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The appliability of systemic functional linguistics and its role in discipline integration

Abstract: The present article aims to investigate the model and significance of discipline integration based on the appliability of systemic functional linguistics. To this end, it first describes the inevitability of the emergence of social semiotics; then it explores the six appliable characteristics of social semiotics: sociality, systemicness, applicability, transdisciplinarity, dynamicity, and multimodality. It next studies the basic conditions of discipline integration and the models of integration. After that, it investigates the basic model of discipline integration in systemic functional linguistics, which includes four basic types: direct application, borrowing, complementarity, and backwashing. It finally examines the model of the discipline integration process, including choice of a theme, choice of problems to be solved, choice of applicable disciplines, the contextualization of disciplines to be integrated; and the effect of the discipline integration in solving problems is also discussed. It is hoped that this study will shed light on cross-disciplinary or transdisciplinary research.

1 Introduction

Systemic functional linguistics (hereafter SFL) treats language as a "social semiotic" (Halliday 1978), and social semiotics is a branch of semiotics investigating meaningful practice and explaining meaning-making. It marks a new stage in the development of modern semiotics, which shifts the focus of study from the internal characteristics of the sign to the role of the sign in social practice (Zhang 2010a: 153).

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It was Halliday (1978) who first put forward the theory of "language as a social semiotic", which holds that language evolves as a system of "meaning potential" (Halliday 1978: 39; Halliday and Hasan 1989) or as a resource that enables the speaker to use language to do things in a specific social context, and language is a system with three metafunctions: ideational, interpersonal, and textual.

Like other disciplines, in the West, semiotics was also originated from research on philosophy in ancient Greek. In the 2nd century B.C. to 3rd century B.C., "[t]he Stoics formalized the dichotomy between form and meaning, distinguishing in language the 'signifier' and the 'signified', in terms strikingly reminiscent of de Saussure's *signifiant* and *signifie*" (Robins 1990: 19, italics in original). The process of creating chains of signs is called semiosis, which refers to a successive process of pointing to the relevant aspects of the sign: the signifier points to the concept, and the concept points to the entity that represents the sign.

Saussure inherited and developed the semiotic theory of the Stoic School. He believes that language "is a system of signs in which the only essential thing is the union of meanings and sound-images, and in which both parts of the sign are psychological" (Saussure 1974 [1916]: 15). Signifier refers to the sound image of sign in the listener's mind, and signified refers to the concept of sign in the listener's mind. Neither of them is material, but both are related to the material form involved in the sign: the sound image is related to the sound as carrier of the sign, while the concept is related to the referent, the material entity of the sign (see Figure 1).
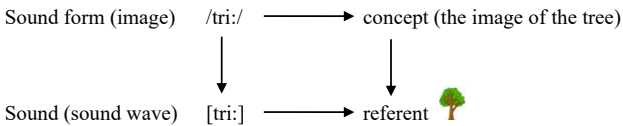

Figure 1: The relation between the sign and the material entity in Saussure's theory.

In Saussure's semiotic theory, language "is a system of signs in which the only essential thing is the union of meanings and sound-images, and in which both parts of the sign are psychological" (Saussure 1974 [1916]: 15). "Taken as a whole, speech cannot be studied, for it is not homogeneous […]" (Saussure 1974 [1916]: 19). The sole object of the linguistics proper is language (Saussure 1974 [1916]: 20).

Compared with Saussure's semiotic theory, Halliday's social semiotic theory not only focuses on Saussure's *langue* (language), that is, the systemic nature of language, or "meaning potential", but also studies "speech". Saussure's semiotics focuses on the synoptic characteristics of language, while social semiotics focuses on the dynamic characteristics of language and the process of social communication.

The social process involves communication and application. Its meaning and semiotic system are shaped by the power relationship: the change of power will result in the change of the semantic system (see Figure 2).
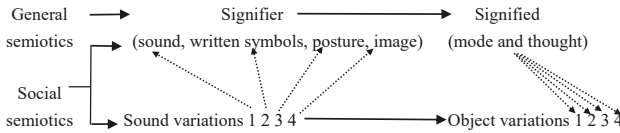

Figure 2: General semiotics and social semiotics.

Social semiotics is the study of how the semiotic system makes meaning in the social context, including the following three aspects: (1) how people design and interpret meaning and design and interpret discourse; (2) how the semiotic system is shaped by social interests and ideology; (3) how we can adapt to the new social changes. It is concerned with the explanation of the variability of semiotic practice, i.e. *parole* (speech). It shows how individual creativity, changing historical circumstances, and new social identities and projects can change the patterns of design and usage (Hodge and Kress 1988). The semiotic system is a resource that can be used and designed by people to make meanings. Its main task is to develop an analytical and theoretical framework to explain meaning-making in social context.

2 The characteristics of appliability of social semiotics

Social semiotics is a branch of general semiotics, a theoretical concept, and a theory is knowledge that can be independent of practice or related to practice. Halliday (2006) proposes that social semiotics, in spite of being a theory, is characterized with "appliability", which refers to the fact that a social sign is supposed to be appropriate for (linguistic) application. In this way, social semiotics can be called "appliable semiotics".

Social semiotics focuses on how signs and semiotic systems function in social communication between the participants. In this sense, it is a system of signs, social in nature, dynamic, and is appliable to deal with problems in social communication, and at the same time, it is transdisciplinary and multimodal as it is concerned with the application of the theory to solve problems in another discipline or other disciplines. It has the following six appliable characteristics:

sociality, systemicness, applicability, transdisciplinarity, dynamicity, and multi-modality (See Zhang 2010b: 5–10).

(1) Sociality: Sociality is the basic feature of a social sign. According to this feature, social semiotics specifically studies how signs and semiotic systems function in social practice and communication. For example, to paint, we should regard the painting not only as one with similarities and differences with others, but also as an item in communication, such as a work of art, the aesthetic value of which can be appreciated or can demonstrate the artist's wisdom and skills.

Social semiotics studies how social interactions are carried out. It means that all social interactions are meaningful, and so they are the result of choices from the semiotic system. It is also related to the interaction between participants and develops through the social process. According to this feature of social signs, social semiotics involves the integration of multiple disciplines. For example, the production of a painting involves art or technology, while social interaction involves humanities.

(2) General value: The general value of social signs is to realize the practical use in social communication. Specifically, the social sign is concerned with the study of how the theory can be better applied to social communication, doing things, solving practical problems, and achieving goals. For example, to study the sign 'tree', it asks such questions: why does it appear here? What is the purpose of using it? In what environment? How can we use it to achieve the desired effect: suggesting something, asking someone to do something, or telling someone to do something? In this specific case, the object of research is biology, and the actual purpose of research is social science.

(3) Basic form: From the perspective of their basic forms, signs exist in semiotic systems and are the resources of meaning-making in the process of communication. From this perspective, this paper studies how to make choices from semiotic systems to achieve the purpose of communication, which is the meaning potential of the instances of *parole*. The semiotic system is not synoptic in nature, but it is always possible to be selected in dynamic social and cultural situations. For example, to study the person system of language, we need to study the relationship among different pronouns in the person system, and at the same time, we should also study how they function in the context, such as functioning as Subject or Object, and how it acts as a cohesive element in discourse construction.

(4) Practice in nature: Social semiotics is constructed from the perspective of the function of the signs in social practice. Therefore, the study of social semiotics is not limited to the internal aspects of the semiotic system, but goes beyond

the scope of the internal characteristics of the relevant semiotic system, and has entered many fields related to social actions and activities, such as power, social strata, aesthetics, politics, and language teaching. For example, the focus of the study of painting system is not the internal characteristics of painting, but how to use it to express its own emotional or social significance, or to show the power relationship. A picture of Barack Obama in the newspaper may embody the photographer's attitude towards him. This is related to politics and power. Moreover, this social semiotic study also involves many disciplines, such as art, politics.

(5) Form of existence: The social sign is defined according to the function of the sign in the context of social communication, and it will have different characteristics in different social contexts. Therefore, the main form of its existence is variation. Firstly, all social practices take place in different contexts, such as in different fields, in different communication relations between communicators, and in different communication channels and media. Social semiotics theory should explain these variations and find useful models for them. For example, in the social semiotic research of clothing, the research focus is not the general characteristics of clothing, but how to use different clothes in different contexts. Different clothes have different status and power significance, suitable for different occasions, different people, and different seasons. Secondly, the semiotic system will change with the changes of social environment and power relations, so social semiotics studies the dynamic aspects of social practice. For clothing, social semiotics studies not only its different roles in different environments and occasions, but also the changes of fashion at different times or in different social periods, involving history and politics.

(6) Form of realization: The social sign realizes discourse meaning in social communication, and discourse is usually multimodal. In discourse analysis, a main task of research is the process of multimodal synergetic realization of meaning, such as advertising, film, painting, and calligraphy. Each mode plays a unique role in expressing the discourse meaning as a whole, and they are complementary in the construction of the overall discourse meaning in the process of communication. They involve different types of modes, for example, advertising can be realized by calligraphy, writing, frame design, speech, singing, painting, photos, and so on, while movies involve mobile setting, action, dialogue, sound, music, and so on. In multimodal discourse, each mode is related to roughly one discipline, and language and other modes involve the relationship between linguistics and other disciplines.

3 Conditions for discipline integration and the choice of modes

Since the beginning of the 21st century, the integration between disciplines has become the growth point and breakthrough to promote the theoretical innovation and development of various disciplines. The innovation and development of linguistic theories are also inseparable from the mutual integration and mutual learning between various theories and schools within the discipline of linguistics, as well as with other humanities, social and natural sciences. Linguistic research also has the attribute of interlingualism and interdisciplinarity, and continues to move towards the interdisciplinary and transdisciplinary integration, which emphasizes the problem or the theme orientation and jointly solves complex problems through the synergy among different disciplines. Therefore, it is urgent to establish a transdisciplinary platform based on linguistics to gather researchers in different disciplines such as linguistics, computational science, medicine, psychology, sociology, and anthropology, and we can form a joint force to put forward and solve some major problems and realize innovative development. SFL, as an appliable linguistics, naturally has this transdisciplinary nature.

3.1 Conditions for discipline integration: Complementarity of disciplines

When a discipline can not survive and develop in the new environment, or can not complete the communication task from the perspective of practice, it needs another discipline or several disciplines to supplement, improve and strengthen it so that it can keep on growing in terms of theoretical development and practical application.

Discipline integration involves the understanding of the characteristics and advantages of each discipline and how they can complement each other. In this sense, we need to borrow Bernstein's research on knowledge construction in social education to explore the model of discipline integration. Bernstein (1999: 157–173) did not make a distinction between discourse and knowledge. In this way, simple knowledge needs simple discourse, and complex knowledge needs complex language to express it. He developed a classification system of human discourse. In this study, Bernstein's knowledge structure theory is mainly used to determine the types and characteristics of discipline knowledge and discourse, as well as the basic principles for teaching this knowledge.

3.2 Types of discipline knowledge

From the perspective of knowledge representation, Bernstein first distinguishes between vertical discourse and horizontal discourse. The difference between the two is divided by the form of knowledge. Horizontal discourse refers to the discourse of daily life, which is characterized by "common sense" knowledge. It is common knowledge known to all and accessible in life. It has the same history and development experience. It is oral, local, context-dependent, specific, implicit, multi-level, and sometimes contradictory. It is related to people and their living environment to the greatest extent. A key point of this kind of knowledge is that it is organized in segments; that is, the knowledge segments embodied in this discourse can be irrelevant to each other or not closely related to each other. The knowledge segment can be regarded as what Martin (1992) calls "genre", which is the process that people experience in doing things in life.

At the same time, Bernstein (1999: 157–173) also made a difference between repertoire and reservoir. The sum of all the "segments" mastered by a person is repertoire, while the sum of "segments" shared by the whole community is a reservoir. This coincides with Martin's view that the cultural context is characterized by genre (Martin 1992: 495). Repertoires are different from each other. In this way, the more common characteristics of each repertoire in this community, the stronger its cohesion, and vice versa. Similarly, the closer the "segments" in a repertoire are to the reservoir, the stronger the person's social communication ability, and vice versa. At the same time, we use the concept of "segment" to represent each genre, but it does not mean that they are equally important, and some are more important than others.

For the native language learner, this way of language teaching and learning on the basis of these 'segments' also has its unique features: the teaching and learning of each "segment" can be different, and this kind of knowledge and language learning is generally not carried out through formal education, but through communication, simulation and demonstration in families, peer communications and communities. However, for foreign language learners, this is the basis and first focus of learning, because daily discourse is the basic part of the whole individual discourse (repertoire) to be developed. At the same time, due to cultural differences, differences in basic knowledge also need to be developed in both knowledge and language.

As shown in Figure 3, "[a] vertical discourse takes the form of a coherent, explicit, and systematically principled structure, hierarchically organized, as in the sciences, or it takes the form of a series of specialized languages with specialized modes of interrogation and specialized criteria for the production and circulation of texts, as in the social sciences and humanities" (Bernstein 1999: 157–173). Vertical discourse is a discourse that needs to be learned in formal education. It has two
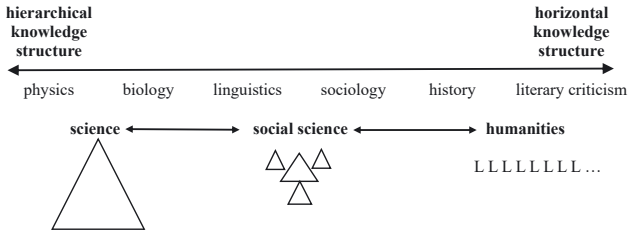
Figure 3: Vertical discourse as complementarity and cline (Martin 2011: 43).

forms: science and engineering discourse, which is a discourse organized in a hierarchical form with a coherent, clear, and systematic structure, and humanities and social sciences discourse, which is a series of discourses produced and transmitted in the form of professional language. This discourse takes professional problems and professional standards as the basic mode of discourse. It has strong distribution rules to control the access, communication, and evaluation of discourse. It is usually re-contextualized in terms of time, space, and participants. The integration of vertical discourse is the integration of meaning, and the process of vertical discourse is hierarchical. In fact, every time new knowledge is added, it fills the gap in the original knowledge at a certain level.

In terms of knowledge structure, vertical discourse has two structures: hierarchical knowledge structure, which belongs to the knowledge structure of science and engineering discourse, and horizontal knowledge structure, which belongs to the knowledge structure of Humanities and Social Sciences discourse. Hierarchical discourse structure is intended to create a general proposition or theory, integrate lower-level knowledge, and use an integrating code. The horizontal discourse structure highlights the uniqueness of different languages. Each language may be different from other ones, such as literary research is literary criticism, philosophical research is exploration, and so on. The knowledge of different disciplines in the horizontal discourse structure is different. Some are closer to science and engineering, such as mathematics, linguistics, and economics. They are considered to have "strong grammar"; Some are closer to everyday discourse, such as anthropology and sociology. They are considered to have "weak grammar".

From the perspective of learning, learners can easily identify disciplines with a strong grammar in the vertical discourse structure and horizontal discourse structure, while in the discourse practice of the horizontal discourse structure with a weak grammar, learners may doubt whether they are doing research in the discipline, such as sociology and anthropology. His disciplinary status needs to be expressed through naming and language markers. The perspective or principle of its re-contextualization is how the learner reads, evaluates, and produces a text. In

the hierarchical knowledge structure, the learning theory is the most important, although he also learns an angle and principle at the same time. Bernstein (1999: 157–173) used Figure 4 to represent the relationship between different types of knowledge and discourse.

Discourse

Vertical ◄——— Power relations ———► *Horizontal*
within   between   within

D.R.   Reservoir
                                                  D. R.

Horizontal ◄————► Horizontal ◄————► Repertoires
knowledge   knowledge
structures   structures

Grammars
strong   weak

Transmission
Explicit   Tacit
                    (crafts)

Figure 4: The relationship between different types of discourse (Bernstein 1999: 168).

This model shows that for the discourse and knowledge to be taught, we must first determine whether it is vertical discourse or horizontal discourse. In native language teaching, horizontal discourse is generally not taught in the classroom, but in foreign language teaching, horizontal discourse is the basic discourse, which needs a long time and a lot of classroom teaching practice. If it is a vertical discourse, we should choose whether it is hierarchical knowledge structure or horizontal knowledge structure. If it is a horizontal knowledge structure, we should also make a distinction between strong grammar and weak grammar. Strong grammar and vertical knowledge structure can be treated in similar ways of teaching. If it is weak grammar discourse, we need to determine whether it is explicit or implicit. These options need to be realized by selecting appropriate teaching procedures, methods, and modes of teaching.

3.3 Disciplinary knowledge integration mode

From a transdisciplinary perspective, the first level of knowledge integration is the integration of scientific and technological knowledge, including science and engineering knowledge, humanities and social sciences knowledge, and daily life

knowledge. In this integration, the general mode of the two types of knowledge division is that scientific and technological knowledge is used to solve the problems in human daily life. Scientific and technological knowledge needs to find its application field in daily life to solve problems, while daily life knowledge needs scientific and technological knowledge to solve problems that it cannot solve by itself. At the same time, when solving the problems of daily life, scientific and technological knowledge also needs the support and guidance of daily life knowledge.

The knowledge of daily life is discrete and segmental, which is liable to result in problems inside it and the relationship between segments. Scientific and technological knowledge is hierarchical and highly integrated. It is easy to connect and integrate seemingly unrelated components between segments. At the same time, it can also provide higher-level knowledge to solve problems that cannot be solved by knowledge in daily life. Therefore, the basic feature of this integration is to use vertical knowledge discourse to solve the problems in horizontal discourse (See Zhang and Wu 2021: 45–52).

This level of integration is of great significance to foreign language teaching. To learn a foreign language, we must first learn the discourse of daily life and master the daily knowledge of all aspects of daily life. However, to really engage in a professional work in the future, we also need relevant professional knowledge. Therefore, we need to integrate the two in a complementary manner on the basis of mastering the discourse of daily life or at the same time mastering specific professional knowledge. This is the "foreign language + major" model practiced in foreign language teaching in China. The key is to integrate the two in students' transdisciplinary ability (See Figure 5).

L1, L2, L3, … Ln
Segment 1, Segment 2, Segment 3
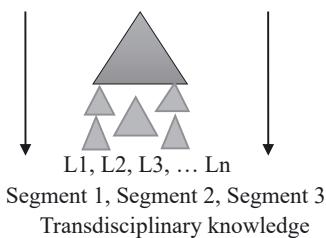Transdisciplinary knowledge

Figure 5: First level of knowledge integration.

The second level of knowledge integration is the integration of hierarchical knowledge structure and horizontal knowledge structure, that is, the combination of arts and science. The characteristic of knowledge integration at this level is that both of them are vertical discourses, which depart from the scope of daily

knowledge and enter the scope of professional knowledge generally endowed in formal education. However, the similarity between it and the first level integration is that the hierarchical knowledge structure is easier to be used to solve the problems in the horizontal knowledge structure. Due to its discreteness, the horizontal knowledge structure is prone to problems, such as disputes, which need to be solved by the hierarchical knowledge structure. At the same time, the specific implementation of hierarchical knowledge structure also needs the assistance, support, and guidance of horizontal knowledge structure. In knowledge integration, not all types of knowledge can perform their respective duties synoptically. They are also interactive, synergetic, and cooperative.

This level of integration is still of great significance for foreign language teaching. The competence of high-level foreign language learners includes not only high language proficiency in daily discourse and professional discourse, but also the broad knowledge of arts and sciences as the background. This is a necessary capacity for a foreign language learner with high overall quality. The basic feature of this level of integration is to solve the problems existing in the horizontal structure with hierarchical structure knowledge (as shown in Figure 6).
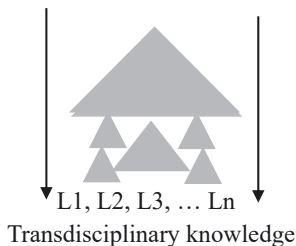

L1, L2, L3, … Ln
Transdisciplinary knowledge

Figure 6: Second level of knowledge integration.

The third level of knowledge integration is that of disciplines within the hierarchical discourse structure. This integration is mainly based on the major disciplines the learners are engaged in, expanding and extending them to one or some other specific disciplines, so as to make up for the drawbacks and limitations of the disciplines they are engaged in, break the discipline barriers, absorb the common characteristics of different disciplines, and improve their professional competence and professional communicative competence.

This knowledge integration model uses the knowledge of adjacent disciplines to solve the unsolvable problems in this discipline. This kind of knowledge integration also includes the main characteristics of the integration of scientific and engineering knowledge and social science knowledge (as shown in Figure 7).
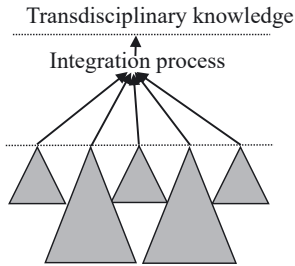
Figure 7: Third level of knowledge integration.

In this way, the basic principle of discipline integration here is to use hierarchical discipline knowledge to solve the problems in low-level discourse or segmental discourse.

4 The systemic functional model of knowledge integration

As shown in Figure 4 above, Wignell (2007: 184–204) placed linguistics behind physics and biology belonging to science and engineering, and before social sciences such as sociology and history, and humanities such as literature and art. This shows that it has the disciplinary characteristics of science and engineering, such as scientific experiments and data statistics, as well as the characteristics of social science, such as social investigation.

(1) SFL is directly applied to the research of other disciplines. The main point here is the shift of research perspective from other disciplines to linguistics. The theory of SFL is used to solve problems in other disciplines: the nature of language and the internal characteristics of related disciplines complement each other (See Figure 8).
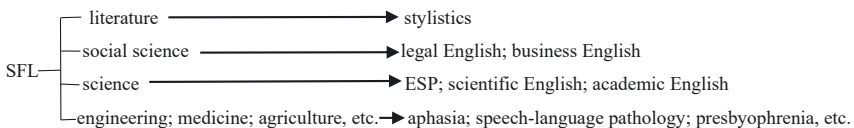

Figure 8: The application of SFL to other disciplines through discipline integration.

In this case, linguistics becomes one that shares the characteristics of all the other disciplines. First, the mystery of language and that of human thinking

are one, which needs to be confirmed by the most advanced scientific means. Secondly, the characteristics of its social communication need to be studied by means of field investigation, mathematical statistics, and so on, and finally, the spirit, emotion, and attitude of people expressed in language need to be studied through humanities. The basic model of discipline integration is shown in Table 1, in which a dialogue is presented between SFL and other disciplines. In this dialogue, the other disciplines are supposed to meet with certain problems, and SFL can provide solutions to these problems.

Table 1: SFL directly applicable to other disciplines.

Other disciplines	SFL	Solution
I meet with a problem that I can't solve myself.	I'll help you solve it.	Provide theoretical support, theoretical framework, or ideas, schemes, and procedures for solving problems
I meet with a problem I can't solve satisfactorily myself.	I'll help you improve it.	
We have different ideas and disputes with each other.	I'll help you settle the dispute.	
I have been using traditional methods with no innovations.	I'll help you with a new plan and some new ideas.	

As a result, as it is only applied research, and although the theory of linguistics can be integrated with other disciplines to which linguistics is applied, so that it forms a new research model, SFL itself has not suffered losses, but will learn from, perfect and improve itself in this applied research. For example, language teaching can shed light on the understanding of the essential features of language.

(2) Appliability through borrowing: When some problems are found within a discipline that can not be solved by itself in the process of its own development, which involves the knowledge and characteristics of other disciplines, it is necessary to borrow, for instance, the research results of SFL, which can shed light on and provide methods or ideas for its own research. For example, although artificial intelligence is very advanced and cutting-edge, it involves language problems in many fields, such as simulating the thinking activities and discourse activities of human brain, producing discourse that meets the needs of communication and context. In addition, other disciplines are the same, like philosophy, literature, law, business, and management. This is again demonstrated as a dialogue between SFL and other disciplines in Table 2, in which other disciplines are supposed to borrow SFL theory as solutions to their problems.

As a result, if the theory of SFL provides effective support and help for the research of this discipline, it will be integrated with this discipline and may become

Table 2: Appliability of SFL through borrowing.

Other disciplines	SFL	Solution
I came across a question, which may be answered by the linguistic theory.	Try me if you need me!	Providing theoretical support, or ideas, schemes, procedures, etc. to solve the problems.
I have a problem which can be solved by a linguistic theory.	You can try and see if I'm useful.	
I have studied with traditional methods for many years, but it is difficult to make innovations. Linguistics has developed many new theories. I'll try to see if they are useful.	If necessary, I can help you provide a new research idea or method.	

a main part of this discipline. In this way, the latest research results of the discipline can also be good feedback and enlightenment to the linguistic research and improve the theoretical level of linguistics itself. If not, it can be abandoned and alternative research methods can be adopted. But this will not affect the existence and development of the linguistic theory.

(3) Appliability through complementarity: Above, we have discussed some characteristics or attributes of language by borrowing those of other disciplines, such as social attribute, psychological attribute, artistic attribute, computational statistical attribute, and educational attribute, so as to develop sociolinguistics, psycholinguistics, computational linguistics, and educational linguistics. Here, the essential attribute of language is extended and continued by some other disciplines to form a distinctive research direction.

The result of discipline integration is that the two disciplines are integrated, which makes them coexist with, promote and develop each other. At the same time, it also leads to a new transdiscipline. From the perspective of SFL, it can produce systemic functional sociolinguistics, systemic functional educational linguistics, functional stylistics, and so on.

On the one hand, the integration of disciplines has developed linguistics itself and made the sociality and educational nature of linguistics more prominent and clear, and the integration of disciplines leads to an intermediary discipline: systemic functional sociolinguistics, exploring the social attributes of linguistics, and the linguistic characteristics of sociology.

(4) Appliability through feedback: The appliability of SFL theory makes it easier to be combined with other disciplines. When it is widely used to solve problems in other disciplines, it is easier to find help or answers in other disciplines

when it has problems that it can't solve by itself, such as the expression of language in social communication and human consciousness, the location of language in the brain and the process and expression of language activities; the generation and development of language in the human brain; children's language development; and language learning mechanism.

5 The model of discipline knowledge integration process

The integration of discipline knowledge is based on multidisciplinary knowledge. According to the above research, multidisciplinary knowledge is composed of three parts: (1) Segmental knowledge composed of daily life knowledge, which is the basis for the formation of human common sense; (2) Horizontal knowledge structure, including the types of knowledge close to hierarchical structure in Social Sciences; (3) Scientific hierarchical knowledge structure of science and engineering.

The selection of various types of discipline knowledge should be made according to some necessary conditions. To take college foreign language education as an example, students firstly need to master the common knowledge of human daily life, that is, the common knowledge necessary for one's life, such as the necessary knowledge related to clothing, food, housing, and transportation. Without this knowledge, one can not find the problems that he or she should solve in one's future life and work, and other knowledge one has learned will be useless. Secondly, to engage in research in a discipline, in addition to the strong disciplinary knowledge, students also need to understand the common sense knowledge related to the discipline. For example, for those who conduct geological research, the more they know about mountain conditions and landforms, the better. Some need field work, and to do sociological and anthropological research, they need to understand local conditions and customs, and also need to investigate specific local communities.

For the comprehensive selection of knowledge, the most important thing is to select disciplines according to objectives and tasks. For example, considering that most students want to be foreign language teachers after graduation, they should focus on disciplines that are related to their future careers. In addition to linguistics and literature, they should also choose pedagogy, psychology, teaching methodology, educational technology, and other related disciplines. Here, the selection

of these disciplines requires a clear understanding of the role of each discipline in the discipline integration and its relationship with other disciplines, such as complementarity, overlap, and intersection. According to the logical semantic relations proposed by Halliday (1994: 220), they can also be divided into projection, including projecting thought or projection locution, and expansion, including elaboration, extension, and enhancement. However, as there are no ready-made integration models in the world, we should select a discipline set according to our needs, accumulate knowledge conforming to this discipline set, and clarify their respective positions and roles in this discipline knowledge integration.

The knowledge learned in each discipline is not different from that of general disciplines. A new task is to put the knowledge of each discipline in its appropriate position. Related to the first difficulty is that teaching this multidisciplinary knowledge requires teachers to come from different disciplines. For example, teaching in normal education needs teachers who teach pedagogy, psychology, educational technology, and teaching methodology, as well as teachers who teach computer science, internet technology, and information technology.

If a team is formed for a task or problem, first, teachers of various disciplines are needed. At the same time, this combination is temporary and uncertain, which further increases the difficulty. According to the Legitimate Code Theory (LCT) by Maton (2013: 8–22), knowledge is formed by transforming from relatively decontextualized and condensed meaning into contextualized and simple meaning; that is, knowledge can be truly absorbed and mastered through the process of contextualization. The contextualization process is the same as the "situated practice" in the teaching model of multiliteracies proposed by the New London Group (1996: 60–92), which "is the part of pedagogy that is constituted by immersion in meaningful practices within a community of learners who are capable of playing multiple and different roles based on their backgrounds and experiences. The community must include experts, people who have mastered certain practices […]. Such experts can guide learners, serving as mentors and designers of their learning processes."[1]

One of the main components of LCT is semantic wave theory. Its organizing principle is regarded as semantic code, including two dimensions: semantic gravity (SG) and semantic density (SD) (Maton and Howard 2020: 94). Semantic gravity refers to the degree of relevance between semantics and context, which can

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[1] The New London Group (1996: 60–92) proposed a multiliteracies teaching model which consists of four components. Apart from "situated practice", there are overt instruction, through which students develop an explicit metalanguage of design; critical framing, which interprets the social context and purpose of designs of meaning; and transformed practice, in which students, as meaning-makers, become designers of social futures.

be divided into strong and weak, expressed as $\pm$SG and $\pm$SD. The higher the degree of semantic dependence on context, the stronger the semantic gravity; The stronger the independence of semantics to context, the weaker its semantic gravity. Semantic density refers to the degree to which meanings are condensed in social and cultural practice. The higher the semantic density, the more the meaning is condensed in social practice; The lower the semantic density, the less the meaning is condensed in the sign. The combination of semantic gravity and semantic density with the time dimension can represent the mode of teaching through semantic waves. It can be seen that, generally speaking, knowledge with strong semantic gravity is context dependent, while knowledge with strong semantic density is less context dependent.

In the integration of discipline knowledge, the contextualization of knowledge is a complex process, which involves not only the contextualization of the knowledge of a single discipline, but also the simultaneous contextualization of multidisciplinary knowledge, and the contextualization of different discipline knowledge at different stages.

As the integration of discipline knowledge is carried out around a theme, the integration and application of discipline knowledge is problem-oriented. The knowledge of related disciplines is contextualized in the process of solving problems, from knowledge with low semantic gravity to knowledge with high semantic gravity, but usually with low semantic density. Knowledge with high semantic gravity and low semantic density is easier to be mastered and understood. For example, it is a problem to carry out foreign language teaching reform and improve the quality of foreign language teaching. In order to solve this problem, transdisciplinary knowledge is needed.

Firstly, it is necessary to select appropriate teaching content for teaching to contextualize the knowledge of the discipline. At the same time, the presentation of knowledge should also conform to the psychological and cognitive rules and principles of students' knowledge accumulation and internalization, so as to contextualize psychological knowledge; meanwhile, it should be presented by teachers or students through modern educational technology, so as to contextualize educational technology knowledge more effectively. Finally, both teachers and students need to search for information through internet technology, information technology, and other means to supplement or confirm the relevant knowledge and information, so as to contextualize the knowledge from information technology. The contextualization of this knowledge is made to achieve a goal and improve the efficiency and effect of foreign language teaching. They are contextualized at the same or different stages of the process. Through their common contextualization, multidisciplinary knowledge can be integrated into one, which can be naturally applied to a theme or solve a problem, and become the integration of disciplinary knowledge. This process is represented in Figure 9.
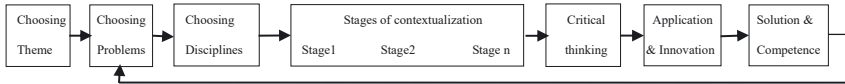
Figure 9: The integration of discipline knowledge in contextualization.

The model means that the integration of discipline knowledge is always around a theme, such as teaching or learning a foreign language. But when you have chosen the theme, you need to deal with a specific aspect of the theme: a topic or a problem related to the theme, such as to let the students master a certain aspect of the knowledge of business management in English. In order to solve such a problem, you need to make sure what knowledge from what disciplines is necessary for the problem, such as linguistics, education, and business management, and also you need to make a decision as to how these different types of knowledge are presented to the students: in what sequence, simultaneous or separately, and so on. This involves the design of the curriculum, in which the choice of the right teachers and the teaching procedures are also involved. The fourth stage is to put the design into action, making the knowledge of different disciplines implemented for the solution of the problem and integrated. In business management English teaching, the students are taught this knowledge by the respective teachers in different stages and phases in the context of classroom teaching or in the context of authentic communication in business management in English. The fifth stage is concerned with a critical reflection on the contextualization process. It means what is taught and learned in the teaching process is further examined, reflected, and interpreted in relation to the purpose of the teaching and learning, to what was learned and taught before, and to the teaching and learning effect of the design and the choice of modes. The sixth stage is concerned with the application of the knowledge and capacities learned and developed, including the application of these aspects to similar areas, and the innovative use of them in new areas. Through their common contextualization, critical thinking, and application, multidisciplinary knowledge can be integrated, being naturally applicable to a theme to reach a goal, or solve a problem.

6 The effects of discipline integration

The integration of discipline knowledge has three prominent effects: enhancing competence, promoting practice, and enabling integration. From the perspective of enhancing competence, in the process of contextualization of this knowledge,

the degree of integration with other disciplines and the appropriateness of integration depend on whether it really plays the role that this discipline knowledge should play, that is, whether it has become the ability of teachers or students to solve practical problems, or whether it has promoted teachers' or students' teaching or learning efficiency.

From the perspective of promoting practice, the integration of discipline knowledge comes from practice and is applied to practice at the same time. It is impossible to integrate discipline knowledge without contextualization and solving problems in practice. For example, if students only learn the knowledge of different disciplines in books and do not combine it with that of other disciplines to solve problems, it is difficult for them to integrate the knowledge of other disciplines, because the integration and effects of the knowledge of different disciplines are carried out in a given context, that is, in solving practical problems.

From the perspective of enabling integration, when the knowledge of a single discipline is used to solve a discipline problem, it is integrated in the process of contextualization and becomes an integral part of the total knowledge needed to solve this problem. We can no longer clearly distinguish which discipline the knowledge belongs to. Teachers can realize which part of knowledge may come from which discipline. For example, in foreign language teaching, there is neither pedagogical knowledge nor psychological knowledge specifically taught, but they both play an important role in the formation of teaching process and become integrated with other discipline knowledge.

However, in order to truly make the integration of discipline knowledge become the ability of the students through the integration of discipline knowledge, we still need to make the integration of different disciplines more and more perfect and effective through practices. In addition, according to the multiliteracies teaching model proposed by the New London Group (1996), it also needs to go through the stages of critical thinking, application, and innovation to truly become a transdisciplinary ability.

Through the process of knowledge learning and practice, relevant discipline knowledge can be stored as single discipline knowledge or converted into certain practical ability at the same time, but it can not be said that it has become a real integration of discipline knowledge, because the final mastery of knowledge needs to go through the process of speculation and evaluation to make knowledge theoretical and objective, such as the position of discipline knowledge in the whole process of practice, relationship with other disciplines, and the sub-stages in which it is contextualized.

In this way, it is a necessary stage to make self-reflection, demonstration, criticism, comparison, speculation, discussion, and debate during or after the practice of discipline knowledge integration. The final integration of knowledge of

related disciplines, the integration of discipline knowledge, and students' trans-disciplinary ability need to be tested in practice (New London Group 1996: 60–92).

Students should be able to use this knowledge to find problems and tasks, design action plans, or creatively apply this knowledge to the practice of solving relevant problems effectively in the context of changing world, so as to finally determine that the knowledge of these relevant disciplines has indeed become their transdisciplinary competence, which can be used to solve new problems.

7 Conclusion

This study investigates the model and significance of discipline integration based on the appliability of systemic functional linguistics. The above research shows that the development of social semiotics theory manifests the appliability of SFL, which is clearly demonstrated by the six characteristics of social semiotics. The basic condition of discipline integration is discipline complementarity when completing a task. The types of discipline integration can be the integration of daily knowledge and humanities, the integration of humanities and science and engineering, and the integration within science and engineering. SFL can be applied to discipline integration in four ways: direct application, borrowing, complementarity, and back-feeding. The basic models of SFL applicable to discipline integration are: choosing a theme, choosing problems, choosing applicable disciplines, the contextualization process of disciplines, and solving problems.

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