideline that states that sentences should be between 15 and 20 words, the next factor that interviewees mentioned that influenced their survey choices. Interviewees preferred the example in the survey that had "*shorter sentences*". One stated that "*if there's a very long sentence I sometimes get lost or just skip the second half of the sentence*". Although only one interviewee mentioned specifics in terms of the actual number of words, with one interviewee commenting that "*if the sentence is very long, the person has to keep a lot in his mind*". However, one interviewee preferred longer sentences because "*I'm trying to explain everything*". There is a possibility that this interviewee might have misunderstood the question, because the statement relates more to his/her own writing than directly to the survey Plain Language examples.

Another point that interviewees commented on regarding the Plain Language examples was that they preferred the examples where the technical terminology was explained. One interviewee expressly stated that he/she preferred the "*one without the CFD abbreviations*" and another interviewee said that "*if it's highly technical content then, it's easier for me to get lost*". This confirms that the interviewees agreed with my second Plain Language guideline that instructs funding proposal applicants to use words that readers are likely to understand.

The last two points that interviewees made regarding their choices is that they liked the use of bullet points – especially when an interviewee was pressed for time, this influenced his/her choice. One interviewee based his/her choice on whichever example he/she understood the fastest. This actually supports my study because one of the factors that is very important for funding proposal reviews is time. Reviewers often need to do the reviews under time constraints. Three interviewees commented that they preferred bullet points, with one interviewee specifically preferring bullet points "*instead of one big paragraph*". These comments regarding bullet points support my fourth Plain Language guideline regarding breaking up complicated texts with vertical lists.

6.2.10 Overall findings of the first round of interviews

The first round of interviews resulted in interesting comments regarding the interviewees' writing process, their awareness of Plain Language principles, and their willingness to work with language practitioners. Although all the interviewees indicated that they would be willing to work with a language practitioner, they expressed concern regarding the practicalities of such a collaboration. All the interviewees expressed an opinion that Plain Language can benefit their respective industries and responded very positively to my chosen definition. The interviewees indicated that they not only preferred shorter sentences, but when they were choosing their preferred example text, they also preferred shorter paragraphs (linking to my third Plain Language guideline of writing concisely).

6.3 INTERVIEWS: ROUND 2

For the second round of interviews, some respondents to the survey indicated that they would be willing to participate in a follow-up interview. These interviewees were members of SACNASP, predominantly registered scientists from a wide range of specialisations. As discussed in Chapter 3, I conducted the second round of interviews to clarify some of the survey respondents' answers and to probe some of the themes that emerged from the first round of the interviews and the survey. For the second round of interviews, I adapted the questions for Section 1 and Section 4 and these differed from the first round of interviews. I have included a detailed rationale for the second round of interview questions in Section 3.6.3.

The national lockdown due to the Covid-19 pandemic resulted in a delay in conducting the second round of interviews. Ideally, these interviews should have taken place soon after respondents submitted their survey responses. The interviews were also not done in person but took the form of a phone call because it was not possible to meet for the second round in person. This was a major limitation as some interviewees' phone signals were weak at certain points during the course of the interviews and the quality of the recordings was not as good as with the first round of interviews. With the face-to-face interviews in the first round, interviewees volunteered information more willingly. With the telephonic interviews, some interviewees were not as comfortable volunteering information or expanding on their answers. For the discussion to follow, I mention in more detail the answers that differed significantly from the first round of interviews. Where there was a repetition of similar answers, I just briefly mention these again.

6.3.1 Question 1 and Question 2: Experience

As I already mentioned in Section 3.6.3, the second round of interviews started with a set of three demographic questions to give context for the discussion, and also to establish rapport with the interviewees. I repeated the demographic information from the survey, because of the time lapse, also to remind interviewees about the study.

I started the second round of interviews with the question of which field the respondents worked in. Interviewees worked in various fields in the sciences, including engineering. The follow-up question was how many years the interviewees had in their various fields. Answers ranged from seven years to more than 40 years' experience in their respective fields. This first question set established that the interviewees were well suited for this study.

6.3.2 Question 3 and Question 4: Writing habits

After establishing rapport with the interviewees, the interview focused on the writing that interviewees need to do as part of their everyday responsibilities. With the first round of interviews, I asked how often they need to write. I was also able to first review the survey data before conducting the second round of interviews. From these survey responses, I established that some participants do not need to write. To steer the conversation with the second round of interviewees, I started with the question on whether interviewees needed to write reports or funding proposals. This helped me to probe the interviewees about their relevant writing habits based on their answers to this question. Of the seven interviewees for the second round, six indicated that they write reports and funding proposals, but one interviewee indicated that he/she does not do any sort of writing as part of his/her duties. This interviewee volunteered that he/she is a software reviewer and only interacts verbally with clients.

After establishing that most of the interviewees do have to write in various forms, Question 4 asked: *How often do you need to write reports or funding proposals?* The responses are set out in Figure 6.14.

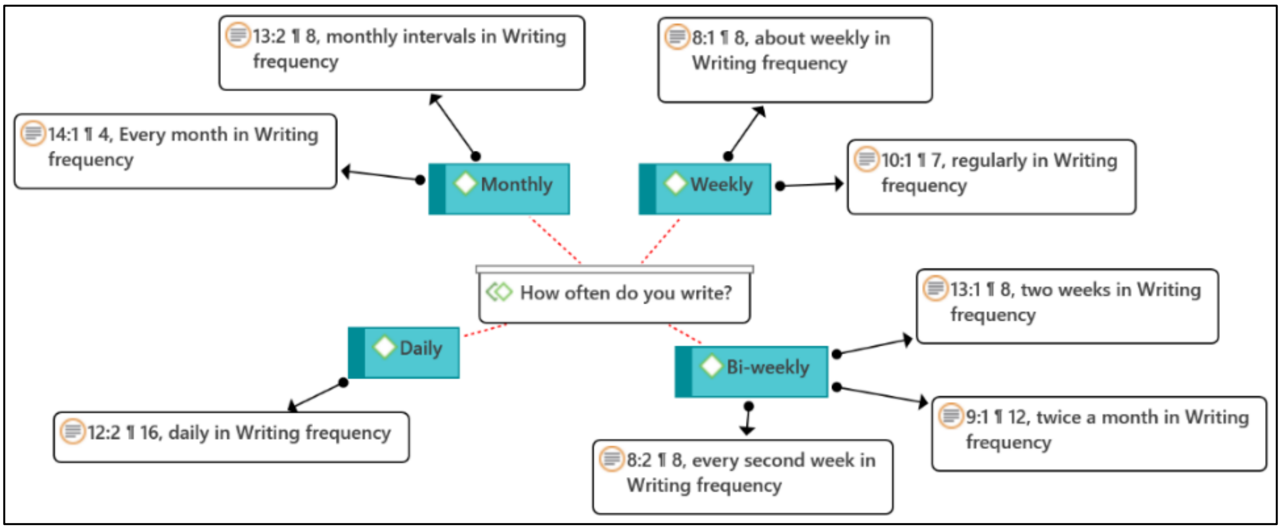


Figure 6.14: Frequency of writing, Round 2

The interviewees' answers ranged from daily to monthly. These responses are very similar to the responses that I collected in the first round of interviews and nothing novel came out of this round for the same question.

6.3.3 Question 5 and Question 6: Audience

The next two questions asked interviewees to identify the stakeholders that they need to communicate with and how often the language contains technical terminology that readers might not be able to understand. The questions were:

Question 5: *Who are the stakeholders you must communicate with when writing funding proposals?*
Question 6: *How often is your writing in a technical language that a reader might not understand?*

Interviewees indicated that they need to communicate with fellow scientists, clients, as well as the public. The public was a stakeholder that the first round of interviewees did not mention. Some interviewees from the second round indicated that they do writing that is specifically aimed at engaging the public and policy-makers. Figure 6.15 shows the interviewees' responses to Question 5.

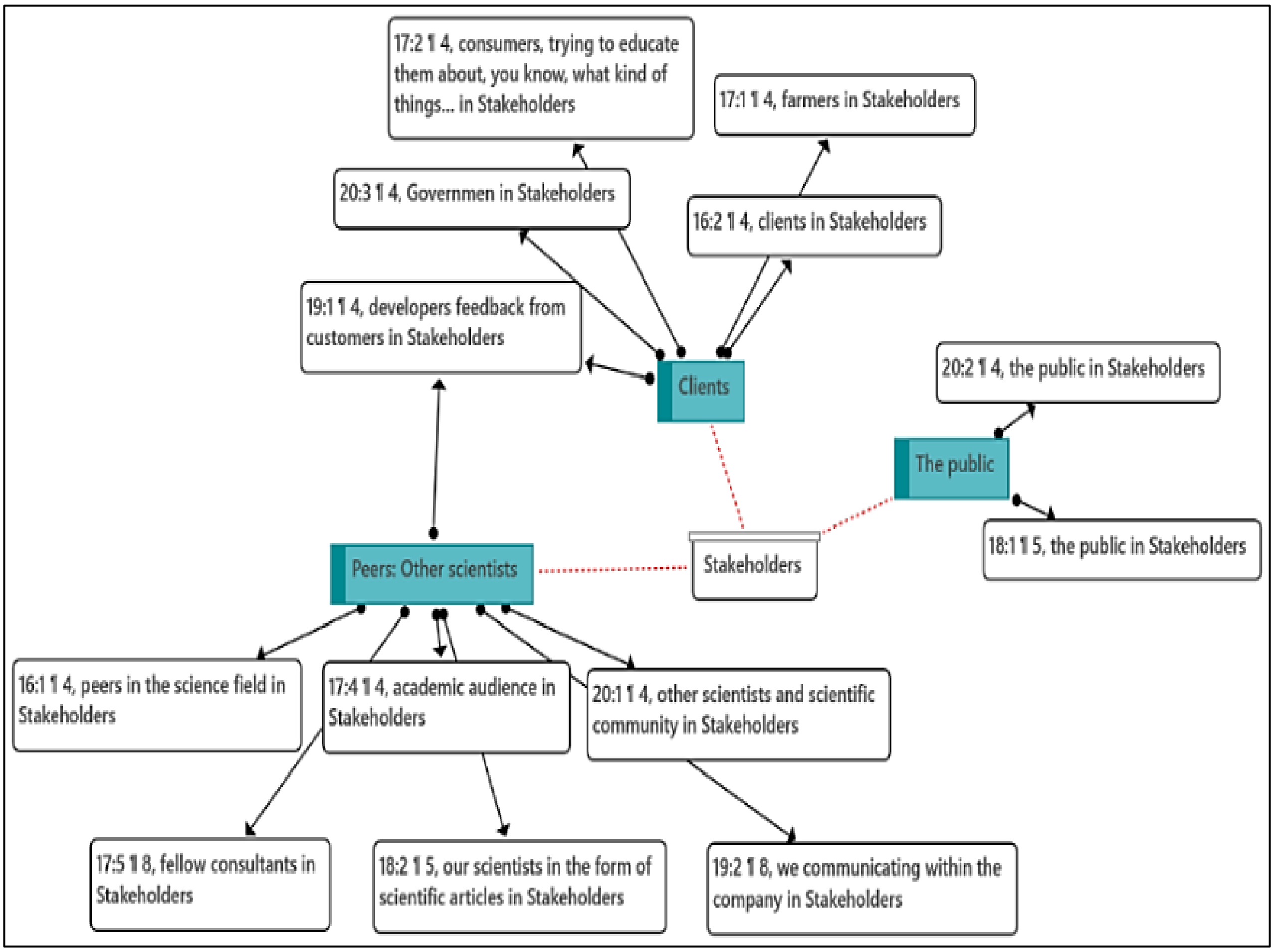


Figure 6.15: Stakeholders, Round 2

For the purpose of this study, I will not investigate this topic further, as I am not concerned with how scientists need to communicate with the public, but only in how Plain Language can assist in clarifying interdisciplinary communication as it can be applied to funding proposals.

To follow-up on Question 5, I asked interviewees in Question 6 how often the language contains technical terminology that readers might not be able to understand. From the first round of interviews, I established that scientists do use technical terminology in their writing. For this round I wanted to probe this a bit further and therefore asked interviewees to comment on how often they think that their writing contains technical terminology that readers might not be able to understand. Four out of the seven interviewees indicated that they do not know how to answer the question and three interviewees indicated that they believe about 40%, 60%, and 80% of the time their writing will contain technical language that their readers will not understand.

6.3.4 Question 7: Strategies for clear writing

I asked the next questions to gauge the interviewees' awareness of various strategies to accommodate readers who might not understand their reports or proposals. Question 7 asked: *How* *do you usually try to accommodate the issue of someone maybe not understanding your document?* I repeated this question in the second round of interviews to establish if there were different strategies that this group used to the strategies the first interviewees mentioned. This group also mentioned that they need to communicate with the public, so asking them what strategies they use provided me with some valuable insights. Figure 6.16 shows the various strategies mentioned by the second round of interviewees.

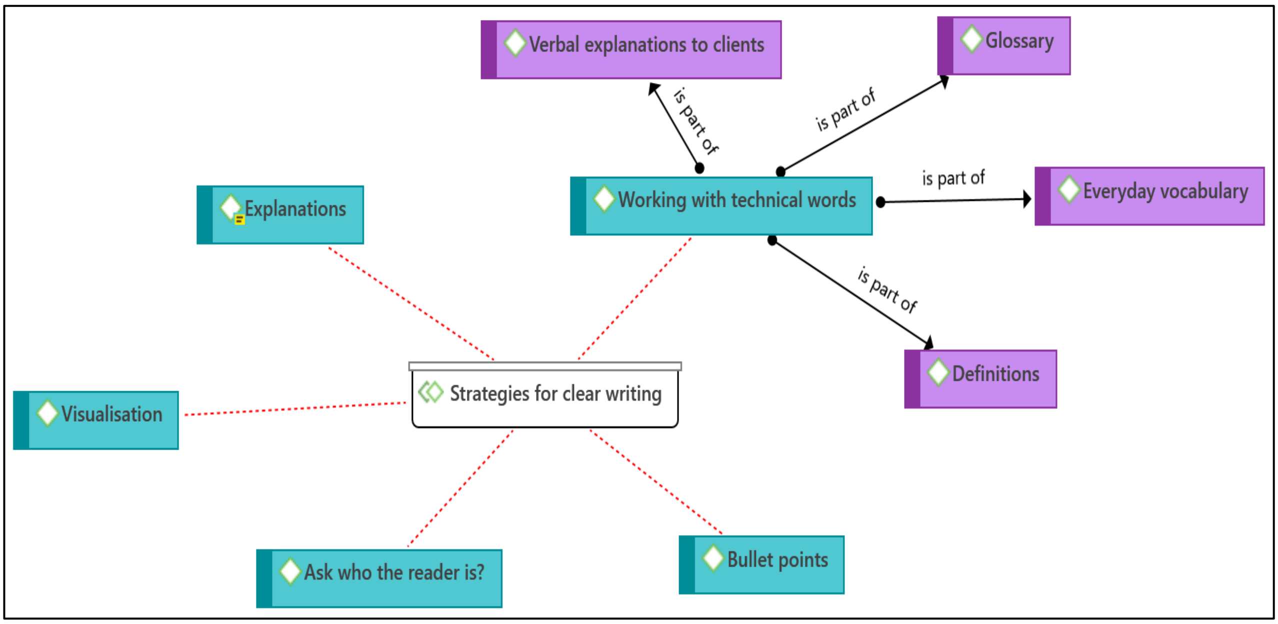


Figure 6.16: Main strategies for clear writing

The main themes that interviewees mentioned regarding strategies that they use when they attempt to write clearly were visualisation, an awareness of working with technical words, asking who the reader is, adding explanations where necessary, and using bullet points. Although the interviewees from the first round of interviews showed an extensive awareness of different ways to attempt to make their writing as clear and understandable as possible, the strategies that emerged from the second round were slightly different. One interviewee in the second round mentioned that he/she had just finished a presentation before the interview regarding unclear communication and some of the strategies he/she uses to ensure that clients understand the content of his/her writing.

The first theme that emerged from this round of interviews that differed from the first round of interviews was visualisation. In this context I used “visualisation” as a term that refers to including all manner of visuals such as figures, graphs or infographics. Interviewees mentioned infographics as one way to “visualise” information for their readers. The interviewees’ responses regarding visualisation are set out in Figure 6.17.

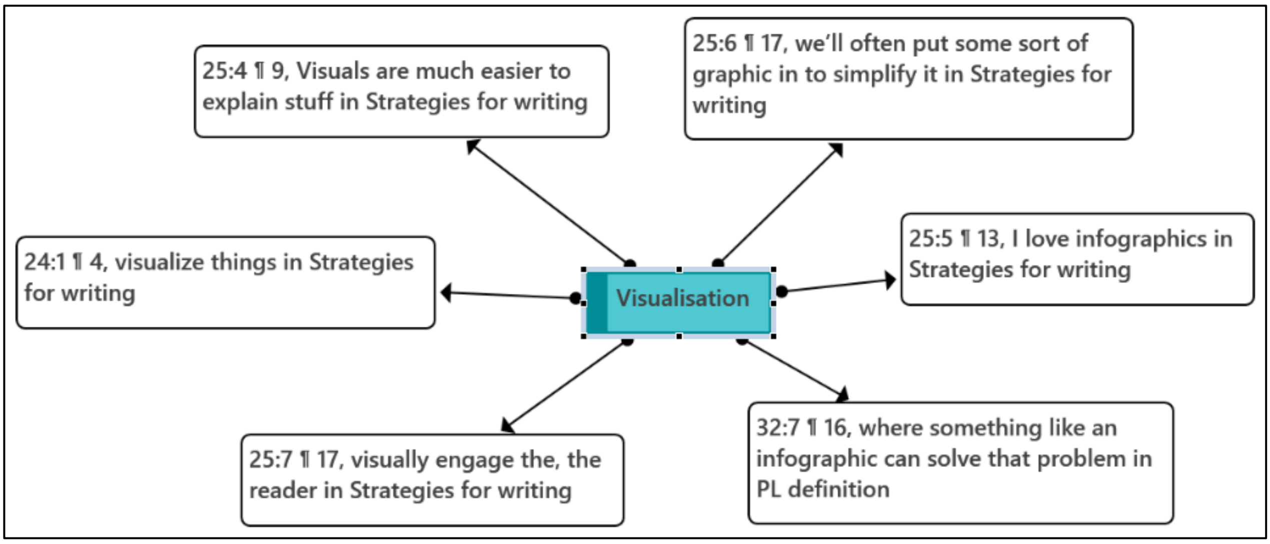


Figure 6.17: Visualisation as a strategy for clear writing

Although the interviewees from the first round of interviews mentioned visualisation as a strategy, only one interviewee mentioned it and said that he/she "*can put a figure in or something to explain what's happening*". One possible explanation for this is that the interviewees from the first round do not communicate with the public and "visualisation" might not be an option for them, as funding proposal templates do not always allow for visuals to be included.

As discussed in Chapter 4, the first document I analysed, the Technology Demonstrator, allowed visuals to be included in the appendices, but the second proposal focused more on the collaborators' experience and outputs of the project. In the second round of interview responses, visualisation as a theme was more prominent. Interviewees mentioned that they use visualisations to help simplify technical information and to engage the reader. Although interviewees mentioned infographics as a strategy to visualise information, to "*visually engage the reader*" is not very clear as a description. In future research, this concept of visually engaging the reader can be further explored. One respondent specifically mentioned that his/her life partner was a graphic designer and that he/she often thinks in terms of how to represent information in terms of visuals rather than in words.

The second strategy that interviewees mentioned was that they try to work with technical vocabulary in a few different ways. Figure 6.18 shows the four ways that interviewees use in approaching technical terminology.

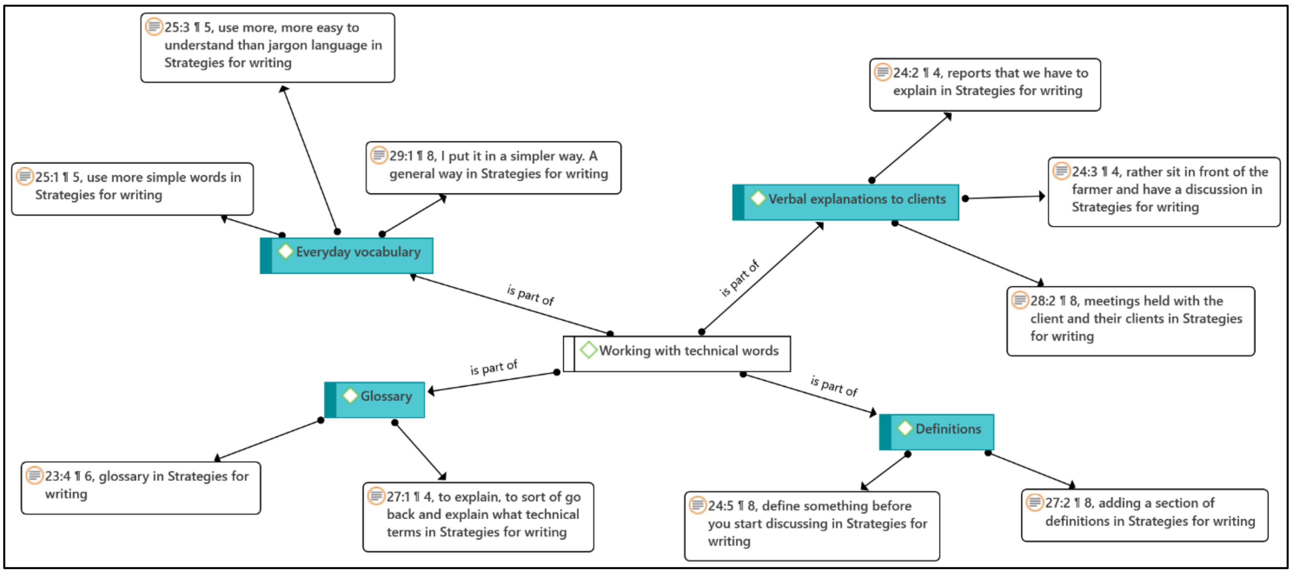


Figure 6.18: Ways that interviewees work with technical words

Although the first round of interviewees mentioned that they try to keep their writing simple, they did not mention vocabulary explicitly. The second-round interviewees specifically mentioned "*more easy to understand than jargon language*" and "*put it in a simpler way*" as strategies they use to ensure that their writing is clear. Another way that interviewees attempt to clarify technical terminology in their writing is that they use verbal explanations to supplement their writing. From the first round of interviews, supplementing writing with face-to-face meetings seems to be a popular strategy. Interviewees mentioned that they hold meetings, explain some of their reports in person and sometimes prefer to "*sit in front*" of their audience "*and have a discussion*". However, with funding proposals these verbal explanations are not always possible. The last way that interviewees mention that they attempt to clarify technical words is by using a glossary and defining concepts for the readers. Interviewees mentioned that they "*define something before you start discussing*", *"(add) a section of definitions*", and "*explain what technical terms mean*".

The remaining themes repeated from the first round of interviews and interviewees indicated that they use explanations, bullet points, and ask who the reader is. These are very similar to the first set of answers, so I do not discuss these themes in more detail again. As with the first set of answers, it is important to note that the participants in this study show an understanding of writing and an awareness of Plain Language guidelines (see Section 2.11). This was not as obvious at the start of this study as the proposals that I analysed did not apply these strategies explicitly. This could imply that although scientists are indeed aware of the strategies, they are not always skilled in applying Plain Language guidelines effectively.

6.3.5 Question 8 and Question 9: Plain Language and its perceived benefits

The next set of questions related to my chosen Plain Language definition and the perceived benefits it could have in the sciences:

Question 8: *The definition of Plain Language is:*
The writing and setting out of essential information in a way that gives a cooperative, motivated person a good chance of understanding it at first reading, and in the same sense that the writer meant it to be understood.
Have you ever heard of this before?

Question 9: *Do you think Plain Language can be beneficial to your industry?*

Two interviewees indicated that they had heard of the definition before this study, but five respondents indicated that they had not heard of the definition before. As with the first round of interviews, all the interviewees, without exception, indicated that they think Plain Language can benefit the sciences and the various industries that they work in. Figure 6.19 shows some of the comments that interviewees made regarding the benefits they thought Plain Language could potentially have.

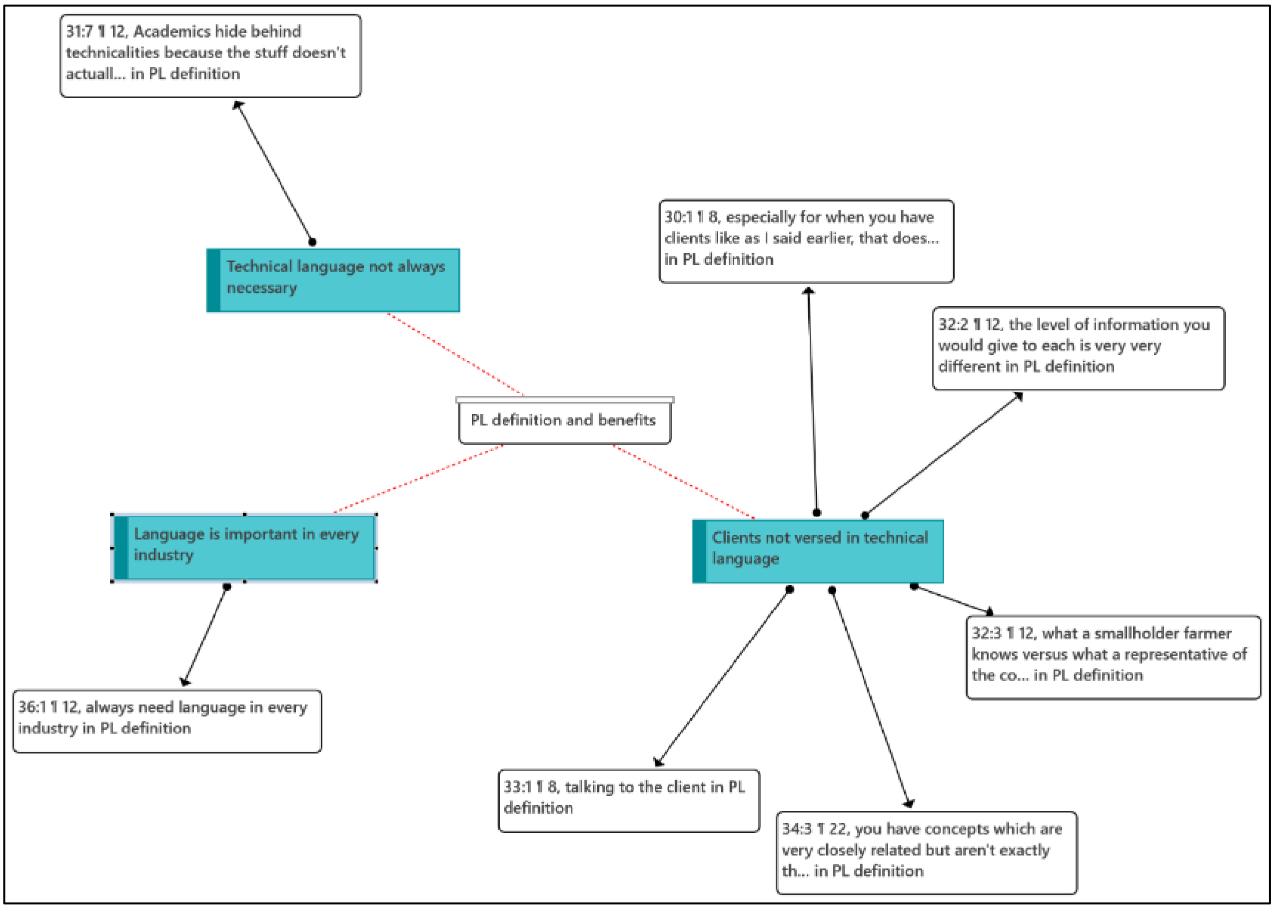


Figure 6.19: Perceived benefits of Plain Language

When I asked interviewees to expand on why they thought that Plain Language can benefit their industries, they volunteered that technical terminology is not always necessary, clients are not well versed in technical language, and language is important in all industries. Unlike the first round of interviews, interviewees were more reluctant to expand on their answers and to elaborate as extensively as the first-round of interviewees did. The three themes that these interviewees mentioned were also different to those that interviewees in Round 1 suggested (see Section 6.2.6).

6.3.6 Question 10: Factors that influenced decisions in the survey

With this question it was important to determine whether there were particular elements in the Plain Language and original text examples that influenced the interviewees to choose a specific example. Question 10 asked: *When you completed the survey, what were some of the factors that influenced you choosing one example text over another?* Interviewees were not able to remember the details of the survey because of the fact that there were too many weeks that had passed before I was able to conduct the second round of interviews. However, the interviewees were able to remember that some examples used bullet points and commented on that. Most interviewees voluntarily expanded on their preferences for certain elements of writing, and these are presented in Figure 6.20.

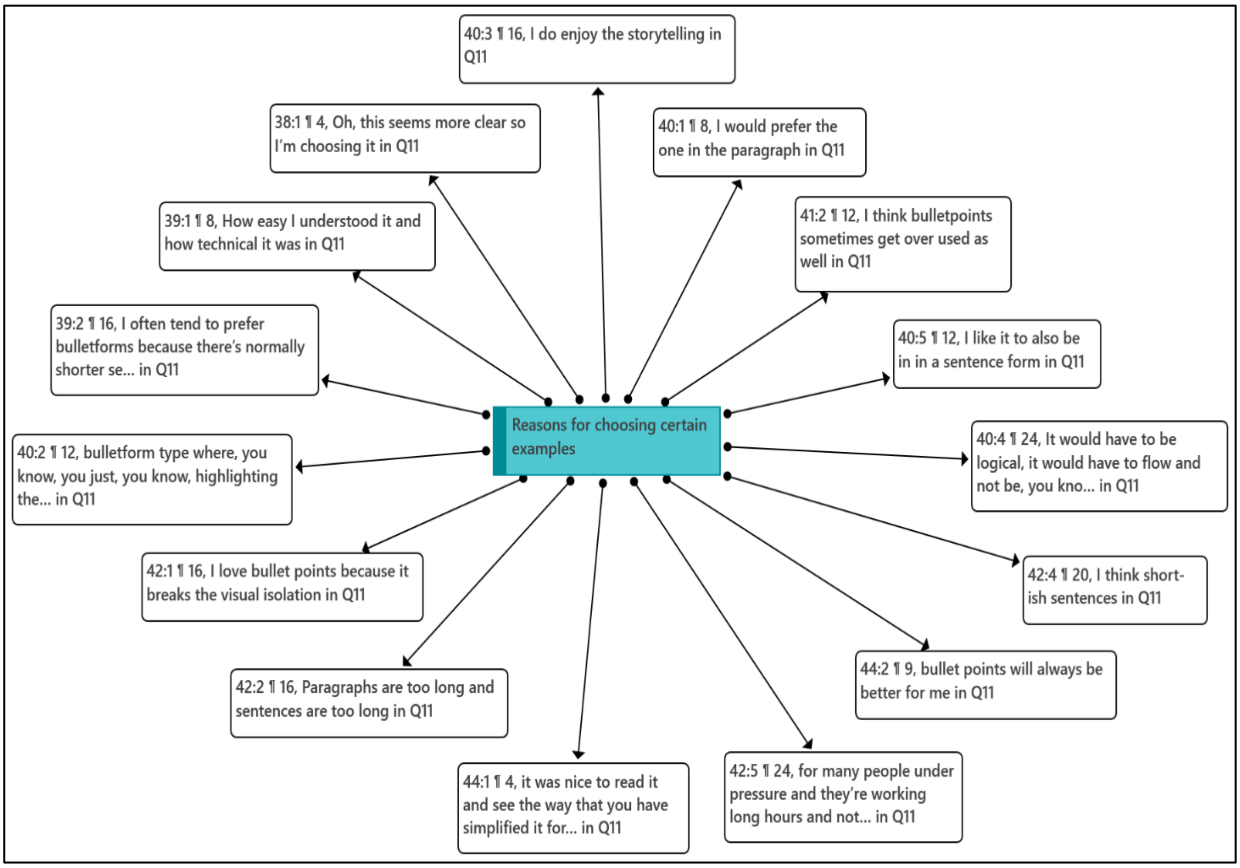


Figure 6.20: Reasons for preferring certain examples

What I noticed and that stood out for me from the reasons that interviewees volunteered was that one interviewee said he/she likes *"the storytelling"*. I took this to mean that interviewees do prefer science that rather tells the audience the story of the science as proposed by Greene (2013:13) as a "powerful way to communicate information to an audience". One interviewee mentioned that long paragraphs and long sentences influenced his/her choice and he/she did not opt for the samples that were long paragraphs and long sentences. Not all interviewees preferred the bullet points, and one interviewee commented that he/she thinks that bullet points are overused, and another interviewee stated that he/she preferred the examples that were presented in paragraph form.

One interviewee also mentioned a preference for shorter sentences because "*for many people under pressure and they're working long hours and not getting enough sleep, shorter sentences help a lot towards quicker understanding*". As I have already mentioned, reviewers often need to review several proposals under tight time constraints and this interviewee's comment regarding "*quicker understanding*" relates to my definition where it is important to ensure that a document is understood at first reading.

6.3.7 Question 11, Question 12, and Question 13: Language practitioners

The last section of the interview focused on the language services industry. The purpose of the last three questions was to check how much the interviewees know about the language services industry. These questions were designed after the results of the survey indicated that respondents had some knowledge of the language services industry, although they might not be explicitly aware of Plain Language. Question 11 asked: *Have you ever worked with a language practitioner (editor, technical writer)? If yes, what was that experience like? If no, what are some of the reasons that prevent you from working with a language practitioner?*

Figure 6.21 shows the number of interviewees that have had experience working with a language practitioner.

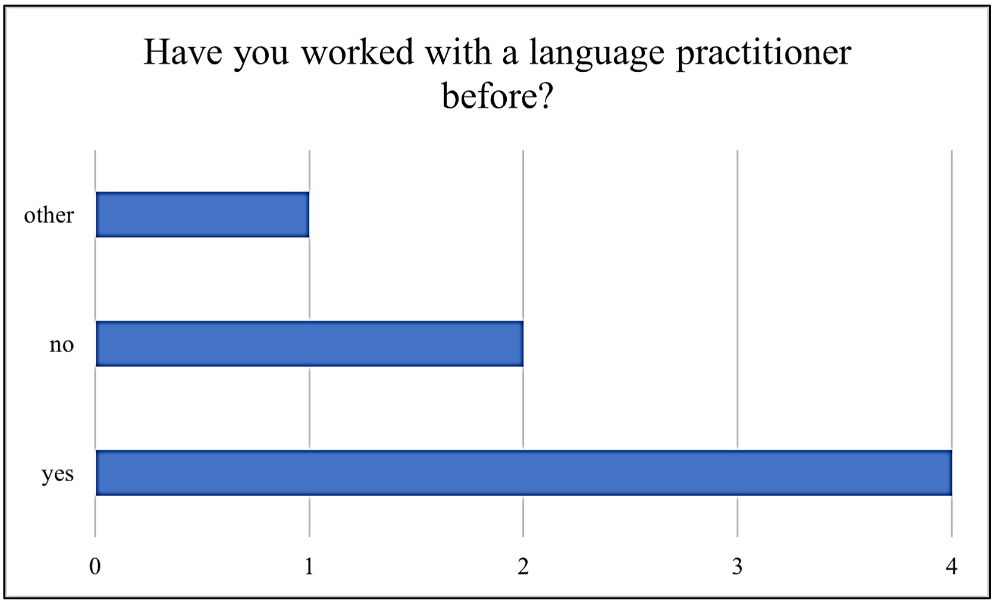


Figure 6.21: Previous experience working with a language practitioner

Figure 6.21 shows that four of the seven interviewees have worked with a language practitioner previously. Two interviewees have not worked with language practitioners before and another interviewee stated that he/she did not have to work with a language practitioner as he/she edits and proofreads colleagues' work. This particular interviewee volunteered that he/she started working in this capacity after he/she helped a French-speaking colleague with his/her dissertation and then realised that his/her language skills are good enough to work as a language practitioner. He/she stated that he/she does not need formal language training as he/she feels "*I think I have the gist of it*" and also considers his/her language skills adequate as he/she has "*done two Master's dissertations before*". I think that this speaks to the misconception that it is not necessary to have formal training to work in language-related services.

As a follow-up to the question of whether interviewees had experience working with a language practitioner, I then asked interviewees to expand on what their experience working with language practitioners was like. The responses to this question were mixed. Some interviewees had a very positive experience, other interviewees had negative experiences, and still others indicated that the experience was mixed. I represent the comments regarding Question 11 in Figure 6.22.

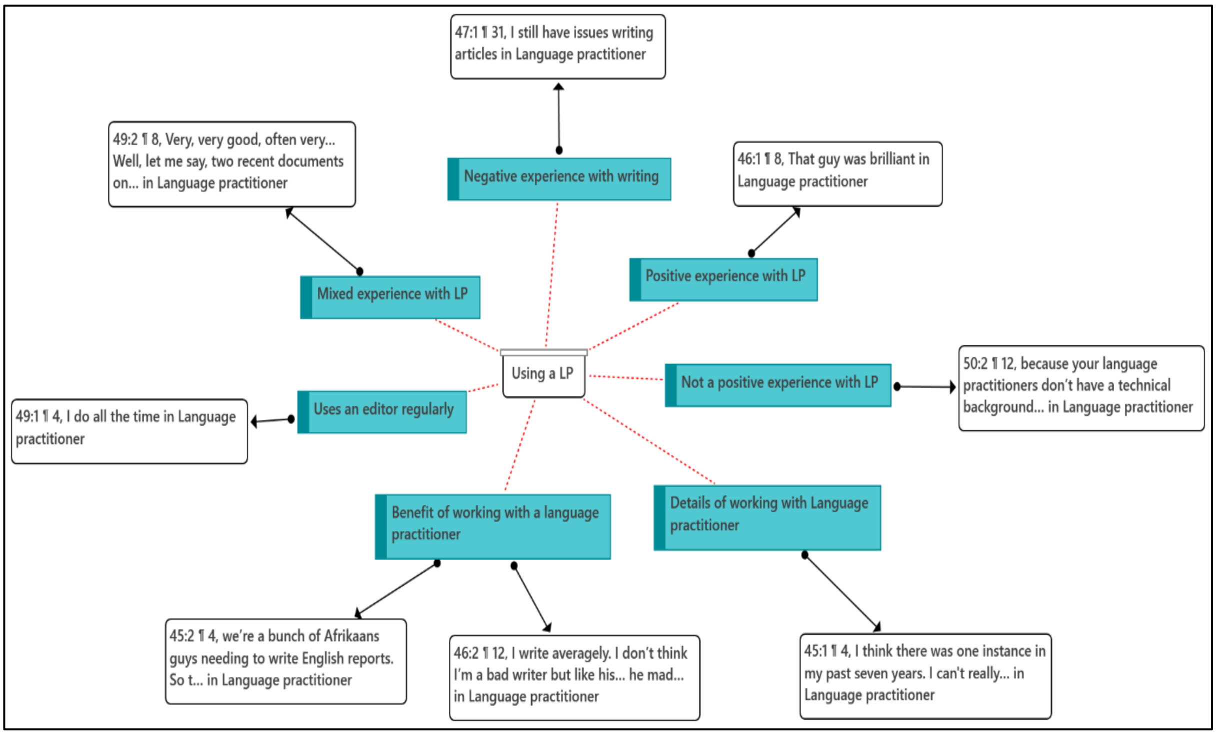


Figure 6.22: Experiences using a language practitioner

One interviewee stated that although he/she had a positive experience in the past, he/she had a less positive experience recently. He/she stated that

> *the very good [language practitioner] is somebody who knows enough about the subject matter to actually pick up on some of the the issues in the document…That is fantastic to work with because…that's something where a specialist language practitioner comes in.*

Another interviewee stated that he/she had a very positive experience working with a language practitioner and said "*that guy was brilliant*". However, one interviewee mentioned that from his/her experience language practitioners are just "*a bunch of ex-school teachers*" and that he/she struggled working with language practitioners "*because you language practitioners don't have a technical background that you do. That's the problem*". This particular interviewee again showed that his/her opinion of language practitioners' services is limited to vocabulary, and the interviewee held that if a language practitioner does not have the technical vocabulary it is not possible to work with a language practitioner. He/she ended the conversation regarding this topic with *"for me personally I don't see the use"*. In both sets of interviews, this interviewee was the only participant that reacted particularly negatively to this question.

By contrast, two other interviewees expressed a positive view of language practitioners and volunteered the benefits that they perceived working with a language practitioner to have. The first interviewee stated that

> *we're a bunch of Afrikaans guys/girls needing to write English reports. So the sentences can become a little bit too long and the grammar sometimes flies out the window… Yes it's always nice, especially if you're not…if it's not your first language to have someone else just have a look through it.*

This interviewee continued that he/she sees the value of language services in helping "*to clean that up*" where reports are concerned. Another interviewee expressed that he/she "*think[s] my…, I write averagely. I don't think I'm a bad writer but like his/her…he/she made stuff much better. You know, like you can see the value of someone like that*". These two interviewees' expressed a positive experience working with language practitioners. The follow-up to Question 11 focused on the fees that language practitioners charge.

Question 12 probed how much interviewees thought language practitioners ask for their services, since one of the main reasons cited in the survey for not using a language practitioner was cost. Question 12 asked: *How much do you think language practitioners ask for their work? Do you think that is expensive?* Interviewees ventured an estimate of how much a language practitioner will earn per hour and also indicated that time is a "cost" that they associate with language services. Figure 6.23 summarises the interviewees' comments related to the rates of language practitioners.

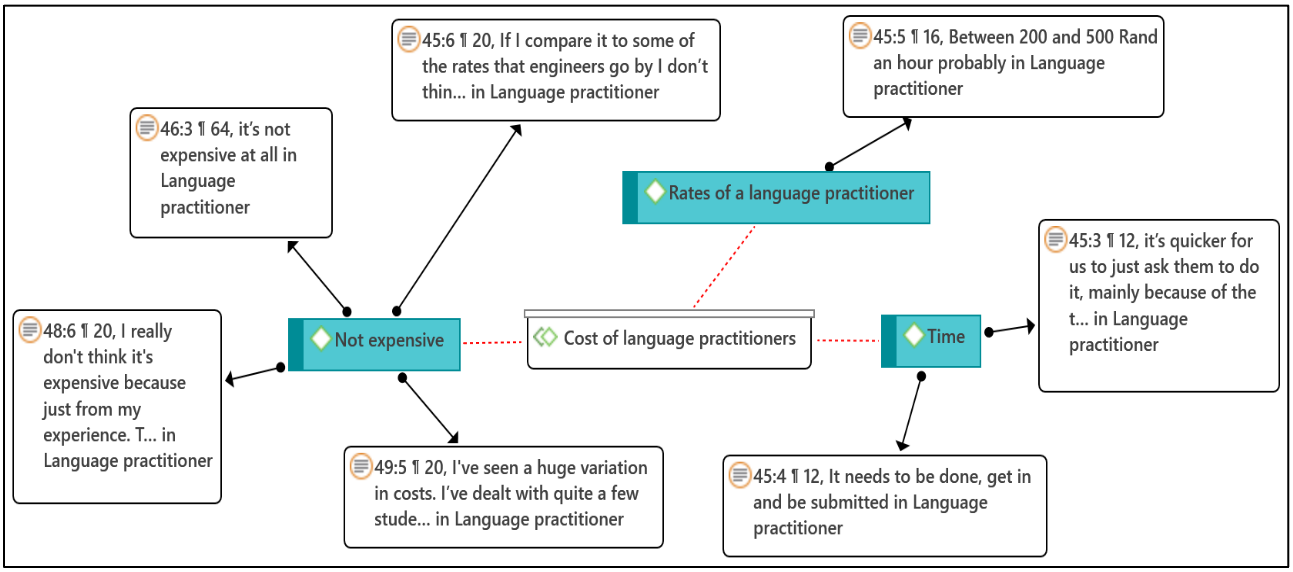


Figure 6.23: Perceived cost of a language practitioner

One interviewee stated that he/she has had many students whose work had to be edited and the cost varied significantly. Another interviewee estimated that language practitioners ask between R200 and R500 per hour. Two interviewees mentioned that they cannot afford to ask a language practitioner to work on their documents and that it is quicker to get colleagues to look at the work. Four interviewees mentioned that they do not think that language practitioners' fees are expensive. The interviewee who indicated that he/she edited dissertations stated that he/she asked R25 per page when he/she provided language services. This is a very low fee compared to industry rates. A leading university in South Africa pays a flat rate of R34 per 100 words (subject to tax at source). If a page is on average 300 words long, in other words three times R34, which equals R102, then R25 per page is about a quarter of what professional practitioners do ask.

Overall, most interviewees did not feel that language services were expensive, even though respondents to the survey identified cost as a reason not to use language practitioners. Another interviewee commented that he/she was not guaranteed an income from his/her writing and therefore, the cost was irrelevant, because he/she cannot afford to pay for language services as he/she "*can't afford to place economic value on getting it done professionally*". He/she continued: "*that's the reason why we don't use someone in your position. Or someone with your skillset. It's not because it's not valuable. It's because we can't place value on it at this point in time.*" How language practitioners can ensure that the sciences prioritise the language aspect of proposals is an area that warrants further research.

To conclude the second round of interviews, I asked interviewees for their opinions on the language services industry and whether or not they thought that it should be regulated or not. Question 13: *Currently language-related services as an industry are mostly unregulated in terms of quality and price. Would you like to retain the option of being able to negotiate fees with a practitioner, or would you rather have a fixed price set by some kind of government or industry regulation?* Figure 6.24 shows the interviewees' comments regarding this question.

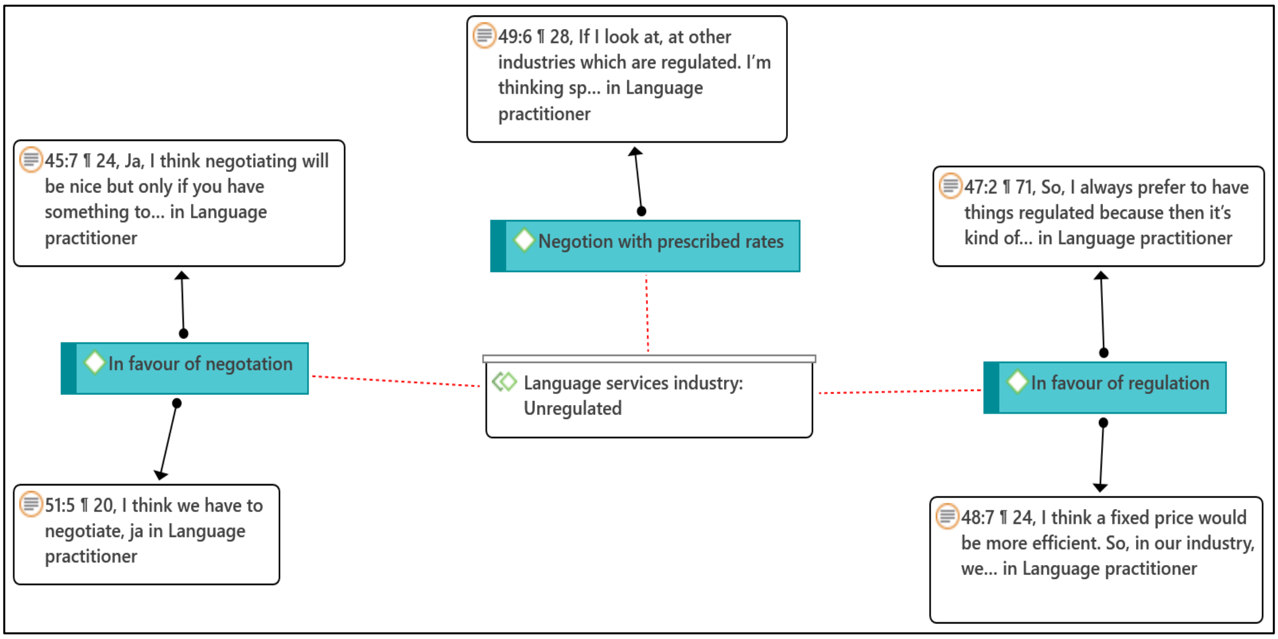


Figure 6.24: Language services industry: unregulated

Interviewees were in favour of being able to negotiate fees, but only if there is a starting price that interviewees would be able to consider. One interviewee stated the following:

> *Maybe probably starting off it would be nice to have a base price because, for instance, now I get a language practitioner to assist on a certain job I will probably ask a whole range of them for prices to sort of gauge it. Sort of having a mini tender process because you won't just go for the first one because then maybe someone comes in at two or three grand an hour.*

This is similar to the view of another interviewee who was also in favour of being able to negotiate fees with language practitioners, but wanted a fee to compare a quote to in order to ensure that he/she still pays a fair price but receives a professional service.

Two interviewees stated specifically that they would prefer the industry to be regulated because this then allows for consistency and "*then it's kind of, you know what you're getting and where it's coming from versus some random person because you can be scammed*". This "feeling" of getting "scammed" and mistrusting the language services industry is a theme I discuss in more detail in Section 6.4.3.

6.4 ADDITIONAL IMPRESSIONS AND THEMES FROM BOTH ROUNDS OF INTERVIEWS

After analysing all the structured and open-ended questions in the two rounds of interviews, some comments that interviewees made regarding Plain Language stood out. These comments were not made in response to specific questions, but rather emerged while the interviewees and I were discussing other questions. Because interviewees did not make these comments in response to a specific question, it indicates a personal opinion and is arguably closer to their true feelings than when responding to the questions. As mentioned for the interviewees in Round 1, there can be interviewee bias in that interviewees may want to please the interviewer and give answers they think the researcher would want to hear (Collins *et al*. 2005:192).

6.4.1 Comments about Plain Language

One of the first themes that emerged in the interviews was opinions on Plain Language. Although all respondents were positive about the use of Plain Language for their industries, in further discussion they did make comments about Plain Language that showed certain misconceptions. Two interviewees made comments relating to still sounding professional even when one is using Plain Language, such as "*it's just dovetailing plain languages with still writing professionally*" and "*you want to sound professional in your writing*". This implies that these interviewees' hold that clear, simple writing is unprofessional writing. For future research this would be an additional topic to investigate: what do engineers and people working in technical fields think professional writing is? Unfortunately, as this was a theme that emerged only after the analysis of the interviews and survey, I was unable to explore this further to get clarification. Future research will be able to probe this idea that Plain Language is "unprofessional" further.

As part of this theme, some interviewees noted a concern for how peers will perceive them if they used Plain Language. One interviewee specifically referred to academics, saying that "*academics are gonna look at that and be like 'What, you know, what the heck is wrong with you, we all know that'*" and another interviewee noted that "*the two problems we have is people who think they understand it and don't understand it*". Several interviewees agreed that Plain Language will be difficult in the sciences because language practitioners do not have the necessary knowledge also to translate the technical knowledge. Three interviewees did not agree with this and commented that "*a lot of engineers tend to overcomplicate a thing*", that "*a lot of times people think that they should sound fancy or trying to sound smart*", and that

> *people can't actually use plain language because they don't actually understand it. When I do understand things well, I can explain it with plain language because it's actually a concept that can be explained. Academics hide behind technicalities because the stuff doesn't actually make sense.*

These additional comments show that interviewees are divided on the benefits of Plain Language and how it would be able to benefit the science industry.

The second concern that interviewees noted regarding Plain Language was that the technical terminology is critical to the work, echoing Halliday and Martin's (1993:70) view that "…you cannot separate science from how it is written or rewrite scientific discourse in any other way". The first interviewee who commented on this said that "*some of the technical terms, we can't use any other wording for it*", and another interviewee stated that "*[s]ome technical things that would be difficult to convert to plain language or transfer to plain language is sometimes just easier to just use the normal... the normal jargon, rather than expanding it in plain language*".

This indicates a slight misconception from this interviewee's side in terms of the use of "jargon". Although technical terminology (often called jargon) might be critical when one is discussing work in an academic scenario amongst peers, in the context of funding proposals, the technical terminology might only detract from explaining the value of the new research to reviewers. In Plain Language, the audience should be the focus of any writing. Considering that a panel of reviewers consists of experts from various fields is key in writing a funding proposal that is clear and understandable at first reading. Another interviewee noted a concern that "*some of the risk is… sometimes if it's too simplified you… for you leave out some stuff*". I would like to address this statement at two levels.

Firstly, in the context of a funding proposal, all the technical details, although significant to people working in the same field, do not necessarily add to the reviewer's understanding if the reviewer is in a completely different field. In this context, focusing on the details that will give a reviewer the best understanding of what the project or funding would entail seems to be a more logical approach. Secondly, if the writing follows a reader-centred strategy, I firmly believe that only the relevant information will be included and that this concern about "leaving stuff" out might not be valid. Another interviewee commented that "*that's where the value of it came… some jargon, which has to be there, if you're not saying that jargon, there's going to be a misunderstanding*". "*Misunderstanding*" the science is a concern that other interviewees, as well as survey respondents, mentioned on more than one occasion throughout the interviews and survey. I expand a bit further on this theme in Section 6.4.3.

Another concern regarding technical terminology is that an ostensibly familiar word can mean something different in a specialised field. Dating is one such example of a word that has a different meaning based on the specialised context. In everyday vocabulary, "slippers" and "boots" may refer to footwear, while in mining and some other engineering fields, a slipper is something like a metal plate applied to a sliding piece, to receive wear and permit adjustment, and a boot is "the transformation pieces connecting horizontal round leaders to vertical rectangular stacks made of galvanized steel and can be installed with sheet-metal screws" (The Project Definition, n.d.:n.p.), in a car it might be a "an enclosed compartment of a car for holding luggage, etc, usually at the rear" (Collins Dictonary, n.d.:n.p.) or "a rubber covering for the connection between each spark-plug terminal and ignition cable in an automotive ignition system" (Collins Dictonary, n.d.:n.p.), or "a protective covering over a mechanical device, such as a rubber sheath protecting a coupling joining two shafts" (Collins Dictonary, n.d.:n.p.), among many other meanings. Accurately inferring the meaning of a word based on the context of the document rather than the reviewer's knowledge framework is a concern that I explored in more detail in Section 4.5.4.2.

The third theme regarding Plain Language that emerged from the interviews was a concern that Plain Language will result in longer documents. One interviewee's comment regarding technical terminology was the concern that "*some terms that are well-known that you are trying to re-explain which can lengthen your document*". The concern for the length of texts was also evident when survey respondents preferred the shorter original text in Example Set 2 as opposed to the longer Plain Language version. I expand on the survey results in Chapter 5.

The word "well-known" also needs further exploring. What might be well-known to the interviewee (he/she might be working in the same field as the original text author) might be completely unknown to a reviewer. On the other hand, if the word seems familiar to a reviewer because of his/her particular field but it has a completely different meaning in the context of the proposal, reviewers could make completely wrong inferences. In contrast to this interviewee's comment, another interviewee stated that for him/her the length of a document is not a concern: "*[M]yself and my colleagues we tried to make things as simple to understand as possible. To that end we sometimes give a detailed explanation*."

The fourth theme was the perception that interviewees expressed regarding Plain Language. On several occasions while discussing Plain Language, interviewees used language such as "*dumb it down*" and "*water it down*". One interviewee said: "*When you're writing reports you don't really want to water it down, if I can call it that? Not water it down but a technical report needs to be a technical report*." One interviewee commented that he/she does not like saying "*dumb it down*", but rather "*simplify it, you use more, more easy to understand than jargon language*". Another interviewee supported this by saying "*so they would say you dumb it down, but that's not, you just use more simple words*". Using these words, interviewees showed an awareness of Plain Language, but it also indicates that interviewees have not been sufficiently educated on the benefits of Plain Language. Although several interviewees tried to explain what they mean by "simplifying", they were not able to give practical examples or explain clearly what this means to them. Broadly speaking, Plain Language is about simplifying documents but it also advocates keeping the reader in mind at all times, ensuring that a message is as clear as possible and can only be interpreted in one way, and that readers can access information without unnecessary effort while understanding it at first reading.

The last two comments relate to how Plain Language can be used for funding proposals. One interviewee was unconvinced that applying Plain Language principles to funding proposals will have any impact. One interviewee commented that "*sometimes it's a matter of opinion or personal biases versus… versus the actual science*" and another interviewee stated that "*that's what it comes down to. I mean, I write for different funders but, or different stakeholders. You've gotta…you've gotta change your angle to meet what the funder wants*". I agree with this interviewee in the sense that language is definitely not the only aspect that will influence a reviewer's opinion on whether or not research warrants funding. How a project will affect a community, or address a global need (for example, resolving world hunger) will also factor into a reviewer's decision. However, even if a project has the potential for long-lasting impact, but reviewers do not understand the merit or cannot break through the "technical clutter" then a proposal might also be rejected because the message was not as clear as it could be.

Although all interviewees responded positively to the idea of Plain Language, it seems from this additional analysis it does seem that interviewees are divided on the use of technical terms, the length of texts, and what Plain Language is.

6.4.2 Misconceptions about what language practitioners offer

From various statements that interviewees made, there seems to be a perception that language practitioners only work on grammar and punctuation. One interviewee stated that "*it takes skill to do proper punctuation and grammar*". Another interviewee thought that language services "*sort of cleaned it up and made it nice*". Another misconception is that speaking English is good enough to provide language services. Two interviewees made comments regarding this stating that "*there are a lot of English-speaking engineers working with us*" and "*for me personally, I don't see myself using one. If I can't speak English by now, I shouldn't be in this business*".

There were also several comments about only needing a language practitioner if you are a second language English speaker. Interviewees commented that "*we're a bunch of Afrikaans guys needing to write English reports. So, the sentences can become a bit too long and the grammar sometimes flies out the window*" and that "*it's always nice especially if you're not… if it's not your first* *language to have someone else just have a look through it*". This seems to imply that interviewees have an oversimplified idea of what language services offer and the real value of working with a language practitioner.

Two interviewees were very positive about language services and commented that "*not everybody is… is good at putting their thoughts on on paper in English*" and that language services are "*essential because language is… it takes enormous amounts of time*". One interviewee in particular commented extensively on the value of language services:

> *When I read someone's technical blog or something, I immediately see if there's a spelling mistake or a grammar mistake. And that kind of takes away from the document unnecessarily. It's things that can just be fixed beforehand. But the impact that it has. I mean, if you forget to put in a s after a verb for singular. The message is still there, but, you know, you degrade it ever so slightly. If I send a document out, and I'm absolutely sure there's none of that, like no mistakes anything like linguistically. It's just the more confidence that you're going to deliver.*

This closing statement shows a keen awareness of clear communication and the importance of language services. As with the importance of Plain Language, interviewees made opposing statements regarding the value they perceive language services to have. In my opinion there is definitely some more education needed to convince the technical fields of the value of language services. One interviewee specifically responded that *"it cost money to do stuff like that… It's not because it's not valuable. It's because we can't place value on it at this point in time"*. Ensuring that as language practitioners, we are able to educate clients on the potential benefits of professional language services, might be one way to ensure future collaboration between language practitioners and more technical professions.

6.4.3 Mistrust of language practitioners

The next theme that emerged from interviewees was that they do not trust language practitioners. One interviewee made a comment related to being misquoted, or the science being misrepresented: "*I worry that, you know, that I'll be misquoted. It's very important to me that it doesn't get misconstrued*." This particular interviewee raised the concern that if his/her work is misrepresented then he/she might be called "*an idiot*" and this damages his/her technical reputation. Another interviewee's view seems to support this fear that language practitioners are not trained in technical fields, and, therefore, do not have the skills to be able to represent technical information accurately. This interviewee stated: "*I've bumped heads with language practitioners. Because you language practitioners don't have a technical background that you do. That's the problem.*"

Another interviewee stated:

> *[O]ne of my biggest frustrations is that there's such a big miscommunication between the science and between the popular media and between the, you know, average person on the street, is that, you know, if you read an article in the newspaper that says, 'This was discovered by science.' What is understood by that and what's meant by that are often very different.*

The context of this can be further explored. Another interviewee had a particularly negative opinion of language practitioners stating that "*you can be scammed*" when asking about the reasons for not using a language practitioner. The last interviewee's comment on language practitioners indicates the importance of good client relationships. This interviewee's experience of working with a language practitioner was not very positive: "*[T]hey're very intense and they're very strict and I understand why… you're getting criticized by them at the same time.*"

The reality is that in an unregulated industry like language services, this is a common complaint. Although professional associations such as the South African Translator's Institute (SATI) and the Professional Editor's Guild (PEG) aim to maintain a professional standard by offering clients the opportunity to lodge complaints against their members, there is very little they can do about fly-by-night editors that do not have professional qualifications or join associations. Although efforts are being made in South Africa to regulate the industry, one interviewee commented that it might not solve all the problems. This interviewee stated that the industry that he/she works in is regulated by several professional bodies (SACNASP as an example for the survey respondents), but there will always be concerns related to skill. He/she stated that even in his/her field of geology, "*all geologists are not created equally*". This is valuable to keep in mind, but for the purposes of this study, it is concerning that interviewees experience language services negatively. It seems obvious that language practitioners need to focus on providing a professional service, as this is what is expected. There are practitioners who need to upskill to maintain proper client relationships. As part of this, it is also important for language practitioners to check their work with their clients, to ensure that the information in the technical documents is indeed correctly edited.

6.4.4 An interest in training

The last theme emerged when I asked interviewees about whether they would be willing to work with a Plain Language practitioner. Several interviewees answered that although they would be willing to work with a language practitioner, and think that Plain Language is vital, they would not want a language practitioner to work on proposals and reports, but rather they think the value would lie in a language practitioner's willingness to provide training to scientists and engineers regarding Plain Language. One interviewee stated that Plain Language "*is something that people should put* *value in. And I think, you know, if there was a course or something that the members of our team could participate in it would be something that would be worth prioritising*". A second interviewee commented that he/she

> *wouldn't want you to work on our documents. I wouldn't bring the language practitioner in to work on our documents. I would rather use the language practitioner, to train the engineers on to be sensitive and to be aware of the influences that language has so that when they write, they are driven by those healthy principles.*

A third stated that "*I would like to have someone educate the people to make sure that they are well-equipped and aware of what they can do and how important it is*". Another interviewee expressed a need and interest in training so that he/she could learn for the "*next time*". He/she responded that in principle Plain Language sounded promising and that

> *I think maybe more in terms of like training for like my benefit maybe as like a review process so that I can learn for the next time. Because being able to keep me for me being able to communicate quickly and effectively can save me a lot of time, we have a lot of systems in place to especially here to do a lot of calculations really fast. So my time now is spent writing. The thinking is another part, which comes up hand in hand with the writing. Yeah. So, if I could write faster by just kind of not having to think about the language because it's just sort of there, it's more I think the training side would be more useful maybe than review.*

This particular interviewee expressed an interest in being able to learn the necessary skills to be able to communicate quickly and effectively, showing a keen awareness of how much time writing can take. He/she feels that training will help scientists and engineers to be able to do the writing part of their day-to-day functions and that training would be more effective and useful rather than collaborating with a language practitioner to review documents.

Another interviewee expressed this need for training as a solution for what he/she sees as the perceived failure of the education system. He/she stated:

> *People come out of the education system, believing that they must now prove something in how they communicate, which is a big drawback. And the way that how students are taught to write for example in the communication modules in engineering. I presented it for two years. I tried to do it differently. But you, you get an assignment, and you have to write the pages, or you can. It's not purpose driven. It's not the real-world stuff. And then they get stimulated to do this posturing thing to kind of use big words there was a big paragraph, and I wrote it and honestly, to this day, I don't know what they said. So my feedback is that you use many words but you say nothing. So it is a problem. The simplicity and the importance of plain language should be taught there. So that when I employ somebody, I don't need to educate them. And those communication modules are throw-away neglected modules. It's nobody respects them or very few people respect them. And we pay. Industry is paying a very high price because that is not taken care of properly.*

This interviewee expressed a concern around how scientists and engineers are trained and expressed a concern that the communication and writing training that students already receive, as discussed in

Section 2.5, is inadequate. This interviewee also stated that these "communication" modules are not taken seriously and that the result of the fact that these courses are disrespected is that the industry then pays "*a very high price*". Although the interviewee did not expand on what he/she meant with the industry paying a high price, it is possible that he/she is alluding to the fact that proposals are not clear enough and other writing might also result in not getting contracts or being able to effectively communicate with clients and other stakeholders.

6.5 CONCLUSION

In this chapter, I focused the discussion on the data that I had collected from two rounds of interviews. The research questions that I wanted to investigate through the interviews were "Which Plain Language guidelines (and associated) strategies would be appropriate in addressing the fact that science writing contains technical terminology and abstract concepts, affecting the clarity of proposals at a micro-level?" and "How do scientists perceive Plain Language and language practitioners? How do their perceptions inform their willingness to work collaboratively on projects with language practitioners as part of the team?"

For my first research question, I asked interviewees to provide comments on why they preferred one sample text over another in the survey. Interviewees seemed to prefer bullet points, shorter paragraphs and explaining technical terminology. These responses confirmed that my proposed Plain Language guidelines were appropriate for this study. Interviewees in both rounds of interviews showed a keen awareness of writing strategies to ensure that the readers understand the content of their documents. However, these strategies were not necessarily visible in the documents that I analysed for the purpose of this study. In respect of my second research question, interviewees all expressed a willingness to work with language practitioners, but also commented on the practicalities of such an arrangement. As an alternative, several interviewees suggested training in Plain Language principles as of more value to scientists.

CHAPTER 7: CONCLUSION

7.1 INTRODUCTION

This study began with my own experience working with scientists and engineers on funding proposals. Writing funding proposals is a time-consuming process, with no guarantee of success, because many projects compete for the same limited funding. The inter- or multidisciplinary nature of funding proposals can also be an obstacle for hopeful candidates, especially as review panels often consist of a variety of reviewers from different specialisations, making it unlikely that reviewers will be from the same field as the funding applicants.

This interdisciplinary nature of the funding proposal process, using templates, poses a useful scenario in which to consider applying Plain Language guidelines for peer-to-peer communication across scientific specialisations. For this study, based on my literature review, I proposed the following definition of Plain Language as it relates to funding proposals:

> A funding proposal that is in Plain Language presents essential research in such a way that elements of storytelling, organisation and structuring work together to give a reviewer a good chance of understanding the funding proposal at first reading. A funding proposal's language is clear and concise to ensure that a reviewer also understands the content in the same sense that the writer meant it to be understood.

Applying Plain Language guidelines is one possible way to ensure that reviewers are able to assess the merit of proposed research by being able to follow the science story, gaining access to the most important information in a proposal as early on as possible to enable the reviewer to understand the content at first reading. Effectively applying Plain Language guidelines can also ensure that reviewers understand the content of a proposal in the same sense that the funding proposal applicants meant the content to be understood.

This study focused on whether or not this would be a possibility and if so, how a language practitioner such as myself, without scientific training or experience, would be able to apply Plain Language principles to technical content that I do not fully comprehend. I wanted to determine, besides the obvious vocabulary constraints, what some of the challenges would be if I (and other language practitioners) worked on technical documents. Alternatively, I also wanted to explore whether or not scientists would be willing to work with language practitioners on funding proposals.

In this chapter, I summarise my findings, reflect on the limitations of the research, and explore possible recommendations for future research. I also reflect on the original contribution of this study, which arises from the fact that it focuses on interdisciplinary science communication, whereas prior Plain Language research relating to the sciences has predominantly focused on how to communicate science clearly to the general public. How Plain Language principles can help scientists to communicate their funding proposals clearly in interdisciplinary peer-to-peer communication has not yet been investigated in the field of Plain Language. Because of the technical nature of the sciences, it was important also to look into the obstacles that language practitioners would face with possible future collaborations. I was unable to find prior research pertaining to how scientists perceive collaborating with language practitioners. Therefore, this study also focused on the experiences of scientists regarding language practitioners and language-related services. I conclude this chapter with suggestions on possible future research directions.

7.2 SUMMARY OF RESULTS

The main research question that I wanted to answer through this study was whether or not Plain Language guidelines can be applied to interdisciplinary science communication, specifically funding proposals, to improve clarity and understanding. If this is possible, then I wanted to investigate how I would go about doing this.

In order to answer this main question, I investigated answers to the following sub-questions:

- What obstacles do *science experts* face when they read proposals, especially in the context of trying to decipher highly scientific and technical information?
- What obstacles do *language practitioners* face when they read highly scientific and technical content in funding proposals?
- Which Plain Language guidelines (and associated) strategies would be appropriate in addressing the fact that science writing contains technical terminology and abstract concepts, affecting the clarity of proposals at a micro-level?
- If science is, according to several experts, a “language” different from English, how can guidelines for Plain Language be adapted to fit different kinds of scientific or technical communication?
- What are the limitations on the use of Plain Language in the context of fixed templates for such documents?

- How do scientists perceive Plain Language and language practitioners? How do their perceptions inform their willingness to work collaboratively on projects with a language practitioner as part of the team?

These questions were all answered in the six phases of my research. In the first phase I completed an extensive literature review and a preliminary document analysis of two funding proposals to enable me to select preliminary Plain Language guidelines that I could apply in Phase 2. The literature review enabled me to investigate the nature of science communication and English as the *lingua franca* of the science community, including that community in multilingual countries such as South Africa. This multilingual situation necessitates strategies that will ensure effective communication across disciplines. Having to work in English as a second or other language while also trying to understand difficult information can be seen as a serious obstacle in reading funding proposals. This then addresses part of my sub-question focusing on the obstacles that science experts face when they read funding proposals, especially in the context of trying to decipher highly scientific and technical information. In the literature review I also discussed how the languages of mathematics and science differ from "ordinary" English and how these differences can influence the understanding of complex scientific content. This discussion highlighted obstacles that scientists from different fields as well as language practitioners face when they need to work on highly scientific and technical content in funding proposals.

Orr and Schutte (1992) and Halliday (1989) explain that the language of science and mathematics contains technical terminology and abstract concepts, which affects the clarity of the content in documents such as funding proposals at a micro-level. For the scientific vocabulary to have meaning, the context within which it is included in funding proposals becomes crucial. These are important considerations when deciding on appropriate Plain Language guidelines (and associated) strategies for this study. I also needed to consider the limitations that templates impose on applying Plain Language guidelines. Although templates restrict layout changes (in that the structure and sequence of the "science story" at a macro-level will not be changed), good templates can be excellent tools for structuring a schema. Templates provide reviewers with a sense of familiarity, enabling them to know what to expect from the proposal. The limited space for including content in a template can be a disadvantage, so my third Plain Language guideline attempts to address this by instructing proposal applicants to write concisely. I derived eight guidelines from the literature review which informed the subsequent phases, especially the second phase, which focused on the document analysis of two funding proposals and selecting sample texts of Plain Language versions to include in the survey. These guidelines were:

- Guideline 1: Organise your material so that readers can grasp the important information early and navigate through the document easily.
- Guideline 2: Use words your readers are likely to understand.
- Guideline 3: Write concisely.
- Guideline 4: Use vertical lists to break up complicated text.
- Guideline 5: Over the whole document, make the average sentence length 15 to 20 words.
- Guideline 6: Prefer the active voice unless there is a good reason for using the passive.
- Guideline 7: Reduce cross-references to a minimum.
- Guideline 8: Sequence process steps for clarity.

In Phase 2 of this study, I completed an in-depth document analysis of two funding proposals by applying readability tests and my eight guidelines. From these documents I selected sample texts to "translate" into Plain Language for the purpose of including these sample texts in the survey for Phase 3. The document analysis enabled me to explore further the obstacles that science experts and language practitioners face in trying to decipher technical documents such as funding proposals. The document analyses confirmed the obstacles that the literature revealed in Phase 1: field-specific terminology and abstract concepts are difficult to understand at a micro-level, and if reviewers are unclear at a macro-level on why the research is important and why they need to focus on the proposal, then the message can be lost. The document analyses also revealed that although examples of some scientific concepts can provide context to reviewers, it is critical that these examples be concise and clear. An obstacle that language practitioners face is that without a scientific background, it can be difficult to determine the best way to approach the proposals and how to apply Plain Language guidelines.

The document analysis also helped me to investigate how Plain Language guidelines need to be adapted to fit within the constraints of the language of science and mathematics, as well as templates. My Plain Language Guideline 6 instructs funding proposal applicants to prefer the active voice unless there is a good reason to use the passive voice. The document analysis reveals that although there were difficult scientific concepts in the proposals that needed clarification, the challenge was not necessarily that it was written in the passive voice. Both proposals already preferred the active voice but failed to answer questions related to the what, how, and why regarding the importance of the research. In terms of my selected Plain Language guidelines regarding templates, there will often be cross-references because funding proposals applicants might need to refer to information that the template only allows to be included later in the template, even though my Plain Language Guideline 7 suggests that applicants should reduce cross-references to a minimum. This guideline should also include a suggestion that content be organised in a way that ensures that wherever a concept or terminology is mentioned the first time, the context is clear enough so that the reviewer will not need to depend on the cross-reference to clarify the information.

I concluded Phase 2 of the research by selecting seven example text sets to include in the survey. The purpose of including the sample texts was to test the readability and understandability of my Plain Language versions with survey respondents.

Phase 3 consisted of the drafting and deployment of a survey and a first round of follow-up interviews. The purpose of the survey was to gain insight into scientists' demographic information, their writing habits relating to funding proposals, the primary language they work in, and to test whether respondents understood the Plain Language texts at first reading. I included the Plain Language sample texts to test whether using Plain Language principles could help improve comprehensibility in proposals on the premise that such comprehensibility would be more convincing to a panel of reviewers. This also helped me to answer my research question that related to which Plain Language guidelines and strategies would be appropriate for funding proposals. The survey also helped me to determine whether applying Plain Language guidelines to funding is even a viable option to consider from scientists' perspective. The survey included questions to explore respondents' perception of language practitioners and their willingness to collaborate on projects. The survey respondents indicated mixed experiences working with language practitioners and cited several reasons for not wanting to collaborate with language practitioners.

The second part of Phase 3 included a first round of interviews with engineers from a consulting company. In this first round of interviews, all the interviewees responded positively to the concept of Plain Language, and they all believed that it could benefit their industry. The interviewees were also positive about the idea of collaborating with language practitioners, but mentioned several challenges with such a collaboration, mainly that language practitioners are not trained in a technical background, which could result in misunderstanding and the misrepresentation of key scientific abstracts and concepts. Time and cost also emerged as obstacles.

Before I could continue with Phase 4, I needed to do a preliminary data analysis of the survey results and the first round of interviews to design the second round of follow-up interviews. The second round of follow-up interviews aimed to answer some of the questions that were raised in the survey and the first round of interviews. The second round of interviewees included a section on language practitioners' fees and the lack of regulation in the language services industry.

Although survey respondents noted the cost of language practitioners as a reason for not using their services, the second round of interviewees contradicted this, as the interviewees did not feel that language services are unaffordable. The interviewees for the second round were divided on whether the industry should be regulated and the advantages of such regulation.

Both rounds of interviews (in Phase 3 and Phase 4) indicated that some of the main reasons for choosing a specific sample text were a preference for bulleted lists, shorter sentences and the use of less technical terminology (or where such terms were used, explanations were added).

After completing both the quantitative and qualitative data collection, I was able to complete the data analysis in Phase 5 of the study. Overall, the data indicated that participants in this study preferred the Plain Language versions of the sample texts more often than the original versions. The data also revealed that participants are not adequately educated on the value of Plain Language and what the movement proposes beyond simplifying vocabulary and writing shorter sentences. Participants in this study also equated language services to only checking spelling and grammar. This indicates again that language practitioners need to educate clients on the value of language services and the benefits of applying Plain Language guidelines. Contrary to my proposition that collaboration with a language practitioner would be the preferred solution, participants expressed a strong preference for training on Plain Language as an alternative, indicating that time, cost, and the technical terminology were obstacles to collaboration with language practitioners who lacked a technical and scientific background.

The final phase of my study involved proposing a final set of Plain Language guidelines for future use. This final phase also allowed me to reflect on the limitations of this study and my recommendations regarding future research.

7.3 LIMITATIONS OF THIS STUDY

From the start of this study, I was aware of the time-consuming aspect of using a test group to test Plain Language versions of my sample texts. After initial conversations with scientists and engineers I realised that it would be challenging to find a test group willing to give me their extended time. I decided to conduct a survey to test my Plain Language versions but I needed to limit my sample texts in terms of length to ensure that survey respondents would only need to take about 10 minutes to complete the entire survey. I also needed to limit the interviews to between 10 and 15 minutes. This time limitation could have affected the respondents' choice regarding the Plain Language sample text choices in the survey. Therefore, for the purposes of this study, I used short examples without much context from the rest of a document. Although I was granted permission to analyse the two funding proposals and was fortunate to be part of the initial concept meetings for the second funding proposal, I was not able to test my initial Plain Language sample texts with the original funding proposal applicants. I needed to rely on my own research and conversations prior to submission but did not have further access to the teams that wrote the proposals. This is a major limitation and I acknowledge that any gaps in the Plain Language sample texts would have benefited from this technical input.

The number of respondents to the surveys was too low for the survey results to be statistically significant, and I was unable to find any correlation between the respondents' demographic information and their preferences for either the Plain Language sample text or the original text in the survey. A larger sample of respondents and a larger data set would enable a more detailed statistical analysis on the factors that influence respondents' preference for either the original text or the Plain Language text. Although I acknowledge this limitation, for the purpose of this exploratory design, the survey data was deemed sufficient to interpret and make assumptions regarding the final set of Plain Language criteria that could be used for future collaboration between engineers, scientists, and language practitioners.

The purpose of the follow-up interviews was not to gather statistically significant information, but to gain qualitative insight into scientists and engineers' perspectives on Plain Language, whether or not they thought Plain Language could benefit their industries, and their experiences working with language practitioners. The 16 interviewees who participated in this study is an appropriate number for this type of exploratory study (Staller, 2010:1161). However, for consistency, it would have been ideal if I could have interviewed the second set of interviewees face-to-face as I managed to do in the first round of interviews. The national lockdown due to Covid-19 also resulted in five interviewees not being able or willing to participate in the second round of interviews. The time delay between participants' completion of the survey and the second round of interviews may also have resulted in interviewees' having forgotten some of the context of the purpose of the study. Interviewees were also more reluctant to volunteer information in telephonic interviews, compared to the first round of interviews.

The last limitation relates to my relationship with the two funding proposals. I was involved in the second document from the conceptualisation phase. There was definitely an advantage to being part of the meetings and having access to the authors. It provided me with the opportunity to build my technical vocabulary as it related to this specific research field. Most language practitioners who have the opportunity to work with scientists and engineers are only involved in the final stages of drafting a funding proposal. Language practitioners are trained to ask clients questions and query information that is not clear, but this can be a very time-consuming process. If there is a tight deadline for the submission of a funding proposal, such follow-up by the language practitioner might lead to frustration in the clients, and may not always result in the most effective collaboration between engineers, scientists, and language practitioners. The ideal would be to be involved in a project from the start as one of the stakeholders on a project.

Based on the limitations of this study, there are several topics and trends that can be investigated in future research.

7.4 RECOMMENDATIONS FOR FUTURE RESEARCH

One of my first observations while completing the data analysis for the survey and the follow-up interviews was that the respondents and interviewees equated language services to “checking spelling and grammar”. When I asked the respondents for their reasons for not using a language practitioner, they commented on the fact that “*Word has a spell check*”. This impression that language practitioners’ skills are limited to these two “basics” is worth investigating further. For language practitioners who want to work with scientists and engineers, it would be beneficial to give a very detailed description of the advantages of language services. Future research could focus on developing a questionnaire to determine exactly the type of services that scientists and engineers would find beneficial. One interviewee stated that “*the problem is that… it cost money to do stuff like that…and that’s the reason why we don’t use someone in your position. Or someone with your skillset. It's not because it's not valuable. It's because we can’t place value on it at this point in time*”. What are scientists and engineers’ expectations regarding language services? What would language practitioners be able to offer that will encourage scientists and engineers to value a language practitioner’s services?

For this study, I did not distinguish between senior engineers, senior scientists and scientists and engineers just starting out in their careers. How would the needs of these two groups differ in terms of Plain Language sample texts and writing support? According to the survey data and follow-up interviews, scientists and engineers with multiple years of experience are more comfortable with their own language skills. Although there was no significant correlation between respondents’ years of experience and their preference in choosing a sample text, there is room to investigate this particular aspect of the survey in more detail.

The data for this study did not match the demographic statistics for South Africa as it relates to English home language speakers. With a more focused data set, it would be possible to probe aspects such as age, where an engineer or scientists studied and how that influences their preference for Plain Language. For this study, I had approached three independent professional bodies for scientists and engineers. The two professional bodies specifically aimed at engineers were not willing to participate in this study, so the respondents were mostly from scientific fields rather than specifically from engineering. Future research could focus on only engineering fields and how the different subspecialisations within engineering would be able to benefit from Plain Language principles.

Another statement from survey respondents and interviewees regarded what they called "*professional writing*" and how using Plain Language principles rendered the writing "*less professional*". Unfortunately, I was not able to probe this particular statement and future research could focus on probing what scientists and engineers regard as "professional writing" and which aspects of Plain Language they feel are not professional.

Initially, I posited that working alongside language practitioners, engineers would be able to improve communication without the extra pressure of learning a new "skill". I was of the opinion that instead of teaching generic communication skills, language practitioners can provide scientists and engineers with language support to enable them to produce the clearest possible documents. From the data that I collected for this study, it was clear that there are several obstacles and constraints that make this type of relationship less likely to be realised. Respondents stated that they did not foresee there ever being enough time for a language practitioner to review funding proposals before they need to be submitted. Respondents also claimed that because of the budget constraints associated with securing funding, there was no guarantee that they would be able to get a return on their investment regarding language services. According to respondents, although they can in theory agree to the benefits of Plain Language for their various fields, they remain unconvinced that they would be able to overcome these obstacles. They mentioned that adequate training would be a proposition that they would be far more willing to spend time and money on. Most universities already offer communication and language courses. Future research could focus on investigating how these courses could be adapted to include training scientists and engineers on Plain Language principles and how to apply these to effectively communicate their research.

Although this study did not focus on Plain Language guidelines and how it can benefit science communication with the general public, future research can focus on investigating the advantages of using Plain Language to communicate with a scientifically illiterate audience and the possible advantages of including Plain Language guidelines could be in this context.

A last theme that would be valuable to investigate in future is the idea that language-related services are often associated with a "female" skill. In the science industry, how often are language services (including devolution to peers responsible for reading and evaluating funding proposals) relegated to the female scientists because they are "better" at communication? I did not focus on gender for this study, but some comments from the follow-up interviews relating to languages being a "female" skill and the fact that the interviewees were predominantly male can be something to investigate further in future research.

7.5 FINAL PLAIN LANGUAGE GUIDELINES

After completing this study, the eight adapted Plain Language guidelines in Table 7.1 emerged as the most relevant regarding funding proposals.

Table 7.1: Final Plain Language guidelines

Guideline 1: Organise your material so that readers can grasp the important information early and navigate through the document easily.	It can be difficult to determine what reviewers might already know. Therefore, I suggest that information be structured in a way that gives the reviewers the purpose of the proposal as soon as possible. This will also aid the reviewers in reading the science story and ensuring that the merit of proposed research is as clear as possible.
Guideline 2: Use words your readers are likely to understand.	With the specialised vocabulary that funding proposals will inevitably include, and word limits, briefly clarify potentially ambiguous or unfamiliar terms upon first use. Do not define each term, rather clarify when first used. Ensure that words around the technical terminology are clear enough to enable readers to infer meaning correctly.
Guideline 3: Write concisely.	Present information in as simple a manner as possible for reviewers to grasp the importance of the proposal as early in the document as possible, and to follow the essential points without repetition.
Guideline 4: Use vertical lists to break up complicated text.	Vertical lists, with correct parallel structure, allow readers to get to the essence of the information at first glance and without a need to reread a document several times. For process steps, it is important to organise this vertical list chronologically.
Guideline 5: Over the whole document, make the average sentence length 15 to 20 words.	Complex ideas are often written in long, overly complicated sentences. Vary sentence lengths but keep the average between 15 and 20 sentences, as these are the easiest to read.

Guideline 6: Prefer the active voice unless there is a good reason for using the passive.	Scientific breakthroughs are often communicated using abstract nouns and the passive form. Although the process is usually the key to any scientific research, texts should be written in the active unless it changes the context of what the researcher is trying to say.
Guideline 7: Reduce cross-references to a minimum	In a template, limit referring reviewers to sections later in the template. Keep all relevant information together and explain technical terminology where it is first mentioned as far as possible.
Guideline 8: Sequence process steps for clarity.	Correctly sequencing events can help to tell the science story clearly. Sequencing will help a reviewer to follow the why, what, and how of a proposal at first reading.

7.6 FINAL REFLECTIONS

Throughout this study, I experienced a very welcoming and positive response from most of the respondents, engineers, and scientists that I approached. Overall, most respondents were enthusiastic about Plain Language and willing to embrace the principles in their writing. The value of language skills that language practitioners can offer is an aspect that the industry can benefit from to communicate more clearly to prospective clients. Working in technical fields is challenging, the content takes extreme effort to understand, but is not impossible to master. Conversely, technical and scientific language can indeed be enhanced by the application of Plain Language guidelines, which language practitioners can potentially teach scientists to use from the inception of a document.

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APPENDICES

Appendix A: Letter requesting SACNASP to distribute the survey to its members

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Department of English

Department of English
University of Pretoria
Pretoria 0002, South Africa
1 November 2018

Dear …

Distribution of survey on making funding proposals and tenders more effective

My name is Antoinique van Staden [redacted]. I am a student doing a PhD in English at the University of Pretoria under the supervision of Dr Idette Noome, who can be reached at 0124203379 or [redacted] for further information.

I am writing to you to request your assistance in inviting members of your organisation to participate in the study entitled "Using Plain Language for more effective interdisciplinary engineering communication". The purpose of this study is to develop viable Plain Languages guidelines to assist engineers in communicating technical information in an effective manner, and engineers' participation will assist in determining the effectiveness and readability of texts.

The background to this study is that to ensure funding for research and projects, engineers frequently need to communicate their ideas to a panel of reviewers in the form of written proposals applying for funding in terms that the reviewers can understand. Communication is complicated by the fact that the reviewers do not necessarily work in the same field as a particular proposer, because engineering is a blanket term covering mechanical, electronic, civil and industrial engineering, to name just a few fields. Interdisciplinary communication is thus crucial in funding and project proposals. Reviewers may also not be first-language speakers of English. One way to make sure that documents are effective in communicating their chosen message is to apply Plain Language. Plain Language can be defined as

> [T]he *writing and setting out* of essential information in a way that gives a cooperative, motivated person a good chance of understanding it at *first reading*, and in the *same sense that the writer meant it to be understood*. (Cutts, 2004, my emphases)

In my study, I will analyse sample documents and rewrite them in Plain Language. The second part of the study consists of a survey to help test which Plain Language principles are the most effective. This is where I need your assistance to distribute the questionnaire. I understand that your mailing list(s) are confidential, and request that you forward my request for participation (Appendix A)[22] and the link to the questionnaire on the surveymonkey website to your members. The survey (see Appendix B)[23] will cover demographic information (without asking any identifying details), choosing between text samples and a few questions about attitudes to language practice. It will be completely anonymous and participants will complete the survey through the website www.surveymonkey.com.

If your organisation would be willing to assist in this research by distributing the survey participation cover letter and link, please complete the consent form overleaf for me to submit to my university's ethics committee.

Your organisation's participation will make a valuable contribution to better understanding of engineering communication.

Yours sincerely
Antoinique van Staden

Antoinique van Staden
Tel number: [redacted]
E-mail address: [redacted]

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[22] In this thesis, Appendix C.
[23] In this thesis, Appendix E.

Appendix B: Consent from SACNASP

Consent form:

I [redacted]...have read the information on the proposed research and am satisfied that participants will be fully informed of the purpose of the research, the confidentiality of the data and the participants' rights via the Request for participation (Appendix A) and the consent form in the questionnaire itself (Appendix B).

On behalf of (name of organisation)

...SACNASP...,

I agree to distribute the Request to participate (Cover letter) and survey link to www.surveymonkey.com to members via our mailing lists in 2019.

I have the right to print a copy of this consent form for my personal information and the organisation's records.

Signature [redacted] Date...13 November 2018...

Appendix C: Request for participation in survey

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Department of English

Dear Scientist/Engineer

Your participation in a survey on making funding proposals and tenders more effective.

I would like to invite you to participate in the study entitled "**Using Plain Language for more effective interdisciplinary engineering communication**". The purpose of this study is to develop viable Plain Languages guidelines and ways to assist scientists/engineers in effectively communicating interdisciplinary technical information. Your participation will assist in determining the effectiveness and readability of texts.

My name is Antoinique van Staden [redacted]. I am conducting research for a PhD in English at the University of Pretoria under the supervision of Dr Idette Noomé, who can be reached at 0124203379 or [redacted] for further information.

The aim of this study is to explore whether and how applying Plain Language principles to **funding proposals and technical documents** such as tenders can help scientists/engineers to communicate their work more effectively to an interdisciplinary panel of experts. The procedure consists of a survey on demographic information (which will not identify you personally) followed by a few questions on how you feel about working with language practitioners and examples of original texts and texts rewritten in Plain Language to test your preferences. The survey should take 10-20 minutes to complete.

The completion deadline for the survey is 3 April 2020. To respond, click on the link below.
Better technical communication for scientists/engineers

[redacted]

Better technical communication for scientists/engineers
Take this survey powered by surveymonkey.com. Create your own surveys for free.

Your participation in this study is voluntary. Refusal to participate will involve no penalty. You have the right to withdraw from the study at any time. Any information you provide will be kept completely anonymous. I will ensure that no information you provide can be linked to your responses. You are also assured that only the researcher and supervisor will have access to the data, and that the data will be stored securely, in accordance with the policy of the University of Pretoria. Surveymonkey's security policy can be found at the following link (separate from the survey):

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwj9gPaX6LfdAhUELMAKHXxqDcoQFjAAegQIBhAB&url=https%3A%2F%2Fwww.surveymonkey.com%2Fmp%2Flegal%2Fsecurity%2F&usg=AOvVaw1f5zPv3uso83AU7z8nNzZe

Please note that you are under no obligation to answer any questions that you are not comfortable with. The findings of the study can be made available to you on request after completion of the study.

The **homepage of the survey includes a section indicating your informed consent to participate in the survey**. Your participation will make a valuable contribution to better understanding of interdisciplinary engineering communication.

Yours sincerely
Antoinique van Staden

Antoinique van Staden — Tel number: [redacted] — Email: [redacted]
Idette Noome
Humanities 16-29 — Tel number: 012 420 2421 — E-mail address: [redacted]
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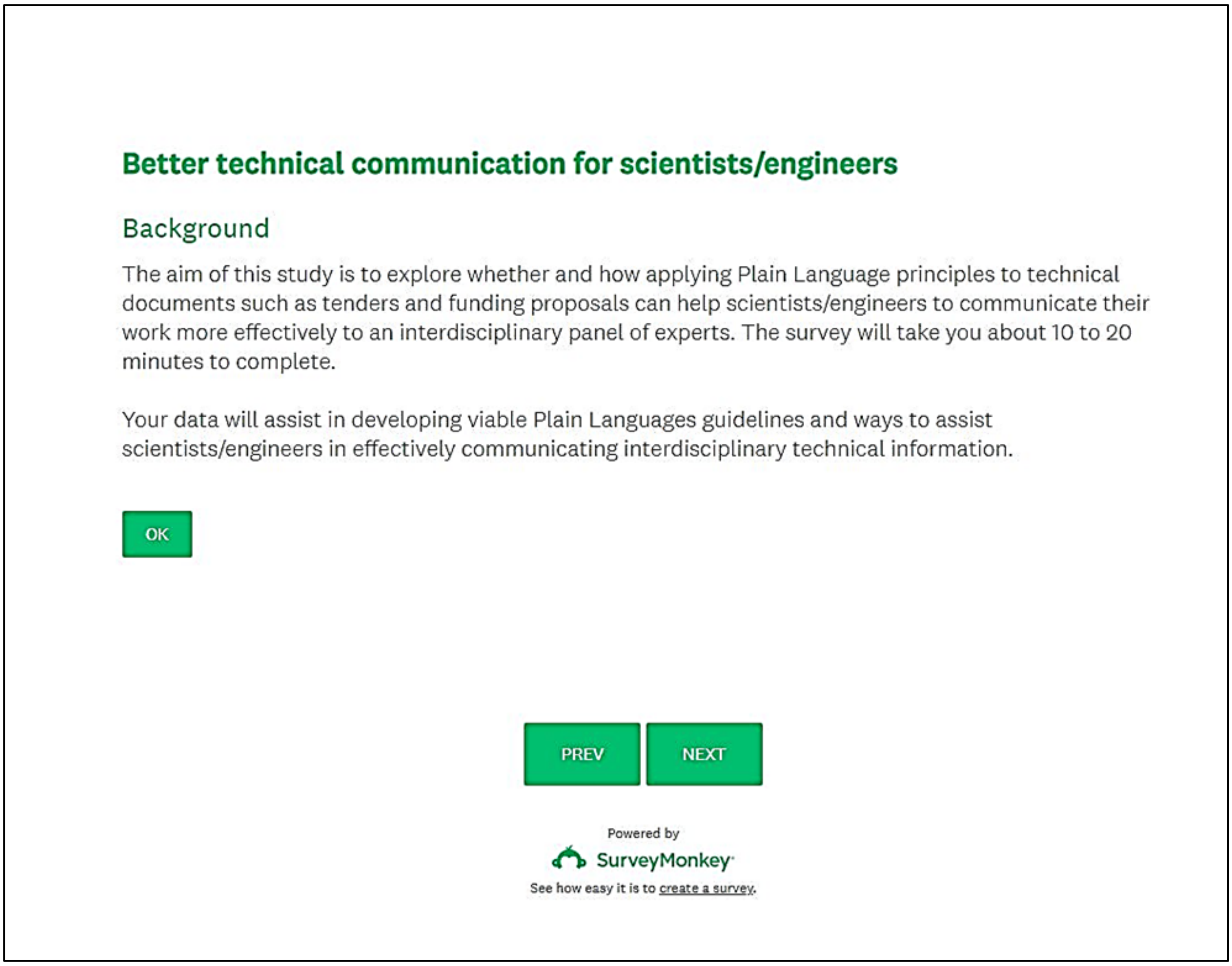
Pretoria 0002 — Cell +[redacted]

Appendix D: SurveyMonkey: Background to the study



Better technical communication for scientists/engineers

Background

The aim of this study is to explore whether and how applying Plain Language principles to technical documents such as tenders and funding proposals can help scientists/engineers to communicate their work more effectively to an interdisciplinary panel of experts. The survey will take you about 10 to 20 minutes to complete.

Your data will assist in developing viable Plain Languages guidelines and ways to assist scientists/engineers in effectively communicating interdisciplinary technical information.

OK

PREV NEXT

Powered by
SurveyMonkey
See how easy it is to create a survey.

Appendix E: Full survey from SurveyMonkey

Thank you for participating

Your participation in this study is voluntary. Refusal to participate will involve no penalty. You have the right to withdraw from the study at any time. Any information you provide will be kept completely anonymous. I will ensure that no information you provide can be linked to your responses. You are also assured that only the researcher and supervisor will have access to the data, and that the data will be stored securely. Please note that you are under no obligation to answer any questions that you are not comfortable with. The findings of the study can be made available to you on request after completion of the study.

1. I understand the terms of the survey

○ I would like to continue

Demographic Information

2. What is your field of specialization?

3. Highest qualification obtained

- Baccaleurs
- Honours
- Masters
- Doctorate
- Other

4. Home Language

- English
- Afrikaans
- isiZulu
- isiXhosa
- Sepedi
- Setswana
- Sesotho
- Xitsonga
- Siswati
- Tshivenda
- IsiNdebele
- Other

Writing in field of specialization

5. 1. How often do you need to write reports?

- ◯ Never
- ◯ Once a month
- ◯ Every three months
- ◯ Twice per year
- ◯ Once per year
- ◯ Other

6. If other, please specify.

7. Is your work dependent on outside company funding?

- ◯ Yes
- ◯ No

8. If yes, how often (on average) do you need to write funding proposals?

- ◯ Never
- ◯ Once a month
- ◯ Every three months
- ◯ Twice per year
- ◯ Once per year
- ◯ Other

9. If other, please specify.

10. Do you write funding proposals on your own?

- ◯ Yes
- ◯ No

11. If no, how many peers (on average) write funding proposals together?

12. How many pages long (on average) is each funding proposal?

13. Are you provided with a template for the proposal?

- ◯ Yes
- ◯ No

14. How easy do you find it to navigate the template and write your specialization into it?

- ◯ Very easy
- ◯ Bit of an effort
- ◯ Difficult
- ◯ Almost impossible

15. Would you prefer to write according to a template?

- ◯ Yes
- ◯ No

Primary language that you work in

16. Primary language that you work in?

- English
- Afrikaans
- isiZulu
- isiXhosa
- Sepedi
- Setswana
- Sesotho
- Xitsonga
- SiSwati
- Tshivenda
- isiNdebele
- Other

17. How proficient do you feel in working in this language at work?

- Completely proficient
- Fairly confident
- Sometimes struggle
- Not at all proficient

18. How comfortable are you with your own writing skills?

- I'm a good writer and know how to write clearly.
- I sometimes need help, but overall I am able to communicate efficiently.
- I know how to convey my message, even if it's not elegant.
- I can't write and don't enjoy writing.

19. In writing funding proposals, or any other writing you do for work purposes, do you ever use a language practitioner or communication specialist to review the proposal before submission?

- Yes
- No
- Sometimes

20. Reason for using/not using a language practitioner

Preferred Plain Language examples

21. Choose the option you find easier to understand at first reading.

- ◯ Leakage detection gas in a 3D space using CFD and IIoT.
- ◯ A detection system for the earlier identification of gas leaks for implementation in mining and refinery environments.

22. Choose the option you find easier to understand at first reading.

- ◯ Hazardous gasses are sometimes accidentally released. If this is not detected quickly, it could potentially have deadly consequences (e.g. explosions or illnesses caused by long-term exposure). Leaks can also harm the environment. A method to detect gas leaks from a few sparse data sources is currently widely applied, but faster detection with pinpoint accuracy will save money, time and lives.
- ◯ The accidental release or leakage of hazardous gasses is a serious health and environmental concern, with potentially deadly consequences. The ability to detect the source of such a leak rapidly and accurately will help reduce or manage these risks.

23. Choose the option that you find easier to understand at first reading.

- ◯ We intend to develop a [smart] wireless gas sensor system based on the CSIR on-chip nano gas detector. The intended approach is to use in-situ wireless gas sensors interacting with a Computational Fluid Dynamics (CFD) model and a spatial weather system (possibly augmented with in-situ airflow sensors) to pinpoint the source of the leak. CFD modelling has the potential to accurately model the gas dispersion and threats as a function of physical characteristics in the environment surrounding a plant or underground mining domain.

  Through the CFD-generated model, it will be possible to find the optimal placement, type and number of gas sensors needed to effectively negate health and environmental risks. Due to the high computational costs associated with CFD methodologies, the approach will require generating a reduced order model (ROM), trained with a large set of CFD scenarios. Combining ROMs with mathematical inverse methods allows for the creation of an intelligent system to pinpoint gas sources using a sparse set of fixed-point gas concentrations and airflow measurements.
- ◯ We propose a gas detection system that is capable of estimating the source and location of a leak in real-time. The ability to pinpoint the source of a leak accurately has the potential to significantly reduce the risks associated with gas leaks. Our proposed system will use wireless gas sensors, based on the CSIR nano-chip, interacting with a Computational Fluid Dynamics (CFD) model and a spatial weather system, to predict the source of a leak accurately. The CFD-generated model will make it possible to find the optimal placement, type and number of gas sensors needed in any specific environment. CFD modelling enables gas dispersion and the threats it poses to be modelled accurately, so it will be possible to develop an intelligent system to pinpoint gas sources using a sparse set of fixed-point gas concentrations and airflow measurements.

  Developing this smart system has the benefit of reducing health, environmental and economic risks associated with gas leaks in mines, and will also be commercially applicable to fuel refineries or similar environments where leaks are an everyday reality.

24. Choose the option you find easier to understand at first reading.

- ◯ A tool for coupling software to enable multi-physics simulations.
- ◯ A black-box coupling tool for partitioned, multi-physics simulations.

25. Choose the option that you find easier to understand at first reading.

◯ Consider the following example of blood flow through an artery. A pressure pulse (from the heart), causes the artery walls to expand, which in turn causes the pressure pulse to propagate through the artery. This pressure pulse propagates through the arterial system at enormous speeds (close to 500cm/s) which in turn slowly forces the blood to circulate. The very nature of the blood flow problem is a strongly coupled system between fluid flow and structural deformations. The blood flow is a direct result of the artery wall displacements, where these displacement again depends on the fluid flow. To solve problems of this nature requires accounting for highly non-linear, strongly coupled interactions between these multiple physical domains.

◯ Fluid structure interaction (FSI) describes how fluid flow interact on solid surfaces. It is how a solid surface will respond to the fluid pressure and how the solid will again disperse the fluid around the solid surface. Where the fluid and solid interact with each other is called an interface. To numerically predict what the results of this interaction would be, is really difficult and can sometimes be inaccurate.

I am going to explain how blood flows through an artery as an example of a coupled system between fluid flow and structural deformations:

· When the heart pumps it sends a pressure pulse that travels along the length of an artery. This happens at enormous speeds of close to 500cm/s.

· As the pressure pulse travels, it gathers momentum, and this is called a propagating wave and this is a direct result of the strong coupling between the fluid flow and structural deformation.

· This high pressure causes the artery walls (solid) to expand outwards.

· As the artery walls expand outwards it changes the way that the blood (fluid) behaves. The pressure on the artery wall increases, while the force from the wall disperses the fluid.

· This cycle of pressure and force repeats and as a result blood continues to flow through the arterial system.

To accurately model how blood flows through the arterial system, you have to take into account the non-linear, coupled interactions between the fluid flow and the solid structure.

26. Choose the caption that you find easier to understand at first reading.

◯ When a heart beats, a pressure pulse is sent through arteries. As this pulse move through the arteries, the blood increases like a wave. This pressure wave causes the artery walls to expand and this is called artery wall displacements. This image shows how the fluid (blood) interacts with the solid surface (artery walls) at two different points as the blood flows. Blood flow is a popular fluid structure interaction (FSI) benchmark problem. Because this is numerically challenging, it is used as an example of the type of problems that black-box partitioned solvers struggle to solve.

◯ Pressure pulse propagation through a section of an artery at two different time steps, where the wall displacement is amplified 10 times. It represents a popular benchmark problem and is inspired by the type of flow problems encountered in haemodynamics, and is often provided as an example of the class of problems to which black-box partitioned solvers are ill-suited.

27. Choose the option that you find easier to understand at first reading.

◯ To solve for fluid-structure interactions we have two independent domains, namely a fluid domain and a solid domain, which share a common interface. The coupling tool in an iterative, or successive/staggered fashion solves the two domains. Solving for the fluid sub-domain provides an interface stress state or forces (in the form of pressures and shear stresses). The coupling tool transfers these forces to the solid sub-domain interface. Solving for the solid sub-domain (with these forces as boundary conditions), provides a new interface displacement which is once again transferred to the fluid domain. This iterative cycling is repeated until convergence is achieved (i.e. the relative change in the primary variables fall below some required tolerance). Once convergence has been achieved the time step is advanced and the same process is repeated.

◯ Fluid structure interactions rely on two independent domains: a fluid domain and a solid domain. These two domains share a common interface. An interface is the actual boundary where the fluid domain and the solid domain interact on each other. Our tool solves the two domains in successive steps:

- First, the tool models the fluid domain which results in pressures and shear stresses along the shared interface boundary. The coupling tool then transfers this data to the solid domain's interface.
- These pressures and shear stresses are applied as boundary conditions. The data from the solid domain now gives the interface the displacements in the boundary and is once again transferred to the fluid domain.
- This cycle is repeated until the programme achieves convergence.

Further communication

28. Thank you for completing the survey. If you would be willing to answer some follow-up questions regarding Plain Language, please leave your email address and I will be in contact.

Appendix F: Participation request for follow-up interviews

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Department of English

Department of English
University of Pretoria
Pretoria 0002, South Africa
6 July 2020

Dear Respondent

Follow-up interview request

My name is Antoinique van Staden [redacted]. I am a student doing a PhD in English at the University of Pretoria under the supervision of Dr Idette Noomé, who can be reached at 0124203379 or [redacted] for further information.

Thank you for completing the survey *Better technical communication for scientists/engineers*. You indicated that you would be willing to answer some follow-up questions.

I would like to schedule a time with you before 30 July for a ten-minute telephonic interview when it is convenient for you. (In view of Covid-19, a telephonic meeting is the easiest option.) In order to do this, please indicate a date and time for this interview to take place and provide me with your contact number.

- Your participation in this study is voluntary. Refusal to participate will involve no penalty.
- You have the right to withdraw from the interview at any time.
- Any information you provide will be kept completely anonymous. I will ensure that no information you provide can be linked to your responses. You are also assured that only the researcher and supervisor will have access to the data, and that the data will be stored securely in password protected electronic form, according to the University of Pretoria's data storage policy.
- You are under no obligation to answer any questions that you are not comfortable with.
- The findings of the study can be made available to you on request after completion of the study.

Thank you again for your willingness to participate in this study.
Yours sincerely
Antoinique van Staden

Antoinique van Staden	Tel number: [redacted]	Email: [redacted]
Idette Noome		
Humanities 16-29	Tel number: 012 420 2421	E-mail address: [redacted]
University of Pretoria	Fax number: 012 420 5191	www.up.ac.za
Pretoria 0002	Cell +[redacted]	

Consent form:

I …………………have read the informed consent form provided above. I voluntarily agree to participate in this study and give permission for the interview to be audio-recorded. I have the right to print a copy of this consent form for my personal information.

I can be contacted for arrangements for the interview at (tel./email) ………………………………

The following date and time will suit me best:

Date………………………………………………. Time ……………………………………..

Signature…………………………………………. Date………………………………………

Appendix G: Follow-up interview Questions – Round 1

1. How often do you need to write reports or funding proposals?

2. Who are the stakeholders you must communicate with when writing funding proposals?

3. On average, how often is the proposal written in technical language with specific jargon that your reader might not always understand?

4. How do you usually try to accommodate the issue of someone maybe not understanding your document?

5. What are the repercussions, if any, of a reader not understanding your document?

6. The definition of Plain Language is:

The *writing and setting out* of essential information in a way that gives a cooperative, motivated person a good chance of understanding it at *first reading*, and in the *same sense that the writer meant it to be understood*. (my emphases)

Have you ever heard of this before?

7. Do you think Plain Language can be beneficial to your industry?

8. If you think Plain Language could be beneficial, would you be willing to work with a Plain Language Practitioner on your documents?

9. What are the problems you foresee working with a Plain Language Practitioner?

Appendix H: Follow-up interview Questions – Round 2

Section 1: Demographics

1. In which field do you work? (establish engineer, science, research, …)

2. How long have you been working in this field?

3. Do you have to write reports? Y/ N or funding proposals? Y/N or tenders? Y/N

Section 2: Writing experience

4. How often do you need to write (communicate your work in a written form)? (per month or per year)

5. Who are the stakeholders you must communicate with when writing?

6. On a scale of 1-10, how often is the report/funding proposal /tender *(adjust depending on demographic response to Q3 above)* written in technical language with specific jargon that your reader might not always understand?

7. How do you usually try to accommodate the issue of someone perhaps not understanding your document?

Section 3: Plain Language

8. The definition of Plain Language is:

The writing and setting out of essential information in a way that gives a cooperative, motivated person a good chance of understanding it at first reading, and in the same sense that the writer meant it to be understood.

Have you ever heard of this before? Y/N

9. Do you think Plain Language can be beneficial to your industry? Y/N

Can you expand on why you say so?

10. When you completed the survey, and you had to choose between the two example texts, what were some of the factors that influenced your choice? (Why did you choose one example over another?)

Section 4: Language practitioner

11. Have you ever worked with a language practitioner (editor, technical writer)?

If yes, what was that experience like?

If no, what are some of the reasons that prevent you from working with a language practitioner?

12. How much do you think language practitioners ask for their work? Do you think that is expensive?

13. Currently language-related services as an industry are mostly unregulated in terms of quality and price. Would you like to retain the option of being able to negotiate fees with a practitioner, or would you rather have a fixed price set by some kind of government or industry regulation?

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Appendix I: Request for Author's Consent

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Department of English

Dear Author (personalised per author)

Document analysis consent

My name is Antoinique van Staden ([redacted]). I am a student doing a PhD in English at the University of Pretoria under the supervision of Dr Idette Noome, who can be reached at 0124203379 or [redacted] for further information.

I would like to ask for written permission to use the following technical proposal document/funding proposal/technology demonstrator .... for the purposes of analysis and rewriting based on Plain Language principles and then distributing key examples to survey participants for comment. The survey will be completely anonymous and I will take care to ensure that there is no reference to your company and/or key research questions discussed in the extracts used for the survey.

The aim of this study is to explore whether and how applying Plain Language principles to funding proposals and technical documents, such as tenders can help engineers to communicate their work more effectively to an interdisciplinary panel of experts. The background to this study is the fact that to ensure funding for research and projects, engineers frequently need to communicate their ideas to a panel of reviewers in the form of written proposals applying for funding. When projects are proposed to clients, engineers need to account for what the reader is likely to want from a brief and after completing this project proposal, then communicate to a reader the essence of the project in terms that the reader can understand. Communication is complicated by the fact that the reviewers may not necessarily work in the same field as a particular proposer, because engineering is a blanket term covering mechanical, electronic, civil and industrial engineering, to name just a few fields. Interdisciplinary communication is thus crucial in funding and project proposals. Reviewers may also not be first-language speakers of English. One way to make sure that documents are effective in communicating their chosen message is to apply Plain Language. Plain Language can be defined as

The *writing and setting out* of essential information in a way that gives a cooperative, motivated person a good chance of understanding it at *first reading*, and in the *same sense that the writer meant it to be understood*. (Cutts, 2004).

All documents will be kept secure (on a password-protected computer in a secure location) and only the researcher and supervisor will see the original documents and participants in the survey will not be provided with any revealing information regarding the origins of the original documents. The purpose of the study is to develop viable Plain Languages guidelines to assist engineers in communicating technical information to a non-technical audience in an effective manner. The results of the study as well as the rewrites of the original documents will be made available to you upon request after the completion of the thesis and the examination process. Providing me with an example document is completely voluntary and you under no obligation to give permission for the use of the documents. You can withdraw your document from the study at any point without prejudice. No remuneration is offered for use of the document. You may, however, benefit from seeing the suggested rewrites.

Yours sincerely
Antoinique van Staden

Antoinique van Staden
Tel number: [redacted]
Email: [redacted]

Idette Noome
Humanities 16-29
University of Pretoria
Pretoria 0002
Tel number: 012 420 2421
Fax number: 012 420 5191
Cell +[redacted]
E-mail address: [redacted]
www.up.ac.za

Consent form:

I ……………………………………………have read the document analysis consent form provided above.

I voluntarily agree to provide the requested sample document and give permission for the document to be analysed and key examples used in a survey.

I have the right to print a copy of this consent form for my personal information.

Signature……………………………………..   Date……………………………………….

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Department of English
University of Pretoria
Pretoria 0002, South Africa
1 November 2018

Dear Author

Document analysis consent

My name is Antoinique van Staden [redacted] I am a student doing a PhD in English at the University of Pretoria under the supervision of Dr Idette Noome, who can be reached at 0124203379 or [redacted] for further information.

I would like to ask for written permission to use the following technical proposal document/funding proposal/technology demonstrator .... for the purposes of analysis and rewriting based on Plain Language principles and then distributing key examples to survey participants for comment. The survey will be completely anonymous and I will take care to ensure that there is no reference to your company and/or key research questions discussed in the extracts used for the survey.

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Yours sincerely
Antoinique van Staden

Antoinique van Staden	Tel number: 074 1483820	Email: an[redacted]
Idette Noome		
Humanities 16-29	Tel number: 012 420 2421	E-mail ad[redacted]
University of Pretoria	Fax number: 012 420 5191	www.up.[redacted]
Pretoria 0002	Cell +27 82 78 12 052	

Consent form:

I ....[redacted]......have read the document analysis consent form provided above.

I voluntarily agree to provide the requested sample document and give permission for the document to be analysed and key examples used in a survey.

I have the right to print a copy of this consent form for my personal information.

Signature..........[redacted]

Date.......13/11/2018.........................

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Department of English
University of Pretoria
Pretoria 0002, South Africa
8 January 2019

Dear Author

Document analysis consent

My name is Antoinique van Staden ([redacted]). I am a student doing a PhD in English at the University of Pretoria under the supervision of Dr Idette Noome, who can be reached at 0124203379 or [redacted] for further information.

I would like to ask for written permission to use the following technical proposal document/funding proposal/technology demonstrator **LEAKAGE DETECTION AND BLACK-BOX COUPLING TOOL** (Funding proposals and technolody demonstrator) for the purposes of analysis and rewriting based on Plain Language principles and then distributing key examples to survey participants for comment. The survey will be completely anonymous and I will take care to ensure that there is no reference to your company and/or key research questions discussed in the extracts used for the survey.

The aim of this study is to explore whether and how applying Plain Language principles to funding proposals and technical documents, such as tenders can help engineers to communicate their work more effectively to an interdisciplinary panel of experts. The background to this study is the fact that to ensure funding for research and projects, engineers frequently need to communicate their ideas to a panel of reviewers in the form of written proposals applying for funding. When projects are proposed to clients, engineers need to account for what the reader is likely to want from a brief and after completing this project proposal, then communicate to a reader the essence of the project in terms that the reader can understand. Communication is complicated by the fact that the reviewers may not necessarily work in the same field as a particular proposer, because engineering is a blanket term covering mechanical, electronic, civil and industrial engineering, to name just a few fields. Interdisciplinary communication is thus crucial in funding and project proposals. Reviewers may also not be first-language speakers of English. One way to make sure that documents are effective in communicating their chosen message is to apply Plain Language. Plain Language can be defined as

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Yours sincerely
Antoinique van Staden

Antoinique van Staden
Idette Noome
Humanities 16-29
University of Pretoria

[redacted]

Pretoria 0002 Cell +27 82 78 12 052

Consent form:

I, [redacted] have read the document analysis consent form provided above.

I voluntarily agree to provide the requested sample document and give permission for the document to be analysed and key examples used in a survey.

I have the right to print a copy of this consent form for my personal information.

Signature…[redacted]…… Date……16 Nov 2018……………………

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Department of English
University of Pretoria
Pretoria 0002, South Africa
8 January 2019

Dear Author: [redacted]

Document analysis consent

My name is Antoinique van Staden ([redacted] I am a student doing a PhD in English at the University of Pretoria under the supervision of Dr Idette Noome, who can be reached at 0124203379 or [redacted] for further information.

I would like to ask for written permission to use the following technical proposal document/funding proposal/technology demonstrator/services agreement ....as.....issued.... for the purposes of analysis and rewriting based on Plain Language principles and then distributing key examples to survey participants for comment. The survey will be completely anonymous and I will take care to ensure that there is no reference to your company and/or key research questions discussed in the extracts used for the survey.

The aim of this study is to explore whether and how applying Plain Language principles to funding proposals and technical documents, such as tenders can help engineers to communicate their work more effectively to an interdisciplinary panel of experts. The background to this study is the fact that to ensure funding for research and projects, engineers frequently need to communicate their ideas to a panel of reviewers in the form of written proposals applying for funding. When projects are proposed to clients, engineers need to account for what the reader is likely to want from a brief and after completing this project proposal, then communicate to a reader the essence of the project in terms that the reader can understand. Communication is complicated by the fact that the reviewers may not necessarily work in the same field as a particular proposer, because engineering is a blanket term covering mechanical, electronic, civil and industrial engineering, to name just a few fields. Interdisciplinary communication is thus crucial in funding and project proposals. Reviewers may also not be first-language speakers of English. One way to make sure that documents are effective in communicating their chosen message is to apply Plain Language. Plain Language can be defined as

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All documents will be kept secure (on a password-protected computer in a secure location) and only the researcher and supervisor will see the original documents and participants in the survey will not be provided with any revealing information regarding the origins of the original documents. The purpose of the study is to develop viable Plain Languages guidelines to assist engineers in communicating technical information to a non-technical audience in an effective manner. The results of the study as well as the rewrites of the original documents will be made available to you upon request after the completion of the thesis and the examination process. Providing me with an example document is completely voluntary and you under no obligation to give permission for the use of the documents. You can withdraw your document from the study at any point without prejudice. No remuneration is offered for use of the document. You may, however, benefit from seeing the suggested rewrites.

Yours sincerely
Antoinique van Staden

Antoinique van Staden
Idette Noome
Humanities 16-29
University of Pretoria
Pretoria 0002
[redacted]

Consent form:

I [redacted] have read the document analysis consent form provided above.

I voluntarily agree to provide the requested sample document and give permission for the document to be analysed and key examples used in a survey.

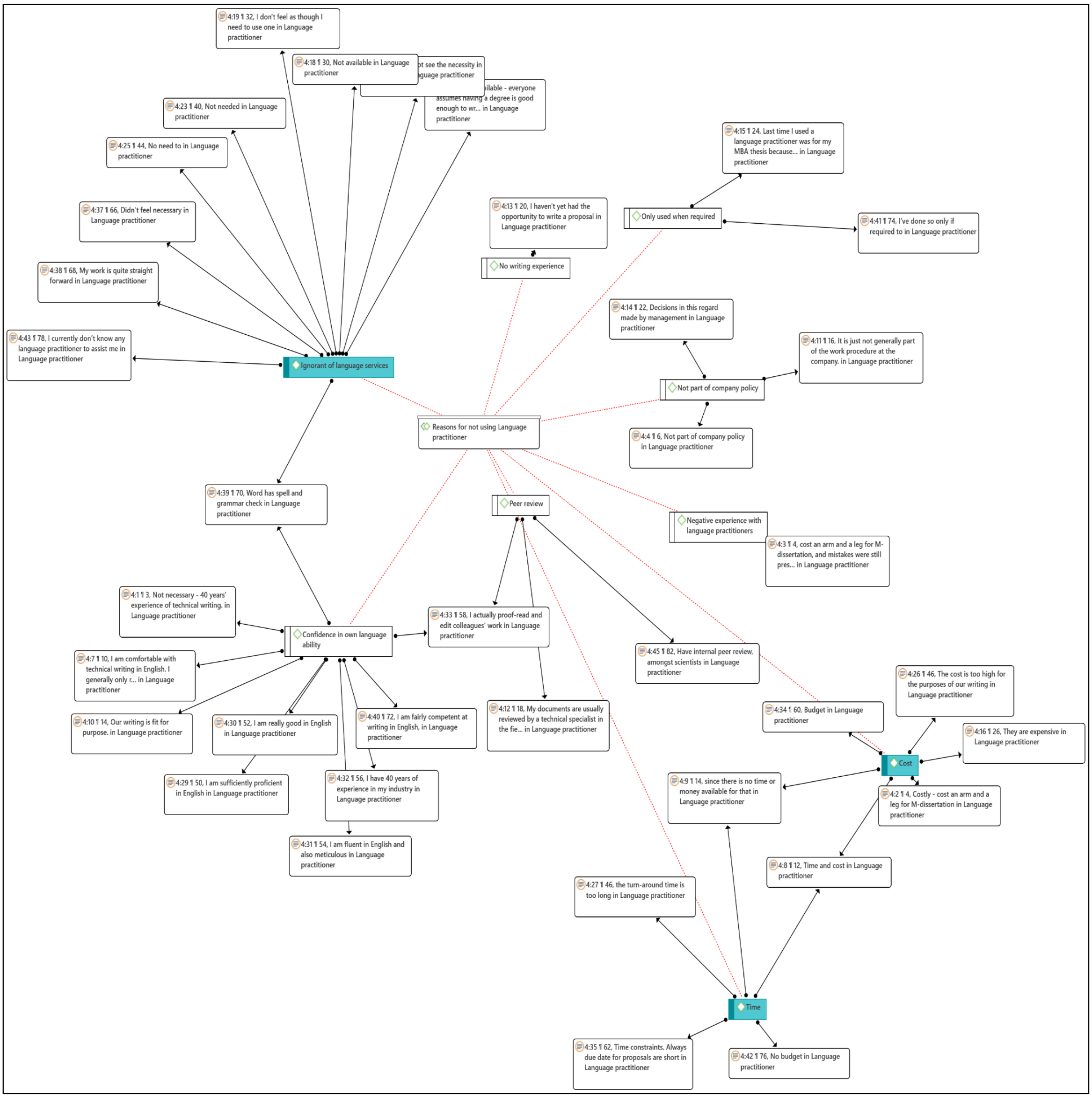
I have the right to print a copy of this consent form for my personal information.

Signature [redacted]

Date 11/2/2019.

Appendix J: Reasons for not using a language practitioner

Full diagram of interconnectedness between reasons for not using a Plain Language practitioner



Appendix K: Detailed descriptions of readability tests

- ***Flesch Reading Ease Formula***

This specific mathematical formula uses the average sentence length (ASL) minus the average number of syllables per word (ASW) to determine the readability ease (RE):

RE = ASL - ASW.

A score of 90-100 is considered to be easily understandable by an average 5th grader.[24] A score of 60-70 is considered easily understandable by 8th and 9th graders and a score of 0-30 should be easily understood by university graduates.

- ***Flesch-Kincaid Grade Level***

The formula that this test uses looks like this:

FKRA = (ASL x 0.39) + (ASW x 11.8) - 15.59.

The results are based on school grades: a score of 9.3 indicates that a 9^{th} grader would find the text easy to read.

Total polysyllabic word count	Approximate grade level (+1.5 grades)
1-6	5
7-12	6
13-20	7
21-30	8
31-42	9
43-56	10
57-72	11
73-90	12
91-110	13
111-132+	14

[24] These grades are based on the American schooling system.

- ***Gunning Fog Index (FOG) Formula***

The ideal score for this index is 7 or 8. Anything above 12 is too hard for most readers. The Gunning Formula's underlying message is that short sentences, written in Plain English, will achieve a better score than long sentences written in more complicated language.

- ***Smog Index***

The results of the index are indicated in the Smog conversion table below:

- ***Coleman-Liau Index***

Unlike the syllable-based readability tests already discussed, this index only focuses on the length of the words in characters. This is the mathematical formula used for this index:

CLI = (0.0588 x L) – (0.296 x S) – 15.8.

In the mathematical formula, L is the average number of letters per 100 words. S is the average number of sentences for 100 words. The results indicate a grade level, so a result of 10.6 indicates a text that a 10^{th} or 11^{th} grader would find easy to read.

- ***Automated Readability Index***

This index derives a score based on ratios for word difficulty (number of letters per word) and sentence difficulty (number of words per sentence). The results of this formula give a score that indicates the approximate age that would find the text easy to understand. A score of level 1 relates to grade 1. The average age of a grade a learner relates to an age of 6 to 8 years old.

- ***Linsear Write Formula***

Similar to other readability formulas, the Linsear Write Formula determines the grade level that would find the text easily understandable. Sentence length and more than three syllables in a word influence this score, one way to lower this score is by using shorter sentences and less complex words.