

Theory of Knowledge

Essay

Question 2

“There are only two ways in which humankind can produce knowledge: through passive observation or through active experiment.” To what extent do you agree with this statement?

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The writer William Blake once said that “The true method of knowledge is experiment” (BrainyQuote, 2015). Humans have always strived for knowledge, and some believe there are two ways we produce knowledge - passive observation, which can be defined as producing knowledge by developing conceptual models through reasoning from observing a particular event or situation to explain the particular phenomena, and active experimentation, which can be defined as the learner participating in the production of knowledge. The statement of this essay assumes that produced knowledge can only fall into one of two categories - either produced through passive observation or active experimentation. Therefore, it can be said that the statement presents a false dilemma. This essay aims to explore the knowledge question *‘To what extent do both passive observation and active experimentation play a role in knowledge production and are there any other forms in addition to this?’* I will uncover the relationship between passive observation and active experimentation in producing knowledge in the natural sciences and mathematics. I will also look at how history and imagination may offer other forms of knowledge production.

The use of passive observation or active experimentation is most commonly thought of in relation to the natural sciences. For instance, a chemical reaction, and any visual changes that occur, are passively observed before academic knowledge is applied to produce practical knowledge, which is done by testing proposed hypotheses that are then supported or falsified. Through this process, new theories are made and existing ones are extended. An example of knowledge production attributed to passive observation can be illustrated in Charles Darwin's theory of evolution. Darwin based his theory on his observation that species overproduce beyond what the environment can support and there was genetic variation within populations. He then deduced that organisms with beneficial adaptations survived long enough to pass on those characteristics to offspring (Christ's College, 2015). An example of this is Darwin's finches. Although Darwin was not aware of the variation in beaks of Galapagos finches, he did speculate that the finches had descended from a common ancestor and individual finches varied to adapt to their environment. Nonetheless, the variation Darwin observed in the morphology of the finches led to the induction and subsequent conception of the theory of evolution (Truthinscience.org.uk, 2015). Hence it is evident that the process of passive observation plays a role in the natural sciences that it allows for induction, which can potentially lead to new scientific knowledge.

The idea of passing on heritable characteristics in Darwin's natural selection theory has led to advances in the field of genetics with the produced knowledge of selective breeding. An example of how selective breeding stemmed from active experimentation is illustrated in R. C. Tyron's experiment, which showed that maze-learning ability is a heritable trait in rats. Tyron tested a large sample of rats on their ability to run a complex maze. He found that some rats made fewer errors, which he labeled 'maze-bright', while the rest were termed 'maze-dull'. From this, Tyron selectively mated bright rats with other bright rats and dull rats with dull rats and found that the performances of the maze-bright group and the maze-dull groups became progressively distinguishable (Google Books, 2015). As such, it is evident that active experimentation and subsequent observation of rat's performances enabled Tyron to produce knowledge in the natural sciences on the fact that maze-learning ability in rats is indeed influenced by their genetic makeup.

The production of knowledge in mathematics occurs in a manner similar to in the natural sciences. This is illustrated by Buchberger's model of the formation of mathematical knowledge. Dr. Bruno Buchberger proposed his model of mathematical discovery, and thus, the formation of mathematical knowledge occurred in phases involving both experimentation and observation. Buchberger suggested that this knowledge spiral has three phases: experimentation, exactification and application. The exactification phase can be considered passive observation as the mathematician attempts to make generalizations from data gathered in a particular problem to change the conjecture into a mathematical theorem that can act as a justified knowledge claim. The formation of a mathematical theorem produces knowledge that can be implemented in fictitious or real-world situations to form new algorithms (Bastian, Bammi & Howard, 2008). Therefore, Buchberger's model hints that mathematical knowledge is produced in a quasi-empirical manner, in a way similar to the natural sciences, where both passive observation and active experimentation methods are used in the knowledge production for these areas.

On the other hand, knowledge acquired from History can be examined from two different perspectives. Some believe the production of historical knowledge stems from active experimentation. For example, when archaeologists excavate fossils or tombs, it can be said to be knowledge produced by active experimentation through making new historic discoveries. Others may believe knowledge production in history has few similarities with the natural sciences. This can be supported in an interview with Judith P. Zinsser, an academic and historian, who argues that a historian will study an era before formulating a question to establish a hypothesis that can be tested

against the most certain facts in the context of an era, which shows how a shift in historical knowledge can be attributed to both passive observation and active experimentation (Bastian, Bammi & Howard, 2008).

However, some argue that the production of knowledge in history can be attributed to other means, such as memory and language. The Rape of Nanking is an example of how language is used to influence people's 'truth' or 'knowledge' on the event. Accounts of the event differ - while the Chinese confirm the event, some Japanese do not, and a controversy has erupted over Japan teaching a revised version in history textbooks, or even not mentioning it at all. This has led to tensions in Sino-Japanese relations - Chinese historian Pu Xiaoyu states that Chinese have a "strong sense of mistrust and animosity toward Japan", stemming from war crimes and "strengthened by the belief that Japan is unwilling to admit to and apologize for the atrocities" (Wikipedia.unicefuganda.org, 2015), while Japanese historian Takashi Yoshida states that "Nanking crystallizes a much larger conflict over what should constitute the ideal perception of the nation" - whether "Japan, as a nation, acknowledges its past and apologizes for its wartime wrongdoings" or not (Yoshida, 2006). Therefore, in this sense, language can be used to subvert what observation and experimentation tell us.

On the other hand, imagination can also be considered as another form of knowledge production in addition to the two mentioned. Imagination is often defined as forming new ideas and exploring new concepts that may possibly go beyond the boundaries of reality. Some people may regard imagination in a broader way - as to be associated with creativity, problem solving and originality (Ibpublishing.ibo.org, 2015). Friedrich August Kekulé, a German organic chemist famous for his work on the structure of benzene, is an example of knowledge production using imagination, as he discovered the benzene ring structure in a dream (Kim, 2015). Another example is John Nash, the winner of the 1994 Nobel Prize in Economics and regarded one of the best mathematicians of the twentieth century. It was Nash's extraordinary imagination that allowed him to propose the Theory of Games, which has led to advances in fields such as in politics, economics and evolutionary biology (Bastian, Bammi & Howard, 2008).

Imagination has also played a significant role in knowledge production in the Arts. An example of this is the novel 'The Things They Carried' by, Tim O'Brien. O'Brien was able to effectively convey some of the problems of storytelling, as well as the horrors of war, based on his experiences in the Vietnam War. Although it can be argued O'Brien blends fact and fiction in his stories, leaving the reader uncertain as to what is true and what isn't, it could also be argued that O'Brien allows us to 'choose' what we believe. It could also be argued that the novel makes a wider comment on writing and storytelling. By leaving us in doubt, he makes a powerful statement on loss - not just what the soldiers have lost in the war, but also what we lose by not having been there. Readers who were not in the war are forced to use their imaginations to fill in what O'Brien does not tell us about the Vietnam War, and this helps show how the truth can be bent while being told. In O'Brien's stories, anything seems possible, and this use of imagination further reflects how normality seems to cease in the face of war and how everything seems unfamiliar. Literature does not claim to be an accurate depiction of events or depict the truth, and thus, imagination can be used not only to reveal how little we actually know about certain things, but also about the human desire to tell stories in general.

Overall, it is evident that both passive observation and active experimentation play a role in producing knowledge in natural sciences, mathematics and in some cases history. However, it is important to clarify that knowledge production from these areas of knowledge are not solely based on one method, but rather a combination. Furthermore, it is evident that there other forms of producing knowledge, as exemplified through the use of memory and language in various fields, particularly in accounts of historical events, and imagination, where creativity leads to new ideas. The method of knowledge production in the natural sciences, within which the statement seems to be rooted, provides a rather simplistic take that is difficult for us to completely agree with. Therefore, without acknowledging the wider range of methods of knowledge production such as imagination and arts, our knowledge is in a sense only limited to what we can substantiate from the natural sciences.

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