**TOK Essay**

1. Can there be knowledge that is independent of culture? Discuss with reference to mathematics and one other area of knowledge.

(1583 words)

We are humans, and we develop certain knowledge as time passes, and our society grows more and more mature. The concept of knowledge itself is based on the experience of human beings and societies. However, is there knowledge independent of culture? I would like to define key terms used throughout this essay first. Knowledge has three aspects: the acquisition and dissemination of knowledge, the production of knowledge, and the application of knowledge. I consider the production of knowledge as a function that takes in problems and phenomena in the real world, process them using some previous knowledge (including methods and tools), and output the new knowledge. “Culture refers to the customs, arts, social institutions, and achievements of a particular nation, people, or other social group” (Cappi, 2022). Because the acquisition and dissemination of knowledge usually require other knowers as media, I would say that these two processes are closely related to culture; hence, I won’t focus on this aspect when analyzing the extent of knowledge dependency on culture; instead, I would consider the other two parts primarily. Defining some form of knowledge independent of culture to be either the production of knowledge or the application of knowledge is not related to any specific cultural background. More specifically, claiming “the production of knowledge” to be independent of culture means that the problems and phenomena take a smaller portion while previous knowledge is more dominant in the input. On one hand, in mathematics, knowledge is usually the mathematical theories, equations, and notations, and knowledge independent of culture means that the mathematical theories and systems are independent of the civilization that created them to be theories and abstract tools. On the other hand, in natural sciences, knowledge is the theories in scientific fields such as physics, and their various applications. By saying knowledge in natural science is independent of culture, it means that the knowledge becomes universal, beyond any specific cultural background, and shared by the entire humanity. My idea considering this prompt is that there can be knowledge independent of culture in both mathematical and physical knowledge.

First, mathematical knowledge can be dependent on culture, especially in ancient periods when mathematical systems are not fully developed. The production of knowledge requires the problems in real life and previous knowledge, but math developed in ancient periods have little previous mathematical knowledge to study, so knowledge developed at that time can only be based on real-life observations, which take place within certain cultural contexts. In other words, the construction of preliminary mathematical concepts is also a cultural process. For example, in prehistoric times, “the Incas and other ancient Andean cultures use the ‘quipu method’ to keep records and communicate information using string and knots” (Cartwright, 2021). This primitive medium of mathematics only does basic calculations such as counting, adding, or subtracting whole numbers of items because its purpose is to record the harvest of crops or evaluate the value in trade. While the concept of Math did not exist at the time, the mathematical tools developed by ancient people act as a way to record and benefit people’s life. The input in the production of the Quipu method is the difficulty in counting and calculations commonly performed in the Incas life. Because application and production are dependent on culture, early mathematical knowledge is dependent on culture.

However, mathematical knowledge can be independent of culture, especially in the modern and developed system of mathematics. The current math world is divided into different categories, such as arithmetic, geometry, and number theory. The math theorems get more and more abstract when the problems become more complex. For example, calculus is an essential tool in mathematics initially proposed to solve problems with “infinitesimal” like calculating the volume of a sphere. Its production aspect contains knowledge from other branches in mathematics, which is mainly arithmetic and geometry, and calculus acts as a combination and extension of these two. Because arithmetic and geometry are somewhat independent of culture as abstract tools, the production of calculus is more independent of culture. For the application aspect, apart from being applied to solving real-life problems like calculating the area or volume of an irregular shape, it is a fundamental tool used in an advanced subfield of math called analytics. As the depth of math increases, the knowledge becomes an abstract tool not directly associated with any specific cultural experience but purely about mathematics itself. Additional layers of theoretical math knowledge rely only on mathematical truths already established. Hence, there can be some math knowledge independent of culture as the problems studied by math become increasingly removed from our everyday experience.

Second, ancient knowledge in natural science is dependent on culture. Knowledge in natural science usually has a real-world origin for a real-life application. To produce knowledge, previous knowledge as the input would already have a practical application, so the knowledge output would likely be dependent on culture as well. Hence, by saying knowledge in natural science is independent of culture, the application of knowledge should be a universal tool that transcends the cultural background. The development of primitive knowledge is often a summary of phenomena, so primitive knowledge is highly dependent on culture. Later, new knowledge combines previous knowledge to become better tools and methods, but the new applications still aim at solving real-life problems. For example, ancient Greek scientist Archimedes invented a hydrodynamic screw that can “transport water from low-lying areas up to irrigation ditches” (Buddies and Finio, 2022). The production of the screw was aimed to benefit irrigation systems in ancient Greek; additionally, this tool requires previous knowledge of engineering and spiral in mathematics. Even though the previous knowledge used here is somewhat theoretical, it is still derived from our experience with solving real-life problems. Because the input of production is culture-specific, the production of knowledge is dependent on culture. Moreover, the application of the screw is related to culture: for societies where irrigation is not essential such as for nomadic tribes, the screw would find little application. Early knowledge in natural science is indeed dependent on culture.

Nevertheless, similar to the trajectory of mathematical discoveries, knowledge in natural sciences has become independent of culture. The primary target for developing natural science knowledge is to create tools to solve practical problems, but these problems begin to take on a universal scale that does not belong to any specific culture or nation. The invention of the telescope is one such example. Both optics and astronomy have a high entry bar. Without an advanced education, one cannot simply grasp the laws of optics and astronomy through cultural experiences. They are as difficult to learn for a European as for a Chinese person with a similar level of education. Therefore, the knowledge regarding the production of telescopes is already largely independent of culture. Meanwhile, the application of the telescope goes far beyond the scope of culture. The effectiveness of a telescope as a tool is universal for all human beings regardless of their cultural background; thus, there is knowledge independent of culture in this regard. Another example of the universality of physical knowledge is Isaac Newton’s Law of Universal Gravitation. He generalized that the force that causes an apple to fall on one’s head is the same force that keeps the moon in the Earth’s orbit. While people’s interpretations of apples falling and the moon orbiting the Earth can depend somewhat on their cultural understanding of these phenomena, the idea capsulated by Newton’s discovery is above culture. The scope of application of this law is not limited to any region or country; instead, it becomes a tool directly aiming at understanding the universe. Admittedly, Newton’s discovery has had a cultural impact, especially in the realm of religion. Still, how culture reacts to knowledge is irrelevant for our discussion of knowledge’s dependence on culture. In summary, knowledge in natural sciences is more dependent on the culture in ancient periods, because knowledge formed at that time is either a combination of phenomena or an empirical summary of real-life observations. In contrast, knowledge in modern times exceeds the context of human culture, becoming a value for the whole of mankind. Hence, knowledge in natural science is becoming more independent of culture over time.

In conclusion, there can be knowledge independent of culture for both mathematical knowledge and natural science knowledge. The commonality between these two areas of knowledge is that they are both highly dependent on the culture in early times, because knowledge is mostly “knowing how”, to record and benefit people’s lives. In our current society, knowledge becomes more about “knowing that”, where knowers can build new knowledge based on knowledge in the past regardless of their cultural experiences. Now, new knowledge is used widely across cultures. The difference between these two areas of knowledge is that math is more about abstract theories that eventually break away from the culture. In natural sciences, usually, knowledge would have an application, so the only case of the knowledge being independent of culture is to become universal knowledge applied on the whole of mankind or beyond this Earth.

On a large scale, the knowledge that is more abstract will be independent of culture because it will hardly attract the attention of the general public if it does not directly impact their lives. Almost all knowledge based on abstract theories departs from our cultural background. International collaboration in the sciences also mandates that the process and the final product must transcend borders and cultures. Therefore, it is foreseeable that knowledge produced in the future will be even more independent of culture.

**Bibliography**

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