AN INTERPERSONAL ANALYSIS OF THREE SELECTED LESSONS IN THE BOOK "EXPLORING SCIENCE 5"

Ta Thi Thu Hang*

Faculty of Language Education and Professional Development,
VNU University of Languages and International Studies, No.2 Pham Van Dong, Cau Giay, Ha Noi, Vietnam

Received 15 April 2024
Revised 24 May 2024; Accepted 30 May 2024

Abstract: The study investigates the interpersonal meanings expressed through the mood and modality resources presented in the textbook "Exploring Science 5" authored by Penny Johnson and Mark Levesley. This textbook is employed in the instruction of fifth-grade science in various countries, including the United States. The analysis is conducted within the theoretical framework of Systemic Functional Linguistics (SFL). The results reveal a notably high occurrence of declarative clauses used in the corpus of the three lessons, whereas interrogative and imperative clauses constitute a modest proportion. Regarding modality, the use of modality in the corpus of the three lessons is not extensive and mainly involves modality conveying "probability" and "obligation". These results suggest that the authors frequently shape knowledge in a particular manner that is aligned with the style of scientific texts.

Keywords: systemic functional linguistics, interpersonal meaning, mood, modality, Exploring Science 5

1. Introduction

In recent decades, Systemic Functional Linguistics (SFL) has demonstrated its applicability across various disciplines, including linguistics, education, discourse analysis, sociolinguistics, and language teaching, as noted by Bartlett and O'Grady (2017). Within the realm of discourse analysis, a multitude of publications within the SFL domain have emerged. Several scholars have conducted research on the language found in school textbooks, both in English and other languages, utilizing Systemic Functional Linguistics (SFL) as the underlying theoretical framework. These researchers include Unsworth (2000), Christie (2002), Martin (1989, 1991, 2005a, 2005b), Halliday (2005a, 2005b), Wignell, Martin, and Eggins (2005), and Schleppegrell (2008). Of particular note are two prominent studies by Hoàng Văn Vân (2016, 2017) that address the experiential and interpersonal dimensions in the text of the Grade 8 biology book. These studies are highly valuable as they offer practical suggestions to textbook writers that, in addition to imparting scientific knowledge, fostering interaction between the writer and the learner is essential.

However, in reviewing the existing literature, it becomes apparent that there has not been any research focused on the educational language presented in the science book *"Exploring science 5".* Therefore, an analysis is conducted on a science textbook *"Exploring science 5"*, investigating how the authors shape interpersonal meanings within science texts.

* Corresponding author.
Email address: hang2013dhnn@gmail.com

Due to the limited time and scope of the study, three lessons in three different subjects are chosen to study. The chapter is dedicated to addressing two primary inquiries:

- What interpersonal resources are employed to construct communication between the teacher as textbook writer and the student as reader in the selected lessons of *"Exploring science 5"*?

- How are they employed?

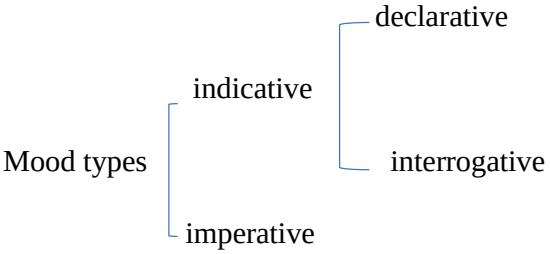
2. Theoretical Framework

2.1. An Overview of SFL

The research adopts a theoretical framework of systemic functional linguistics (SFL). SFL was developed by Michael Halliday, a renowned linguist whose exploration of language within social contexts began in the 1950s and was further refined in the 1960s. Halliday's seminal work, "*Language as Social Semiotic*" (1978), laid the ground for SFL by conceptualizing language as a social semiotic system, emphasizing its functional role in meaning construction within social settings. This theory recognizes language as a multifaceted semiotic system comprising four primary strata: phonology, lexicogrammar, semantics, and context. Within SFL, lexicogrammar examines how linguistic structures (grammar) are structured to convey meaning and serve various communicative functions in diverse contexts. In SFL, language is characterized by three principal functions: the ideational function, encompassing experiential and logical components, the interpersonal function, and the textual function. This study specifically delves into interpersonal meaning in the texts of *"Exploring science 5".*

2.2. Mood and Modality

SFL conceptualizes mood and modality as distinct mechanisms employed to convey interpersonal meanings within clauses. The mood system serves as the grammatical embodiment of speech function semantics in communication, establishing interactive roles between speakers/writers and listeners/readers. According to Halliday and Matthiessen (2014), the two primary roles in speech are "giving (inviting to receive)" and "demanding (inviting to give)". The exchange involved in these roles can be either "goods & services" or "information". These combinations of speech roles and types of commodities result in four main speech functions: "offer", "statement", "command", and "question". Based on these main speech functions, Halliday & Matthiessen (2014) classified the following mood types.



(Adapted from Halliday and Matthiessen, 2014, p. 162)

The indicative is the grammatical category commonly used to exchange information. Within this category, statements are typically conveyed through the declarative form, whereas questions are conveyed through the interrogative form. Additionally, interrogatives are divided into yes-no interrogatives for polar questions and WH-interrogatives for content questions.

Below are some examples extracted from the lessons of "*Exploring Science 5"*.

B1 is a declarative clause simplex that functions to state a fact.

B1	Many people	love		chocolate.
	Subject	**Finite**	**Predicator**	**Complement**
	Mood		**Finite**	

In B24, an interrogative clause asks students to add the missing information about things to happen.

B24	What	might	happen
	Subject	**Finite**	**Predicator**
	Mood		**Residue**

Imperative mood type falls in three forms: *unmarked for person or polarity, marked for person and marked for polarity* (Halliday & Matthiessen, 2014).

	unmarked for person or polarity	**marked for person**	**marked for polarity**
positive	look	YOU look	DO look
negative	DON'T look	DON'T YOU look	DO NOT look

(Adapted from Halliday and Matthiessen, 2014, p. 165)

As can be seen, the *unmarked positive for person* has no MOOD element and has RESIDUE only while the other types have MOOD element with Subject *You* or Finite *Do – Don't.* In the selected texts of the book, all of imperative clauses are *unmarked for person.* Let's see an example.

B38	Name	a mineral
	Predicator	**Complement**
	Residue	

Regarding the Mood element, it consists of the Subject, Predicator, Complement, and Adjunct.

- The Subject, typically instantiated through a nominal group, assumes a primary role in affirming or denying propositions - an entity that provides the reference against which propositions are evaluated (Halliday & Matthiessen, 2014).

- The Predicator, often realized through a verbal group, serves as a secondary inherent element within the clause, offering a locus for various options within the mood and other interpersonal clause systems. This element is crucial for asserting or negating statements (Halliday, 1994), and its realization facilitates the assessment of modal aspects of the clause (Matthiessen et al., 2010).

- The Complement, typically expressed through a nominal group, constitutes a non-inherent element within the clause, potentially occupying the Subject's position and signaling proposition completion.

- The Adjunct, often embodied by an adverbial group or prepositional phrase, functions as another non-inherent element, providing additional contextual information.

These elements encompass various types, such as circumstantial, modal, and conjunctive Adjuncts. The sequence of these components within a clause is depicted as follows: **+Subject ^ +Predicator ^ -Complement ^ -Adjunct.**

Mood relates to the polarity of statements (whether they are affirmative or negative). However, there exist not only two distinct poles but also other *"intermediate possibilities"* between them, which are referred to as Modality or the speaker's assessment or judgment.

Within a proposition, two primary types of *"intermediate possibilities"* are identified: the *"degree of possibility"* (expressed with terms like possibly, probably, certainly) and the *"degree of usuality"* (such as sometimes, usually, always). Halliday and Matthiessen (2014) differentiated these from other forms of Modality by labeling them as Modalization. This can be conveyed through a finite modal operator, a modal adjunct, or both.

In a proposal, categorized by the speech function of *"demanding"* or *"offering"*, *Halliday* and Matthiessen (2014) distinguished between the *"degree of obligation"* (indicating what is allowed, supposed, or required) and the *"degree of inclination"* (expressing willingness, eagerness, or determination). This latter aspect of Modality is termed Modulation and can be expressed through a finite operator or by expanding the Predicator using verbal group complexing.

3. Research Design and Methodology

3.1. Unit of Analysis

This study is centered on investigating the aspect of interpersonal meaning; therefore, clause simplexes are selected as the focal unit of analysis. A clause simplex typically comprises a subject, a finite verb, and occasionally, supplementary elements that form the Predicator. According to Halliday and Matthiessen (2014), the clause simplex is regarded as the highest-ranking grammatical unit as it encompasses all three metafunctions of language.

3.2. Data Collection and Analysis

3.2.1. The Book "Exploring Science 5"

"Exploring Science 5" is a specific installment within the broader *"Exploring Science"* series authored by Penny Johnson and Mark Levesley and published by Pearson - Longman. Tailored for fifth-grade students, this book aims to provide a comprehensive exploration of scientific concepts relevant to this age group. The content of the *"Exploring Science"* series is typically aligned with national and international curriculum standards, making it suitable for use in various educational settings. The series covers a wide range of scientific topics, including **biology, chemistry, physics, and Earth sciences**. Each topic is presented in a clear and accessible manner, suitable for students of different abilities.

The book *"Exploring Science 5"* includes three subject **biology, chemistry and physics**. Biology covers 18 lessons; chemistry covers 17 lessons and physics cover 16 lessons. For the scope of the study, the data collected is limited to 3 lessons randomly chosen for study.

- Biology: Lesson 5Aa (Food for thought)

- Chemistry: Lesson 5Ca (Solids, liquids and gases)

- Physics: Lesson 5Ea (The shape of the Earth)

For analytical purpose, each lesson is coded as Text 1 (5Aa), Text 2 (5Ca), and Text 3 (5Ea). The clause simplexes within the three lessons are encoded as follows: B1, B2...C1, C2,

and E1, E2... Here, B stands for Biology corresponding to the lesson 5Aa, C stands for Chemistry corresponding to the lesson 5Ca, and E stands for Earth corresponding to the lesson about Earth in 5Ea.

3.2.2. Aspects of Analysis

The analysis for the grammatical and lexical features of three texts from the book *"Exploring Science 5"* from interpersonal perspective is confined to the following three aspects:

(i) Quantitative analysis in general is conducted to provide information for subsequent analyses and discussions.

(ii) The analysis of the frequency and distribution of mood types used across the dataset as well as within each individual lesson.

(iii) The analysis of the frequency and proportion of different modality and modulation used across the dataset and within each lesson.

4. Findings and Discussions

4.1. Quantitative Analysis in General

Table 1

Quantitative Analysis in General in Three Lessons

	Dataset	**Text 1**	**Text 2**	**Text 3**
Number of words	1148	369	310	469
Number of clause simplexes	144	45	46	53
Number of words per clause	7.9	8.2	6.7	8.8

From Table 1, we can observe that the total word count across the three selected texts is 1148 words, with the first text consisting of 369 words, the second text 310 words, and the third text 469 words. The total number of clauses analyzed is 144, with 45 clauses from the first text, 46 clauses from the second text, and 53 clauses from the third text. The average word count per clause simplex across the entire corpus is not high, approximately 7.9 words per clause simplex. Specifically, the first reading averages 8.2 words per clause simplex, the second reading averages 6.7 words per clause simplex, and the third reading averages 8.8 words per clause simplex.

4.2. Mood Types

Based on the sections presented above, the discourse in the corpus was analyzed according to declarative, interrogative, and imperative mood types. The quantity and proportion of these discourse types are specified in Table 2.

Table 2

Mood Types in Three Selected Lessons

Texts	**Declarative**	**Interrogative**	**Imperative**	**Total**
Text 1	35	5	5	45
Text 2	37	7	2	46

Text 3	48	4	1	53
Total	**120**	**16**	**8**	**144**
Percentage	**83%**	**11%**	**6%**	**100%**

4.2.1. Declarative Mood Type

Examining Table 2, we can observe the utilization of three mood types across the three selected lessons from the textbook. Among these, declaratives dominate at a rate of 83% (120/144). Specifically, in text 1, declaratives account for 78% (35/45), 80% (37/46) in text 2, and 91% (48/53) in text 3. It is noteworthy that of all declarative clauses, only 15 out of 120 are negative, while the rest are affirmative statements. As aforementioned, the declarative mood functions as a means of making statements or expressing information. In the case of *"Exploring Science 5"*, most of affirmative declarative clause simplexes are employed to inform readers (mostly students) the information involving the lessons. For instance, in lesson content related to health issues (Biology – Food for health) and the classification of foods as either beneficial or detrimental to health, most of declarative clause simplexes primarily provide information concerning the composition or impact of various foods on health. Let us consider example B16. In this example, the author presents factual information about the main components found in sweets.

B16	Sweet things	contain		lots of a carbohydrate called sugar.
	Subject	**Finite**	**Predicator**	**Complement**
	Mood		**Residue**	

Similarly, in another example, the author provides scientific information about the role of calcium in the body.

B29	Calcium	is		a mineral that helps to make bones and teeth
	Subject	**Finite**	**Predicator**	**Complement**
	Mood		**Residue**	

Likewise, in subjects like chemistry (solids, liquids, gases) or earth science, most declarative statements function to provide students with relevant knowledge.

C4	Ice	is		a solid.
	Subject	**Finite**	**Predicator**	**Complement**
	Mood		**Residue**	

The number of negative declarative sentences is relatively modest (15 out of 122). For instance, in Lesson 1, there are only two instances where negative declarative sentences are used in first and second conditional clauses, presenting situations in which excessive consumption of sweets by students would adversely affect their health.

B6	you	would not be		very healthy.
	Subject	**Finite**	**Predicator**	**Complement**
	Mood		**Residue**	

The proportion of declarative sentences is the highest, with affirmative statements being overwhelmingly predominant. This indicates that the lesson content consists of indisputable information. In this context, the author (writer) serves as the information provider, while the learners receive the information passively, with no two-way interaction taking place.

4.2.2. Interrogative Mood Type

Interrogative clauses rank the second after the declarative ones. Before this mood type is discussed in details, the classification and some basic features of this mood type need to be reiterated. SFL outlines two primary types of interrogative clauses: polar and non-polar. Halliday and Matthiessen (2014) clarify that the key distinction lies in the certainty implied for the questioner. A polar interrogative clause indicates uncertainty on the part of the questioner regarding the proposition, whereas a non-polar clause implies certainty about the proposition itself, despite lacking specific details.

Interrogative clauses account for 10% of the total. Specifically, Lesson 1 constitutes 9%, Lesson 2 constitutes 15%, and Lesson 3 constitutes 8%. It is notable that within the three surveyed lessons, all clauses belong to the category of non-polar interrogatives. These clauses require students to provide missing information such as *"who, what, which..."* Let's study some examples below.

B19	What foods	have	you	eaten	today
	Complement	**Finite**	**Subject**	**Predicator**	**Adjunct**
		Mood			
	Residue				

As can be observed, in example **B19**, a piece of information is assumed as given, which is that the reader (student) had breakfast this morning, and the missing information that needs to be addressed is "what food".

C16	Which property	is		the same	for both solids and liquids?
	Subject	**Finite**	**Predicator**	**Complement**	**Adjunct**
	Mood		**Residue**		

Similarly, in example **C16**, the implicit question assumes that the reader (student) has grasped the properties of both liquids and solids, and the missing information that needs to be answered is which property is the same for both types of substances. In example **E23**, the author assumes that these individuals could not see the picture of the Earth and asks the students to explain the reason.

E23	Why	couldn't	these people	just	look at	a photograph of the Earth?
	Adjunct	**Finite**	**Subject**	**Adjunct**	**Predicator**	**Complement**
		Mood				
	Residue					

Thus, it can be observed that although the number of interrogative mood types appears at a low frequency, there is an interaction between the writer and the students. In this interaction,

the writer requests information, and the students are asked to provide it.

4.2.3. Imperative Mood Type

According to Halliday and Matthiessen (2014), the imperative mood uses a distinct set of personal pronouns compared to the indicative mood. In the imperative, which is used for transactions involving goods and services, the Subject can be 'you', 'me', or 'you and me'. All imperative clauses found in three lessons can be classified **as the unmarked for person** which has no MOOD element and consists of Residue only.

This type of mood accounts for 6% and begins with verb phrase *"write down, look at, draw or think".* Both material and mental verbs are used in imperative clause simplexes. All the imperative clause simplexes used in the three lessons are intended to instruct students to perform certain tasks to reinforce their knowledge after each section of the lesson. For example, in B10 and C9, the author asks the students to list various types of food or create a table to categorize different substances.

B10	Write down	all the foods on the list.
	Predicator	**Complement**
	Residue	

C9	Draw	a table	to show	which ones are solids and which ones are liquids.
	Predicator	**Complement**	**Predicator**	**Complement**
	Residue			

In the two examples above, the reader implicitly understands that the main subject is "you" (the student). Regarding social distance, the omission of the subject "you" indicates a degree of separation in the relationship between the writer and the reader (students). This use of language creates a formal, rather than intimate, atmosphere.

4.3. Modality

Table 3

Modality in Three Selected Lessons

Text	Number of clauses	Modalization		Modulation	
		Probability	Usuality	Obligation	Inclination
Text 1	45	7	0	3	0
Text 2	46	4	1	3	0
Text 3	53	10	0	1	0
Total	**144**	**21**	**1**	**7**	**0**
Percentage	**100%**	**15%**	**1%**	**5%**	**0%**

The table shows three texts based on the number of clauses and their use of linguistic modulation in terms *of probability, usuality, obligation, and inclination*. Text 1 (45 clauses) shows significant modalization in *probability* (7 occurrences) and moderate modulation in *obligation* (3 occurrences). Text 2 (46 clauses) exhibits lower modalization in *probability* (4

occurrences) and *obligation* (3 occurrences), with minimal modalization in *usuality* (1 occurrence). Text 3 (53 clauses) demonstrates higher modalization in *probability* (10 occurrences) and moderate modulation in *obligation* (2 occurrences). Overall, the analysis shows that *probability* modalization occurs in 15% of all clauses, while *obligation* modulation occurs in 5% of clauses. Modalization related to *usuality* (1%) is less frequent and *inclination* is absent.

Probability modalization reflects the writer's degree of certainty when presenting information. For instance, in B22, the author states that the types of food illustrated in the images help children develop, but acknowledges that many factors influence a child's development. Therefore, the use of modality suggests that the writer is not 100% certain that food alone contributes to a child's growth and development. Modality is realized through the word *"will"* - this represents a median degree of expressing possibility (Halliday & Matthiessen, 2014).

B22	The foods in this photograph	will	help	you
	Subject	**Finite**	**Predicator**	**Complement**
		Modalization (probability)		
	Mood		**Residue**	

The limited use of modality expressing *probability* further indicates that the information presented in the text is considered incontrovertible.

Obligation modulation is the second most frequently used after *probability* modalization. This type of modality is primarily employed in the text to describe the duties and responsibilities of students. For example, in B7, the students are asked to vary types of food in their diet.

B7	You	need	to eat	different types of food
	Subject	**Finite**	**Predicator**	**Complement**
		Modulation (obligation)		
	Mood		**Residue**	

In the example C45 below, the word *"should"* expresses a median degree of obligation (Halliday & Matthiessen, 2014), which requires students to be aware of these features of solids and liquids.

C45	You	should	know	some properties of solids and liquids
	Subject	**Finite**	**Predicator**	**Complement**
		Modulation (obligation)		
	Mood		**Residue**	

Usuality modalization is used only one time in all three selected lessons with the word *"often"*.

Thus, it can be observed that modality expressions constitute a very small proportion of the entire three lessons and do not play a significant role in text composition. The number of *probability* modality is the highest, reflecting the author's level of certainty regarding certain

pieces of information. *Obligation* modality, on the other hand, is used to require or remind students to complete a specific task.

5. Conclusion

5.1. Summary

Therefore, it can be concluded that, among the three selected readings from the book *"Exploring Science 5"*, the authors have employed all three mood types to establish relationships. Specifically, the declarative mode dominates (83%), with the interrogative (11%) and imperative modes (6%) representing a modest proportion. Modality elements are also sparingly used in these three lessons with a humble rate (21% in total), in which *probability* modality is mostly employed to express the author's degree of certainty when providing some pieces of information for students.

5.2. Implications

Therefore, based on the research findings, several key points can be inferred:

(i) An overwhelming number of declarative clause simplexes are used, indicating a clearly defined relationship between the writer and the reader (students). The writer assumes the role of imparting knowledge, which is presented as almost indisputable (with assertions and very few *probability* modality expressions employed), while the students are positioned as passive recipients of information.

(ii) The interaction between the author and the reader or student, who is the primary user of the textbook, is not prominently highlighted, as indicated by the relatively small number of interrogative and imperative clause simplexes. Furthermore, the second most common type of interrogative sentence is "non-polar", where part of the information is assumed and the student needs to address the missing information. Therefore, if the second type of interrogative clauses were supplemented before interrogative words like *"Who", "What", "Which"*, etc., students might have more opportunities to explore before they respond and interact implicitly with the writer, or students would be more inclined to answer questions. For example, before the question "*What foods have you eaten to give you energy?"* the author could add the question *"Have you had breakfast this morning?".*

(iii) All imperative sentences have their subjects hidden, thus creating a sense of one-way interaction, with the writer requesting actions from the students.

(iv) Given the nature of a scientific text, modalities are not extensively utilized. The majority of modality expressions are used to describe the likelihood of a phenomenon related to biology, chemistry, or earth science occurring. Modalities indicating *"obligation"* aim at outlining the responsibilities of students after each lesson in terms of understanding the content or knowing what to do next.

5.3. Limitations and Recommendations for Further Study

This study only explores one level of significance of the three lessons in the textbook. To obtain a comprehensive view and facilitate generalization of the fundamental characteristics of the textbook as well as comparisons with other scientific textbooks, three levels of meaning should be investigated, and all lessons should be examined. In addition, future research should explore types of subjects used in mood types, which to some extent reveal the relationship between the writer and the reader more clearly. This can also help in understanding the style of using types of subjects in writing scientific books.

References

Johnson, P. & Levesley, M. (2004). *Exploring Science 5*. Longman.

Halliday, M.A.K. (1978). *Language as Social Semiotic*. Hodder & Stoughton Educational.

Halliday, M.A.K. (1994). *An introduction of functional grammar* (2nd ed.). London E. Arnold.

Halliday, M.A.K. & Matthiessen, C. I. M. (2004). *An introduction to functional grammar* (3rd ed). Edward Arnold.

Halliday, M.A.K. & Matthiessen, C. I. M. (2014). *Halliday's introduction to functional grammar* (4th ed.). University of Birmingham, UK.

Hoang, V. V. (2016). Tiếng Việt trong sách giáo khoa khoa học phổ thông: Khảo sát đặc điểm ngữ pháp - từ vựng của 7 bài học trong Sinh học 8 từ bình diện chuyển tác [The language of Vietnamese school science textbooks: A transitivity analysis of seven lessons in Biology 8]. *Tạp chí Ngôn ngữ* [*Journal of Language*], *6*(325), 11-31.

Hoang, V. V. (2017). Ngôn ngữ của sách giáo khoa khoa học phổ thông: khảo sát đặc điểm ngữ pháp - từ vựng của 7 bài học (ngôn bản) trong Sinh học 8 từ bình diện liên nhân [The language of school science textbooks: A interpersonal analysis of the Lexicogrammatical Features of 7 Lessons (Texts) of Biology 8]. *Tạp chí Ngôn ngữ* [*Journal of Language*], *9*(340), 28-54.

PHÂN TÍCH NGHĨA LIÊN NHÂN CỦA BA BÀI HỌC ĐƯỢC CHỌN TRONG SÁCH "EXPLORING SCIENCE 5"

Tạ Thị Thu Hằng

Khoa Đào tạo và Bồi dưỡng Ngoại ngữ, Trường Đại học Ngoại ngữ, Đại học Quốc gia Hà Nội, Số 2 Phạm Văn Đồng, Cầu Giấy, Hà Nội, Việt Nam

Tóm tắt: Bài viết nhằm khảo sát nghĩa liên nhân được thể hiện thông qua các nguồn lực thức và tình thái trong sách giáo khoa "Exploring Science 5" do Penny Johnson và Mark Levesley biên soạn. Sách giáo khoa này được sử dụng trong giảng dạy khoa học lớp 5 ở nhiều quốc gia, bao gồm cả Hoa Kỳ. Phân tích được thực hiện trong khuôn khổ lý thuyết Ngữ pháp Chức năng Hệ thống (SFL). Kết quả cho thấy sự xuất hiện đáng kể của các thức tuyên bố trong tập hợp ba bài học, trong khi các thức nghi vấn và mệnh lệnh chỉ chiếm một tỷ lệ khiêm tốn. Về phương diện tình thái, việc sử dụng các biểu đạt tình thái trong ba bài học chiếm một tỉ lệ nhỏ và chủ yếu liên quan đến tình thái thể hiện "khả năng" (probability) và "nghĩa vụ" (obligation). Những kết quả này cho thấy các tác giả thường định hình kiến thức theo một cách cụ thể phù hợp với phong cách của các văn bản khoa học nhưng hạn chế tính tương tác giữa người viết và người học.

Từ khóa: ngữ pháp chức năng hệ thống, ý nghĩa liên nhân, thức, tình thái, Exploring Science 5