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The Study of Comparison between English Language and Mathematical Language

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Abstract: The development of comparative linguistics has always been pushed ahead by the teaching of English. Based on the basic principles of applied linguistics, this paper, initiated by the needs of English teaching and learning, illustrates the feasibility and significance of comparison between English language and mathematics language and explores the similarities between the learning methods of English and mathematics. We shall provide a comparative investigation of English study and mathematical thinking, trying to give some efficient methods for studying and teaching English.

Keywords: language comparison, English methodology, mathematical methodology, migration method

1. Introduction

In the early 19th century, European linguists established historical comparative linguistics, which made a comparison between kin languages. Though Chinese and English do not belong to the same language family, many linguists in China, based on their English teaching practice in a long period, have gradually realized that making a comparison between English and Chinese is an

effective method to promote their teaching quality and have conducted much research in this field. Yet many researchers may wonder whether there is any comparability between English and mathematics language? Sure, our answer is yes, the reasons are listed below.

2. To See the Feasibility of Comparing English Language with Mathematical Language from Relations between Language and Thinking

The so-called thinking is direct or indirect conceptual reflection of human's brain about nature, mutual relation, and the intrinsic rules of the outside world. Mathematical thinking is a process of understanding mathematical objects by people, including the deduction process of solving real problems by means of mathematical tools. There are various thinking processes, such as procedure thinking, space thinking, axiomatic thinking. The methods of thinking include abstract thinking, mapping thinking, logical thinking, induction classification thinking, etc. At the beginning of the twentieth century, An American linguist F. Boas believed that there seems to exist direct relations among various forms of language, culture, and thinking. E. Sapir [1] and B. L. Whorf [2] also pointed out that thinking and language have intimate relations. These linguists talked about the intrinsic connection of the mutual reaction and restriction of language and thinking from either the angle of the worldwide vision or the hypothetic way. In his book [3]"A Comparison of Conceptual Structure for English and Chinese," Guoqiang Lu explored how human brains use conceptual thinking for the two languages' transmission and how to use the conceptual structure to deal with thinking pattern of the languages, based on the theory of cognitive semantics. He further pointed out that the comparison between the two languages is actually that of their thinking pattern.

From its very birth date mathematics has been a twin brother of thinking. The existence and development of mathematics depend on thinking, and mathematics can only be represented via thinking. On the other hand, mathematics is a tool for thinking and is gymnastics for the training of thinking. At the same time language is a principal tool for thinking and is a constituting element of thinking. Thinking must be expressed in a language format with a certain way. A difference in thinking manner is a main cause for the difference in language. People from different nations have different ways of thinking pattern due to the difference in social history, philosophy and religion, life habit, and the environment. In particular, eastern and western people have very different thinking ways, which results in significant difference in the two languages of Chinese and English.

For mathematics as a common language in the world, in the past people only mostly noticed the difference between mathematical thinking and other scientific thinking activities, and sometimes this difference was made absolute without noticing their common features. Particularly when considering mathematics as a language, the common part of mathematics and language has been ignored from the angle of language as a tool of expressing thinking process. By considering mathematics and thinking as separate items, considering mathematics as a pure language we explore the intrinsic relation between mathematics and English from the thinking point of view.

2.1 English Conceptual Structure Thinking and Mathematics Mapping Thinking

In the modern study of language comparison, one new idea is to deal with the thinking pattern by using the concept structure. Proposing a comparison of two languages is in fact comparing the two languages' thinking patterns. In other words, it is a mapping that uses the concept

structure thinking to deal with the language information concept. Mapping is a mathematical terminology. The process of forming and developing the mapping concept is a series of processes of weak abstraction, that is, the process from the special to the general.

Mapping is a special relation and actually a correspondence relation. Its definition is: Let A and B be two nonempty sets and let f be a correspondence rule. If for every $x \in A$, there exists a $y \in B$ that corresponds to x, then f is called a mapping from A into B [4].

The concept of mapping belongs to modern mathematics. From the definition of mapping an important distinction of modern mathematics and classic mathematics can be easily seen that in classic mathematics one studies the numeric relation between objects, that is, the discussion of the correspondence relation problem is over the field of numbers, while in modern mathematics the discussion of the correspondence relation problem is over abstract sets, which can include the correspondence relation with respect to the concept structure. This provides the theoretic basis for the fact that through a grammatical structure some English sentences may not be explained as clear as the one using the mapping structure. For example:

1. John's sold the car to the dealer.

2. John's given the car to Mary.

They have the same grammar structure, but are different as far as the concept structure is concerned. Sentence 1 expresses an event of trading. Trading events include exchanges of items with money, and so the concept structure that expresses trading events has the structure of two domains. One is the set of all considered items, and the other is a set of money. Sentence 2 only expresses an event with one domain about the domain change, so it only constitutes one concept structure. Using the concept of mapping, we have

Example 1

$$\text{material set(car)} \xrightarrow{mapping(sold)} \text{money set}$$

Example 2

$$\text{material set(car)} \xrightarrow{mapping(given)} \text{person}$$

They are two different concept mappings, and their concept structure difference can also be proved by means of question-answer deduction sentences. For sentence 1, we can ask the question with "how much", but for sentence 2 it cannot be asked this way. Thus the English sentences with two concepts should use the corresponding rule to realize the mapping.

2.2 Consistency of English and Mathematical Abstract Thinking

Abstract thinking and description thinking are two basic forms of human being's thinking. Due to the historical reason on the eastern and western cultures, the thinking manner of Chinese culture possesses stronger descriptiveness, while that of the western culture has stronger abstraction. Mathematics is a subject of extremely strong abstraction, and mathematical objects are products of abstract thinking. Therefore, mathematical thinking is not only the starting point of researching the relation of mathematics and thinking, but also a starting point of exploring the relation of English and thinking.

Abstract thinking begins in general from people's initial contact of phenomena in activities. During the process of carrying out research and applications people discover the phenomena which appear periodically and predict some natural laws.

Such phenomena attract the attention of researchers, and after deep investigations a natural abstract thinking activity appears. Abstraction can normally catch some special phenomenon and then finds general rules from special cases. Mathematical abstraction has two important principles, that is the strong abstraction principle and the weak abstraction principle.

Strong abstraction introduces new characteristics to the concept

pattern, which in fact increases the content of the concept and shrinks its extension, so that the research is put toward a small part of objects. It also selects some individual characteristics from some parts of original objects to determine their nature, and then combines with the original characteristic to regulate or define new patterns.

Strong abstraction is a general phenomenon. For example,

Function $\xrightarrow{strong\ abstraction}$ function with limit $\xrightarrow{strong\ abstraction}$ integrable function $\xrightarrow{strong\ abstraction}$ continuous function

$\xrightarrow{strong\ abstraction}$ differentiable function

Here the propositional strong abstraction is also a general phenomenon in mathematics. It is easy to understand from corollaries of a large number of existing theorems in mathematics that corollaries are results that can be deduced from theorems, so they are special cases of theorems and are products of strong abstraction.

Weak abstraction can be viewed as a kind of thinking activity that uses new methods to construct new mathematical objects. That is, it is a method that gradually reduces the specialty of the object, and selects some characteristics or emphasized aspects and ignores other characteristics, forming patterns which are weaker limit, more popular and more general than original objects. For example,

Early function concept (algebraic function) $\xrightarrow{weak\ abstraction}$ The 18th century function concept(analytic function) $\xrightarrow{weak\ abstraction}$ The 18th century function concept(variable function) $\xrightarrow{weak\ abstraction}$ Modern function concept(mapping)

Hence, the concept of mapping is a product of weak abstraction of early functions. From another angle we can see that the mapping concept from the above weak abstraction is obtained for the purpose of reducing content, extending extension, adding new elements, and increasing the scope of research.

In the studies of English and mathematics, using abstract thinking can have the effect of achieving the whole goal with half energy. For example, in the process of English study, we can abstract seven basic patterns of sentences with general rules from concrete and special English sentences and their applications:

(1) SV: The river rose.

(2) SLVA: They are hungry.

(3) SVO: I love my motherland.

(4) SVOO: Father bought his son a car.

(5) SVOC: Mathematic makes us intelligent.

(6) SVOAD: He impressed me deeply.

(7) SVP: We stood for two hours.

In the study of mathematics we can also deduce via abstract induction general conclusions from the computation of definite integrals of special concrete functions.

We abstract a general conclusion: The derivative of an even function is an odd function. The methods of introducing new characteristics, increasing concept contents, or shrinking extensions with respect to concept patterns are often used in the definition of English sentence pattern concepts. For example,

(1) SVO: I like skirts.

(2) SVAO: I like red skirts.

(3) SVAAO: I like all red skirts of this type.

It is also true in the English sentence pattern definitions that one realizes weak abstraction by means of method of adding new elements to extend the extensions of definitions. For example, the sentence (4) SVADAAO: I like not only all red skirts of this type, but also green skirts of the same type. Now we can see (4) is an example of weak abstraction of (3). In addition, all clauses, such as subject clause, object clause, adjective clause, and adverb clause, are generated from the manner of realizing

weak abstraction via adding new elements (sentences) to extend the extension.

2.3 Thinking Consistency of English and Mathematical Logical Analysis

Due to the influence of the Confucian culture in the way of Chinese traditional thinking, the thinking manner of emphasizing the nature-humanity harmony displays the emphasis of global harmony in language and follows the principle of semantic connection. Consequently, the language does not pay great attention to rigorous logic, and so it is a kind of parataxis language. The western traditional philosophic thinking is based on nature-humanity separation, pays more attention to rationality, and emphasizes logical analysis. Its reflection in language is more emphasis on format and rationality, complete structure of sentences, thorough thinking expression, and more logical behavior. The resulting language is clear and objective mostly, and thus is a hypotaxis language. The biggest feature of mathematics is the rigorous logic besides high abstraction and wide applications. Therefore the logic of mathematical thinking and the continuity of English thinking are consistent.

Actually most linguists in the twentieth century considered the structure of language as their main research object. However, research tools for the language structure cannot be looked for from within the language itself, but can only be looked for in logic. The famous logicians of the twentieth century G. Frege [5], B. Russell [6], R. Carnap [5], H. Reichenbach, R. Montague [13] and etc not only did research in mathematical logic and mathematical language, but also analyzed natural language with this method. They have indicated that “natural language and artificial language of logicians have no fundamental difference from the theoretical viewpoint.” During the middle of the twentieth century, linguists and logicians began to apply the logical analysis method to

analyzing the English language and then extended it to the semantic analysis and pragmatic analysis. This means that the essence of forming discourse is logic and the essence of understanding discourse is also logic; all discourses have the logic of thinking deeply hided. The natural language is rich and colorful and variations of languages change indefinitely. The key point to explain why they have commonalities and similarities is the generality of logic. The difference of mutual translation of English and Chinese is in fact the difference of logical thinking in the two languages. Coherent discourse is the language exhibition of thinking continuity, and the so-called thinking continuity is nothing but the logic of thinking. Any language symbols lacking logic are meaningless. Mathematical logic can just make up the lack of consistency. Hence the mathematical thinking method is more helpful toward the study and research of the English language.

One example to show the helpfulness of mathematical thinking for studying English was experienced many years ago by someone in his graduate school examination of English. That test was a normal multiple choice one, just like a GRE in the United States. So for each problem is only correct answer is one of five candidates listed as (A), (B), (C), (D), and (E). For a couple of problems he was not sure which answer was correct, but because he was a mathematics student, he successfully used the "exclusion method" in mathematics so that he excluded all the wrong answers, and thus he obtained the correct answer, which helped him achieve a high English exam score. It is possible that with the same language ability level, those with a good mathematical logical ability should be able to receive a higher test score.

2.4 Consistency of English and Mathematical Object of Thought

Eastern and western cultures are of two different types. Influenced by the thought that men are masters of the world and can beat the nature,

Chinese culture places man as the center when analyzing things objectively. Thus it reflects a strong feeling of nature masters' participation in everything, and people are often subjects in the language expression. Western people pay attention to objects, so the target of their thought is normally toward the outside. Reflected in language, English often puts non-material word as subject. This leads to a difference of theme and focus in the subject of discourse of English and Chinese. Mathematics as one kind of language is a common one for all science. Known as the "father of modern science", the great physicist Galileo once claimed "The world before us is like a huge book written by the mathematical language. Without grasping the mathematical symbol and language, one cannot see clearly, like wandering in a dark maze."The Nobel Prize winner physicist Richard Feynman also said "If there were no mathematical language, the universe could not be described."These words show that the thinking goal of mathematics is the natural object, which is consistent with the English thinking. In a word, mathematical think and English thinking are consistent in observation, analysis, research, and etc.

2.5 Consistency of English and Mathematical Categorization Thinking

English and Chinese are non-relative languages; the former belongs to the Indo-European and the latter the Sino-Tibetan. The two languages have a big difference, and it causes a great difficulty for the Chinese students to study English. More specifically, English has various tenses, complicated grammar rules, ever-changing tones, strict requirements on gender, number, and format, and etc. Mathematics, as an artificial world's common language, has the same feature as English with respect to the way of thinking about naturally solving problems. But to study English one must solve the difference between the English thinking and the Chinese thinking. The usual methods for solving problems with mathematics are:

Observe, classify, induct, analog, of return migration, and etc. [8]. Carefully analyzing these methods is also a common method for the solution of problems in English study and mathematics study.

The basic structure of English sentences can be classified into seven groups in the study of English: 1. Subject + verb (SV) 2. Subject + verb + object (SVO) 3. Subject + verb + indirect object + direct object (SVOO) 4. Subject + verb + subject complement (SVC) or subject + linking verb + Adjective (as predicative)(SLVA) 5. Subject + verb + object + object complement (SVOC) 6. Subject + verb + object + adverb (SVOAD) 7.Subject + verb + prepositional phrase (SVP)

There are three types of sentence structure: 1. Simple sentence, 2. Compound sentence, 3. Complex sentence.

Another classification is based on the goal and purpose of the sentence, which results in three types: 1. declarative sentence, 2. interrogative sentence, 3. exclamatory sentence. Furthermore, there are difficult sentence categorization and similar sentence categorization, etc. Also, there are classifications in the study of mathematics:

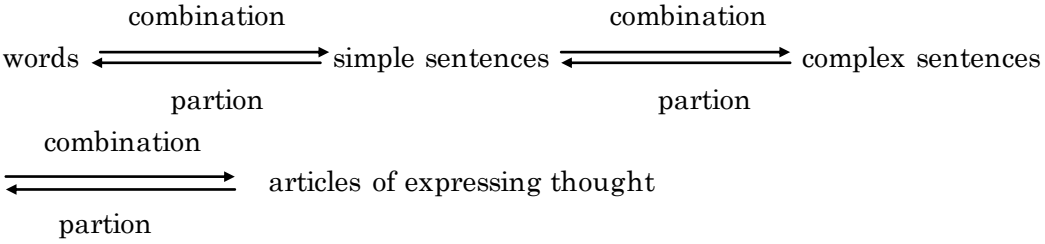
1. Classification based on the limit concept: Continuous class, differentiable class, integrable class, and analytic class.
2. Classification according to function characters: periodicity, parity, monotonicity, boundedness and so on.
3. Classification of equilaterals: Parallelogram, rhombus, rectangle, and square.

This expresses that, although English and mathematics have various differences, solving problems and thinking methods are consistent in many aspects.

2.6 Consistency of English and Mathematical Decomposition and Combination

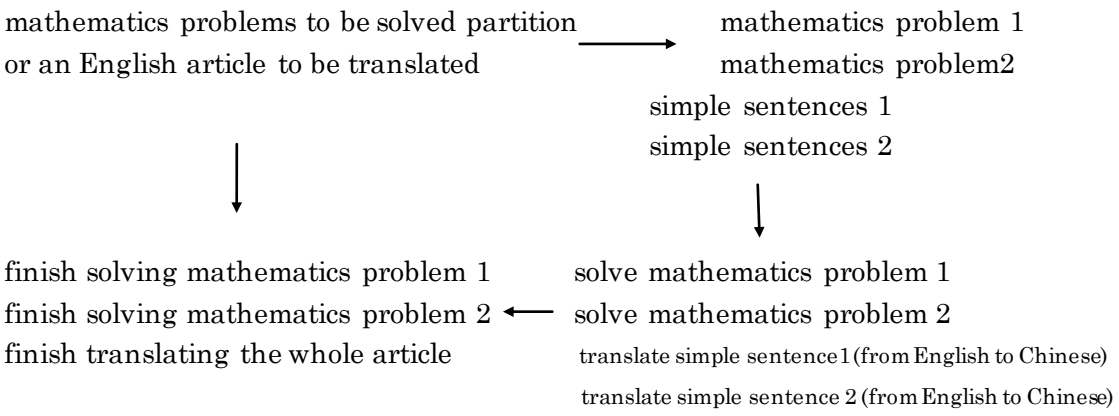
The principle of understanding tells us, satisfaction of only superficial observations is not enough to understand something. One must go into the depth of the thing by means of the decomposition technique to have a better understanding. It is no exception for mathematics and language sentences. That is, through deep exploration and via decompositions one can master the nature and original meaning of questions and sentences. First, it is only through decompositions in mathematics that one can clearly understand the various intrinsic relations. Dividing a problem into several ones which are familiar to us, we can find the method that can solve the problem. By the same token, in English study, only by decomposing a complex sentence into several parts one can recognize the content of each part of the sentence, know the structure of the sentence, and determine the meaning of the sentence.

For example, we have the following process in the study of English:



To understand an article one must partition the article into complex sentences, and then partition these complex sentences into simple ones which are familiar (easy to understand), which helps realize the purpose of understanding the article.

The method of the above decomposition and combination thinking for solving problems can be summarized as the following diagram:



This means that the thinking methods for solving problems in English and mathematics are consistent.

2.7 From the Framework of Montgue's Formal Semantics View to Study the Feasibility of Comparison between English and Mathematics.

In his paper "Universal Grammar" Montague set up the most general principles of language description. Its heart is that there should be a few following important points: syntax is an algebraic system, there is a relation of homomorphic mapping between syntactic constituents senmatic components. The heart of Montague's "Universal Grammar" is homomorphic struetune, in fact, it is a nequinement to follow its combination principles. Montague's homomorphic mapping has been accepted as an important concept by most of linguistics.

2.8 According to the Characteristics of Modern Linguistic Theory to Study the Feasibility of Comparison between English and Mathematics.

What western modern theoretical linguistics intentionally pursues is not limited to providing a unified grammatical operating system for one concrete language; it also supplies the theoretical model of universal grammar, from which concrete grammar suitable for all concrete human languages can be deduced. In this way, elements of universal grammar

must be abstracted from phenomena of various concrete languages. And mathematics language, as an artificial universal language, created and shared by all people of globe, has a lot of similar characters to developed languages such as English, French and Chinese, and people's thoughts in developed countries. Therefore, it spontaneously becomes the language powerful in explaining natural human languages. Consequently, the comparison between English and mathematics language is feasible.

3. The significance of comparing English language with mathematics language

One of the trends of the research on linguistic generalities of modern languages is to abstract the generalities from the language descriptions. Because linguistic generalities have restrictive function to relations between structures of various kinds of concrete languages, they must be quite abstract. Likely, the most important two characteristics of mathematics are great abstraction and an extensive application. Therefore, it is significant to compare English with mathematics language.

3.1 The Comparison Helping to Deepen Our Understanding of Modular Models and Enhance Our Theoretical Research in Language Field.

All the work done by western modern linguists was to set up an abstract linguistic model for human beings based on linguistic module systems, which are classified into inner-modules and outer-modules. That is to say western modern linguistic theory is not a theory about concrete languages, but a theory aiming at setting up systems of restricted rules for all possible sentences in all possible languages, which can be fulfilled only by mathematics thinking. Besides, from the description of inner-module and outer-module, we can see that both the mapping thinking mode of the inner-module and the epistemic thinking of the outer-module are closely related to mathematics. That is why the comparison between English and

mathematical language can help to deepen one's understanding of linguistic module model as well as boosting the research level in language field.

3.2 The Comparison Enabling Us to See the Essence through Phenomena without Being Blinded by Concrete Language Occurrence.

As known to all, we can sum up the whole process of the mathematics language thinking as the following: to observe objective phenomena, to grasp chief characteristic, to abstract concepts or establish models, to demonstrate and reveal the inner regularity by judging, inducing, analogizing, associating, logically reasoning and calculating. In advanced mathematics, the concepts of definite integral are mathematics models summed up and abstracted from different problems in fields of different subjects. Seeing the essence through the appearance, they are not limited to concrete fields or concrete problems. But in respect of concrete mathematics problems, some of them are geometrical ones and some are physical ones as if they would not be compared. However, in essence, they all can be compared, and, it is just the comparison we really want, the comparison of essence. Similarly, if English and mathematical language are to be compared, induced and summarized, the same result can be yield. In fact, in this early century two pioneers in modern linguistics, Russian linguist J. Baudouin de Courtenay [9], Poland and Swiss linguist F. de Saussure [10] realized that language must keep a close relation with mathematics. Danish linguist L. Hjemslev [11] even regarded language as a system of a pure abstractive relation. Later representative figure of descriptive linguistic school—Z. S. Harris [12] introduced mathematics methodology into the objectivity and formalization of linguistic descriptive method.

3.3 The comparison may help to improve English teaching quality and effects.

In the early 20th century American linguist F·Boas[6] once pointed out that linguistic culture was in connection with thinking pattern. E·Sapri [7]and B·L Whorf [8] also thought that thinking and language were closely related. Professor Guoqiang Lu[3] has put forward that the comparison of two languages, in fact, is the comparison between two thinking modes of two languages, too. On the ground that mathematics language is a universal language of the world, it is meaningful to compare the thinking modes of mathematics and English from the perspective of thinking. For example, the contrast between English conceptual structure thinking and mathematical mapping thinking, the similarity between English and mathematical decomposing and combining thinking show the compatibility of English learning methods and mathematics learning methods. If thinking modes of mathematics can be adopted in English teaching, it will surely raise the quality of English teaching and make English teaching more effective.

4.The comparison between the learning methods of English and mathematics

4.1 Conceptual Structure Thinking and Mathematics Mapping Thinking have the same origin.

A major processing tool for conceptual structure thinking to deal with languages information is mapping, which is an important mathematics concept, and a corresponding relation. As regards the comparison between languages, it is nothing but corresponding relations between various language structures. Hence, conceptual structure thinking actually adopts mapping thinking of mathematics.

4.2 The Consistency of Learning Methods of English and Mathematics between the Principles They Follow in Solving Problems

Principles of learning: As is known to all, the process of learning is from the known to the unknown, from the simple to the complex, from the special to the general, and principles of solving problems: The principles of solving problems are the reverse of the process of learning. Generally, the principles of learning and solving problems are effective methods in learning both English and Mathematics and solving their problems. For example, we learning English step by steps, from words, simple sentences, complex sentences to texts composed of simple sentences and complex sentences. While to understand an essay, we must first split the whole text into complex sentences and then to simple sentences. Let's take a look at learning mathematics. In learning calculus of advance mathematics, the major object we study is function, with focuses on its continuity, derivability, and integrability. The learning also abides by the principle of learning, namely, from the simple to the complex. The whole learning process can be divided into four steps: First, learning the basic elementary functions, functional properties (continuity, derivability, integrability etc.); second, the properties of function algebra (continuity, derivability, integrability etc.); third the properties of composite function; fourth, the properties of general function. While, to solve the problems about general function, we usually transform general function into five kinds of basic elementary functions to achieve the goal of finding the properties clearly. All of these show that there is a close correspondence between methods of learning English and mathematics as well as methods of solving their problems.

4.3 The Use of Analogy, Deduction, Migration Methods in the Teaching and Learning of English Language

"Migration method" refers to the influence and effects of students' acquired knowledge, skills, techniques and methods on their learning new knowledge, skills, techniques and methods. "Analogy" is a formal logic concept, which means "a similarity". Analogical deduction is to compare the new knowledge with relevant knowledge they have leant and then, by reasoning and analysizing, transfer the acquired knowledge from exploring one object to another object that we have relatively less knowledge in mind. Analogy, deduction, migration can help students to unconsciously "migrate" from one field of study to another.

For instance, we all know the words "aquiferous"(meaning "containing water") and "fructiferous" (meaning "being fruitful"). And it is also known that the prefix "aqui-" implies the meaning of "water", "fruct" the meaning of "fruit", while the suffix "-ous" indicates an adjective with a meaning of "having or involving". Thus we can make an assumption that "-fer-" may imply a sense of "containing, bringing or producing". In turn, we may get the meaning of the following words by analogy and deduction: auriferous, calciferous, ligniferous, luminiferous, metalliferous, odoriferous. What can be concluded here from this example is that to teach with analogy, deduction and migration means to induce new knowledge from the acquired knowledge, to look for similarity, to create a context, to enlighten thinking and to learn new techniques by reviewing the old ones. Those with some knowledge of word-building may assume that all these words can be learnt easily if students learn word-building first. It is true. But what we emphasize here is that we are not learning word-building simply for the purpose of remembering some word roots or affixes, we are actually attaining some learning methods and cultivating the habit of reasoning, which may help us to master the acquired word roots and affix as well as getting the meaning of some fashionable words that have not been compiled into dictionaries yet, such as workaholic, bookaholic, footballholic, beefaholic, sweetaholic and spendaholic.

It can be seen that all these words share the same suffix "holic". Though with some knowledge of word-building, it will still be difficult for us to get the meaning of them without analyzing, analogizing and deducting. On the contrary, it won't be very difficult for us to get the meaning of them if we have formed the habit of analogizing, reasoning and deducting. By analyzing the well-known word "alcoholic", we may get the conclusion that "holic" implies the meaning of "being infatuated with, having a great love of ". Based on the acquired knowledge of word-building, we may get the respective meaning of the above mentioned words by analogizing and deduction as the following: being addicted to work, being infatuated with books, being infatuated with football, having a great love of beef, having a great love of sweets, having a great desire of spending money.

4.4 The Use of Analogy, Education, Migration in the Teaching and Learning of Mathematics

In learning advanced mathematics, the concept of definite integral in almost all the text books are induced by the dealing with the problem of calculating the areas of trapezoid with curve side, while none of them explains the reason for choosing this problem instead of calculating the areas of other geometric figure formed by curves. In all the text books, the steps involved in solving the above problem include segmentation, replacement, summation limit, the execution of which, instead of the reason of doing so, is also the emphasis of all the teachers in teaching this part. But actually, it is the reason that can cast some light on the learning process. We will provide the answer to it in the following part.

We know that the concept of definite integral originates from the problem of calculating the areas of geometric figure formed by curves. But to settle this problem, basic principles of resolving problems must be followed, namely, from the complex to the simple, from the unknown to the

known, from general to the specific. We only know how to calculate the areas of geometric figures formed by straight lines. In learning to get the areas of geometric figures formed by straight lines, we follow the principles of learning, namely, from the simple questions to the complex ones, that is to say, to learn calculating the areas of triangles and rectangle first. Then, we follow the basic principle solving problems, namely, from the complex to the simple to work out the problem----dividing the geometric figure formed by any straight line into several triangles and then changing the problem of calculating the area it to calculating the area of several triangles.

Now, we need to calculate the areas geometric figures formed by any curves. By analogizing, naturally, it will occur to us that we need a figure which can function as a triangle in the above mentioned case, to represent complex figures by simple ones. By analogical reasoning, we may find that the simple figures formed by curves are triangle and trapezoid with curved side. Then which one has the function of representing complex figures? Analyzing any figures formed by curves, we can get the conclusion that it is formed by finite number of trapezoids with curved side. Hence, we get to know that trapezoids with curved side can function as triangles in the previous example. That is to say, to calculate the area of any geometric figures formed by curves, we need to calculate the trapezoids with curve in it first. In this case, we learn to calculate the areas of figures with curved lines in advanced mathematics by analogizing it with that problem of calculating the area of figures formed by straight lines in elementary mathematics, which is also the answer to the question we posed at the beginning of this part.

From the above examples we can see that the universal use of analogical reasoning is a very effective teaching method. It may arouse students' interest; boost their participation in researches works as well as allowing them to transfer their learnt knowledge and skills to the unknown object.

5.Conclusion

Just as no final conclusion can be reached in the history of human scientific research, neither is there a method that can fit all fields in language leaning. None of any human activities can go without methodology. One of the major features of human activities is the clear purpose. To fulfill the purpose, different means have to be adopted. For instance, a frequently adopted method in English learning is inductive method, which may include various concrete forms. Some inductions are made according to roots, some meanings, some antonyms, other synonyms, etc. Thus, learning methods are multi-perspective, omnibus and need constant exploration. While the comparison of mathematics and English is still at the probing stage, the research method is worth consideration. Frequent application of English and mathematics comparison in the teaching of both subjects is an effective way, which can help students master the effective learning methods of reaching the unknown by the known. It is also significant in cultivating inter-disciplinary talent of good qualities as well as promoting their ability in autonomous learning and doing researches.

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References

[1] Edward Sapir, Language: An Introduction to the Study of Speech [M]. Beijing: the Commercial Press, 1985.

[2] Chunli Zhu, Jidong Wei, On the Rationale of Whorf's Linguistic Views [J]. Journal of P.L.A University of Foreign Languages, 6, 1999.

[3] Guoqiang Lu. A contrastive Analysis of English and Chinese Conceptual Structure,[M]. Shanghai Foreign Language Education Press, 2008.

[4] Lizhi Xu, Shuxin zheng, Relational Mapping Inversion Method [M]. Jiangsu Education Press, 1989

[5] Ma Liang, Carnap's Theory of Meaning [M]. Social Science Academic Press, 2006.

[6] British Russell, (translated by) Yuan Liu, Logic and Knowledge [M]. Beijing; Commercial Press, 1966.

[7] L · T · F · Gamut, Logic, Language, and Meaning [M]. the University of Chicago Press, 1991.

[8] B·L Whorf. Language, Thought and Reality [M]. MIT Press, 1972.

[9] J · Baudouin de Courtenay, The Beginnings of Structural Linguistics, [M]. Indiana University Press, 1972.

[10] F · de Saussure. Course in General Linguistics, [M]. Landon: G · Duckworth, 1983.

[11] L · Hjelmslev. Linguistic Systems and Language Change, [M]. Gredos Editorial S.A, 1976.

[12] Z·S· Harris. Mathematical Structures of Language, [M]. Huntington, N.Y.1979.

[13] Montague · R. Universal Grammar,[M]. In Thomason, 1970.