

TOK Essay

Can there be knowledge that is independent of culture? Discuss with reference to mathematics and one other AoK. WC: 1581

To explore this topic, understanding of the definition of knowledge and culture are necessary to study their interrelationship and dependency systematically. What is knowledge? Knowledge is the understanding or skill about a topic that's gained either by direct experience such as by doing/observation, or indirectly via instruction and education. Culture is the sum of beliefs, morals, and traditions of acting, that are practiced by an individual or group and passed down over time. Our knowledge determines what we know while our culture determines what we believe and how we act. It is true that knowledge and culture commingle deeply, as what we know deeply affects our beliefs and actions. In this essay the question of how far knowledge can be independent of culture will be explored by examining two different areas of knowledge, history, and mathematics. These are two very different and complex areas of knowledge and offer a good basis to compare and contrast the dependency as one depends on proof and logic while the other depends strongly on analysis and interpretation of the past.

For mathematics, it appears that knowledge is dependent on logic and proof and is thus mostly independent of culture as it can be derived and verified objectively. To explore this, I will first examine the early stages of mathematics to show that knowledge and culture can be independent of one another. In the earliest examples of mathematics, many different civilizations, with no contact with one another, independently determined the same mathematical insights despite their cultures and societies being very different. For instance, geometry as a branch of knowledge arose independently in many ancient cultures such as the Egyptian, Greek, and Indian

civilizations. All these distinctly independent cultures managed to derive basic tenets of geometry for measuring the earth, to be able to build straight walls, roads, or construct impressive buildings. A specific real-life example of this is when the Egyptian Pyramids were being built in North Africa in 2500 BC with the exact right angles and proportions based on the golden ratio. Meanwhile the pyramid of the sun was being built by the Aztecs in San Juan Teotihuacan in the Americas (Rogers). Both cultures were completely distinct in their culture and were separated by vast distances and centuries of time. Yet, having no contact with one another, they derived the same precise geometry for the right angles for the bases and worked with the same value of π . This shows that knowledge of mathematics can arise independent of our cultures.

In my personal experience looking at mathematics, I perceive it to be similarly independent of culture as well. As part of my Mathematics IA, I am researching the COVID pandemic using mathematical models like SIR which governs how infectious diseases spread in a population. I have encountered many web sites and mathematical articles by researchers from India, USA, and China who all speak in different languages or come from very independent social and cultural backgrounds. The only common part between all these researchers and myself is that we can all understand the universal mathematical equations in the SIR model and improve or verify that knowledge independently. So despite me not being able to share culture or language I can find and improve my knowledge of mathematics independently. A third interesting example of this is the Search for Extraterrestrial intelligence, SETI. Humans have been looking for signs of intelligent life elsewhere and the most universal way of looking for this is to find radio or light signals that come with mathematical signals built into them like the pattern of the number π (Diamond). In fact, the NASA voyager mission uses the same concept where humanity sent the first probes into deep interstellar space where it may encounter an alien

civilization. This illustrates that even across non-human galactic scales, mathematical knowledge is a universal and independent truth for any intelligent civilization regardless of their culture or even their biology.

Although there is strong evidence on how mathematics can develop independent of culture, there are also counterclaims which we must examine. One counterclaim is that all our mathematics knowledge has grown based on our cultural roots and these historical interactions that are embedded in mathematics. This claim is often made by researchers who focus on ethnomathematics. An example of this might be when Americans watch the NFL Superbowl and see it as LVI using the roman numerals for 56 (Benne). It shows the Latin cultural historical roots of arithmetic in the west has persisted into the modern world. Similarly, most equations use Greek letters or symbols like π to show their cultural roots. Cultural dependency can also be seen where the work of Sir Isaac Newton was dependent on the introduction to western mathematics by Leonardo of Pisa in Italy who borrowed from Arabic mathematics espoused by Al Khwarizmi that was introduced into Europe (Carter). Essentially this shows modern knowledge in mathematics did in fact sometimes depend on our cultural history and built up in layers. However, these examples do not explain how cultures that didn't have any contact or share even basic notions of culture still managed to derive the same mathematics independently. For example, when the Mayans in 300 BC were using zero as a place value and no other civilizations were doing the same other than the Gupta Empire in India. It is hard to find any evidence of cultural continuity for the knowledge that existed in those peoples. In summary, different societies who don't share the same cultures have derived the knowledge of mathematics to create the same geometry, arithmetic, and

algebraic knowledge. So, while it can be true that culture can influence mathematics it is possible to create objective knowledge in mathematics that transcends our cultures.

I selected history as a second area to examine culture and knowledge as it tends to be perceived as a very different area of knowledge than mathematics. In history, a lot of the knowledge is very dependent on culture since history is collected by looking at fragments of other people's past actions and often interpreting what happened given the cultural milieu of the time. As an example, almost every nation or people has knowledge of its founding and its key historical events as well. We examine artifacts, buildings, artwork and writing to understand our history. All of these are elements or fragments of the culture of another time. The culture of building tombs and writing for the dead in Egypt gave us knowledge of the living conditions of the day, while the legal writings of the code of Hammurabi in a tablet show us how the Sumerian civilization worked thousands of years ago. Our Historical knowledge thus strongly depends on the cultural artifacts of humanity. Knowledge of history also in turn influences culture. Every nation and people develop their national perspectives and social views based on their historical events whether those were wars, conquests, or migrations. Our language, food and art, is all influenced by our historical truths. History and culture are then often codependent on each other. A personal example of how knowledge of history is in fact culture dependent came to my attention during my research for my history project. This was about the Cuban Missile Crisis and how Fidel Castro's communist regime played a role during the crisis which brought the world nearly to a nuclear destruction. While doing research, I was surprised to find a lot of starkly differing perspectives and explanations to what led to the crisis. Even though they all describe the same historical events, the knowledge, it is interpreted and colored by the different cultural and political perspectives from each of the different nations of Russia, Cuba, and America. They have different

historical knowledge of the same crisis as it filters through their national culture. In American sources, I saw a lot of historical evidence about how Russia betrayed America by placing missiles in Cuba but when I read translated Russian and Cuban sources, I saw that they deeply believed that history shows America at fault for threatening a small neighbor. This shows that history and the facts we learn can be deeply dependent on people's cultures.

However, despite these instances where knowledge of history and culture are influenced by each other there are also other examples where culture and historical knowledge are more independent. Some examples where culture is independent of historical knowledge is that while there is historical evidence where people in the past used to practice slavery or even cannibalism, modern cultures no longer accept this. Despite this being part of historical knowledge, it is no longer part of a lot of cultures today and people abhor these historical practices. Another example is how we have clear knowledge of evolution which is a part of human history. However, in different cultures people still believe in alternative views where there is a creator God, and humans are created. These examples show that our verified knowledge of the history of humans is not dependent on our religious or cultural beliefs. This shows that knowledge of history can be deeply dependent on culture, however there are instances where this is not true, and history and culture are separate.

In conclusion, I have identified examples of mathematical knowledge which are independent of culture. I have also seen that culture can influence our knowledge especially in areas like history. Overall this essay shows that despite the instances where knowledge is codependent on culture, there are clearly instances where knowledge can also effectively be independent of culture.

Works Cited

- Benne, Jon, and SB Nation NFL. "Super Bowl: Why Does the NFL Use Roman Numerals for the Game?" *SBNation.com*, SBNation.com, 30 Jan. 2018, www.sbnation.com/2018/1/30/16935190/super-bowl-roman-numerals-used.
- Carter, Janet. "Janet Carter." *World History*, 14 Nov. 2018, worldhistory.us/great-thinkers/pioneers-of-mathematics-from-pythagoras-to-isaac-newton.php.
- Diamond, Bill. "Home." *SETI Institute*, www.seti.org/.
- Rogers, Leo. "Geometry: A History from Practice to Abstraction." *NRICH*, 2008, nrich.maths.org/6352.