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A Qualitative Analysis of Personality Traits of Natural Scientists in China

Zhen Chen[1,*], Guandong Song[1]

[1]*School of Humanity and Law, Northeastern University, Shenyang, Liaoning Province, China 110169*
**Correspondence Author: Chen Zhen, E-mail:zhenchenneu@163.com*

ABSTRACT. *According to the results of word frequency analysis, semantic analysis, and high word frequency statistical analysis of 396 documents including interviews, news and autobiography of 133 Chinese Academy of Sciences and Chinese Academy of Engineering members selected in 2015, it can be found that There are 16 factors in the order of the personality traits of natural scientists in China in order of high word frequency. They are cooperation, good innovation, strong scientific research interest, keen intuition, rigor, curiosity, attention to ability improvement, perseverance, broad knowledge background, and high work efficiency, perfectionism, humility, excellent early performance, willingness to study, able to endure hardship, good at learning, etc. Among them, the word frequency of the first four factors such as cooperation accounted for 21.21%, 15.21%, 8.68%, and 8.63% of the total word frequency, respectively, reaching a total of 53.73%. The case study results of 8 natural scientist samples show that the case study and literature research trait types tend to have the same word frequency percentage, of which the first three trait types and permutations are completely consistent with the literature research. This research result has very important theoretical and practical significance for the construction and management of China's scientific research team.*

KEYWORDS: *Natural Scientist; Personality Traits; Qualitative Research*

1. Introduction

The so-called scientist personality traits are the personality traits that distinguish scientists from non-scientists. Natural science [1] generally refers to the science of studying organic or inorganic things and phenomena in nature. Scientist [2] is a general term for people who use systematic activities to discover new knowledge. The narrow definition refers to scientific researchers who use scientific methods for research and have made important influences or contributions in a certain field. A scientist is usually an expert in one or more scientific fields. Although in a broad sense, personality traits can refer to researchers engaged in natural science research, in order to make the research more representative, personality traits in this article

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refer to researchers with positive senior titles engaged in natural science research.

The Theory of personality trait was first proposed by American psychologist G. W. Allport in the 1940s.He opposed Freud's view of the unrealistic personality structure, and held that traits are the basis of personality, and are some persistent personality characteristics based on everyone's physiology.[3]He used case studies to analyze various representative personal traits from a large number of letters, diaries, and autobiography and divided them into three types: primary, central, and secondary. [4]Cartel (R. B. Cattell) inherited and developed G. W. Allport's classification of personal traits, and creatively proposed the periodic table of psychological elements:[5]The first level is individual and common traits; the second level is surface and root traits; the third level is physical and environmental traits; the fourth level is dynamic, ability, and temperament. [6]On the basis of R. B. Cattell, H.J. Eysenck used factor analysis to divide the dimensions of personality, namely the five dimensions of introversion-extroversion, neuroticism, psychoticism, intelligence and conservativeness—radicalism. But he finally acknowledged that there are only three basic dimensions of personality: the introverted-extroverted dimension that determines the internal and external tendencies of the personality; the neurotic dimension that expresses emotional stability; the spiritual dimension that reflects negative personality traits such as self-centeredness, aggressiveness, and utilitarianism. H.J.Eysenck and his wife compiled the world-renowned H.J.Eysenck Personality Questionnaire based on these three dimensions. Ernest Tupes[7]et al. used lexical methods to repeatedly analyze and verify the trait variables of R. B. Cattell, examined the structure of 22 simplified description factors of 8 samples, and identified 5 relatively stable factors. After that, many scholars further examined the models of "five traits" including openness, responsibility, extraversion, pleasantness and neuroticism, and finally formed the famous Big Five Factor Model. The domestic research on personality traits is mainly localization research based on the existing foreign personality traits research. Such as the revision of the R. B. Cattell 16PF scale.

The research on scientist personality traits at home and abroad has the following aspects: The first is the research on the difference between scientists and practitioners. It is believed that the work interests of scientists and practitioners are predicted through personality traits. Although the differences between the personality traits of scientists and practitioners are generally considered to be solved by proper education, the training model can only provide partial solutions. [8]The second is the use of narrative methods to study the personality of scientists. It is believed that the personality traits of scientists can be obtained by analyzing different vocabulary in the narrative materials. And by using the Big Five Personality Scale to analyze the personality traits of Chinese scientists, it is found that Chinese scientists not only have the characteristics of high conscientiousness, low easy-going and low neuroticism in Western Big Five personality theory, but also have the unique characteristics of Chinese people. The character is indifferent to integrity, and its performance is mainly in "selflessness". [9]The third is the research on the growth process of scientists and its influencing factors. It is believed that many factors in the three dimensions of personal quality, "important others" and

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"organizational environment" have an impact on the growth and achievement of highly cited Chinese scientists. Among them, personal qualities include the gender of the scientist, social background, early residence area, hard work and interest, aspirations and ideals, professional vision, and religion (case); "important others" include teachers, research partners, relatives, etc. at all levels of education; The organizational environment includes institutions receiving higher education, working institutions, laboratory environments, and professional society organizations. The professional mobility of scientists between different institutions is also an important variable that affects their academic growth and achievement. [10]This research will first use literature analysis methods and word frequency analysis tools to perform word frequency analysis on the literature of scientists' life development experience to obtain high-frequency related vocabularies that can describe personality traits; secondly, according to the theory of semantics, the high-frequency personality traits are summarized according to contextual semantics to obtain a personal traits description table; finally, a structured interview was designed to conduct a case analysis to verify the accuracy of the personality description form.

2. Research Design and Methods

2.1 Selection of Samples

The qualitative research sampling of the personality traits consists of two parts. The first is a sample of literature on personality traits. Chinese Academy of Sciences and Chinese Academy of Engineering selected in 2015 as research objects, including 11 people in mathematics and physics, 9 people in chemistry, 12 people in life sciences and medicine, 10 people in geography department, 10 people in information technology science, technology 11 in science, 9 in mechanical and carrier engineering, 8 in information and electronic engineering, 9 in chemical / metallurgy and materials engineering, 8 in energy and mining engineering, 8 in civil / water conservancy and construction engineering and environmental protection, and there are 6 people in light engineering, 9 people in agriculture, 7 people in medicine and health, and 6 people in engineering management. A total of 396 academician sample literatures were selected, including biographical literatures, literatures influencing scientific output factors, literatures on scientific cooperation, literatures on professional achievements, etc., including 105 talks, 161 interviews, 49 news articles, and 81 autobiography.

The second is a sample case study data of personality traits. Based on the principle of convenient sampling, eight members of the case survey were selected from academicians, scholars from the Yangtze River, the winners of the Young Thousand Talents Program, subject leaders, and general doctoral supervisors.

Table 1. Sample of a Case Study of Personality Traits

Name	Age	Gender	Birthplace (Category)	Study abroad experience	Title	Work unit
Kang Yan	54	Male	City	Yes	Professor	Neusoft Digital Medical Systems Co., Ltd.
Jin Hong	55	Female	City	Yes	Professor	Harbin Institute of Technology
Qin Yukun	85	Male	City	No	Professor (Academician)	Harbin Institute of Technology
Wang Hui	41	Male	Countryside	Yes	Professor	Harbin Institute of Technology
Liu Tengfei	33	Male	City	Yes	Professor (The youth of thousands people)	Northeastern University
Fu Jun	39	Male	Countryside	Yes	Professor (The youth of thousands people)	Northeastern University
Zhang Mingxue	56	Female	City	Yes	Professor	Liaoning University of Traditional Chinese Medicine
Tang Lixin	52	Male	Countryside	Yes	Professor (Cheung kong scholar)	Northeastern University

Case source: Structured interviews based on interview outlines based on trait types derived from the literature research. The interview duration of each interviewee is controlled between 40 ~ 45min, the speaking rate is about 160 Chinese characters per minute, and the interview material of each interviewee is between 6400 ~ 7200 Chinese characters. It should be noted that in the process of the interview, the author will follow the specific content of the interviewee's answer on the premise of the basic interview outline of each interviewee. Then, on the premise that the general description of the question does not change, the details of the question and the order of questions are modified.

2.2 Research Method

2.2.1 Literature Analysis

The method of literature research is to use literature to indirectly investigate historical events and social phenomena. Literature research has the characteristics of indirectness, non-interference and non-reactivity, and it is one of the effective ways of humanities and social science research. The main process of collating and analyzing the literature on personality traits in this study is as follows;

(1) Establish a numbering system

At the stage of collation and preliminary analysis, the method of numbering by person is adopted first, and each text material is numbered, and a numbering system

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is established, that is, each scientist corresponds to one piece of data. However, each material may include more than one document, and may cover one or more of multiple types of qualitative information such as biography and interviews. At the same time, taking into account the differences in regions, disciplines and genders, the subjects (mathematics-M, physics-P, chemistry-C, geoscience-G, biology and medicine-B) and gender (male-M, female-F) also included in the numbering system. In this way, the number can be in the form of acronym + subject + locality + gender (if it is female). For example, Deng Xiaogang, academician of the Department of Mathematical Physics, Chinese Academy of Sciences, numbered Dxg-P-M.

(2) Open Coding

The coding is also called “login”, and the purpose is to find the code that is meaningful for this research.[11]“Code number” is the most basic meaning unit in data analysis. By searching for the code number and its relationship, you can make the original data go beyond the original organization, reorganize it in a new unit, and then discover the significance. The criterion for finding the code number is the frequency of occurrence of related words.

The initial stage of code number search is usually open, that is, any words or phrases that express an independent meaning related to the research question in the original data are registered and represented by numbers. In qualitative research, collation and analysis of data are often performed simultaneously. The collation of data is based on a certain analysis, and the collation behavior is subject to the existing analysis system. In addition, with the deepening of data compilation, researchers will have some preliminary ideas for the research objects and even construct “native concepts” or “native theories”, which should be recorded in time as the basis for subsequent in-depth analysis. In this study, we mainly use memos to record preliminary thoughts during the analysis.

(3) Establish a Coding System and a Classification System

After the open login, input the literature into the word frequency analysis tool to get the corresponding high-frequency vocabulary table, and then input the high-frequency words into the coding system. According to the context to find the association between code numbers, meanings of high-frequency words, the purpose is to make the registered code numbers tend to concentrate. Finally, a coding system is formed.

(4) Conduct Generic Analysis

According to this coding system, qualitative materials are re-read, semantic extraction is performed according to the context of descriptive materials, and the extracted context is classified.

(5) Form Preliminary Results or Theories

After the analysis of the above-mentioned qualitative data is completed, the main research conclusions of this thesis have gradually formed during the analysis. Although there is controversy in the social sciences about whether the purpose of qualitative research is to establish a theory, in Chen Xiangming’s view, the theory in

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qualitative research is not a traditional "axiom" that conceptualizes and abstracts social reality. Most of them belong to "an explanation based on original data and specific social phenomena in specific situations". According to this view, the results of qualitative research are integrated with the theory itself.

For specific operations, here is an example from XueQikun, an academician of the Chinese Academy of Sciences.

No.: Xqk-P

XueQikunis very stern with himself: he has not taken a decent vacation or weekend. He works an average of 330 days or more every year and works 15 hours a day.After repeatedly preparing and measuring more than 1,000 samples, XueQikun's team [1] finally found the best element mix and structure ...It took four years' hard work to make such achievements [2]. And these 4 years of hard work come from 30 years of accumulation. Opportunities are always given to those who have accumulated for a long time. Before entering the study of quantum anomalous hall-effect, XueQikun has been engaged in the preparation, characterization and physical properties of ultra-thin film materials [3] for more than 20 years [4].The growth kinetics of topological insulator materials is very similar to his long-term research on gallium arsenide [4]. Thus, he carried out experiments according to the method of growing gallium arsenide, and first established the growth kinetics of topological insulator materials.

"Have you ever wondered what would happen if the experiment of the quantum anomalous Hall effect was not successful?" The reporter asked curiously.

XueQikun immediately corrected: "Basic research itself is full of uncertainty. Even if the cherry on the top is not picked, the beautiful flowers and plants along the way are all results [2].XueQikun used an example in the realization of the quantum anomalous Hall effect to illustrate, "For example, we found that there is no difference in the overall conductivity of the magnetic material [3] doped in a certain interval in the insulating material [3].This is an interesting phenomenon [3], so we discovered the new characteristics of topological insulators, and unexpectedly harvested a new fruit in the field of magnetism." XueQikun believes that basic researchers must set a high-level goal. The dissertation and author ranking must not become scientific research purposes. When climbing to the peak, there will be a lot of gains along the way, and even a wider new world will be opened up. Thus, a new solution to the problem [2] was discovered.

Translation of Number:1.Cooperation; 2. Good at innovation; 3. Interest; 4.Persistence

In the first step, the corresponding tables are obtained from the word frequency of all the materials, and the documents are compared according to the tables; in the second section, the high-frequency words in the materials are marked. Among them, cooperation (team), good at innovation (results, problems), perseverance (long-term, many years), and interest (interesting, material).What needs to be explained is the division of the meaning of the word material, because in this document, various material categories including magnetic materials, insulating materials, and thin film materials are mentioned. Generally speaking, this represents the use and experimentation of various materials. Generally speaking, it represents the perseverance of scientists. **"For example, we found that there is no difference in the overall conductivity of magnetic materials that are doped in a certain**

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interval in the insulating material. This is an interesting phenomenon, so we have discovered the new characteristics of topological insulators. This unexpected harvest in the field of magnetic." This shows that in addition to the spirit of hard work and willingness to study, what is more important is the interest in scientific research, a kind of personality traits that use the laboratory as a playground. This is the same story as Edison, after suffering the ridicule of a large number of journalists and news media, insisted on a lot of experiments to finally determine the carbonized bamboo filament as the filament material of the light bulb. [12]Not only the spirit of willingness to study, but also the strong interest in science as a support.

2.2.2 Case study

Case study is "an empirical study for analyzing phenomena in real situations, especially for situations where the boundaries between phenomena and the environment are not very clear." Compared with other methods, case studies can reveal the whole picture of a typical case more comprehensively for detailed description, discussion and analysis, which is suitable for the study of multi-level analysis units. There are two main methods of case study of narrative psychology. The first is the narrative analysis of life stories and the second is the psychological biography. Because this article focuses on the analysis of the scientist's own experience, the author conducted structured interviews in accordance with the principles summarized by his colleagues at MeAdams (MeAdams, 2008). [13]The purpose is to allow scientists to explain their own experience and analyze the combination of personal traits and their own experiences. First, establish the outline of the interview. The outline of the interview is as follows:

Outline of the Interview

1. With regard to the scientific research results you have obtained, which factors do you think are more critical for scientific researchers?

2. I would like to know what causes you to concentrate on your studies?

3. What abilities do you think ordinary scientists should have?

4. What other hobbies and hobbies do you have in your life? Are your other hobbies helpful to your research?

5. Since you studied at a foreign university, how do you think these experiences will affect you?

6. Who in your studies and research have influenced you a lot?

8. How do you define innovation in scientific research? Does the knowledge in other disciplines help your research experience in any specific way?

7. Can you talk about your life or research experience?

8. What scientific research experience do you have in your research process that you are most proud of?

9. What factors have always supported your continued love of scientific research regardless of any difficulties?

10. What kind of people do you think are suitable for doctoral studies?

11. What setbacks have you encountered? And how was it overcome?

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Secondly, high-frequency vocabulary with part-of-speech, such as adjective, verb, noun, article, numeral, etc., is obtained by word frequency analysis software. Then return all high-word frequency words to the original text. Use QSR-NVivo11 software to return each word to the original text, excluding words with unknown meaning.

Finally, the classification of each high-frequency word in its context is performed, and standard error calculation is performed on each category to verify the accuracy of the trait classification obtained above.

3. Research results

3.1 Results of literature research

The research on the relationship between vocabulary and personality has been deepened in narrative psychology. Different vocabularies can express different personality traits. [14]Therefore, this article makes a qualitative analysis of the use of adjectives, verbs, nouns, definite articles, and pronouns in the scientific literature corpus based on the collected literature. By analyzing the frequency of words and semantics, we try to derive high-frequency words representing personality traits. Finally, we compare individual and group to reveal the personality structure characteristics of personality traits in narrative context.

First, the adjectives, nouns, verbs, and articles in the literature are extracted according to part-of-speech through QSR--NVivo11, and adjectives look for words related to personality traits.

Among them, adjectives represent the likes and dislikes of the research object, and the most direct personality traits represent the type of vocabulary; nouns focus on family, work, social relations, verbs focus on control, love (cooperative or modest), trends, judgments, and so on. Indefinite articles are related to creativity, language expression, critical spirit, experience, interest, and aesthetics (Fast & Funder, 1998).Then the words are returned to the context of the article to remove words that are not obvious, such as adjectives that have nothing to do with personality characteristics: happy, not good, good, etc.; noun words, such as: role, level, only;

Finally, it is classified. Below we take adjectives as examples to illustrate the process of word extraction.

First, import all the documents into QSR-NVivo11, and set the function to get the top 100 adjectives in the document. The vocabulary and word frequency are shown in Table 2.

Table 2. Table of Adjective Vocabulary and Word Frequency for Chinese Personality Traits

Adjective	Word frequency	Adjective	Word frequency	Adjective	Word frequency	Adjective	Word frequency
Important	164	Arduous	10	Strict	6	Harsh	4
Major	84	Accurate	10	Enduring	4	Long	5
Excellent	76	Great	13	Noble	6	Far	5
Rigorous	43	Weak	13	Precious	7	Clean	5
Young	50	Clever	12	Astonishing	7	Interesting	5
Outstanding	41	Solid	10	Rare	7	Big	5
Big	45	Superior	12	Top	4	Proper	4
Different	44	Ordinary	11	Persistent	6	Poor	3
Complex	40	Famous	11	Practical	7	Ingenious	4
Famous	40	Bad	9	Accurate	6	Fruitful	3
Biggest	44	Plain	8	Loose	5	Famous	4
Gigantic	31	Exciting	10	Weak	5	Amicable	3
Highest	28	Good	10	Stereotype	4	Eye-catching	3
Good	23	Advanced	10	Poor	4	Hardworking	3
Special	22	Intense	8	Longest	6	Slight	4
Modest	13	Beautiful	10	Quiet	6	Open	2
Ordinary	20	Plain	7	Strange	6	Kind	4
Happy	19	Broad	8	Deep	5	Superb	3
Effective	19	Ordinary	7	Naughty	5	Unique	4
Outstanding	13	Splendid	9	Thoughtful	5	Strong	4
Solid	13	Original	8	Deepest	5	Beautiful	4
Remarkable	14	Precious	8	Restrained	4	Beautiful	4
Persistent	15	Suitable	8	Meticulous	5	Open	3
Obvious	15	Clear	8	Tiny	4	Outmoded	3
Arduous	13	Modest	7	Strict	4	Messy	3

Second, return each word frequency to the literature and classify the words according to the semantics in the Modern Chinese Dictionary. For example: rigorous (serious, careful, thoughtful, rigorous, and neat), precise (very accurate, precise), harsh (conditional requirements are too high, too severe, mean), etc., to classify words that are similar in semantics or related to a category, the results are shown in Table 3.

Table 3.Table of Personality Traits and Source Vocabulary and Word Frequency in China based on Adjective Word Frequency

Trait vocabulary	Source vocabulary and word frequency					
Rigorous	Rigorous	43	Accurate	10	Harsh	6
	Firm	10	Solid	13	Stereotyped	4
	Meticulous	5	Meticulous	5		
	Persistent	15	Firm	5		
Perfectionism	Biggest	44	Gigantic	31	Highest	28
	Remarkable	14	Great	13	Persistent	6
	Top	4	Unique	4		
Intense interest in science	Interesting	5				
Good at learning	Hardworking	3				
Good at finding difference	Different	44	Special	22		
Able to endure hardship	Harsh	13	Onerous	10	Plain	8
	Plain	7	Poor	3	Abominable	9
Excellent early performance	Outstanding	13	Clever	12	Superb	12
Modest	Modest	13	Moderate	7	Kind	3

In the same way, we perform the same research process on nouns, verbs, and articles as adjectives through word frequency and semantic analysis.

According to Price formula [15]:

$$M = 0.749\sqrt{N_{\max}},$$

Among them, M is the lowest word frequency with a high word frequency, and Nmax is the value with the highest word frequency. The calculation is M≈44.877. Therefore, the trait type that is very common in the early period is deleted. From this, it is determined that the scientist's high-frequency vocabulary is a total of 16 from cooperation to high efficiency.

Table 5. Personality Traits and Word Frequency and Percentage in China

Trait type	Word frequency	Percentage %
Cooperation	3590	21.21
Good at innovation	2576	15.21
Intense interest in science	1469	8.68
Keen intuition	1461	8.63
Rigorous	1253	7.40
Curious	1080	6.38
Focus on improving ability	1016	6.00
Persistent	911	5.38
Broad knowledge ken	757	4.47
Efficient	578	3.41
Perfectionism	546	3.23
Modest	482	2.85
Outstanding early performance	378	2.23
Good at exploring	365	2.16
Hardworking	270	1.60
Good at learning	195	1.15

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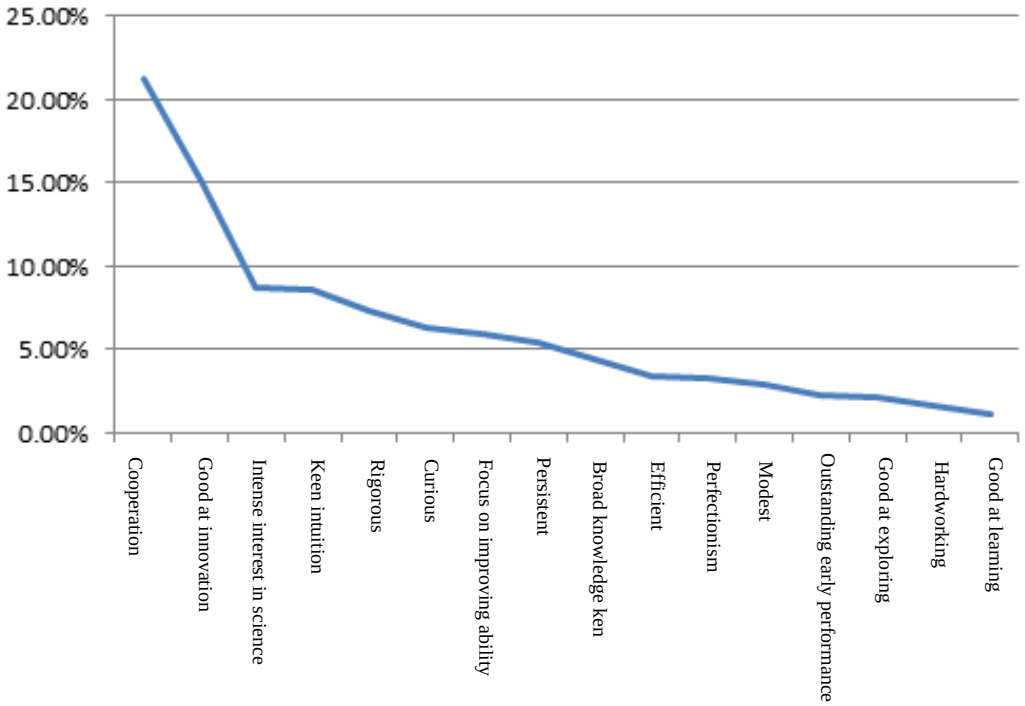

Figure 1. Line Chart of Percentage of Word Frequency in China's Personality Traits

From Table 5 and Figure 1, it can be found that cooperation ranked first in China's personality traits, accounting for 21.21%.As a personal traits in our country, we must first learn to cooperate, that is, integrate ourselves into an organization, a collective, or a team, and concentrate the wisdom of everyone to carry out scientific research. Cooperation is the key to good natural science research. In fact, the success of China's "two bombs and one star" has already proved this. Followed by innovation, accounting for 15.21%.Scientific research is a creative work, and all new discoveries and inventions are the result of innovation. Strong scientific interest and keen intuition ranked third and fourth, accounting for 8.68% and 8.63%, respectively. This shows that personality traits have a strong interest in science and are good at finding problems. The last three are willing to study, able to endure hardship and be good at learning, accounting for 2.16%, 1.60% and 1.15% respectively. It shows that as personality traits need to be willing to study, hard-working and good at learning, but these are only basic traits, not main traits.

3.2 Results of Case Study

The subjects of the case study were structured in accordance with the outline of

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the interview, and the recordings were arranged in text. Enter the text collation results into QSR--NVivo11, after semantic analysis and Price formula: $M=0.749\sqrt{Nmax}$.The high word frequency and percentage results of the eight professors finally formed are shown in Table 6.

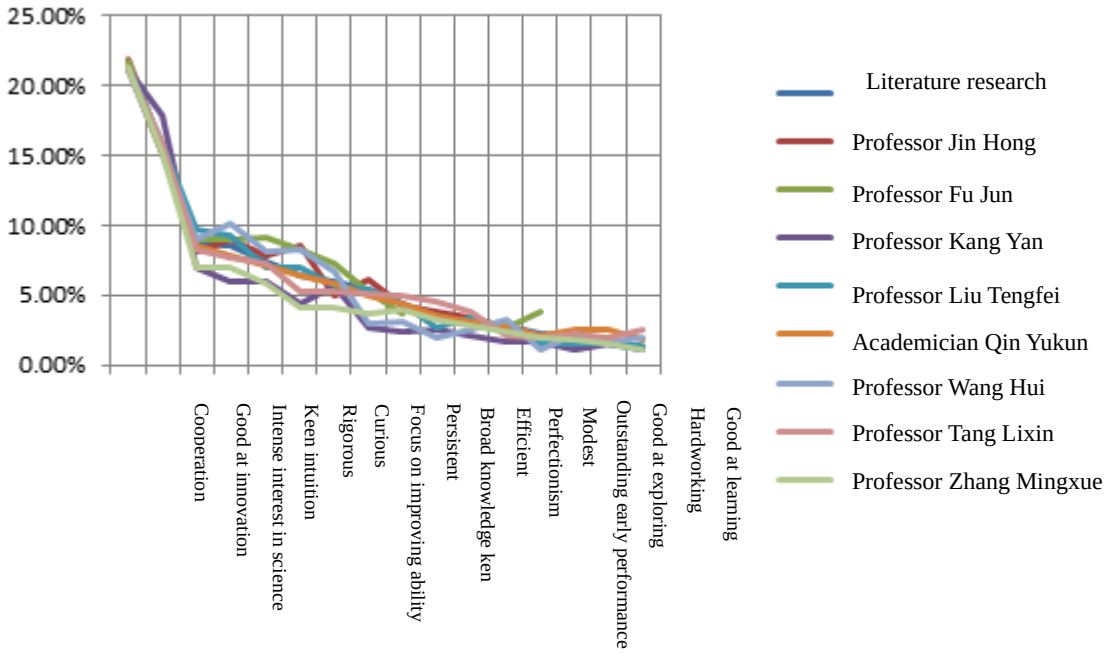

Figure 2. Line Chart of China's Personality Traits Literature Research and Case Studies Trait Type Word Frequency Percentage

As can be seen from Table 6 and Figure 2, it can be seen that the case study and literature study trait type word frequency percentages tend to be consistent. Among them, "cooperation" all reached more than 21%, and "good at innovation" all reached more than 15%. The first three trait types and permutations of the eight personality traits cases are completely consistent with the literature research. However, there are some differences in the types of advantageous traits in different cases. For example, Professor Jin Hong has better performances in literature and other cases in terms of "curious" and "perseverance", but has "hardships" and "good at learning". This aspect has not been included in the high word frequency traits; Professor Fu Jun has a clear tendency to "rigorous", "focus on ability improvement" and "excellent early performance", while "high efficiency", "willing to study" and "can bear hardship" are not included as high word frequency traits. Professor Kang Yan excels in "good at innovation"; Professor Wang Hui excels in "strong interest in science" and "keen intuition", but Professor Wang Hui does not perform well in "excellent early performance".

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4. Discussion

Traits are also called personality in psychology. Personality includes both personality tendencies and personality psychological characteristics. Personality tendencies reflect the source of motivation for personal behavior, while personality psychological characteristics reflect the stable behavioral laws of people. The formation of human personality can be innate or acquired. For example, the formation of a person's traits is mainly affected by genetic factors, while the personality is affected by traits, but it is mainly the habitual behavior tendency formed by acquired learning. Personality traits are the result of a combination of innate heredity and acquired nurture. Freud divides personality structure into ego, self and superego. Innate ego is the reaction of innate instinct. Superego is the ideal pursued by human being, and self is the realistic expression of human behavior. The narrative materials of personality traits are the real expressions of their real life. The author analyzes the high-frequency vocabulary of personality, traits, life, work and study materials, and can reflect the typical characteristics of personality traits. This provides direction for the training of natural science doctoral students.

In this study, the traits of personality traits were found through word frequency analysis of narrative materials and semantic analysis of high-word frequency words. Statistics counted the frequency of words that could reflect the meaning of the same trait. Based on the Price formula, the types of trait-related high-frequency words were obtained. Literature research results show that personality traits can be divided into 16 types, in order of word frequency from high to low, in order: cooperation, good at innovation, strong scientific research interest, keen intuition, rigor, curiosity, attention to ability improvement, perseverance, broad knowledge ken, efficient work, perfectionism, humility, excellent early performance, willingness to study, hardship, and good at learning.

Through literature research, we have obtained 16 traits of personality traits, of which cooperation is listed as the most important trait. Fromm’s expectation theory has proposed the famous VIE model, which introduces the concept of an intermediary factor I (instrumental or instrumental) between V (potency) and E (expected value), and states that the achievement of organizational goals is Tools for personal goals. Therefore, to succeed, a person must first integrate himself into an organization, and achieve personal growth and improvement through the growth of performance in the organization. The second is good at innovation. Scientific research is an innovative work. Without innovative achievements, society cannot be recognized, and it will be difficult to become a scientist. The third is scientific research interest. Scientific research is a very serious and delicate work. Without a strong interest in scientific research, it is difficult to achieve the set goals. The fourth is keen intuition. Intuition is a subconscious behavior based on existing experience, which reflects the ability of scientists to integrate and use existing knowledge, because only the ingenious integration and use of existing knowledge can better find, analyze, and solve problems. Statistics found that the above four factors accounted for 53.73% of the 16 personality factors, indicating their importance in the characteristics of scientists.

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After completing the literature research, a case study was conducted to verify the scientificity of the results. The case study of this study established interview outlines based on the 16 traits obtained above, and selected eight scientists from different disciplines, titles, and age groups in the natural sciences. Structured interviews of 40 to 45 minutes were conducted to control the word count of the case study materials. After that, using the data of structured interviews as research materials, the analysis and investigation of scientist traits were carried out using the same procedures as in literature research. Judging from the results, the distribution trend of the individual traits of each natural scientist is almost the same. In terms of percentage values, the trait data for each case are not much different. The first three trait types and permutations of the eight natural scientist cases are completely consistent with the literature research. The above research results can basically prove the scientificity of literature research.

Case studies have also demonstrated differences in traits among individuals. From the case studies in Chapter 4, it can be found that although the overall trend of natural scientist traits is the same overall, none of the scientists' curves are completely coincident with others. It can be seen from the interview records that this result is inseparable from the personal experience of each natural scientist. For example, Academician Qin Yuzheng's ability to endure hardship and willingness to delve into two aspects is far higher than other scientists. This is inseparable from the hardship of the older generation of scientists in the early stages of national development, especially in the interviews. Academician Qin Yuzheng repeatedly mentioned that he entered the cowshed during the "cultural revolution" and was squeezed by a family of four in the early days of liberation. In a room, and when he was young, he never went home and slept before midnight, which explains why Academician Qin Yuzheng is so outstanding in his ability to endure hardship and willing to study.

This study obtained a classification of 16 trait types of natural scientists through literature research and case studies, and verified them through case studies. However, due to the small number of samples and the limitations of the qualitative research method, the research results are still insufficient. During the research, the author raised the following questions such as:(1) Do certain traits have a logical cause and effect relationship, such as being good at innovation? Is the appearance of this trait influenced by intuition, multidisciplinary knowledge, or the emphasis on ability enhancement?(2) Are certain traits highly relevant, allowing them to be merged? Such as innovation, sharp intuition, can bear hardship, willing to study which of these characteristics are more relevant? Can it be merged? The answers to the above questions require further quantitative analysis of larger samples to continue to come.

5. Conclusion

In this study, the literatures of the academicians of the "Chinese Academy of Sciences and Chinese Academy of Engineering" in 2015 were used as samples, and word frequency analysis tools were used. According to the part-of-speech and contextual semantics, 16 characteristics of natural scientists are obtained. In order of

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word frequency, the 16 characteristics of natural scientists are: cooperation, good at innovation, strong scientific research interest, keen intuition, rigor, curiosity, focus on improving ability, perseverance, broad knowledge background, efficient work, perfectionism, humility, excellent early performance, and willing to study, hardship and good learning. Based on the results of word frequency analysis, further tests were conducted through case studies to verify that due to the differences between congenital inheritance and acquired experience, traits have certain differences between different individuals. However, it is limited by the number of samples and the limitation of the method of qualitative research. There are still some shortcomings in this research, and further qualitative research should be conducted.

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Table 4. Table of Personality Traits and Source Vocabulary and Word Frequency in China

Trait type	Word frequency	Source vocabulary and word frequency							
Cooperation	3590	Team	233	International	258	Professor	215	Lab	197
		Teacher	201	PhD	161	College	148	Tutor	98
		Postgraduate	112	Chinese Academy of Sciences	80	Project	107	School	106
		Classmate	98	Expert	100	Research Institute	86	Academy	88
		Scholar	77	Teacher	72	Office	68	Master	60
		Research group	38	PhD	42	Lead	59	Participate	55
		Leader	42	Leader	43	Organize	43	Carry out	41
		Peer	34	We	460	They	450		
Persistence	911	Time	164	Continued	69	Many years	61	Insist	86
		Continue	41	Persistent	15	Long	5	Always	113
		Always	45	Often	44	Always	43	Long time	36
		Often	22	Forever	17	Basically	6	Anytime	6
		Everyday	37	Each time	27	Each year	25	So	23
		Again and again	14	Life long	10	All day	2		
Perfectionism	546	More	72	Well done	33	Important	164	Major	84
		Outstanding	41	Big	45	Biggest	44	Gigantic	31
		Highest	28	Top	4				
Good at innovation	2576	Problem	494	Achievement	520	System	229	Paper	102
		Process	386	Level	174	Research result	51	Method	69
		Focus	57	Research result	38	Innovation	163	Compare	73
		Relevant	55	Create	40	Different	44	Complex	40
		Special	22	Effective	19				
Keen intuition	1461	Feel	421	Think	299	Maybe	193	Should	65
		Remarkable	14	Perhaps	8	Maybe	9	Then	137
		These	122	Then	52	So	52	That	35
		Some	34	Those	20				
Rigorous	1253	Basis	124	Require	82	Calculate	68	Rigorous	343
		Accurate	10	Harsh	6	Stereotyped	4	Meticulous	5

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		Meticulous	5	Tiny	4	Strict	4	One	529
		Some	69						
Broad knowledge ken	757	Field	119	Engineering	147	Tumor	90	Subject	90
		Aspect	95	Chemistry	57	Steel	53	Bridge	47
		Architecture	59						
Intense interest in science	1469	Research	111	Technology	203	Science	199	(Love) Engineering	117
		Science	135	Academic	122	Interest	89	Big Dipper	63
		Spirit	66	Research work	38	Cell	95	Material (specific)	112
		Like	63	Happy	19	Exciting	10	Intense	8
		Fun	5						
Focus on improving ability	1016	Rumor	90	Physics	104	Environment	107	Hardworking	3
		Cell	99	Material (Subject)	98	Major	129	Theory	100
		Ciliate	30	Ability	76	Individual	93		
Good at learning	195	Score	75	Think	44	Learn	35	Learn	26
		Clever	12						
Hardworking	270	Hardworking	66	Experience	76	Harsh	13	Burdensome	10
		Bad	9	Plain	8	Simple	7	Original	8
		Poor	4	Harsh	4	Stern	6	Night	16
		Year end	15	Spring Festival	12	Morning	11	Holiday	5
Curious	1080	Bookish	3	What	101	How	52	How	48
		Why	17	How	17	How much	15	Where	10
		What	9	What	9	How	4	Which	3
		Question	194	One	529	Some	69		
Excellent early performance	378	2^{nd} prize	48	Honor	62	Graduate	138	Enrollment	29
		Outstanding	76	Outstanding	13	Superb	12		
Modest	482	Student	400	Child	59	Modest	13	Modest	7
		Amicable	3						
Efficient	578	Time	164	Moment	105	Contribution	71	Research achievement	51
		Result	64	Solve	88	Effective	18	Quick	17
Exploring	365	Persistent	86	Hardworking	81	Explore	58	Find	54
		Research	50	Solid	13	Firm	10	Concentrate	13

Table 6 Case study trait types and source word frequency and percentage

Trait Type Name		Professor Jin Hong	Professor Fu Jun	Professor Kang Yan	Professor Liu Tengfei	Professor Qin Yuzhen	Professor Wang Hui	Professor Tang Lixin	Professor Zhang Mingxue
Cooperation	Frequency	183	234	299	227	250	188	297	545
	Percentage	21.89%	21.81%	21.18%	21.35%	21.37%	21.20%	21.23%	21.25%
Good at innovation	Frequency	129	165	210	168	178	138	223	390
	Percentage	15.43%	15.38%	17.87%	15.80%	15.21%	15.56%	15.94%	15.20%
Keen interest in science	Frequency	68	97	98	103	100	80	115	180
	Percentage	8.13%	9.04%	6.94%	9.69%	8.55%	9.02%	8.22%	7.02%
Keen intuition	Frequency	75	97	85	98	91	90	108	178
	Percentage	8.97%	9.04%	6.02%	9.22%	7.78%	10.15%	7.72%	6.94%
Rigorous	Frequency	65	97	84	74	84	72	101	148
	Percentage	7.78%	9.13%	5.95%	6.96%	7.18%	8.12%	7.22%	5.77%
Curious	Frequency	72	88	62	74	75	73	73	178
	Percentage	8.61%	8.20%	4.39%	6.96%	6.41%	8.23%	5.22%	4.17%
Focus on improving ability	Frequency	42	78	39	60	68	60	74	158
	Percentage	5.02%	7.27%	5.76%	5.64%	5.81%	6.76%	5.29%	4.05%
Persistent	Frequency	51	56	38	58	58	26	71	107
	Percentage	6.10%	5.22%	2.69%	5.46%	4.96%	2.93%	5.08%	3.63%
Broad knowledge ken	Frequency	36	40	33	47	51	28	69	104
	Percentage	4.31%	3.73%	2.34%	4.42%	4.36%	3.16%	4.93%	3.90%
Efficient	Frequency	32	-	36	28	41	18	64	93
	Percentage	3.83%	-	2.55%	2.63%	3.50%	2.03%	4.57%	3.31%
Perfectionism	Frequency	29	37	30	36	36	22	53	100
	Percentage	3.47%	3.45%	2.12%	3.39%	3.08%	2.48%	3.79%	2.81%
Modest	Frequency	22	29	23	28	33	29	29	85
	Percentage	2.63%	2.70%	1.63%	2.63%	2.82%	3.27%	2.07%	2.46%
Outstanding early performance	Frequency	17	41	23	16	25	-	28	72
	Percentage	2.03%	3.82%	1.63%	1.51%	2.14%	-	2.00%	1.91%
Good at	Frequency	15	-	15	16	29	20	32	63

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exploring	Percentage	1.79%	-	1.06%	1.51%	2.48%	2.25%	2.29%	1.87%
Enduring	Frequency	-	-	21	16	30	15	27	49
	Percentage	-	-	1.49%	1.51%	2.56%	1.69%	1.93%	1.48%
Good at working	Frequency	-	13	17	14	21	18	35	48
	Percentage	-	1.19%	1.21%	1.32%	1.79%	2.03%	2.50%	1.13%