**Research Consultation Summary**

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ATWP135: Academic Reading and Writing

August 2, 2021

I chose to research the limitations of quantum computing and how that will impact the possible applications for quantum computing. With my background knowledge and information from Scott Aaronson’s, *The Limits of Quantum* (2008), I’ve come up with a working thesis that quantum computing will be more powerful than classical computing, which will allow some problems that would take years on the most powerful supercomputer to be solved quickly, but that quantum computing will not open any new domains of problems which in theory cannot be solved by a classical computer. Aaronson, an assistant professor of electrical and computer engineering at MIT, describes the limits of quantum in the context of NP problems (2008). Grouping problems as P, NP hard, or NP complete is way of grouping problems based on how they scale computationally when the size of the problem is increased. For P problems, or polynomial problems, as the size of your input variable N grows, the number of calculations the computer needs to do is bounded by some polynomial with respect to N. For example, with an input of size N, there is some polynomial CNK where C and K are constants is an upper bound for some other polynomial, say (C-1)NK-1. Aaronson’s article claims that Quantum computers may be able to solve a larger realm of polynomial-time time problems with relative ease, however problems that grow exponentially with respect to the size of their input will quickly get too large for even quantum computers to handle (2008). To understand the limits of quantum computing, I will likely have to research more about how quantum computers work (which I know very little of right now) and more about what types of computational problems exist. Then I will need to find sources which relate the performance of quantum computers to possible applications in the future.

**References**

Aaronson S. (2008). The Limits of Quantum. *Scientific American 298*(3),62-69. <https://www.cs.virginia.edu/~robins/The_Limits_of_Quantum_Computers.pdf>

Scott Aaronson defines some of the limitations of quantum computers in his article “The Limits of Quantum”. Aaronson was an assistant professor of electrical engineering and computer science at MIT when he wrote this and therefore is a reliable source to be making these claims. This article is found in the Scientific American, a journalism company. Given the article is found in a magazine and there are huge simplifications, I would say this article is good for background information on quantum computing. It also gives me a claim to work with, by someone credible, that states quantum computers cannot solve NP-Complete problems, therefore they are more powerful than classical computers, but not able to solve entirely new types of problems.

Bova, F., Goldfarb A. & Melko R. G. (2021) Commercial applications of quantum computing. *EPJ Quantum Technology, 8*(2). <https://doi.org/10.1140/epjqt/s40507-021-00091-1>

Lang, V. (2021). *Digital fluency: Understanding the basics of artificial intelligence, blockchain technology, quantum computing, and their applications for digital transformation*. Apress. <https://doi-org.ezproxy.library.uvic.ca/10.1007/978-1-4842-6774-5>