“Given that every theory has its limitations, we need to retain a multiplicity of theories to understand the world.” Discuss this claim with reference to two areas of knowledge.

What is a theory good for? Peter, a professor of education in the Ohio State University, answered this question on his editorial that he named with the question itself: theories inform the nature (process, relationship between variables) of an area of content. (2012) While theories are essential in the spread of knowledge, many of the more professional theories lack generality and are focused on specific scenarios for greater significance in the professional field while less professional theories tends to be general and lack information. (Baker, 2016) This raises the question, is one single theory sufficient for describing all the knowledge that one needs. I will be looking into this question from several different areas of knowledge: natural sciences and mathematics.

In the natural sciences, theory represents how facts are interpreted, (Tanner, 2017) and this is often done through observation of trends combined with performing scientific tests to determine the reliability of the claim. Since natural science greatly rely on reasoning as a way of knowing, existing theories can be refurbished by new theories to describe phenomenon that old theory does not account for. Newton’s gravitational equation exemplifies this: it sufficiently describe the effects of gravity on Earth, but fails to justify the elliptical orbit of Mercury around the Sun. (Siegel, 2016) Since Newton’s equations were broken in the cases of Mercury’s orbital, Einstein proposed a new equation relating the motion of mass and energy to the curvature of space-time. (Conover, 2018) This new theory is now used for determining the pathways of satellites, such as the Hubble space telescope, which are launched into space to increase human’s understanding of the universe.

In today’s world of physics, most scientists have adapted from Newton’s gravitational theory to Einstein’s relativity theory, as it creates more specific and useful predictions for professional studies in physics. Einstein’s new theory generates numbers with greater precision compared to newton’s gravity equations while not losing generality in its applications. In fact, it can be applied to more situations such as when the object being observed has extremely high mass, making it completely sufficient for being the foundation of modern understanding of gravity. As seen from this example. newer theories are built on top of old theories and improves their limitations, making newer theories have the same advantages as the old theories with less limitations. This thus shows that a multiplicity of theories does not need to be maintained as newer theories are able to perform the jobs of its predecessors but with less limitations.

Conversely, there are also scenarios in which one theory is insufficient in describing the natural world. This is often the case for change in enthalpy questions in chemistry. Students are given question that provides students with certain reactions with known enthalpy changes and are asked the deduce the change in enthalpy for a relating chemical reaction. Students first need to recognize the theory of the conservation of energy, that energy stays constant in a closed system, (NASA, 2013) and it creates a relationship between the enthalpy before and after the reaction. Hess’ law also plays a role. It states that the change in enthalpy is independent of the pathway between the initial and final states, (LibreTexts, 2019) meaning that the enthalpy change of a reaction is only dependent on its reactants and product and dependent from the reaction mechanism. This allows students to use the provided chemical equations to find an alternate pathway for the reactants the reach the product and thus calculate the change in enthalpy of the reaction.

The two theories in this example worked closely together to solve the problem. If one of these theories were discarded, the solution would not have been able to be figured out. Without the conservation of energy, there would have been no way to calculate the change in enthalpy, and without Hess’ law there would have been no link between the change in enthalpies for the reactions provided between the change in enthalpy that is being figured out. Because of the connected nature of theories to solve real life applications, the presence of a multitude of theories is required in certain cases to model and explain certain phenomenons.

Mathematics theory are often very context dependent and plays a critical role when solving math problems. This is the case for probability: two events happening can be classified as independent events, where the probability for event A happening is independent from the probability of event B happening. The two events can also be dependent, where the chance of event B happening depends on whether event A have happened. There is a theory that states that the probability of A and B happening of the same time is equal to the probability of A happening multiplied by the probability of B happening. However, this theory is restricted to cases where A and B are independent events. (Math Goodies, 2017)

This theory is helpful for businesses such as casinos in designing their game. In order to stay in profit, casinos need to make sure that their chance of winning is higher than their customers. In games like the slot machine, where each slot does not affect the outcomes of the other slots, the casino needs to use the independent probability formula to adjust the machines to make profit. In games such as poker, where the chance of drawing cards depends on what have been drawn already, the casino would use dependent probability formulas to calculate its chance of winning. Therefore, a multiplicity of theories are important to keep in mind in preparation for the variety of possible situations which might be faced.

Being limited to the specific situations, math theories also have a specific focus towards a certain direction. In many complex problems such as proofs, where a general understanding of mathematics is required, having one certain theory may not be sufficient. This is the case for the proof for Euler’s identity. (eiπ – 1 = 0) Even the simplest proof of this identity requires trigonometry, complex numbers and Euler’s formula, as this identity is a very special case of Euler’s formula. This identity is very helpful in the field of electricity, as it greatly simplifies the calculations for electrical currents for the engineers designing electrical components. The cause of such a complex proof is that mathematics has a strong reliant on reasoning as the way of knowing.

This combined with the abstract nature of math causes a lot of thinking being required before being able to justify new theories. To this day, there are still many theories, such as the Riemann hypothesis, that have yet to be proven but have real life application eager to apply them. Physics have adopted the Riemann zeta function in the field of electricity to perform calculations. The complex nature of math thus shows the importance of knowing a spectrum of theories, as individual theories will not be able to fully support further development in new mathematics theories.

The reliability of independent theories as suggested by natural science while strengthens the ability of a theory standing on its own, also improves the situation when multiple theories are utilized. While using multiple theories may conflict with each other, as suggested my mathematics, this can be fixed by choosing the theories with caution, such that there is no conflict between the different theories. On the other side of the importance of maintaining a variety of theories, mathematics suggest that it allows a more general understanding of the situation, which is important for increasing understanding of the situation and its future development. The area of natural science also suggests that maintaining a variety of theories will also help overcome the limitations of only having a single theory. Hereby, we see that, while in some situations using single theories are sufficient, there are also situations that problems can only be solved with the use of a multiplicity of different theories. Therefore, it is important to maintain a variety of theories to understand the world.

The implications of this conclusion is that it shows that the procession of more knowledge is helpful for gaining a better understanding of the world and thus promotes the learning of new knowledge. This being said, it is still important to acknowledge that there are situations that does not need a large amount of theories to understand, and overstating the need of multiple theories in these cases will only add complexity to the understanding of the situation.

Word Count: 1433

# References

Baker, A. (2016). Simplicity. *Standford Encyclopedia of Philosophy*, 7.

Conover, E. (2018). Einstein's general relativity reveals new quirk of Mercury's orbit. *ScoemceMews*, 2.

LibreTexts. (2019). Hess's law. *Chemistry LibreTexts*, 5.

Math Goodies. (2017). *Independent Events*. Retrieved from Math Goodies: https://www.mathgoodies.com/lessons/vol6/independent\_events

NASA. (2013). Conservation of Energy. *National Aeronautics and Space Administration*, 2.

Paul, P. V. (2012). What is a Theory Good for? *American Annals of the Deaf*, 4.

Siegel, E. (2016). When Did Isaac Newton Finally Fail? *Forbes*, 3.

Tanner, J. (2017, 29 6). What Is a Scientific Theory. (A. Bradford, Interviewer)