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Construct the Domain-specific Communication Procedures of Chinese Mechanical Engineering Students in the Double Degree Program

Yu Zheng*, Beibei Liu

University of Shanghai for Science and Technology, Shanghai, China.

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***Corresponding author:** Yu Zheng, University of Shanghai for Science and Technology, Shanghai, China.

Abstract

In engineering scientific communication, technical language serves as the carrier of information. Technical languages are linguistic tools for communication in specific field, enabling mutual understanding. This study examines four module handbooks of the Bachelor's program in Mechanical Engineering in the German-Chinese double degree program. The focus is on the compulsory technical modules, which contain the important specialized courses. Firstly, the study analyzes competence descriptions of these courses in the four module handbooks, from which communication procedures can be derived. Based on this analysis, specific communication procedures and typical linguistic resources for successful technical communication are identified. Statistics and analysis demonstrate that students need to be proficient in various areas of technical language such as "explaining", "describing", "evaluating" and "analyzing", as they are elementary for technical communication in the mechanical engineering course. Based on these findings, specialized language courses should be specifically designed to impart the necessary communicative skills to students in relation to these communication procedures. It is important to develop both oral and written communication skills in order to explain complex matters, analyze systems, weigh advantages and disadvantages, and make evaluations.

Keywords

Technical language, domain-specific communication procedures, mechanical engineering, Chinese-German double degree program

1. Introduction

The framework of state cooperation between China and Germany has undergone continuous changes in recent decades, which can also be observed in social and educational policy contexts. Numerous university collaborations in China are supported and promoted through various projects. By 2022, there were already over 500 German-Chinese university partnerships, and 58 study programs and/or institutionalized university partnerships (at the bachelor's level) recognized by the Ministry of Education have been established. One particularly noteworthy example is the "Chinese-German double degree program," where programs are designed at universities and colleges that lead to both national degrees after completing studies partially at the German and Chinese institutions. The dominance of engineering sciences, as well as natural sciences and computer science, is evident, and the study programs are often strongly connected to practical applications. In this context, German is taught as a foreign language for scientific and technical communication purposes. However, specialized language training is often partially integrated into existing language courses and offered as part of the study curriculum [1].

The requirements of internationalizing higher education necessitate a new focus on specialized language instruction within the framework of the Chinese-German cooperation program in China, shifting from general German language

instruction to technical language instruction. Unlike general language, technical language refers to the explanation and mastery of subject-specific knowledge and plays a crucial role in domain-specific communication [2]. Engineering students must possess strong technical language skills in order to effectively communicate professional content in German, comprehend and convey information, and engage with German technical texts.

2. State of Research and Research Objectives

The study of technical languages as a research subject in linguistics emerged in China in the early 1980s. At that time, the examination of German technical languages was mainly based on the systemic linguistic model, focusing on the lexical inventory and syntactic rules of scientific and technical specialized languages. Attention was also given to specialized translations involving technical language structures and the teaching of technical languages. In the late 1990s and early 21st century, specialized languages in disciplines such as economics, law, and computer science gained significance. Research focused on their structural characteristics [3] and specialized language teaching [4, 5]. Particularly, there are now numerous methodological and didactic discussions on Business German [6].

The motivation for this study arises from the fact that specialized language communication in the cooperative bachelor's program in Mechanical Engineering has not been sufficiently discussed. This study seeks to address the following questions:

- Which communication procedures are characteristic of the academic discourse in the field of Mechanical Engineering?
- In which areas must learners be proficient in technical language to effectively communicate?
- And how can the technical language competences of Chinese Mechanical Engineering students are better developed?

Through a qualitative investigation, this study aims to compile the typical communication procedures in the double degree program in Mechanical Engineering. Thus, the research findings can provide insights into specialized language teaching for Chinese Mechanical Engineering students.

3. Theoretical Foundations

3.1 Specialized Languages and their General Characteristics

In comparison to general language, which is seen as the linguistic toolset possessed by all members of a speech community, enabling communication among them, specialized languages serve communication within specific groups of people and require specific subject-specific and linguistic competence [7]. They are considered differentiations within the common language and exist as "coherent, discrete, systematic linguistic constructs" within language. In a sub linguistic understanding, specialized language is defined as "the entirety of linguistic means used in a delimited communicative domain to ensure communication between individuals working in that domain [8]."

According to Hoffmann, specialized languages can be horizontally structured and vertically layered. The fixation of communication domains and their specialized languages leads to the horizontal structure of specialized languages. The vertical layering of specialized languages involves an examination of language as a means of knowledge and communication, progressing from the concrete to the abstract, from the particular to the general, from appearance to essence. For successful specialized communication, precision, explicitness, economy, and anonymity are required, which represent the functional properties of specialized languages. These specific characteristics that appear in the use of specialized languages are characterized by the frequent occurrence of certain linguistic structures at all linguistic levels [8].

3.2 Specific Characteristics of Technical Languages in Engineering

Scientific and technical texts in engineering deal with the description and explanation of nature and technology. They are based on traditional fields such as mathematics, physics, chemistry, and others. Therefore, technical texts in these fields share numerous linguistic features. Many research publications focus on the structural peculiarities of scientific and technical specialized languages, such as Gläser (1998), Satzger (1998), Fluck (2010), Heine (2010), Buhlmann and Fearns (2018).

In their work, Buhlmann & Fearns (2018) compiled specific linguistic features of scientific and technical language found at the morphological, lexical, syntactic, and textual levels. As overarching characteristics, Kuhn identified an impersonal style, integration of mathematical language, a combination of formal language and natural language, as well as various multi-modal elements of visualization [9]. Norms and regulations issued by different institutions are also characteristic of engineering. Based on these important contributions, the characteristics of German scientific and technical specialized languages in engineering can be described as follows:

- On the (morpho-) syntactic level, features include deverbalization, deagentivization, compact sentence forma-

tion with a tendency to avoid subordinate clauses, and a preference for nominal style with multi-component compounds.
- Limited use of personal pronouns, extensive non-verbal information carriers, and formulas are typical of technical languages in engineering.
- The present tense is commonly used as the preferred tense.

3.3 Communication Procedures

The purpose of language communication is to disseminate, persuade, investigate, and develop various methods of language use based on different communication situations. In linguistic communication, content and methods are determined by the field of study. Scientific discourse is characterized by a specific set of communication procedures. Therefore, in the scientific discourse of scientific and technical disciplines, domain-specific communication procedures can be identified. These include naming, defining, classifying, describing, characterizing, exemplifying, referring, comparing/contrasting, determining, giving instructions, recommending, deducing, explaining, arguing, commenting, assessing, concluding, and justifying [10]. Buhlmann and Fearns (2018) pointed out that the frequency of these communication procedures varies and depends on the genre of the text.

4. Research Design

The present empirical study focuses on the module handbooks of the cooperative bachelor's program in Mechanical Engineering at four Chinese universities. These handbooks provide detailed information about the curriculum, learning contents, and intended learning outcomes in the field. The module handbooks give us an overview of the entire learning process of the Mechanical Engineering cooperative project and serve as the basis for the analysis of domain-specific communication procedures. The main focus is on the technical compulsory modules outlined in the four module handbooks, which extensively describe the subject-specific German-language seminars and lectures. Important courses conducted in German include CAD/CAM, Electrical Engineering, Manufacturing Technology, Hydraulics and Pneumatics, Mechanics, Machine Elements, Programming, Control Engineering, Fluid Mechanics, Technical Thermodynamics and Heat Transfer, and Materials Science.

Based on the competency descriptions of the aforementioned courses in the four module handbooks, a qualitative investigation is conducted. Initially, domain-specific objectives and communication situations are identified in the descriptions of the subject-specific seminars and lectures. From there, typical domain-specific communication procedures in the field can be derived. These domain-specific communication procedures are also analyzed to highlight areas of students' specialized language competences.

5. Discussion of Research Findings

A total of 13 subject-specific courses are analyzed in the module handbooks. This results in 56 communication procedures that the students in the cooperative bachelor's program in Mechanical Engineering are expected to master and be proficient in specialized language. These communication procedures can further be categorized into 18 typical communication procedures. As shown in Figure 1, they occur with varying frequencies in the Mechanical Engineering curriculum.

In general, it can be inferred that the most frequent communication procedure is "explaining," accounting for 16%. This is followed by "describing" and "evaluating," both at 13% each. In knowledge transmission, teachers typically ask questions and explain learning content, while learners are expected to answer questions and describe what they have learned. Therefore, Chinese students need to be able to explain and describe in specialized language when engaging in technical communication in German. Mechanical Engineering students are expected to be able to explain in German the functionality of CAD systems, the characteristics and principles of essential manufacturing processes, motion states, and physical laws, control principles for physical quantities using examples, the fundamental laws of thermodynamics, heat transfer mechanisms, and thermodynamic relationships.

The communication procedures related to "describing" include:

- Describing flow behavior
- Describing the applications of CAD systems
- Describing the relationship between electrical characteristics
- Describing the characteristic features of processes
- Describing cause or effect
- Describing control principles
- Describing the important energy conversion processes in Mechanical Engineering.

Students must also be able to evaluate in German the suitability of established models, thermo elasticity, stress and strain states, stability of equilibrium positions, approximation solutions, system-theoretical properties of dynamic sys-

tems, and parameterized controllers.

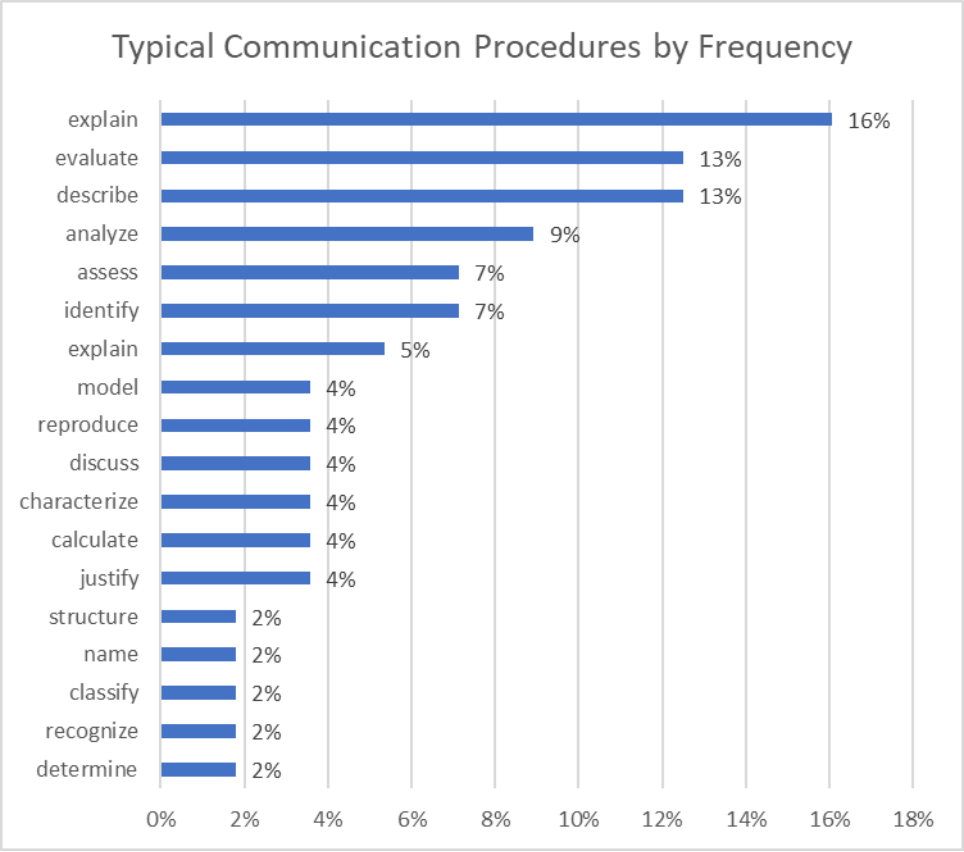

Figure 1. Typical Communication Procedures by Frequency.

And in third place is "analyzing" with 9%. In knowledge and method transmission, Chinese students must also be able to analyze both in written and oral form. This involves critically analyzing complex systems, extensive problem situations, system-theoretical properties of dynamic systems, important energy conversion processes in Mechanical Engineering, as well as thermodynamic relationships.

Furthermore, "evaluating" is used to assess advantages and disadvantages and is also one of the important communication procedures in Mechanical Engineering studies. The module handbooks state that students should be able to evaluate results, material properties, and the efficiency of important energy conversion processes in Mechanical Engineering, and derive the relevant process-specific technical advantages and disadvantages from the characteristic process features.

The procedure of "naming" is closely related to definitions and specifies the precise meaning of a term. Therefore, for a successful study in Mechanical Engineering, it is important to be able to name motion states, causes, fundamentals of thermodynamics, and system-theoretical properties of dynamic systems in German.

6. Specialized Language Didactics in the Double Degree Program in Mechanical Engineering

At the core of professional communication is the exchange and transmission of specialized knowledge. As linguistic tools, specialized languages are characterized by their precise, logical, and economical features and play a crucial role in knowledge acquisition and dissemination. However, specialized languages vary across on disciplines and subject areas. It is therefore crucial to be familiar with domain-specific communication procedures and to master the associated language resources frequently used in professional communication, in order to engage in professional discourse and succeed in Mechanical Engineering studies.

The results of this study provide important insights for the specialized language teaching in the double degree program in Mechanical Engineering. It becomes apparent that students need to possess specialized language competences in various areas to be successful in professional communication. Particularly, the communication procedures of "explaining," "describing," "evaluating," "analyzing," and "judging" are of great significance.

Based on these findings, specialized language courses should be specifically designed to impart the necessary com-

municative skills to students in relation to these communication procedures. It is important to develop both oral and written communication skills in order to explain complex matters, analyze systems, weigh advantages and disadvantages, and make evaluations.

Furthermore, teaching contents and materials should be specifically tailored to the specialized language and communication in Mechanical Engineering. This includes the teaching of specialized vocabulary, typical phrases, and structures used in professional communication. The integration of practical examples and case studies can help students apply and understand specialized language in real-life contexts.

Close collaboration between subject lecturers and language instructors is crucial to ensure effective specialized language support. Subject lecturers can communicate their subject-specific knowledge and language requirements, while language instructors can provide appropriate teaching and learning strategies to enhance specialized language competence.

Moreover, suitable assessments should be developed to evaluate students' specialized language proficiency and provide targeted feedback for improvement.

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References

[1] Zheng, Yu. The Exploration of the Teaching for German Major in Sino-Germany Education Cooperation Program. The Science Education Article Collects, 2, 2015, 211-214+222.

[2] Zhuang, Li. Characteristics of Specialized German Courses and Teaching Suggestions for Sino-German Cooperation Programs. Art and Literature for the Masses, 2018 (18), 188-190.

[3] Li, Dongliang; Liu, Shujie. Characteristics and Translation Strategies of Textile Industry Texts in German. Chinese Science & Technology Translators Journal, 2019, 32(3), 13-15.

[4] Zhu, Jianhua; Chen, Chen. A Study on Language for Specific Purposes in the Light of German Language Thoughts. Journal of Xi'an International Studies University, 2015, 23(2), 35-38.

[5] Gu, Shijia. Research on Problems in Teaching Chemical Engineering German Translation in Universities. Journal of Chemistry and Chemical Industry, 2022, 52(11), 1269-1270.

[6] Zhu, Lianlian. An Investigation of the Application of the Teaching Concept of "methodological diversity" in the Teaching of German for Business and Trade in the Classroom. Policy & Scientific Consult, 2022 (5), 23-25.

[7] Kirsten Adamzik. Fachsprachen. Die Konstruktion von Welten. Tübingen: Narr/Francke/Attempto, 2018.

[8] Roelcke, Thorsten. Fachsprachen. 4. Auflage. Berlin: ESV, 2020.

[9] Kuhn, Carmen. Studentische Textkompetenz im Fach Maschinenbau. Eine qualitative Interviewstudie. Bielefeld: wbv Publikation, 2019.

[10] Buhlmann, Rosemarie; Fearns, Anneliese. Handbuch des fach- und berufsbezogenen Deutschunterrichts DaF, DaZ, CLIL. Berlin: Frank &Timme GmbH Verlag für wissenschaftliche Literatur, 2018.