IBDP Theory of Knowledge Essay

Do good explanations have to be true?

February 22, 2019

Explanations of knowledge are essential for its communications.

Good explanations are clear and useful for its target audience. As a result, whether an explanation is good depends not only on its solidness, but also on its clarity to its target audiences. On the other hand, **true explanations** are precise, rigorous, and in accordance with reality. As a result, whether an explanation is true depends only on whether it describes the explained knowledge accurately, but not on its target audience.

In every discipline, there is massive amount of knowledge, ranging from exoteric to esoteric. **Exoteric** knowledge is simple, so it can easily be understood by the general audiences outside the professional knowledge community of the explained knowledge. On the other hand, **esoteric** knowledge is abstruse, so it is more likely to be understood by professional audiences inside the professional knowledge community.

Whether good explanations of the knowledge have to be true depends on how exoteric or esoteric the explained knowledge is. Exoteric knowledge does not belong to any professional knowledge communities, so they could be clearly and accurately explained to any target audiences with basic common senses from their daily lives. As a result, good explanations of exoteric knowledge are true.

Take an example of the explanation of the commutative property of number additions. If you put three apples on the table and then two, there will be five apples on the table; on the other hand, if you first put two apples on the table and then three, there will also be five apples on the table. The total number of apples on the table has nothing to do with the order to put them, and this is why number additions are commutative. This explanation is clear enough regardless its audiences, because any audiences would have enough life experiences of putting objects on the table, in order to understand it. It reveals the nature of the commutative property accurately as well. Therefore, good explanations of exoteric knowledge are true.

Moreover, since good explanations for exoteric knowledge could easily be true, it is meaningless to explain exoteric knowledge inaccurately. Therefore,

good explanations of exoteric knowledge have to be true.

However, esoteric knowledge is relatively advanced, and is beyond the experiences of the daily lives of common audiences. So whether an explanation about esoteric knowledge is good depends not only on its contents, but also on the **speciality** of the target audiences in the professional knowledge community of the explained knowledge. Concretely, **nonprofessional** audiences do not know the professional concepts to understand precise explanations for advanced knowledge. As a result, the purpose of good explanations are not to **rigorously prove** the validity of the explained knowledge, but to build intuitions for the audiences. So good explanations of esoteric knowledge for nonprofessional audiences do not need to be true.

In natural sciences, good explanations analogize the unfamiliar explained phenomena using the familiar phenomena in the audiences' common lives, such that the audiences can understand the advanced theories, and professional terminologies and concepts of the explained phenomena. These analogies can build important intuitions for the nonprofessional audiences to understand unfamiliar phenomena, since they have limited opportunities of experiments in laboratories, and are less familiar with the professional terminologies as well as concepts in the advanced theories. However, these analogies are essentially different from the real natural phenomena, so they are not accurate explanations.

For example, a good explanation of electricity is the analogy of water. To be specific, the fact that the electric current splits at a circuit junction is analogized by how water stream separate at the t-branch of a pipe. This is a clear and understandable explanation for nonprofessional audiences. But to go deeper, a fundamental difference between electric current and water flow is that all water molecules are similar, but electric charges are either positive and negative. As a result, the phenomenon of capacitance, caused by attractions of different charges, is unaccountable by the analogy of water; the explanation is not consistent with the reality so it is not true.

It is similar in mathematics. The basic concepts in mathematics are origi-

nated from the daily lives of people, but they are defined in a rigorous way under the formalism of the foundation of mathematics. (Novikov, 2011) To be more specific, the concept of infinitesimal was originated from the book *Method of Fluxions* by Sir Isaac Newton, but it was not defined rigorously until the emergence of the epsilon-delta definition of limit by Augustin-Louis Cauchy and Karl Weierstrass. Since nonprofessional audiences cannot understand the complicated concepts and theorems, good explanations reveal the intuitive interpretation of the concepts, instead of their rigorous proof by solid deductions.

For example, to explain that the repeating decimal $0.999\ldots$ is equal to 1, a good explanation to nonprofessional audiences is to show it intuitively. Calculating $1/3$ yields the repeating decimal $0.333\ldots$, so multiplying three on both sides of the equation gives that 1 is equal to $0.999\ldots$. This explanation gives a clear illustration for the nonprofessional audiences. But there is no rigorous explanation of the equality between $1/3$ and $0.333\ldots$, so the explanation is not true.

Therefore, good explanations of esoteric knowledge for nonprofessional audiences do not need to be true. They would better build conceptual understandings for their audiences, instead of prove the validity of the explained knowledge rigorously.

However, on the other hand, professional audiences have solid understandings on the advanced knowledge, terminologies and concepts in their discipline. In addition, the purposes of their explanations are to reveal the precise nature of the explained knowledge to facilitate further understandings and academic discussions, so their explanations must be accurate. As a result, good explanations of esoteric knowledge for professional audiences have to be true.

To be more specific, in natural science, professional audiences have strong intuitions and understandings of the advanced scientific theories, and the professional terminologies and concepts to describe them. Moreover, since the professional audiences are experts in their knowledge community, they need to understand the essence of the scientific theories to boost their future

researches. In this case, intuitive but inaccurate explanations are not useful for professional audiences anymore, but good explanations can only use advanced theories to accurately reflect the nature of the phenomena. As a result, the explanations are true.

For example, a good explanation of the phenomenon of heat transfer for professional audiences is the kinetic theory of molecules. Because temperature represents the average kinetic energy of molecules, heat conduction between solids of different temperatures is explained by the transfer of kinetic energy from faster molecules to slower molecules by their collisions. As the professional audiences already know the kinetic theory of molecules, and it accurately reflects the nature of heat, the explanation is clear and useful for the audiences. Moreover, the kinetic theory of molecules is a precise model of the phenomenon of heat, so this explanation is true.

Similarly, in mathematics, professional audiences understand the complex but rigorous definitions and professional notations of the mathematical languages, to follow the complex rigorous deductions. For example, to explain that the repeating decimal $0.999\ldots$ is equal to 1, a good explanation for professional audiences is to show that the sum of the geometric series with an initial term of 0.9 and a common ratio of 0.1 equals to 1. This was rigorously proved by Leonhard Euler as early as in 1770. (Euler, 2012) As the professional audiences already know the calculation of series, this explanation is clear and understandable to them. Moreover, with the precise definition of limit and convergence of series, this explanation is a rigorous deduction.

Therefore, good explanations of esoteric knowledge for professional audiences have to be true, because only accurate descriptions and rigorous proofs could facilitate further understandings and professional discussions of the explained knowledge and its further implications.

To sum up, whether good explanations have to be true depends not only on how exoteric or esoteric the explained knowledge is, but also on the extent of speciality of the audiences. Good explanations have to be true when the explained knowledge is exoteric. They also have to be true when the

audiences are professional enough to understand the complicated esoteric knowledge. However, good explanations do not need to be true when the audiences are not professional enough to understand the esoteric knowledge.

This conclusion is simple but significant. In communications of knowledge, experts should not explain the esoteric knowledge to nonprofessional audiences using complicated terminologies and complex reasonings, because audiences do not have enough professional knowledge to understand the complex explanations. The classical physics book, The Feynman Lectures on Physics, uses lots of analogies to explain professional physics to undergraduate students. (Feynman, Leighton, & Sands, 2011) On the other hand, the best way to explain the esoteric knowledge to professional audiences is to accurately reveal the precise nature of the knowledge, because intuitive but inaccurate explanations will lead to their confusions in the future. Explanations of knowledge should follow this conclusion to promote the communications of the explained knowledge.

Word Count: 1486

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