

# The Framework of QQ Test

–Evaluation for Two Types of Creative Questions–

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Although the importance of questions has been noted in various fields, there is no method for evaluating questions. In this study, I propose to classify scientific questions into two types to evaluate our creativity. Namely, questions to close and questions to open. The former is a question that is designed to supplement the missing knowledge in order to integrate the knowledge to date and construct more elaborate laws. The latter is a question that creates a so-called paradigm shift by breaking out of the laws that have been obtained so far. Then I present a framework for a “Questional Intelligence Quotient Test (QQ Test)” to evaluate the ability to ask these two types of questions. In the future, I aim to develop an evaluation method using deep learning as well as to verify the reliability of the test.

Keywords: question, creativity, evaluation

## 1 Introduction

Albert Einstein, who established the Theory of Relativity, written in his book like that; “The formulation of a problem is often more essential than its solution... To raise new questions, new possibilities, to regard old questions from a new angle, requires creative imagination and marks real advance in science[5].” The importance of questions are limited only natural science: Claude Lévi-Strauss, who introduced structuralism into ethnology first, said that “The scientist is not a person who gives the right answers, he’s one who asks the right questions[2].” So questions would be essential for humanity and social science too. Furthermore, in the recent business, the key to success is appropriate questions[6]. Einstein answered in an interview by a journalist like that; “If I had an hour to solve a problem and my life depended on the answer, I would spend the first 55 minutes figuring out the proper questions to ask[4].” The importance of questions was appointed in the older times. “Judge a man by his questions, rather than his answers.” is the famous proverb of Voltaire[3], who represented the Enlightenment in 18th centuries Europe, but actually it was written in the book of maxims by Pierre Marc Gaston de Lévis[13]. This proverb would mean, based on the importance of questions in various sciences, questions are more creative than the answers. However, I cannot find the research that discuss what the creative ques-

tions is, or how we evaluate questions from the viewpoint of creativity. In this paper, I discussed these themes from the viewpoints of linguistic and brain activities. Then, I classified creative questions into two types: questions to close and questions to open. The reason of the classification is the studies on questions confuse the two types of questions, especially questions to open have not been discussed in detail to evaluate them in spite of they are more essential for our creativity than questions to close. So I insisted that creative questions should be divided the two types, but they help each other, then we should evaluate and grow them together.

## 2 Two types of creative questions

Sir Isaac Newton wrote that “If I have seen further, it is by standing upon the shoulders of giants” in his letter to Robert Hooke in February 1675[1]. Now, passing about 350 years after him, the giants shoulders have become to be too gigantic to stand upon them. So it is extremely difficult to be creative for us, because we must examine our enormous existing knowledge to check whether our ideas are new or not. By the way, the knowledge that was constructed by our ancestors and that is or will be constructed by us is all expressed by words that contains not only general languages but also numbers, symbols, signs and so on. And more or less,

our thoughts depend on such words, much more our thoughts are complex like science. However, our words, even though they are strictly logical like mathematics, can not express all of the world, because a word is depends on all kinds of classifications and theirs names, and a classification ignores individuality. In other words, if we express something in words, it lose some information. Science have been developed by making such lost information up with questions. Such research questions are important for science because they are the seeds of scientific knowledge. For example, PISA, which is one of the most famous international academic assessment introduced by OECD, appointed the importance of questions as scientific literacy[12]. I call this type of questions as “questions to close”, because this type is resemble to complete a jigsaw puzzle by fitting its pieces. Such questions fall under the first type of creative questions. There is another type of questions that cause a revolution in science, such as to be called a paradigm shift[9]. This type of questions, I call it “questions to open,” can be compared to produce a new rule of a jigsaw puzzle, for example, fitting all the pieces which are laid the faces down. That is the questions to produce a new rule based on understanding its original rule, like “What is the new way to play?.” However, these two types of questions help each other. Precisely to say, the questions to open are depend on the questions to close, because the former needs understanding with the later. In the following sections, I discuss why the two types questions are needed and its validity to classify these two types from the both viewpoints of linguistic and brain activities.

### **3 The reason to classify the two types**

Our knowledge and thoughts are all depend on our language deeply. Our languages are arranged by “linguistic games”, that is, various words have their meaning by their usages among the other words[14]. In other words, each word has no meaning independently, so a word can have its meanings by metaphors[10]. The usages or metaphors accompanied by a word are ruled by the community where the language is shared, namely they are the rules

that are approved in its community. We can lean these rules inductively, that is, we articulate a word as a common item from various utterances contains the word, and the process resembles to predict the next number of a progression[14]. When the prediction is success, we understand and learn something. In this knowing process, a question arise in our brain when we find lost pieces of knowledge in the enormous already known knowledge, that is similar to find lost numbers in a progression. By investing such questions, we take accumulative activities over from our predecessors and complement some scientific rules that form a scientific paradigm. So I call this type of questions as “questions to close.” In neuroscience, this knowing process is called as analogical reasoning or relational thinking[7]. And when we become aware of such rules, specific brain waves appear in the center part of the brain surface, and when we find the rules completely, the brain waves disappear[11]. On the other hand, in the history of science we can find some paradigm shifts, such as Kopernik’s Heliocentric Model, Newton’s the Law of Universal Gravitation, Einstein’s the Theory of Relativity, Darwin’s the Doctrine of Evolution, and so on. This shift is intermittent development of science, and the questions which enable to this shift is different from the questions to close that arise to complete some existing rules. For example, a famous anecdote that inspired Newton to discover universal gravitation is that he saw an apple fall from a tree and wondered why the apple fell from the tree. He is said to have asked the question, ”Why? But precisely, ”If the moon doesn’t fall, why does the apple fall? It is said that the question was something like this[6]. Rather this type of questions arise when we want to deviate form such existing rules, so I call such questions as “questions to open.” This type of questions arise when an existing rules are broken up in some real situations, then by investigating the questions we establish a new rule. In our brain, it is pointed that specific parts of the basal ganglia are active when both we predict some rules and the prediction is failed[14]. In the result, I think we should classify the creative questions into these two types: questions to close and questions to open. However, they help each other, because the latter is depends on the former and the former is needed to investigate the latter, then a new rule is established.

## 4 The framework of QQ Test

I develop a test to evaluate the ability to form these two types of questions, that is to say, Questional intelligence Quotient Test (QQ Test). If I will success in this development, we can assess question ability, that have never been tried, from the viewpoint of creativity. The ability to make the questions to close is related to how much we can understand something precisely, because we must find the lost pieces in our predecessor's enormous knowledge. So this ability is depend on asking how many questions to understand something from 5W1H basically. In NLP (Neuro-Linguistic Programming) we delete or distort or generalize information when we express something by using words. So we must complement the words by asking questions. This question model is called "Meta Model" and twelve types of questions to recover the lost information. I investigate the reliability of evaluating questions from the viewpoint of this Meta Model, when I evaluated the combination of the ability of finding lost information and the ability to express questions by using language, I could get enough reliability statistically[8]. On the other hand, there is no theory or model to evaluate the ability to make the questions to open. However, as I discussed already, by recognizing this ability as mind openness from rules, I can find the probability to evaluate this ability. There are three important points to evaluate this ability: mind openness, deep understanding of rules and constructiveness. If a question lacks only one point, the question is not able to be creative, because such question is just a fanciful idea or complete denial, then such question cannot produce something valuable for us. So we should evaluate this type of questions from these three points.

I propose a framework of QQ Test to evaluate the two types of questions together shown in the figure 1. At first, examinees should read a study assignment, such as texts contains graphs and tables to conclude something, that is different from the old test questions. Next, they express their doubts in the form of questions related to the assignment. The questions are evaluated from the viewpoint of "questions to close" and the appropriateness as sentences. And then, they explain their understanding of the assignment as taking their questions into account. In this process, we can know what they are able to understand on it.

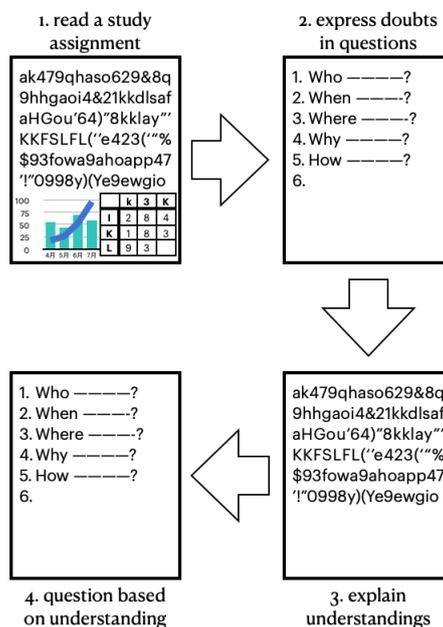


Figure 1: The framework of QQ Test

At last, they make questions based on their understand on it. By these questions we can evaluate the ability of making "questions to open."

## 5 The future issues

I introduced a test based on this framework in my lesson of Graduate School course and its deadline is the end of this August. So I will analyze their questions, and construct evaluation standards for each type of questions. Next, in new test assignments I will evaluate their questions with this standard and verify its validity and reliability statistically. On the other hand, each type of questions must be verify its relation to its correspondent creativity actually. That is, the following two relations must be verify: the relation between the questions to close and the creativity to fitting knowledge pieces which are lost in the enormous already known knowledge, and the relation between the questions to open and the creativity to bring a paradigm shift to science. To verify these relations, two approaches can be thought, that is, the one is a trace survey and the other is a status quo survey. In the former approach, I introduce the test to the young who

aims to research scientifically and evaluate their scientific achievements after years. And in the latter approach, I evaluate the questions abilities of two types of remarkable researchers. The one is who produces remarkable achievements taking accumulative activities over from their predecessors, and the other is who brings some paradigm shifts in their research domain. Furthermore, I develop the method to evaluate the two types of questions by computer, because it is required that everyone takes the QQ Test easily to spread the importance of questions for creativity. Then I examine to use deep learning methods, so-called “AI,” because the questions to close are easy to classify but vary in forms and the questions to open are easy to distinguish by expert researchers but difficult to express the reasons. AI is good at classifying various kinds of things by using big data and leaning a tacit knowledge of our human evaluations or judgements. Based on the knowledge acquired through this development, a computer who ask questions are able to be invented. If this computer can simulate to make questions, my idea that classify questions into the two types is verify to be correct.

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