English Academic Writing by Dutch Engineering Students[1]

Laurent Willemsen

1. Introduction

It may come as a shock to aspiring engineers that a large part of their professional life may revolve around communication and using language effectively. Huckin and Olsen (1991, p. 7) discuss the findings of several studies that suggest that professional engineers spend 25% of their time writing. Anderson (as cited in Elling, Andeweg, de Jong, & Swankhuisen, 2000, p. 14) finds that 40 to 60 per cent of a professional engineer's time is spent communicating with others.

According to the Accreditation Board for Engineering and Technology (as cited in Brinkman & van der Geest, 2003, p. 68), a comprehensive engineering programme should include a project that results in "a report that demonstrates both mastery of the subject matter and a high level of communication skills". Such expectations give a clear insight into what is expected of graduate-level engineering students in this global economy.

Many students, however, have difficulty with writing their thesis in English and with producing readable text. The study discussed in this article examined the writing of students from the faculty of Industrial Design Engineering (IDE) at Delft University of Technology (DUT), who had nearly completed the Master's programme of Strategic Product Design (SPD).

Although not described in detail, the IDE 'Teaching and Examinations Regulations' states that, in general, a DUT master's graduate "is able to work in an international environment by virtue of … language and communication proficiency" (2011, p. 7). It also states that an SPD graduate is expected to be able to "present and report design concepts and (strategic and/or scientific) research findings in a professional manner" (p. 8).

The aim of this study was to define the depth and breadth of the problems experienced by Dutch SPD students. This article is structured to follow the tools as described by Rogers and Rymer (2001). It is split in two parts: one of language competence and one of academic writing competence. It concludes with an overview of the range of issues students experience and how these issues affect their communicative competence.

2. Communicative Competence

One model that can be used to evaluate communicative competence is that of Rogers and Rymer (2001). They set out to develop a means to point out to prospective MBA students areas for improvement in their writing. Instead of evaluating texts on internal merits using a common scoring rubric, they sought to read the texts "as readers seeking to understand writer intent" (Rogers & Rymer, 2001, p. 116). They looked at the text in such a way, from the content level of organisation to the minutiae of individual lexical errors, to assess the "success or failure of interaction between writer and intended reader" (p. 116). After writing the text, students would receive feedback and know where their deficiencies lay. With that knowledge, they could set out to improve their competences.

One reason why such an approach effective is that the suggestions it provides are not limited to a specific discourse. It was used to evaluate the decontextualised essays of the test by those traits most important for writing in an MBA programme. The traits used to evaluate the writing reflect commonly found issues such as "addressing the assigned task, reasoning logically, and avoiding errors" (p. 121). The validity of these traits is, according to Rogers and Rymer, verified by assessment research, which points out that several of the traits found form "significant components of analytical writing quality" (p. 122).

The model helped identify areas of improvement for MBA students, who, as a result, "[felt] more confident that they [could] succeed in the unfamiliar writing context of the business school." (p. 138). One reason for this effectiveness, Rogers and Rymer argue, is the logical progression for discussing writer-reader efforts to communicate (p. 124). It moves from the task tool, concerned with the goal of communication, to the coherence tool, which looks at structure and internal cohesion. Third is the reasoning units tool, which deals with readers' evaluation of credibility and argumentative development. The last tool is that of error and it includes both the errors that affect a writer's credibility as well as those that can change the meaning of a sentence.

The four tools provide a useful framework for this study, as they serve to bring together several relevant theories and language resources. The order of the tools was rearranged to reflect the difference between the goals of the original study and this one. The tools were originally developed to screen individual students at the start of their graduate studies and inform them about their writing proficiency. This current study, however, looks at the writings of graduating students and is more concerned with more general findings. The tools were rearranged from the logical progression used by Rogers and Rymer, chosen to help individual students, to the current one, which clusters the two language tools (i.e. Error and Coherence) and the two academic writing tools (i.e. Argument and Task). Each tool is discussed in turn, with relevant examples from the theses and conclusions on the findings of each tool.

3. Assessing language competence

3.1. Literature on language competence

Language competence is primarily concerned with the ability to use a language to express meaning clearly, i.e., unambiguously and concisely. Mcguire (as discussed in Hoeken, 2008, p. 56) acknowledges the value of language competence in the first stage of his information-processing paradigm, attention for a text. This paradigm suggests that before readers can begin to evaluate the validity of an argument, they first need to pay attention to the text. Gopen (2004, p. 10) has described this using a hypothetical *reader energy*, where the effort a reader is willing to exert to understand a text is divided between understanding what the structure conveys and evaluating the content of the text. The more energy readers lose in reconstructing meaning, the less energy they will have to understand the author's intention.

In reading, readers use the available energy to come up with a fitting interpretation of the text. Readers use both their previous knowledge and the cues given by the author. These cues are what make up the text: the words, clauses, sentences, paragraphs, chapters and documents and they have to fit the reader's interpretation of the text up until that moment. When the difference between the current interpretation and the direction of a cue is too large, this will result in a certain level of confusion and will require that the reader reinterprets the text. The energy that this reinterpretation requires is detracted from the total energy available to understand the meaning of a text.

Although writing effectively can be difficult for native authors and readers, it is considerably more difficult for non-native authors and readers. In the initial stages of learning a second language (L2), learners often rely on and transfer the language intuitions from their first language (L1) to the L2, both to positive and negative effect. This development strategy has its benefits, but for learners to progress beyond basic intermediate stage these intuitions will need to be adjusted to reflect the structure of the L2. This can be seen in the text produced by non-native authors. These authors have to convey meaning using a language they may not be completely proficient in. At the same time, non-native readers have to make sense of a text that is not in their L1.

It is likely that the problems that emerge in writing of non-native authors is the result of this negative transfer. The problems of language competence can be subdivided into two categories, error and coherence. The error category addresses problems on a lexical and grammatical level. The coherence category addresses how sentences, paragraphs and chapters tie together to form a cohesive document.

3.2. Method

I used a modified version of the Rogers and Rymer (2001) model to evaluate the theses of nine students and assess their language competence. As the expectations and requirements are likely to vary between supervisory teams and topics, the theses were selected from several supervising chairs and on a range of subjects. In the sample, both sexes are represented relatively equally (four men, five women).

A selection from each thesis included the executive summary (where present) and a representative chapter. Such a chapter would need to include a sufficient number of student-produced paragraphs, as these would exhibit the issues readers are likely to face in reading the thesis. As many issues arise from language interference, instances in one chapter are likely to be found throughout the thesis.

The selection from each thesis was read and each instance that reflected poor language competence was highlighted. The highlighted instances were categorised using the two tools described in the following sections. This approach gave an overview of common errors and instances of poor coherence of the theses.

3.3. Error tool

Instead of trying to classify errors by some arbitrary measure of severity, Rogers and Rymer categorise them by their disruptive impact. Errors can either affect an author's credibility or interfere with communication. Those errors that affect an author's credibility can be categorised into three categories: *accent errors*, *etiquette errors*, and *credibility errors*. The first category, accent errors, includes those errors that reflect the author's non-native origin and contains missing or wrong articles, wrong prepositions, and incorrect use of idioms. One step up are errors of etiquette. These 'errors' of prescriptivism are more serious, because readers are likely to notice any deviations from what they consider the norm and will judge the author for it (either consciously or subconsciously), believing as they do that "critical thinking is reflected in the observance of grammar rules" (Rogers & Rymer, 2001, p. 130). The last type of errors that affect an author's credibility are those that are recognisable violations of Standard English. Spelling errors, faulty subject/verb agreement, and punctuation errors, all of these "[reduce] the reader's confidence in what a writer has to say" (Rogers & Rymer, 2001, p. 130) and are often the unnecessary consequence of writing quickly and forgetting to proofread.

Although these errors affect the perceived credibility of the author, they are unlikely to interfere with communication to a great degree. The fourth category of error, disruptive errors, is concerned with those errors that do interfere with communication and make the reader's task more difficult. These can either be mistypings resulting in a different word or words used incorrectly, carrying a meaning other than the author intended. When readers try to make sense of a text and are confronted with words that carry a different meaning, they will have to re-evaluate the meaning they constructed and read a text again. Although not discussed explicitly in the model, this type or error also includes L1 interference.

As this study aims to assess communicative competence in the broad sense, it does not exclude mistakes that do not interfere with communication or detract from a writer's credibility. Each mistake has an effect on the reader and, as such, should be included in the evaluation of the student's communicative competence. As these are graduate students, their credibility is likely to suffer if their writing features low-level mistakes.

Examples of common issues

Although the effect of a single error cannot be objectively measured, the errors are arranged so that each next level of errors is more likely to distract the reader and reduce the author's credibility. All these levels affect a text at the same time. In discussing the tools, only those errors and issues relevant to the tool are discussed. The table gives an example of each issue.

Typing errors are relatively minor and are unlikely to seriously impede comprehension. Their effect on an author's credibility, however, is likely to be larger than errors resulting from L1 interference.

typing errors	The Dutch government anounced two years ago that [company] was for sale. (thesis 5, p. 40)	

Spelling errors not only reduce an author's credibility, but may require a reader to reread the sentence and come up with an alternative to the misspelled word.

spelling errors that alter word meaning	Since a brake trough of the electric car has a huge impact on the total demand. (thesis 6, p. 22)	breakthrough

Collocation errors may not be the result of inattention or poor proofreading on the part of the author, but of L1 interference.

Collocation	This technology is not expected to have a great influence on the needed grid capacity either. (thesis 6. p. 23)	major

Similar in their origin and effect, the errors in the thesaurus category are difficult to spot for authors with smaller vocabulary and with the correct 'idea' linked to the word.

Thesaurus	With the pumping system the user can administer a dose of sauce for the consumer. (thesis 4, p. 11)	dispense serving/ quantity

Issues of usage are placed higher than both thesaurus and collocation, because of the effect such 'mistakes' can have on the author's credibility. Some readers have strict opinions on how words ought to be used and will judge those authors who do not consider these notions while writing.

Usage	The growing amount of single households has an important impact on the electricity consumption. (thesis 6, p. 20)	increasing number considerable impact

The second to last level of errors looks at whether sentences are grammatically correct. Although the current approach argues that there is much more to writing well and effectively than writing only grammatically correct sentences, a reader's comprehension process may be slowed down or derailed by wrong verb tenses, strange subject-verb combinations and unintended subject-verb reversals.

Grammar	`In terms of punctuality is Holland the second best in Europe, after Switserland. (thesis 5, p. 38)`	

The last level of errors is reserved for errors similar to the thesaurus level. That level dealt with words that were wrong only to the extent that there was a better word to convey the intended meaning, including both nuance and connotation. In contrast, errors on this level are likely to confuse readers, requiring them to reread a sentence multiple times to determine how this error can be placed in their interpretation of the text.

Dictionary	`The tea podholder avoids that the tea gets a cream layer. (thesis 3, p. 11)`	prevents

The tool was designed to indicate a level of competence according to the prevalence of errors in a text. Rogers and Rymer have come up with six levels of competence, each of which comes with a brief description. The lowest level, 1, describes texts that suffer from: "Numerous errors of many types [that] severely interfere with communication and damage credibility" (2001, p. 131), whereas the highest level, 6, is reserved for texts where: "No errors interfere with communication or damage credibility. [It has no] disruptive errors, but may have a few credibility and/or etiquette errors, and/or accent errors" (p. 130).

Using these descriptions as the range of competence, most theses would score between three and four: disruptive errors and errors that interfere with communication are frequent; credibility and etiquette errors range between frequent and occasional; the frequency of accent errors range between numerous and frequent.

3.4. Coherence tool

Reading a text requires that a reader interprets the meaning of a text. At each level (sentence, paragraph and beyond) and at each moment, the reader creates an expectation of what a text means and what the author intends to say. By anticipating a reader's interpretative choices and expectations, authors can ease this process. This is what is meant with coherence: a text that satisfies the reader's expectations and signals the author's intentions. Conversely, unfulfilled expectations caused by poor coherence slow down reader comprehension (Fahnestock, 1983, p. 407).

One of the most important principles used to ensure coherence is what is called the known-new contract. In interpreting a sentence, most readers look for familiar elements to tie new information to. Similarly, most readers expect a linear progression from low to high informational value. Most sentences will begin with an element that readers are already familiar with and will end with what is most important.

Another important factor in creating coherence is emphasis, making a clear distinction between important and subordinate elements. One effective way to achieve this is through active formulation, which allows the verb to communicate the important action. Connected to this principle is the advice to put topical information in subject position, further adding to the coherence of a sentence.

Where sentences rely on coherence, paragraphs build on cohesion. The distinction between coherence and cohesion is the difference between lexical connection and rhetorical connection. For a reader to judge a paragraph as cohesive it must provide a clear argument and rhetorical connection between its elements.

The paragraph can be considered the basic functional unit of discourse in academic writing. Most readers expect paragraphs to have a distinct topic and point and assume that the topic of a paragraph, that which the paragraph discusses, is located in either the first or the second sentence. Every following sentence should be thematically connected to that stated topic and each paragraph should end with a concluding sentence. The author must ensure a logical progression from statement of topic to conclusion.

On a higher level, multiple paragraphs form the body of a text, preceded by a title and an introduction and followed by a conclusion. An effective introduction often includes a contextualising background, a statement of the problem to be discussed, and a response to that problem. The problem introduced in the introduction is discussed and expanded in the body of a text, which should contain multiple paragraphs. The paragraphs should show a clear link to the surrounding paragraphs and elaborate on the topic. Although there are various types of elaboration available to an author, many beginning authors default to the temporal mode, where they describe their process and activities in chronological order. Although this is one of the easiest organising principles for authors to use, it is often not the best organising principle for a reader to make sense of the topic discussed.

Common issues

There are some common issues that diminish both coherence and readability.

frontal overload	"An informational overload is created by filling the first part of the clause with all the prominent information.... The problem may well stem from a fundamental difference between the structure of the clause in English and Dutch." (Hannay & Mackenzie, 2002 p. 126-7)
faked cohesion	"Some writers try to fake coherence by lacing their prose with conjunctions like thus, therefore, however, and so on, regardless of whether they signal real logical connections." (Williams and Colomb, 2010 p. 78)

sprawl	When authors deviate from a point to add information, and continue to add additional information, losing the original point.

Examples

This section uses the features and issues discussed above to evaluate some sample sentences selected from the theses. In each sentence the verb phrase is made bold, discourse markers are italicised, and possible confusing elements are underlined. This sentence would be less wordy and more effective if it had been written in the active form, instead of the passive.

> By showing images of people who use the product an inspiring ambience **is created**. (thesis 3, p. 5)

This second example illustrates how even liberal use of discourse markers does not aid comprehension when the ideas itself are not clearly expressed already.

> *Third*, electricity **is** intangible and by that difficult to comprehend. *Not only* **is** it difficult to comprehend by the characteristics of electricity, *but also* consumers **are** ignorant about their own consumption patterns, *since* consumption data **is** improperly **communicated**, *hence* they **do not know** what they **miss**. (thesis 6, p. 28)

The examples illustrate how poor coherence makes understanding the author's intention considerably more difficult. All the reader energy is lost in deciding how components relate to each other and what the logical and rhetorical connection between them is. As a result, the reader has less energy available to focus on the content of the text.

Using the descriptions of competence described by Rogers and Rymers, we find that, in the texts that receive the lowest score attainable, (1) "passages are disjointed and there is no overall sense of meaning. Text requires rereading; many passages remain unclear" (p. 127). Texts with a score of 6 "form a meaningful whole with a controlling idea that is logically developed, with each passage clearly related to the next. Rereading is unnecessary, even if content is complex" (p. 127).

Most theses would receive a score of 3: "some passages hold together, but the parts do not form a meaningful whole; context may be missing, parts may be unclear, inconsistent, or unrelated. Cohesive devices may be used appropriately, but some may be inappropriate [e.g. the frequent misuse of therefore], and cohesive devices may not compensate for the lack of overall meaning. Frequent rereading of passages may be required; some passages may remain unclear" (p. 127).

The results discussed in both the error and the coherence tool suggest that many readers will find the theses hard to read. Solving these problems in isolation, however, will not ensure an effective text. To do that requires looking at a different component of communicative competence: academic writing competence.

4. Assessing academic writing competence

Much of our current academic discourse is based on the concept of social constructivism, where the community decides what is legitimate knowledge. This "suggests that the way we understand the world, the categories and concepts we use, are not 'truths' proven and fixed for all time but are specific to particular cultures and periods" (Hyland, 2006, p. 39). Although Johns (as cited in Hyland, 2006, p. 221) suggests that "texts are emotionally neutral and strive to appear objective," much of academic writing relies on persuading "other investigators that one's knowledge is legitimate" (Rose, as cited in Hyland, 2006, p. 111). Instead of enumerating the facts, a successful author uses the available facts to construct an argument and to persuade readers.

4.1. Method

As each discipline relies on different means to persuade their audience, it is impossible to use my own academic expectations (developed while studying English Language and Culture) to evaluate the academic writing of students from a different academic community. Both the purpose of writing a text (task tool) and the suitability of arguments (argument tool) might differ for each community and are determined by each community. To assess what the community's expectations regarding academic writing competence are for SPD students, the initial method was expanded to include several interviews, which served to determine the expectations of the discourse community. As SPD is an applied field of research, with strong ties between academe and industry, it was important to include both and construct a composite understanding of their expectations. The people interviewed included: five full professors, one associate professor/director of education, one instructor of undergraduate students, and one director of business development at a large multinational who has supervised several graduation projects.

In semi-structured interviews, which were recorded and varied in length from 35 to 70 minutes, each interviewee was asked to consider their expectations with regard to theses and academic writing competence in general and to describe what the purpose of a thesis was and what they expected in terms of structure and organisation. The interviews were reviewed and the relevant passages were transcribed. These passages were used to determine what the community's expectations were and what the consequences of poor academic writing competence are likely to be. The theses were analysed in the same way as for language competence, now including these community expectations to assess whether they were written for the correct purpose and reflected the community's style of argument.

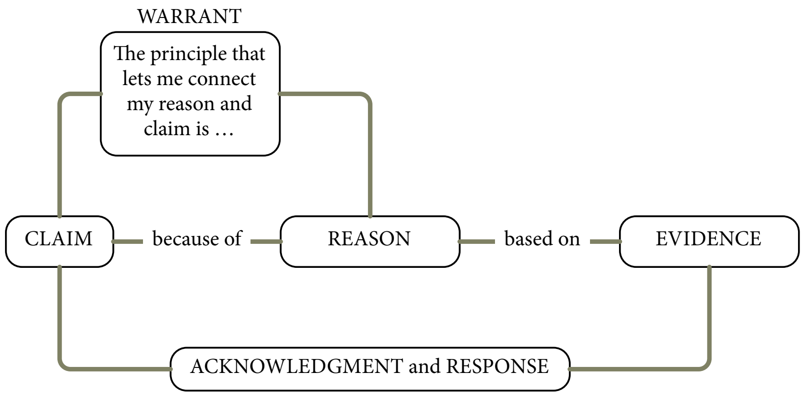

Figure 1: Adapted Toulmin Model

4.2. Argument tool

Although there is considerable variation between scientific communities with regard to what constitutes a valid argument or evidence, the components individual disciplines use to construct and evaluate these are likely to be very similar in nature. Academic writing is concerned primarily with constructing claims and supporting these with evidence and reasons, using subordinate arguments to support major arguments.

The Toulmin model shows that there are several components to each well-made argument. Readers, in evaluating an argument, first look at the claim and try to determine how the reasons support it. The principle that connects a claim and its reasons is called the warrant. A warrant describes a general circumstance followed by a general consequence and reasons and claims are specific instances of these. As an example:

> When a product market becomes crowded,$_{\text{general circumstance}}$ profits decrease.$_{\text{general consequence}}$ The smartphone market is crowded with many companies,$_{\text{specific reason}}$ so it is not an attractive market.$_{\text{specific claim}}$

This example illustrates that introducing a warrant before a claim aids the reader in evaluating how reason and claim are connected. Warrants, however, often rely and build on specific knowledge in a community and over time often become tacitly understood. As a result, conclusions that seem self-evident to people within the community can become difficult to evaluate for outsiders.

One final component of the Toulmin model is ‘acknowledgement and responses’. Authors are expected to anticipate any counterarguments readers are likely to come up with and include a response to these in their own argument. They also will need to make clear what the limitations are of their evidence, reasons and claims, thereby illustrating how certain they are of their claims. This is what is called hedging, described by Johns as one feature of academic writing that effectively aids persuasion of others (as cited in Hyland, 2006, p. 221). Clear use of hedging forces the author to provide a formal and neutral description of their evidence and to be hesitant in claiming absolute certainty.

Examples for argument tool

Academic writing uses a highly formal and a neutral form of language, which aims to ensure that data and results can be objectively assessed. Descriptions of companies are of little value to the company when they consist of statements copied from the company's website, as the following example shows. Although the company may use such language in their promotions and public relations, it is of little analytical value, as most any food company might claim similar achievements, aims and goals.

> [Company] provides <u>delicious, nutritious and convenient foods for families in 200 countries around the world.</u> (thesis 4, p. 11)

As discussed in the literature overview, academic discourse relies on community understanding and a clear distinction between what is understood, what can be assumed and what is unknown. Very few academics would claim certain proof of their claims.

> In this section, literature is presented to <u>prove</u> the claims that diversity in NPD teams is needed. (thesis 9, p. 9)

Another issue with such a strong claim is that it leaves little room for discussion.

Result of the argument tool

A text with a low score (1) introduces "no claims and no support" (p. 129). In texts with a high score (6) the arguments "consist of claims and support and are logical, credible, and complete. Claims are explicitly stated, explained, and substantiated with supporting evidence and support is relevant to claims, varied, concrete, and engaging" (p. 129).

The examples shown illustrate that students have difficulty to use an appropriate style for their writing. Many students make use of informal language and fail to construct an argument beyond supplying the reader with the facts found and the methods used to find these. When they do provide claims, these are often insufficiently hedged and might strike the reader as overconfident and showing little academic consideration.

Looking at the theses from an outsider's point of view, most would receive a score of 3: "arguments are incomplete or inadequate. Claims may be undeveloped with little or no support. When support is used, it may be insufficient, it may seem simplistic (the 'everyone knows' type), or may be inappropriate to the claim" (p. 129).

4.3. Task tool

There is a marked difference between reports written at university and those written for a professional purpose. At university, reports often have an educational function, where students have to convince their tutors that they have the ability to use the methods taught to analyse and solve the problems they face. These analyses and the data found form the main content of their reports. In a professional environment, authors are instead expected to provide their audience not only with a thorough analysis and the supporting data, but also suggest what they are now expected to do. The core content of the document and its focus should be on the future and the actions, instead of the supporting evidence. Evidence is important only to the extent that it is used to convince the reading audience. The author needs to make clear what the relevance is of the text and why the audience should read on.

When students fail to understand what the purpose of a text is, this will have an effect not only at this level, but also at the other levels of argument, coherence, and error. When they assume that they only have to write down the facts they have found, students are unlikely to spend effort on building a cogent argument. Similarly, because they are used to writing reports for an audience that already understands the content, they will not realise how errors may distract a reader from what they are trying to say.

Interview insights

The interviews clarified what most readers expected of the theses and what, in their opinion, the purpose of a thesis is. There were variations in what the academic staff expected of students: some expected a process-driven, method-focussed report, while others preferred a well-argued, solution-focussed thesis. Interviewing a business professional helped to decide, for the current study, what students are expected to do in writing their thesis. Students are expected to support their recommendations with a thorough analysis of the problem and solution-space, not by systematically using all the methods available in a 'checkbox' manner, but by building a cogent argument explaining why they chose the methods they used and how these support their recommendations.

Following Roger and Rymers' description, a text with a low score (1) "does not fulfil the task. Content evidences writer misunderstanding regarding what the writing needs to accomplish. It may be irrelevant to the task. It may surprise or disappoint the reader. Can be characterised as 'off-task'" (p. 151). A high scoring text (6) "fulfils the task completely by addressing reader expectations and meeting situational requirements for the writing. Content addresses reader requirements, issues, concerns, or questions; form is fully appropriate for the context and situation" (p. 151).

To see whether the theses were likely to meet these expectations, the structure of the executive summaries was used to determine whether the theses were chronological or argument-focused. This approach makes giving examples difficult, as it would require the complete text to be presented.

Although there is no clear consensus between supervising chairs about the task the students need to fulfil, to the degree that supervising chairs do agree, most theses would receive a score of 4: "[the thesis] fulfils the task to some degree, addressing some reader expectations and, for the most part, complies with situational requirements for the writing. Content may meet reader expectations to some extent, but not completely. Form may depart from the contextual and situational norms in some respects" (p. 151).

5. Conclusions

Graduating students would be expected to achieve a high score on all four levels of communicative competence. However, if all the scores are taken together, the texts are likely to be evaluated as ineffective and exhausting to read: nearly all pages contain numerous errors, the majority of paragraphs lack coherence, few arguments have explicitly stated claims or a clear connection to the evidence, and there is a considerable difference between what readers expect and authors provide.

The consequences of poorly developed communicative competence are far reaching and are likely to have an effect on the career perspective of graduates. This was made apparent in the interview with the business professional. He suggested that in the professional world, few people get the opportunity to write forty-page reports and most professionals are expected to communicate their progress and findings in short, concise, and clearly written single-page summaries. In such a condensed format, the graduates' level of communicative competence becomes a distinguishing factor and may determine the relative success of their career. One aspect that also negatively affects the value of their theses is, according to the business professional, their difficulty to distinguish between what is certain and which elements are, as of yet, uncertain. This uncertainty makes it difficult for higher management to assess the possible success and value of a proposal.

In summary, the findings of this study suggest that the communicative competence of SPD graduates would benefit from improvements on multiple levels. These improvements are not limited to language competence alone but students will also benefit from additional instruction on academic writing. The issues discussed are likely to be the result of multiple factors and unlikely to be limited to the sample of Dutch SPD graduate students.

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