

TRANSPORT CONSTRUCTION ENGINEERING TERMINOLOGY PLANNING BASED ON LEXICAL RELATIONS AND STUDENTS' NEEDS

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Abstract: *Terminology management can be approached from prescriptive and descriptive perspectives. The former is concerned with terminology standardization while the latter is concerned with term analysis, description, and presentation. With the development of English as a Medium of Instruction (EMI) Program, terminology research to support EMI students has captured the attention of many scholars. However, while most current terminology products are the results of General Terminology, in which specialized experts apply a top-down approach based on their own subjective judgement, there is sparse research into bottom-up terminology planning, which begins with terms extracted from a textbook of a specific subject with their multidimensional relations and EMI students' needs for term resources. This interdisciplinary research follows Cognitive-based Terminology Theories and Lexical Semantics, specifically Lexical Functions. The typical lexical relations (LRs) in Highway Bridge Design terminology are identified based on Lexical Functions (LFs) developed by Mel'čuk. Based on these typical TCE paradigmatic and syntagmatic LRs, the survey questionnaire is composed to investigate TCE EMI students' opinions and needs for terminology resources of a certain disciplinary subject in order to establish an alternative framework for TCE terminology planning based on terminological LRs. The data were then quantitatively analyzed using descriptive statistics and recommendations were put forward for the content and form of term products that help TCE EMI students acquire both disciplinary and linguistic knowledge.*

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I. INTRODUCTION

In Vietnam, the past few decades have witnessed the rapid development of the transport network with impressive structures including many cable-stayed bridges, tunnels, expressways, and elevated railways. The design, construction, and maintenance of these major projects have been conducted with the help of foreign contractors and consultants from foreign countries. The

language for communication is dominantly English and Vietnamese. Being aware of the need for both General English (GE) and English for Special Purposes (ESP) and as regulated by the 2020 Project, the University of Transport and Communications (UTC) requires that all graduate students have B1 English level and complete a 3 - credit - course of TCE ESP. In addition, the university launched the English - Vietnamese Road and Bridge (EVRB) Program in 1989 and has conducted EMI training for EVRB students. The students study 65 subjects with 163 credits during 5 years. They must accomplish B2 English level at the end of the second year and start to study specialized subjects in English in the third year. There is a requirement for English B2 level at the end of the second year, but quite a few students cannot meet the language demands. In addition, the levels of English competence among students are in marked difference while they receive the same input, so a large number of students are left behind at the fifth term when they embark on learning specialized subjects in English. Similar problems occur at other academic institutions that conduct EMI programs. EMI researchers have discovered a great deal of challenging issues concerning EMI practice in Vietnam at macro, meso, and micro levels [10]. Antia and Dyers (2016) [10] researched on the provision of multilingual lecture resources to affirm the biliteracy of university students. The authors state that many language challenges appear to EMI students when classrooms in South Africa and many other countries are becoming increasingly multilingual and multicultural.

Although terminology is the core of specialized discourse and term support plays an important role in EMI training, the students are not adequately supported for acquiring individual specialized subjects. They are provided with English - Vietnamese term lists with little content and linguistic information. The term lists were composed by specialized experts, whose knowledge of specialized subjects is far different from linguistic knowledge. The terms are planned following the top-down approach of General Terminology resulting in term lists containing terms arranged in the alphabetical order as discrete units without term relations. Few subjects have English monolingual dictionaries, and if there are, these dictionaries are more suitable for highly English competent students or native English speakers. There are bilingual English - Vietnamese transport dictionaries; however, they contain large numbers of vocabulary of various subdomains and from other disciplines, so they cannot satisfy students' demands for terminology of a certain specialized subject. The students also use google translation, but many of the students surveyed are not capable of identifying errors in google translated texts. Terminological research for term products to support the students seems to be a neglected area at TCE academic institutions due to time and resource constraints. Traditionally, there is little handshake between specialized subject teachers and English language teachers, who need the assistance of professional terminologists, who possess knowledge of both specialist subjects, linguistics, and terminology. This study follows Cognitive-Based Theories of Terminology [8] to develop onomasiologically organized lexical databases focusing on conceptual and linguistic representation that can help students acquire both content (epistemological) and linguistic knowledge. It links ontology with *multilingual* terminological information and to incorporate ontology into terminological resources [26]. The linguistic approach of *Lexical Semantics* [13] is

adopted for bottom-up terminology planning, which is lexically centered, and usage based. In [27], by applying Lexical Functions (LFs) as the analytical framework, the typical TCE *paradigmatic* and *syntagmatic* lexical relations (LRs) are identified. In this follow-up stage, the researcher continues to investigate TCE EMI students' opinions and needs for term resources in relation with the typical LR in TCE terminology. The overall purpose is to recommend an alternative TCE terminology planning framework resulting in TCE term databases with richer content and linguistic (semantic and syntactic) information to support TCE EMI students.

II. RESEARCH CONTENT

2.1. Literature review

2.1.1. Terminology planning and the need for terminology research from language planning perspective

Guidelines for terminology planning describes terminology planning as an endeavor which “consciously and systematically develops special language according to the needs and requirements of domain communication”. Scholars have highlighted the shortage of terminology research from language planning perspective in many countries. Fishman (1983) [9] states terms are treated as discrete units without relations, orders and patterns, or other facets of languages. Terminology planning is unsystematic and studying terminology from language planning perspective is almost an untouched area in the developing world. According to Jernudd (1983) [11], volumes of lists of the so-called terms that are selected by specialized experts and translators are published. There should be intensive interaction between planners and users and careful preparation of specialized databases which often contain a small number of highly elaborated term entries [11]. Maurais (1993) [14] assures in advanced countries, terminology planning is a systematic activity in which subject-field experts or terminologists/linguists draw up a list of terms covering a whole semantic field whereas in less developed countries, literate amateurs coin words piecemeal, with no systematic attempt at covering a whole semantic field. Similarly, Alberts (1999) [1] highlights the need for systematic terminology planning so that people of different nationalities and language groups could be able to communicate effectively. A pioneer author in language planning-oriented terminology management is Antia (2000) [3], who developed an alternative framework of practice and discourse for terminology management. He counter-argues the historical inadequate view of terminology planning because it could not deal with many problems in African terminology planning situation. The products of African term planning efforts following the traditional terminology planning framework are dictionaries and specialized databases with terms arranged in alphabetical order. The philosophy underlined any terminological endeavor, whether terms originate in an advanced linguistic community or are created as equivalents in other parts of the world, is how to organize terms; therefore, terminology activity must be carried out systematically and terms should cover a conceptual field and related terms should be arranged as conceptual systems [2, 3]. All the above views considered, terminology management from language planning perspective has not received enough attention from research community. Although terminology planning is certainly concerned with needs, the

social aspect of terminology has not been embedded in a broader framework of language planning. In the field of TCE, there have been quite enough Vietnamese term equivalents for domain specific communication, so the matter is no longer term formation but lies in the description and presentation of TCE terminology for pedagogical and epistemological purposes. These arguments justify the needs for language planning oriented TCE terminology research.

2.1.2. *Lexical functions in Terminology*

MTT is a theoretical linguistic framework developed by Mel'čuk & Žolkovskij [16] and Mel'čuk [10, 15, 17-20] for the construction of models of natural language. It allows decomposing meanings into more fine-grained representation via semantic paraphrasing, which helps to deal with synonymy and translation-equivalencies between languages. The theory provides a large and elaborate basis for linguistic description and can be applied to computer applications, including machine translation, phraseology, and lexicography. The authors propose an inventory of more than 60 LFs which codify different types of semantic and syntactic relations. A detailed description of the categories of these LFs are presented in [17]. There are two major kinds of LFs: **Paradigmatic LFs** deal with *selection*. They associate with a key word a set of lexical items that share a non-trivial semantic component and include all *contrast* and *substitutions* relations between lexical items in specific contexts [6]. **Syntagmatic LFs** are concerned with *collocations*, which formalize a semantic relation between two lexemes L1 and L2, which is instantiated in the textual string in a non-predictable way. Such a relation is non-predictable when the co-occurrence of one cannot be derived from the *semantic* selection restrictions of the other, but rather must be learnt as an instantiation of a specific syntagmatic relation. LFs are relevant and useful for term analysis and description.

Although LFs has the outstanding ability for lexical description, they have been applied by very few terminologists for investigating and representing terminology in specialized fields. Faber and Sánchez (2001) [5] discuss the codification of conceptual information in descriptive terminology management in *medical* field. It is possible to elaborate the *macro* structure of a specialized domain and determine what kind of information should be put in the *micro* representation of each concept. L'Homme (2012) [12] uses LFs by Mel'čuk's (1996) [20] to discover the lexical structure and compile a multilingual lexical database in the field of *Environment*. The large set of LFs helps to achieve 3 major aims: 1) to ensure that the coverage of the database is complete by locating possible gaps; 2) to link entries to other entries in a systematic way; 3) to ascertain that descriptions of semantically related lexical units are consistent. Faber (2012) [8] also designs a multimodal knowledge database in environment called *Ecolexicon* with several components and the concepts belong to a large network of *hierarchical* and *non-hierarchical* lexical relations but how the relations were extracted form specialized corpus is not explained and other aspects of information are not included in the database. Tuyén (2019) is concerned with analyzing and describing English terms in Bridge Engineering based on LFs in MTT developed by Mel'čuk [17, 18, 20, 23] in order to find out typical *paradigmatic* and *syntagmatic* lexical relations of highway bridge design terms and recommend term presentation patterns for the event. It follows Faber (2012) [8]'s position that terminology is

essentially a linguistic and cognitive activity and it investigates the relationship between syntax and semantics of terms, embeds ontology in conceptual representation, and links ontology with multilingual terminological information. The term data are extracted from the textbook *Design of Highway Bridge* [24]. The terms are investigated in relation to each other rather than being treated as discrete units. It establishes the conceptual system of the highway bridge design event by means of a bottom-up approach extracting information from specialized texts. The research makes clear both the potential semantic and syntactic behavior of BE term units providing a description of conceptual relations and term combinational potentials. Tuyen (2019) [27] results in the identification of typical paradigmatic and syntagmatic term relations of the Highway Bridge Design Event based on which the survey questionnaire of the current study is designed to elicit information from EMI EVRB students about the terms resources and their needs. The aim of the current study is to identify the EMI students' needs for term resources for a certain disciplinary subjects based on the typical LRs so that more useful term resources can be developed to satisfy their needs for content and language acquisition. It accomplishes the second stage of developing an alternative framework for TCE terminology planning from language planning perspective based on term relations and students' needs.

2.2. Methodology and Data

2.2.1. Research design

The research emerges from the context of TCE EMI training carried out in three major transport academic institutions in Vietnam: The UTC Main Campus in Hanoi, The UTC Second Campus in Ho Chi Minh City, and the University of Transport Technology. It involves an in-depth study of the phenomenon of TCE terminology planning by studying term relations in a textbook of Highway Bridge Design Event in the first stage. In the second stage, it investigates the opinions of EMI TCE students about terminology support for studying specialized subjects in English and Vietnamese. This is a case study which enables the understanding of a complex issue through detailed contextual analysis of one event. Its interdisciplinary nature concerns terminology planning, linguistic theory (lexical functions), and socio-communicative aspect of TCE terms (opinions of EMI students). The survey questionnaire is designed based in the typical lexical relations of Highway Bridge Design Event. The data are analyzed quantitatively; however, descriptive statistics rather than inferential statistics is employed.

2.2.2. Typical LRs in Highway Bridge Design Event as the Framework for developing survey questionnaire

In the phase of term relation investigation, the researcher applies Mel'čuk [17, 18, 20]'s LFs to identify the typical TCE term relations, which consist of both *paradigmatic* and *syntagmatic* lexical relations (LRs). In comparison with the results of previous studies, a wider range of LFs are discovered and other LRs are added. **Table 1** in the **Appendix** clarifies the Framework of LRs and their categories and **Figure 1** summarizes the categories of typical LRs in the highway Bridge Design Event.

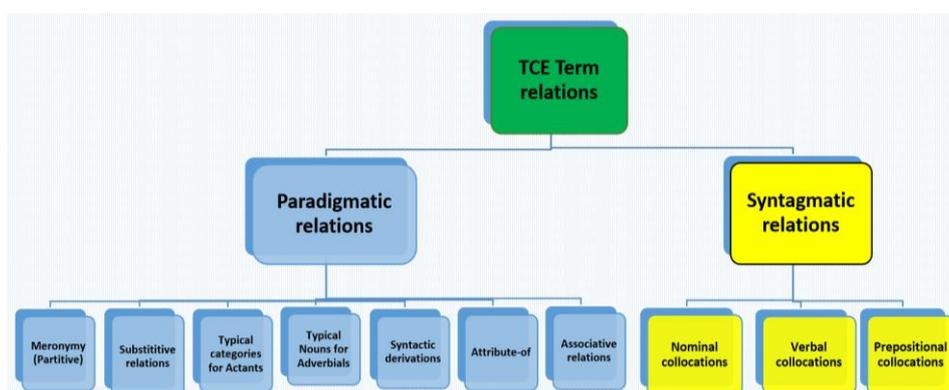


Figure 1. Taxonomy of TCE term relations

2.2.3. Research questions

- 1) What are TCE EMI students' needs for the term resources from the content and linguistic perspectives?
- 2) To what extent do current TCE term resources satisfy Vietnamese TCE EMI students' needs as regards content and linguistic knowledge?
- 3) What typical lexical relations should be included in the TCE term resources to satisfy TCE EMI students' needs for content and language acquisition?

2.2.4. Research Population and Participants

Although there is a vast array of stakeholders and benefiteres of the research, only EVRB EMI students are justified as the research population. The research participants include 265 undergraduate and graduate EVRB students from UTC International Education Department (INED). The students come from different regions of Vietnam, most of whom did not take English as the university entrance exam subject. Although their English proficiencies are not equal, they must have achieved B2 level by the end of the second year as required by the Curriculum. From the first term of the third year, they must study specialized subjects in English. The sampling technique used for the questionnaire survey is *probability sampling*. Although this is the simplest sampling strategy, it is also the most prone to bias. Thus we make use of *sample size calculator* to get reliable results. The sample size should be at least 234 students and 265 participants have answered the survey questionnaire about the available term resources, their attitudes and needs as regards specialized knowledge and English - Vietnamese terminology via *Microsoft Form*.

The tool for collecting data is survey questionnaire designed based on the typical LRs. Technical students might find it difficult to understand terms in linguistic field due to their limited knowledge of English linguistics, so the survey questionnaire is written in Vietnamese with a clear explanation of the purpose of the investigation. Closed-ended Likert-scale questions are used with five answer alternatives: Strongly Agree; Agree; Neither Agree nor Disagree; Disagree; and Strongly Disagree. The Likert-type questions are suitable for large scale survey because the data can be quickly obtained and analyzed statistically using Microsoft tools. The questionnaire was sent to undergraduate and graduate RBVE EMI students on August 22nd, 2020 via two links.

The results were collected on August 29th, 2020 when 265 participants had responded. The statements (items) are grouped into 4 categories. The two optional questions at the end are used for collecting traditional and knowledge-based TCE term resources.

1) Personal information as regards content background knowledge, English competence, and expectation when the students started learning disciplinary subjects in English at university (5 items).

2) To address the 1st research question: The students' needs for term resources for individual disciplinary subjects in respects of disciplinary and linguistic knowledge transference (11 items).

3) To address the 2nd research question: The extent that the available term resources satisfy students' needs for disciplinary and linguistic knowledge acquisition (14 items).

4) To address the 3rd research question: The Lexical relations that should be presented in the term resources including *paradigmatic* lexical relations (13 items) and *syntagmatic* lexical relations (6 items).

2.3. Findings and discussion

The survey questionnaire is designed in the form of Likert scale (not Likert- type) items. The data are analyzed as interval data. The value of the interval distance is calculated as (Maximum-Minimum): $n = (5-1): 5 = 0,8$. Therefore, the meaning of each scale is:

- | | |
|--|------------------------------------|
| 1.0 – 1.80: <i>Strongly Disagree</i> | 3.41 – 4.20: <i>Agree</i> |
| 1.81 – 2.60: <i>Disagree</i> | 4.21 – 5.00: <i>Strongly Agree</i> |
| 2.61 – 3.40: <i>Neither Disagree nor Agree</i> | |

The questionnaire answers were collected and analyzed in correspondence with the research questions and categories of terminological LRs. For each group of information, the results are presented in a table and a collective bar chart. The table indicates the Likert-scale items with corresponding *Mean* value and *Standard deviation*. The nearer the *mean* value is to 5, the stronger the tendency of agreement to the statement. As can be seen from all the tables, standard deviation values of individual items and of different groups are very close to each other, which reflects the respondents' choices are concentrated close to the *mean* rather than widely scattered. In the collective bar chart, the percentage of choices in five scales of agreement are displayed.

2.3.1. The students' general information as regards content background knowledge, English competence, and expectation

Table 2. Mean and Std. Deviation of General information

1. General information	Mean	Std. Deviation
1.1. Expectation to acquire content and English knowledge	4.75	.506
1.2. Self-confidence in background content knowledge	3.77	.910
1.3. Self-confidence in English competence	3.70	.921
1.4. Satisfaction with term support for individual content subjects	3.94	.817
1.5. Self-confidence in using monolingual English term resources	3.78	.882

There are 5 items in this section. The Cronbach's Alpha indicating Reliability Statistics is

0,719. The results indicate that almost all the students registering in EVRB EMI Program expected to acquire disciplinary knowledge as well as English with 77.7 % strongly agreeing and 20.4 % agreeing; the mean value is very high: 4.75 (4.21 – 5.00: *Strongly Agree*). The level of *self-confidence* in content background knowledge, English proficiency, and using monolingual English dictionaries are also quite high with the percentage of Agreement and Strong Agreement of 43.4 % & 21.9 %; 43.8 % & 19.2%; 47.2 % & 20.4 %, respectively making up the average number of Agreement of 65 %. The remaining number of 35% are less competent in content and English language. As regards term support, 30% of the students do not feel satisfied with the term support practice for individual disciplinary subjects. In fact, the research participants do not include the dropouts, whose academic and English level was much lower, and they make up around 35 % of the enrollments. It should be concluded that the students passionately wish to acquire both content and English knowledge but their competence when beginning to learn specialized subjects in English is not high, so term support should be improved to satisfy their needs.

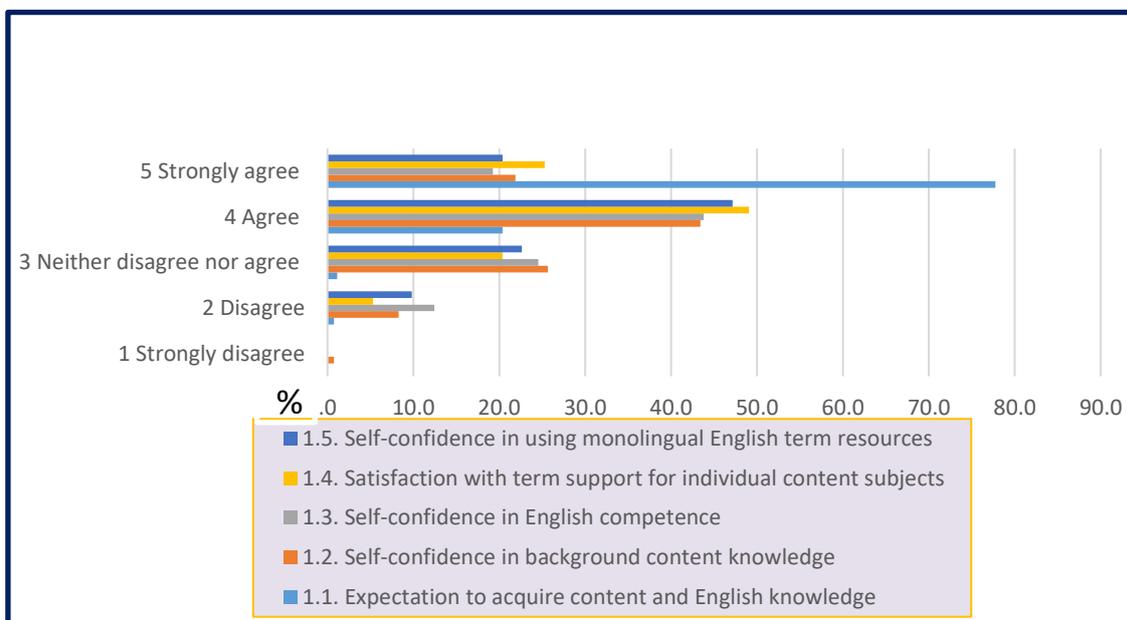


Figure 2. General personal information as regards content background knowledge, English competence, expectation, and satisfaction

2.3.2. The students' needs for knowledge-based term resources

The literature review section indicates that terminology research from language planning perspective is a scarcely touched field, which results in very few term products that are ontologically organized and thus more beneficial to term users. The students are familiar with traditional term products, which are alphabetically composed. When the students hear about knowledge-based term resources that facilitate both content and language acquisition, they highly appreciate their affordances. Their needs are reflected in the results of the second group of information with the mean value higher than that of the first group of information (from 4.05 to

4.53 in Table 3) and the standard deviations are very close to each other from 0.567 to 0.763, which reflects the degree of dispersion from the mean is very low. The Cronbach's Alpha is 0,861 and the total of 265 answers are valid for all 11 items. The students are badly in need of knowledge-based term resources. In Vietnam we have term resources for Transport field, which cover so many subject areas. It is unthinkable to investigate the lexical relations of such a big reservoir of terms. That is why the LRs of one disciplinary subject should be investigated systematically both in breadth and in depth. The term product, therefore, can support one subject from both content and linguistic perspectives. This is a neglected practice in Vietnam. As indicated from Table 3 and Figure 3 items 2.1 and 2.2. are needs for term resources (TRs) for individual subjects and knowledge -based TRs with almost all the students choosing Agree and Strongly Agree: 95.5 % and 97 %, respectively. The students (97 %) not only need term resources for understanding concepts but also for learning terms as lexical units and lexical collocations of terms. They agree that concepts are of prime importance in specialized subject teaching and leaning (96.2% of agreement). The research participants are in support of conceptual mind maps, concept relations, definitions for content knowledge acquisition: the percentage of Agreement and Strong agreement are 43%, 49.4 %, 48.7 % and 42.6 %, 40.8 %, 35.5 %, respectively. The lowest percentage of 35 % strongly agree that definitions should be included in the term resources. They may think definitions are provided in textbooks or technical specifications already.

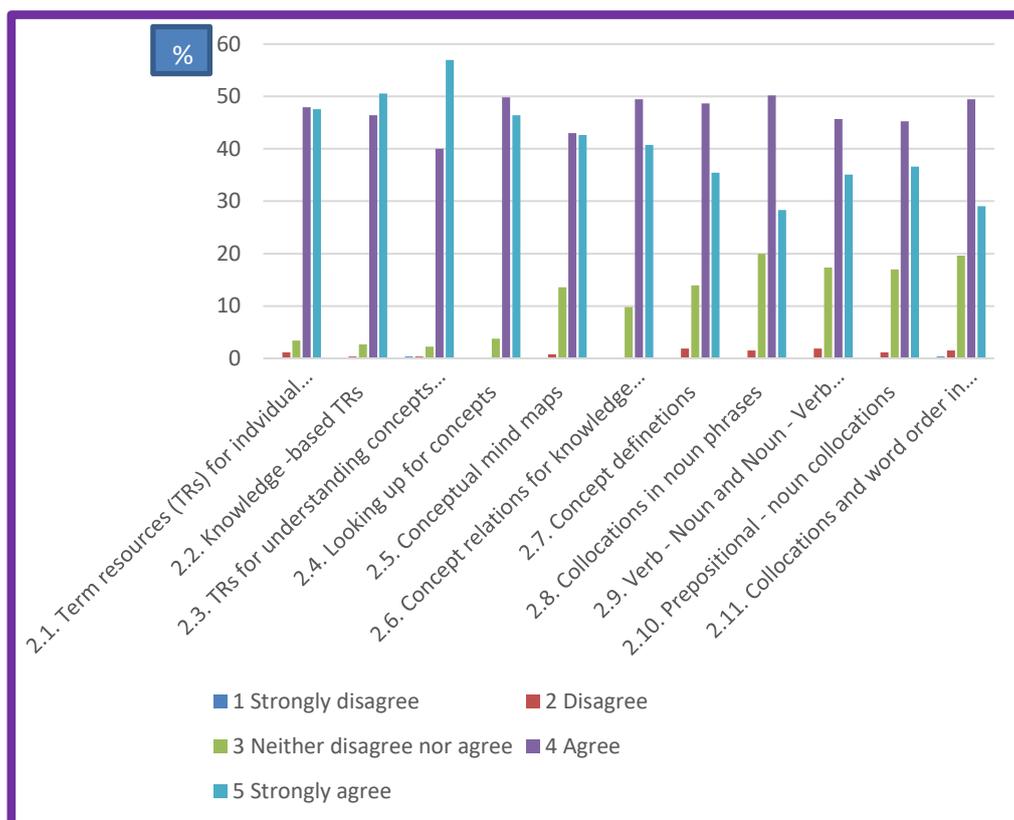


Figure 3. The needs for knowledge-based term resources

The students are asked about their needs for three types of collocations, which include collocations of Noun Phrases, Verb - Noun and Noun - Verb, and Preposition - Noun: 78%, 80,8%, and 81,9 % of agreement, respectively. Most of the students need to learn about collocations from term resources. This comes from the fact that they are not English native speakers and cannot easily produce chains of words and have difficulties in combining words correctly. Literal translation and meanings from the mother tongue may negatively affect their English language use. That is why they need term resources that include not only the content aspect but also language aspect of terms. Lexical relations indicating collocations and word orders should be presented in term resources with the agreement of a very large number of students: 78,5%. The mean values of this category in **Table 3** are very high as compared with the maximum value of 5. The standard deviation values are smaller than those in the first category of general information reflecting the concentration of answer choices about the mean. Concepts are more important to the students than collocations: most statements concerning concepts are Strongly Agreed while statements related to collocations are Agreed.

Table 3. Mean and Std. Deviation of the needs for knowledge-based term resources

The students' needs for knowledge - based term resources	Mean	Std. Deviation
2.1. Term resources (TRs) for individual subjects	4.42	.617
2.2. Knowledge -based TRs	4.47	.571
2.3. TRs for understanding concepts and collocations	4.53	.603
2.4. Looking up for concepts	4.43	.567
2.5. Conceptual mind maps	4.28	.720
2.6. Concept relations for knowledge acquisition	4.31	.641
2.7. Concept definitions	4.18	.735
2.8. Collocations in noun phrases	4.05	.737
2.9. Verb - Noun and Noun - Verb collocations	4.14	.763
2.10. Prepositional - noun collocations	4.17	.744
2.11. Collocations and word order in general	4.05	.762

2.3.3. The level of satisfaction about the available term resources from content and linguistic knowledge transference

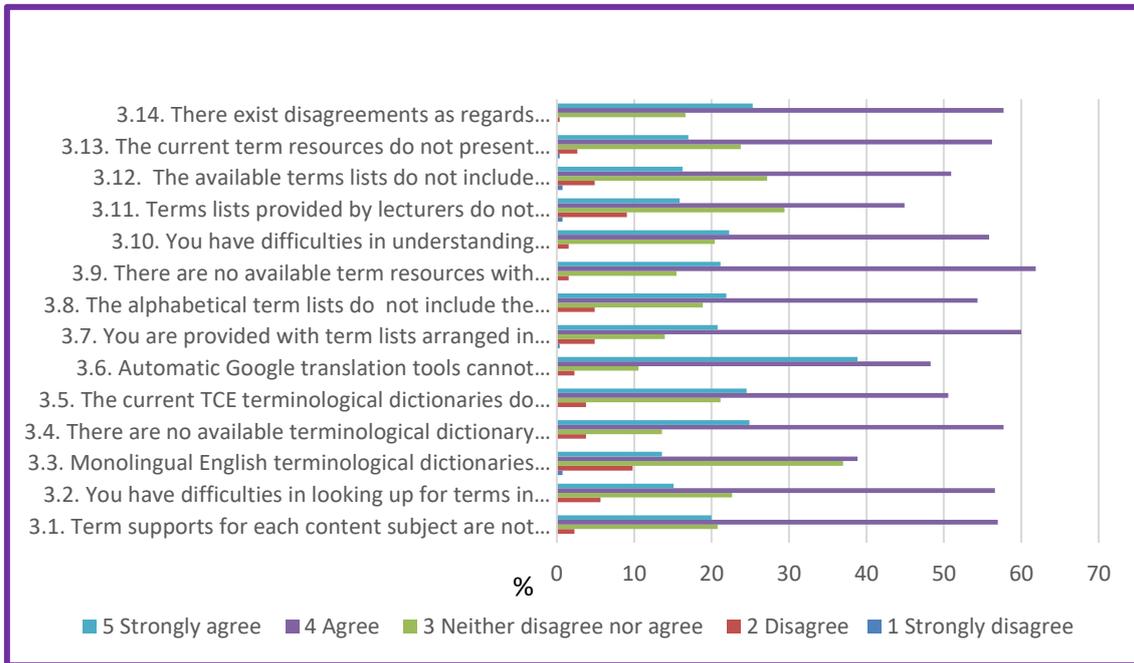
In the previous section we have discussed the *needs* for term resources for individual subjects from content and language perspectives. Now we will see *to what extent the students' needs are satisfied*. The statements are written with negative meanings which are expressed either explicitly with “not” or implicitly. The Cronbach's Alpha indicating Reliability Statistics is 0,881. The mean values of all the items in this category range from 3.55 to 4.24 (**Table 4**), which means the students **agree** with the statements (3.41 – 4.20: *Agree*). They agree with the negative aspects of the available term resources for content and linguistic knowledge transference. The degree of dispersion of answer choices from the mean is wider than that of the previous category because standard deviations are bigger (from 0.654 to 0.878). This indicates the lower level of consistency in the set of answers.

Table 4. Mean and Std. Deviation of the level of satisfaction

Level of satisfaction with the available term resources	Mean	S. Deviation
3.1. Term supports for each content subject are not adequate and effective.	3.95	.705
3.2. You have difficulties in looking up for terms in individual subjects.	3.81	.755
3.3. Monolingual English terminological dictionaries are difficult to use.	3.55	.874
3.4. There is no available terminological dictionary for each content subject.	4.04	.732
3.5. The current TCE terminological dictionaries do not satisfy your term needs for individual subjects.	3.96	.780
3.6. Automatic Google translation tools cannot satisfy your term needs.	4.24	.728
3.7. You are provided with term lists arranged in alphabetical order for individual subjects.	3.96	.760
3.8. The alphabetical term lists do not include the multidimensional relations of concepts.	3.93	.776
3.9. There are no available term resources with conceptual relations.	4.03	.654
3.10. You have difficulties in understanding concepts and content knowledge when terms are treated as discrete units.	3.99	.699
3.11. Terms lists provided by lecturers do not facilitate content and linguistic acquisition.	3.66	.878
3.12. The available terms lists do not include linguistic information.	3.77	.805
3.13. The current term resources do not present lexical relations for learning English word order and collocations.	3.87	.729
3.14. There exist disagreements as regards Vietnamese equivalents to English terms.	4.08	.655

Statements 3.1, 3.2, 3.4. with the means of 3.95, 3.81, and 4.04, respectively are related to the level of satisfaction with term resources for individual subjects. They all agree that the available term resources are neither adequate nor effective, which causes them a lot of difficulties in learning content subjects in English. There are almost no dictionaries for individual content subjects; therefore, the students are provided with word lists composed by their lecturers, in which terms are arranged in alphabetical order without conceptual relations. This prevents the students from understanding the concepts in relation with other concepts (statement 3.7; mean: 3.96). Statements 3.3, 3.5, 3.6, and 3.14 (mean values: 3.55, 3.96, 4.24, and 4.08, respectively) are concerned with the students' level of satisfaction with other available terminological support resources: monolingual English-English dictionaries, English-Vietnamese TCE dictionaries, Google translation, and Vietnamese equivalents to English terms. Monolingual English-English dictionaries are difficult to use as they are more suitable for highly English competent students. English - Vietnamese TCE dictionaries cover too many terms and words from various fields and cannot satisfy the students' needs for individual subjects. They strongly agree on the inadequate role of Google translation, which cannot interpret meanings of specialized concepts and translates texts literally while the students find it hard to correct the errors by themselves. Most of the student (83%) agree that there are controversial issues concerning Vietnamese equivalents to English terms: the percentage of Agreement and Strongly Agreement are 57.7 % and 25.3 %.

Figure 4. Level of satisfaction with the available term resources



Statements 3.8, 3.9, 3.10, and 3.11 are related to the students' attitudes towards concept-based term resources. At presents there are hardly any term resources with conceptual relations to facilitate content knowledge acquisition (statement 3.9; mean: 4.03). The fact that the term resources delivered by lecturers are not knowledge-based is agreed upon by 60% of the students in statement 3.11. 72% of the students agree that they are provided with alphabetically arranged term resources without multidimensional term relations (statement 3.8), so the term resources do not facilitate content and language acquisition. Likewise, 78.1 % agree they have difficulties in understanding concepts and content knowledge when the terms are presented as discrete units. And finally, the linguistic dimensions of terms, in general and LRs denoting collocations, in particular are not presented in the term lists (statements 3.12 and 3.13 with means of 3.66 and 3.77, respectively). All in all, with the mean values of a little below and above 4, all the students surveyed agree that the available term resources for individual subjects cannot satisfy their needs from content and language perspectives. The frequencies (the percentage) of the answer choices are presented in **Figure 4**.

2.3.4. The lexical relations (LRs) that should be included in the term resources

Having investigated the the students' needs and the degree of satisfaction with the available term support, the typical paradigmatic and syntagmatic TCE TRs are given to them to be Agreed upon for inclusion in the term resources. There are abundant linguistic terms in the statements, which the students may find hard to understand, so examples of Highway Bridge Design Event are given for illustration.

2.3.4.1. Paradigmatic term relations

There are 13 items of paradigmatic LRs. The Cronbach's Alpha indicating Reliability Statistics is 0,947. The total of 265 cases are valid. **Table 5** reflects a very high level of agreement of the 13 types of paradigmatic LRs. 4.1, 4.2, 4.3, 4.4, 4.12, 4.13 all receive Strong Agreement (all mean values are above 4.2) while LRs from 4.5 to 4.11 are a little below the scale of strong agreement (all mean values are above 4 and below 4.21). The students have realized the usefulness of the new term products based on LRs that they have hardly got access to. The tables of mean and standard deviations and percentages of answer choices show the warm welcome to the new term management approach.

Table 5. Mean and Std. Deviation of the needs for Paradigmatic LRs

Paradigmatic LRs	Means	Std. Deviation
4.1. Meronymy	4.23	.673
4.2. Opposite - of	4.28	.672
4.3. Synonyms	4.28	.688
4.4. Type - of	4.24	.687
4.5. Agent - of	4.17	.721
4.6. Patient - of	4.12	.737
4.7. Agent - Patient	4.14	.762
4.8. Cause - of	4.17	.772
4.9. Means/ Approach/ Method/Instrument - of	4.17	.790
4.10. Result - of	4.08	.752
4.11. Location - of	4.05	.752
4.12. Nominalization	4.21	.702
4.13. Frame-based presentation of terms	4.22	.730

First, we will discuss the Typology of LRs based on *sense relations* as discussed in Tuyen (2019). This typology includes four major types: *hyponymy* (Type-of or Gener): statement 4.4, *meronymy* (Part-of, which is not included in Raomos et al (1995:353)'s typology): statement 4.1, *synonymy* (Equivalent = Syn): statement 4.3, *apposition* (Anti, Conver, Contr): statement 4.2. The central tendency of Strong Agreement is reflected with all the mean values of more than 4.2. The standard deviations from 0.672 to 0.688 mean the high concentration of answer values about the mean values. The hierarchical relations of Type-of and Part-of have attracted attentions of many terminologists and they are the most common relations in traditionally planned term bases, but they are rare in TCE terminological products. More than 90% of the students agree that LRs meaning Opposite – of and Synonyms, with which they are most familiar as they feed back later, should be put in the term resources.

Table 6. Lexical relations based on sense relations

Paradigmatic LRs	Examples	Means	S.Deviation
4.1. Meronymy (Part-of, Material of)	<i>Top chords – Truss; Masonry – Abutment; Surface layer – Pavement</i>	4.23	.673
4.2. Opposite - of	<i>Superstructure – Substructure; Construct – Demolish</i>	4.28	.672
4.3. Synonyms	<i>Construct – Erect; Deck – Roadway; Steel bar – Steel rod</i>	4.28	.688
4.4. Type - of	<i>Superstructure – Substructure; Construct – Demolish</i>	4.24	.687

The *second* category of Paradigmatic LFs based on *argument roles* (semantic derivations or semantic roles) are mentioned in statements 4.5 to 4.11. These LRs are typical of the Highway Bridge Design Event, so they do not coincide with the typology by Mel'cuk (1998) [15] and Raomos et al (1995:353) [25]. The students agree that all the 7 typical LRs based on argument roles should be presented in the term resources with very high central tendency of Agreement indicated by the mean values from 4.05 to 4.17. Result – of and Location – of LRs receive the lowest percentage of agreement of 80.7 % (mean: 4.08) and 81.1 % (mean: 4.05), respectively.

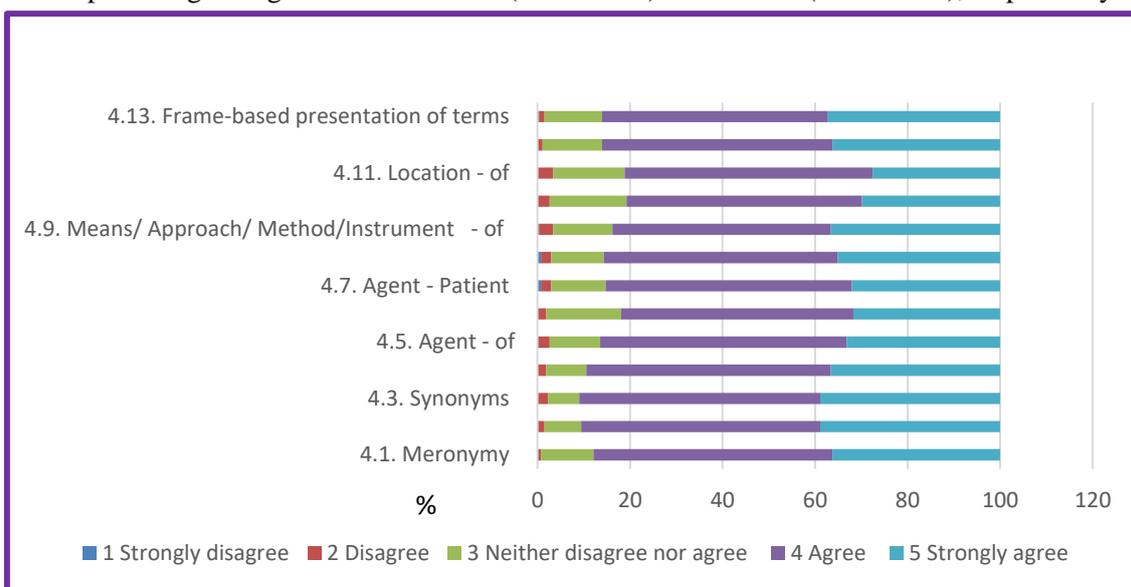


Figure 5. The needs for Paradigmatic lexical relations in term resources

Table 7. Paradigmatic LFs based on argument roles

Paradigmatic LFs based on <i>argument roles</i>	Examples	Mean	Std. Deviation
4.5. Agent - of	<i>Construct – Contractor; Destroy – Storm; Resist (gravity loads) – Stiffening truss</i>	4.17	.721
4.6. Patient - of	<i>Demolish – Bridge; Erode – Abutment; Ensure – Safety; Analyze – Shear-resistance</i>	4.12	.737
4.7. Agent - Patient	<i>Bridge deck – Loads; Suspension bridge – Storm</i>	4.14	.762
4.8. Cause - of	<i>Erosion – Running water; Bridge destruction – Earthquake;</i>	4.17	.772
4.9. Means/Approach/ Method/Instrument - of	<i>Strengthen – Strengthening rods; Reinforce – Truss; Construct – Caisson technology</i>	4.17	.790
4.10. Result - of	<i>Spray – Surface layer; Develop – Compression field theory</i>	4.08	.752
4.11. Location - of	<i>Anchorage – Riverbank; Foundation– Bedrock; Flyover– Creek; Cable-stayed bridge – Bay</i>	4.05	.752

The *last* category of paradigmatic lexical relations is based on *syntactic derivations*. Only one type is found to be typical which is nominalization (statement 4.12). It is very necessary for the students because 36.2 % choose Strongly Agree and 49.8% choose Agree making the total percentage of agreement of 86%. The mean value of 4.21 expresses the scale of Strong Agreement. In this group of variables, statement 4.13 reflects an overall picture of paradigmatic LRs and it is related to Frame-based Terminology. It is aimed to check the students' attitudes towards the terminological presentation pattern with the actants, actions, processes of the specialized event with their multidimensional relations to facilitate content and linguistic knowledge acquisition. They strongly support this presentation format: the mean value is 4.22.

2.3.4.2. Syntagmatic term relations

Syntagmatic LFs [20] consist of three categories: Preposition + Noun, Modifiers, and Verbal functions. Each category contains various LFs denoting both semantic and syntactic aspects of the head word. There are 6 typical TCE syntagmatic LRs. The Cronbach's Alpha denoting Reliability Statistics of 6 items is 0,911.

+ **Prepositional collocations:** (Mel'čuk, 1996) [20] presents five LFs concerning *prepositional phrases*. In addition, another prepositional combination was identified which is *Loc through*: *Across the river, through the truss*. Prepositions form an important domain in English grammar, which is challenging to Vietnamese students because many English prepositions cannot be literally translated into Vietnamese. However, word-by-word translation is a habitual practice of technical students, which results in many errors in productive skills. In TCE texts, 6 types of prepositional combinations presented in **Table 8** are very popular. However, there is only one statement (5.6) in the questionnaire referring to this type of collocation. The tendency of agreement for inclusion in term bases is very high (mean: 4.14 and standard deviation: 0.74).

Table 8. Types of Prepositional collocations

Prepositional collocations			
N0	Explanation	LFs	Example in TCE terminology
1	Prepositions meaning in/at a position	LF Loc in	<i>At a height; At a depth</i>
2	Prepositions meaning moving towards a position	LF Loc ad	<i>To the tower; Towards the anchorage</i>
3	Prepositions meaning moving away	LF Loc ab	<i>From the deck; From a depth</i>
4	Prepositions meaning <i>by means of</i> L with the meaning of instrumentality	LF Instr	<i>Via the tendon; By machine With a strengthening rod</i>
5	Preposition meaning <i>because of</i> L	LF Propt	<i>Due to storm/ traffic impacts</i>
6	Preposition meaning movement <i>through</i> or <i>along</i> L	Loc through	<i>Through the truss; Across the river</i>

+ **Modifiers:** (Mel'čuk, 1996) allocates the category *Modifiers* in Noun Phrases in general language. However, TCE text analysis has discovered that two kinds of quantifiers and qualifiers are typical in TCE texts. In the survey questionnaire, statements 5.1 and 5.2 are written for these two kinds of combinations. The quantifier is clear and extremely popular while the modifier is a

cluster of semantic nuances and needs further investigation. The degree of welcome is similar to the prepositional collocations with the means of 4.19 and 4.06 and standard deviations of 0.714 and 0.713, respectively. These fall in the scale of Agreement (3.41-4.20).

Table 9. Quantifiers and Qualifiers as Modifiers

Quantifier	The modifier of the head noun in a compound nominal that denotes a number or quantity	<i>Two- span bridge; A bridge of five spans; 159 - m center arch; A day's working labor</i>
Qualifier	The pre-modifier of a head noun in a compound nominal	<i>Strengthening rod; Long- span bridge</i>

+ **Verbal collocations:** The last category of syntagmatic LRs are *verbal combinations*, which is very complicated, and the explanation as well as categorization are presented in Tuyen (2019) [27]. The power of this lexical tool is very strong for term analysis, description, and presentation. In terminological dictionaries and term bases, verbs are listed as terms, but they look like verbs in general language. The terminological quality of verbs lies in its combinational potentials. Verbal collocations by (Mel'cuk, 1996) [20] are divided into 1) Causative; 2) Involve; 3) Auxiliaries (support or light verbs); 4) Realizations (fulfillment verbs). The investigation of typical LRs in TCE texts has excluded the group of Auxiliaries (support or light verbs) as typical. These collocations are more useful for describing verbs in general language. Two other verbal collocations of Causative and involve are still vague in the first phase of text analysis. There seems to be no distinctions from the ones in general language. Only one kind of verbal collocations are found to be useful for term description and presentation, which is the groups of *fulfillment verbs* listed in the table below with examples in TCE terminology. Explanation and description of this kind of collocation are described in **Table 10** and in more details in Tuyen (2019) [27]. Students' opinions are asked for in statements 5.3 (Real 1 + Real 2); 5.4 (Fact 0); and 5.5 (Fact 2). These collocations are very popular in TCE terminology and the presentations in term bases are very useful. If these verbs stand alone, their terminological properties are not manifested. This will help to justify the same verb either as a term or not.

Table 10. Collocations of Fulfillment verbs

LRs	Explanation	Examples in TCE terminology
LF Real 1 V+N	Fulfillment verbs mean to fulfill the requirements of L (key word noun). Real 1 takes L (key word noun) as its Dsynt actant II .	<i>To go/travel across a bridge To apply a construction technique To conform bridge specifications</i>
LF Real 2 V +N	Fulfillment verbs: Real 2 takes L (key word noun) as its Dsynt actant II .	<i>To resist gravity loads To bear loads</i>
LF Fact 0 N + V	Fulfillment verbs: Fact 0 takes L (key word noun) as its Dsynt actant I .	<i>The program runs The technology works well</i>
LF Fact 2 N + V	Fulfillment verbs: Fact 2 takes L (key word noun) as its Dsynt actant I .	<i>The truss strengthens (the bridge). The arch resists (the thrust).</i>

Looking at **Table 11**, the students express a passionate support for these kinds of Verb + Noun and Noun + Verb collocations. The mean values and standard deviations of statements 5.3, 5.4, and 5.5 are 4.20, 4.11, 4.12 and 0.677, 0.694, 0.705, respectively.

Table 11. Mean and Std. Deviation of the needs for Syntagmatic LRs

Collocational types	Syntagmatic LRs	Mean	S. Deviation
Nominal collocations	5.1. Quantifier	4.19	.714
	5.2. Qualifier	4.06	.713
Verbal collocations	5.3. LF Real 1 & Real 2	4.20	.677
	5.4. LF Fact 0	4.11	.694
	5.5. LF Fact 2	4.12	.705
Prepositional collocations	5.6. Preposition - Noun	4.14	.740

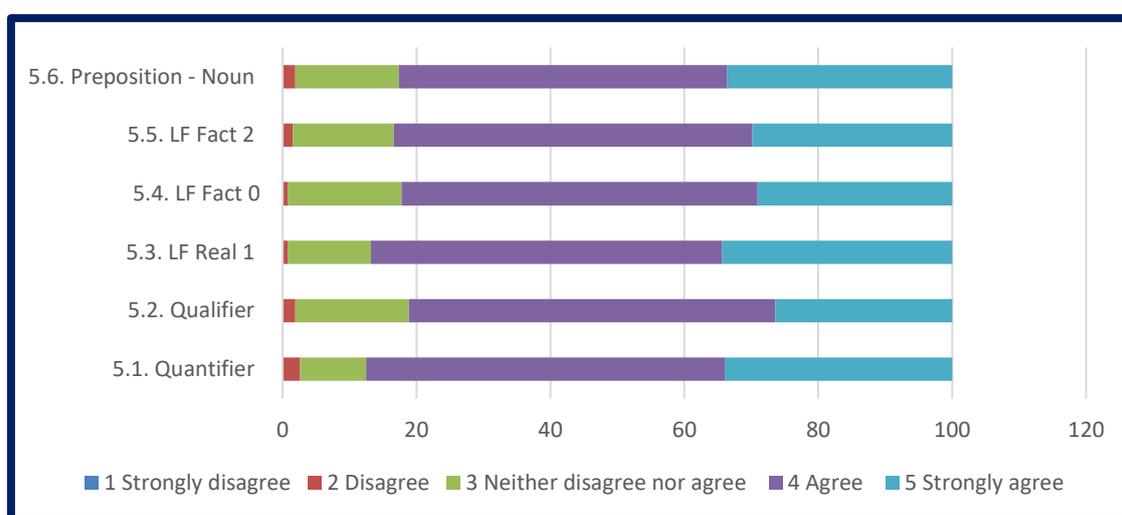


Figure 6. The needs for Syntagmatic lexical relations in term resources

III. CONCLUSION

Terminology support contributes considerably to the successes of EMI training, but the question is how terminology can be planned to support EMI students for content and linguistic acquisition. For each disciplinary subject, the EVRB EMI students are usually provided with traditionally planned terminology term lists without much information from content and linguistic perspectives. Monolingual English-English terminological dictionaries are so difficult for the students to use while English - Vietnamese TCE dictionaries cover too many terms from various subjects but lacking terms for individual subjects. There are hardly any term resources with conceptual relations to facilitate content acquisition. Neither are there term resources with LRs to facilitate language acquisition such as collocations. In this study, terminology research is approached in a new direction based on typical LRs in TCE terminology combined with EMI students' needs. The results from the investigation of EVRB EMI students' opinions have proved that the students always expect to acquire both content and linguistic knowledge, but the

semasiologically organized terms provided to them are treated as discrete units without term relations and they cannot satisfy their needs from content and linguistic perspectives. The students passionately welcome the new onnomasiologically term products of an individual specialized event that present both *paradigmatic* and *syntagmatic* LRs. These term resources not only provide them with specialized concepts and an overall picture of the event with its own processes, actions, and participants but also with linguistic information, especially collocations. This new terminology planning framework can be applied for other specialized events in TCE and other disciplines. However, there remains some limitations of the current study. *First*, thicker data are needed for identifying all terminological LRs to form a comprehensive and exhaustive overall frame and subframes of the Highway Bridge Design Event. *Second*, investigation into the broad but vague lexical relation taxonomies such as Modifier and Associative are needed to further categorize the LRs. Finally, this quantitative research has been conducted in brePadth, so the results are shallow. That is why further interviews and focus groups with TCE EMI students and lecturers should be conducted to explore the phenomenon in depth, especially for constructing the presentation formats of the resulting terminology products.

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APPENDIX

Table 1. Typical LRs in Highway Bridge Design Event

N0	Groups of terms relations	Coding NO	Term relations	Explanation of the relations	Mel'čuk's LFs in general language	Examples
1. Paradigmatic lexical relations						
1	1.1. Meronymy (Partitive)	2	Part - of	Part-of is a vertical relation that also reflects the hierarchical structure of the domain.		<i>Top chords – Truss</i> <i>Deck – Bridge</i> <i>Foundation – Substructure</i> <i>Towers – Superstructure</i> <i>Span – Deck</i>
2		3	Made - of	<i>Made-of.</i> In this study, it refers to the materials for making bridges or bridge parts.		<i>Stone – Arch</i> <i>Steel – Girder</i> <i>Advanced Composite Material – Cables</i> <i>Cast-iron – Rib</i>
3		30	Phase-of	<i>Phase-of</i> relation is applied to processes.		<i>Curing – Concreting</i> <i>Design – Bridge project</i>
4	1.2. Substitutive lexical relations	32	Opposite-of	Antonymy Converseness Contrastiveness	LF Anti LF Conver LF Contrast	<i>Long – Short</i> <i>Superstructure – Substructure</i> <i>Construct – Demolish</i>
5		4	Synonyms	Full or partial synonyms	LF Syn	<i>Construct – Erect</i> <i>Steel bar – Steel rod</i>
6		1	Type-of	Relation means that the term is a subclass of its parent (Faber, 2012).	LF Gener	<i>Tower – Supporting member</i> <i>Caisson – Foundation</i>
7	1.3. Typical category for Actants	5	Agent-of	Si is the standard name of the deep syntactic actant of L.: S1	LF S1	<i>Destroy – Storm Resist (gravity loads) – Stiffening truss</i>
8		6	Patient-of	Si is the standard name of the deep syntactic actant of L.: S2	LF S2 LF S3	<i>Erode – Abutment</i> <i>Analyze – Sheer resistance</i>
9		14	Cause-of	The cause of an action or process.		<i>Erosion – Running water</i>

						<i>Traffic – Surface damage</i>
10		15	Affects	It generally encodes the changes or modification experienced by one conceptual entity		<i>Loads – Bridge deck Storm–suspension bridge</i>
11		12	Organization-of	Name of organization concerning bridge event.		<i>Contractor – Construct department of Transportation – Sponsor</i>
12	1.4. Typical Nouns for Adverbials	33	Means - of (Phương tiện)	Standard name of the <i>means</i> used to bring about the situation denoted by L.	LF Smed	<i>Strengthen – Strengthening rods Reinforce – Truss Tighten – Turn buckle</i>
13		29	Approach/ Method - of (Phương pháp, công nghệ cách thức)	Standard name of the <i>mode / technology</i> .	LF Smod	<i>Construct – Caisson technology Concrete – Self-dumping</i>
14		7	Result-of	Standard name of the <i>result</i> of the situation denoted by L.	LF Sres	<i>Spray – Surface layer Invent – Construction techniques</i>
15		8	Location-of	Location of an entity, action, or process. Standard name of the <i>location</i>	LF Sloc	<i>Anchorage – Riverbank Foundation – Bedrock Flyover – Creek</i>
16		9	Instrument-of (Công cụ máy móc cụ thể).	An Instrument is an object used to carry out an action. It generally refers to the tools, machinery, and devices.	LF SInstr	<i>Vibrate – Roller Block– Construction traffic Sight – Level rod Measure – Break chain</i>
17		34	Goal - of	The location or entity in the direction of which something moves.		

18	1.5. Syntactical derivations	10	Nominalization	Nouns deriving from a verbs or other parts of speech	LF So	<i>Deep – Depth Stiff – Stiffness High – Height Tensile – Tension</i>
19	1.6. Attribute-of	11		<i>Attribute - of</i> relation means the quality or characteristic of a concept		<i>Skid resistance – Surface layer Stiffness – Strengthening member</i>
20	1.7. Associative relations	13		Loosely connected terms belonging to the field		<i>Bridge deck Design Cement Architecture Firm</i>
2. Syntagmatic lexical relations (Phraseology and collocations)						
21	2.1. Nominal collocations	16	Quantifier	The modifier of the head noun in a compound nominal that denotes a number or quantity		<i>Two- span bridge A bridge of five spans 159 - m center arch 27 - m arch span</i>
22		17	Qualifier	The pre-modifier of a head noun in a compound nominal		<i>Rigid beam Reinforced concrete Strengthening rod</i>
23	2.2. Verbal collocations	20	Causative	Collocation of verbs and nouns: “to do something so that a situation occurs”.	LF Caus LF Liqui LF Perm	<i>To attract attention To grant rights To raise opportunity</i>
24		21	LF Involve	A verb that links a non-participant of a situation with the name of the situation acting on him/her/it.	LF Involve	<i>To stand in the wind To catch in a snowstorm</i>
25		31	LF Real 1 V+N Phổ biến Một bộ phận, công cụ, công nghệ đc sinh ra để làm gì	<i>Fulfillment</i> verbs (to fulfill the requirements of L - key word noun). The subject is Agent.	LF Real 1	<i>To go/travel across a bridge To apply a construction technique To conform bridge specifications</i>

26		35	LF Real 2 V +N	<i>Fulfillment</i> verbs: The subject is the Patient	LF Real 2	<i>To face with a technical problem To resist gravity loads To bear loads</i>
27		18	LF Fact 0 N + V	<i>Fulfillment</i> verbs: Fact 0 takes L (key word noun) as its Dsynt actant I. Fact 0 is an intransitive verb	LF Fact 0	<i>The computer program runs The technology works well</i>
28		19	LF Fact 2 N + V	<i>Fulfillment</i> verbs: Fact 2 takes L (key word noun) as its Dsynt actant I. Hành động hướng tới khách thể.	LF Fact 2	<i>The truss strengthens (the bridge) The arch resists the thrust The foundations support (the deck)</i>
29	2.3. Prepositional collocations	22	LF Loc in	Prepositions meaning in/at a position	LF Loc in	<i>At a height At a depth</i>
30		23	LF Loc ad	Prepositions meaning moving towards a position	LF Loc ad	<i>To the tower Towards the anchorage</i>
31		24	LF Loc ab	Prepositions meaning moving away	LF Loc ab	<i>From the deck From a depth</i>
32		25	LF Instr	Prepositions meaning by means of L with the meaning of instrumentality	LF Instr	<i>Via the tendon By machine With a strengthening rod</i>
33		26	LF Propt	Preposition meaning because of L	LF Propt	<i>Due to storm/ traffic impacts Because of earthquake vibrations</i>
34		27	Loc through	Preposition meaning movement through or along L		<i>Through the truss Across the river</i>