Seven Sections Research Method Based on Engineering

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Abstract. Methods are tools for research, and research is the basis of all scientific and technological achievements. In a new field or project, if we go on exploring blindly without systematic approach, it will get half the results with double the effort. Therefore, it is necessary to study methodology. In this paper, a set of research methods of “seven sections” in engineering research is put forward. Compared with traditional research methods, the method is simple, clear and logical. The seven sections method have the characters of completeness and availability, it plays the coordinating roles in the field of engineering research and implementation. Each layer is independent and closely related, and through the description of each layer, it can help more engineers achieve research in an orderly and effective way, especially for students who have just entered engineering.

1. Introduction
The progress of society has promoted more people to engage in scientific research work. Scientific research is no longer mysterious and impossible. Different scientific research paths have different characteristics and require different research methods. The social and behavioral sciences are commonly used in the qualitative method, quantitative method and mixed method, in the field of these methods will be called paradigm, paradigm occupies an important position in the social and behavioral sciences, mainly due to Kuhn's early definition of paradigm, he thinks that paradigm can be repeated use in any particular field in the model, the competition or opposition among different paradigm can exist at the same time [1]. The qualitative and quantitative model pave the way for the later research methods, but their overly philosophical theories tend to deter many researchers. After a long period of practice, researchers in different fields have come into being: behavioral research, case studies, ethnographic studies, grounded theory, research and so on [2]. Through the actual survey and summary from the research of different nature of the study, the British University Fund Committee divide research methods into: basic research, strategic research, application research [3]. There are also many types and classification about the research methods, the paper no longer list.

The continuous development of industrial technology, more and more students are engaged in engineering research, and a scientific research method is urgently needed to guide people to study it rationally. Based on the engineering background, this paper proposes a complete and logical methodology - seven section research method, which aims to improve the efficiency of researchers in engineering field. Any question will be studied at any point in the circle of study or in the chain of reasoning. Seven section research method is a closed link, which can be regarded as from the basic results (i.e. facts and observations), through inductive logic into universal inference (or theory), and then from the universal inference (or theory) through deductive logic into hypotheses to be tested or to a specific event and the results of the prediction [4].
2. Characteristics of Engineering

In 360 encyclopedia, engineering can be defined an applied science, which is the process of using the principle of mathematics and other natural sciences to design useful object process [5]. Though the definition we can get that the ultimate aim of engineering is to apply, The ultimate purpose of engineering is to apply, therefore, in addition to theoretical guidance, scientific research methods should be applied to practice better. The characteristics of engineering are as follows.

1. It covers a wide range of subjects, such as: materials, machinery, electrical information, energy, power and so on.
2. The logic of theory is strong, which needs researchers have logical thinking ability.
3. The ultimate purpose of the study is to apply.
4. Theory and practice are closely integrated. Theory guides practice, and practice examines theory, that is, theory and practice complement each other.

3. Seven Sections Research Method Based on Engineering

"Seven sections research methods", as the name suggests, will be divided into seven sections to discuss the issues, as shown in figure 1.

![Figure 1](image)

In the seven tier model, the first four layers are defined as the subaltern study, and the latter three layers are defined as top level design. each step will be introduced below.

3.1. Topic Research

For most students who just entered the study hall, the most important thing is to determine the research topic. It is related to the problems to be solved, it also lead the way and direction of the study. However, many researchers at the beginning of the study, or even the entire stage of research, are not clear about the subjects they are going to study, so it is important to determine the direction of study prior to research.

Topic research is what the purpose and core of the research is, we should describe it in simple and accurate words. What is simple and accurate? First of all, take the study of signals as an example, the study of signal contains many aspects, such as source, channel, sink, noise, coder, etc.. Signal analysis is the core, then we should determine its "boundary" in the study of signal, not without borders. Secondly, the researchers are engaged in different research directions, but not all of the research is
valuable, so we should keep pace with the times before determining the research direction to make sure what we are doing is valuable. Finally, when the inquiry we are going to make is very complex, to make the object of the observer intuitively clear, the subject of inquiry is required to be concise. the direction topic should be adjusted repeatedly according to physical truth. In a word, in this step we should have a clear research objectives which should be bounded, valuable, concise.

3.2. Application of Physical Environment Research
Under the condition that step 1 is completed, the subjects are then identified. No matter what kind of engineering theory will be put into practice, so the application of natural physical environment can not be ignored. Each object occupies a certain physical space, in a certain physical environment. When the physical environment in which the object is located changes, the results of the study and the object of application will change. Therefore, after determining the object of study, then determine the physical environment of the object application.

Taking sensor applications as an example, the development of sensor technology has enabled hundreds of existing sensors. Different application environments require different functions of sensors, such as temperature and humidity sensor, sensor for measuring carbon dioxide concentration, etc.. Through the sensors, humans can predict natural disasters ahead of time. This example shows the importance of the physical environment to the object of the study. Different physical environment of the terminal equipment requirements different standards, only accurate positioning the physical environment of the objects, it will be better to guide the research process.

3.3. Application of Social Environment Research
After the emergence of social organizations, different physical environment, coupled with different social members form different social environment. Different countries, different races have different beliefs, different habits and different requirements for the same object, which forced researchers to consider social factors in engineering research. The social environment described in this paper generally includes the current social laws and regulations, social culture, religious beliefs, the value of the research object in this social environment, and so on. Therefore, in determining the social environment in which the object is applied, the greatest value is achieved in respect of the current social customs, beliefs, and cultures.

Take the toilet design as an example, I have read a story about the differences between Chinese and American toilets on a web site. This paper takes this as an example to discuss. Obvious differences between species in Europe and Asia, The height of the former is generally higher than the latter, if the toilet design manufacturers design toilet according to the unified standard, it will not work well. so the products before the design in addition to investigate its physical environment, also need to do rigorous investigation of its impending social environment.

3.4. Application Object Research
On the basis of defining the physical environment and social environment, the application object is the ultimate goal of the research, which is to serve the application object. Meeting the application object to the greatest extent and whether by the majority of users receive are standard for evaluating the availability of the study. The ideal research object for users is it is the only one, because it can not only complete certain functions and can be timely to add some other value-added services. A good application can, in turn, reflect the value and significance of the scientific research.

3.5. Minimum Function Set
In industrial system, to realize the automatic control function, control systems are essential. A system is made up of different functions, function set can be simple or complex. In this paper, the minimum function set is to achieve a function which need Minimal module combinations. With the most simple set of modules to achieve the same function, which can not only save the cost but also reflects the value of the use of the system. Give a simple example, SCM to some extent can be seen as a mobile
phone, because it contains the basic function module of the mobile phone, it can realize the basic function of communication, so SCM can be seen as the smallest single-chip communication system set.

3.6. Minimum Technology System Design
When designing the object of the study, the system can be designed to be simple or complex. The minimal technology system described in this article is the simplest system needed to implement minimal functional collections. From the discussion of system reliability, the more simple a system is, the more reliable it is, the cost of the system will decrease, so it will improve its market competitiveness. but the simple system upgrade ability is weak, when the system is attached, in the design according to the actual needs of the needs of the research object. On the contrary, the more complex the system is, the lower the reliability of the system, and when the system is running may it will cause waste of energy, and the cost of the system will be increased accordingly. Therefore, in the study of the object system design, we should consider the various factors mentioned above and select the most appropriate system.

3.7. Road Show and Test
This stage is the only road in all engineering areas. After all the above foreshadowing work has been completed, the system and program designed can not just stay at the theoretical level, the usability of the system needs to be tested by road show and test. to solve the problems in the test, engineers should go back to the above six steps and check each layer, then retest.

After all the above steps have been completed, a basic engineering design model emerges.

4. Conclusion
Method is a research tool, with the correct method, we will get twofold results with half the effort. A good approach not only contributes to scientific research, but also exerts a subtle influence on the ability of researchers. This paper presents and discusses the seven section research method based on engineering. The method is concise and the words is easy to understand. It is different from the philosophy which is difficult to apply in the past. This method only provides a scientific inquiry method for the engineering application, and it is not unchangeable. The researcher should adjust it according to the actual situation when using.

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