Final Presentation on Teaching Advanced Subjects and Survey on Studying Quantum Computing

Sergiy Palguyev

sergiy.palguyev@gatech.edu

1 VIDEO LINK

https://youtu.be/Vq5AdHolT3E

2 PRESENTATION POWERPOINT SLIDES

Background

While some research has been conducted on the matter, most has been from the perspective of academic researchers exploring different options on a cohort of students. The subject of the individual student, however, has been generally ignored. The focus of this paper, as such, is to broadly survey a representative cohort of the well-educated technological industry professional and determine best methods, practices and materials required to provide the necessary foundation for integrating Quantum Computers into the existing technological stacks.
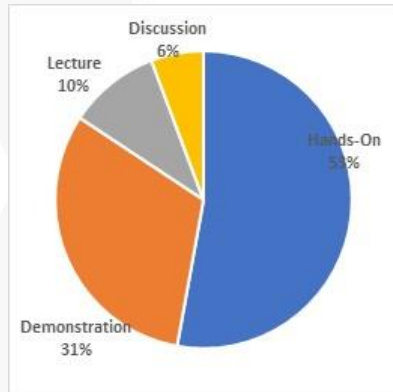
Survey Methodology

The survey will focus on three core areas of teaching advanced subjects: Teaching Methods, Study Material, and Content Delivery.

- Teaching methods will explore, amongst other things, student's affinity to lecture, discussion, demonstration or hands-on teaching styles.
- Study Material will explore the depth and breadth of mate-rial that students prefer to cover in classes.
- Content Delivery will explore various modes of information absorption by the students; in-person, MOOC, Virtual Reality, or other.

Finally, the cohort will consist of student in graduate level Computer Sciences or Engineering disciplines. They may be working professionals in the field or technical leaders and managers and may range in age from 18 to 99.
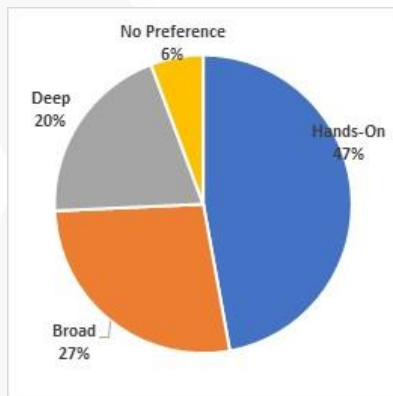
Survey Results on Teaching Style

The survey response for teaching style indicated a clear preference by the respondents for Hands-On learning, with demonstration following as close second. This result is in line with the background research conducted on the topic.
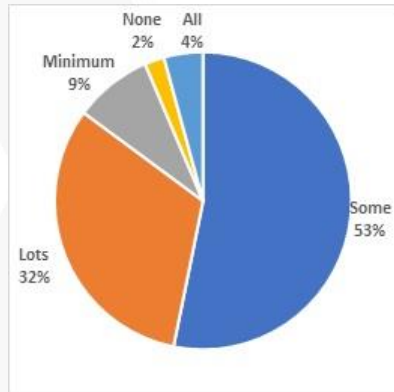
Survey Result on Knowledge Depth

In correlation, the survey on knowledge depth demonstrates students prefer knowledge gained to be that of hands-on, rather than theoretically deep or surface-level broad.

Students tend to desire class material to reflect the need for direct applicability in their current working conditions.

Similarly, the target cohort, being working professionals, have no need for deep knowledge into particulars of a phenomenon or surface level knowledge which bars the student from feel armed with the right knowledge to use the material in their work.
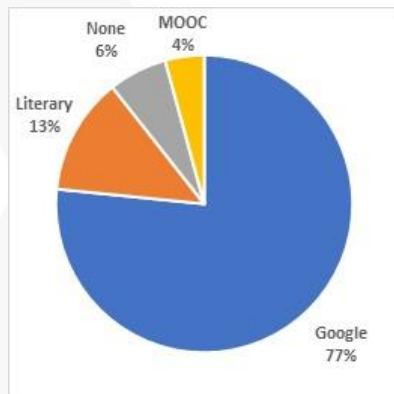
Survey Result on Need for Interaction

The survey response for need for peer-to-peer, TA or professor interaction yielded some interesting results. It is evident that the majority of responders feel some interaction is needed, with those requiring a lot of interaction a close second choice. From this, one can deduce that human interaction is a crucial piece of a well-run educational course.

In the context of advanced subjects, further consideration must be given to determine exactly what is the best way to facilitates these social interactions in order to bring fruit of knowledge to the students engaged in it.
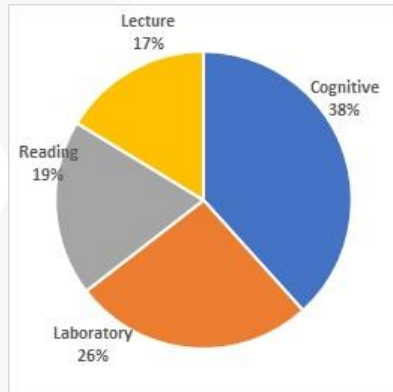
Survey on Outside Sources

The survey into outside sources provides context into the fact that an over-whelming majority of students rely on Google (or similar) search in order to fill in the gaps in knowledge, rather than relying on literary scholar search or supplemental course studies.
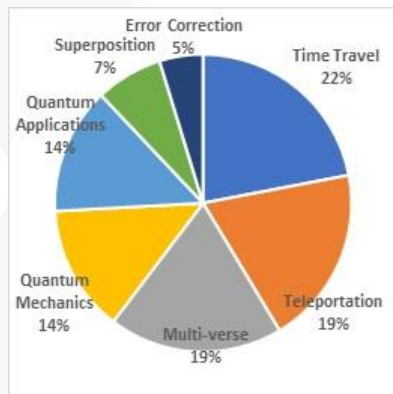
4

Survey of Effective Study Material

The responses to this survey show an interesting trend in survey answers by the target cohort. The conclusion of the Survey on Teaching Methods was that students generally have a strong preference for hands-on learning allowing for better comprehension and material retention. The survey results for individual student study material, however, suggests that Lecture and Reading material is valued in supporting and solidifying new knowledge.

Considering the true meaning of Laboratory Experimentation and Cognitive problem-solving tasks, one may consider the two to be part of the same action – active problem solving. Similarly, Reading and Lecture Material can also be grouped into passive knowledge absorption.

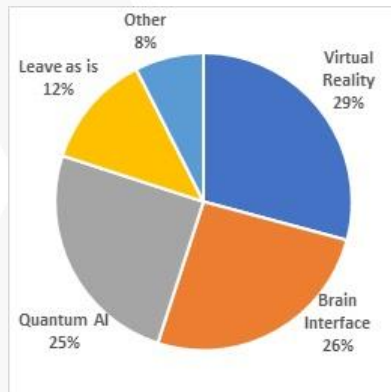## Survey of Interest in Quantum Computing

A survey on topics of Quantum Mechanics and Computing, commonly found in teaching material yielded interesting results. "Buzz-words" such as Time Travel, Teleportation and Multi-verse garnered the most attention while not being fundamental phenomena that a broad survey course in Quantum Computing would cover.

However, Superposition and Error Correction which are vital topics as well as Quantum Applications account for only 26% of interest by the responders.
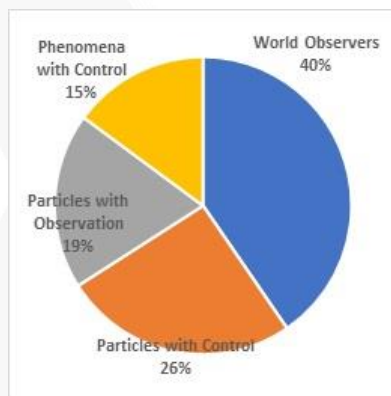
Survey of New Teaching Technologies

A survey on new-age technologies which are poised to revolutionize Educational Technology field supported the premise that Virtual Reality classrooms are a viable choice for the future of education.

The survey results demonstrate that almost 1/3rd of the respondents felt Virtual Reality was a good teaching environment for complex subject studies.

Considering the alternative technologies presented to the students are much further from mature technological realization, Virtual Reality is the most promising technology for the near future.

Survey on Virtual Reality Control

A survey of the student cohort in other preferences for manual control of a virtual world yielded surprising results. The results show a majority of 59% of responders who would prefer to be observers of a Quantum World with 41% which would actually prefer to have control over their world. The irregularity of this survey may stem from many variables.

Summary

The goal of this survey was to determine, form the student perspective, best methods, materials, and tools needed to teach advanced subjects, such as Quantum Computing, in a way as to drive interest, comprehension, and material retention. Considering the responses and statistical significance of the answers provided, the survey was successful in determining the student perspective in the matter.

Future Work

Some of the information gathered throughout the survey was surprising considering the background knowledge conducted prior to distribution. For example, "Survey Result on Need for Interaction" shows a medium to high need for interaction form the student respondents with their peer, TAs and/or professors.

Future research can focus just on this subject, determining what is the best medium, protocol, or modality in which students should communicate to optimize knowledge gain or retention.

Alternatively, an entire field of research can be devoted only to human interaction in Virtual Reality, and what that may look like if the users are represented as particles in a Quantum World.

Conclusion

In conclusion, the field of Quantum Computing is fascinating, mysterious, and vitally important to be studied by a wide variety of educators, students, engineers, and technology leaders. The goal of this survey was to expose the needs of the student in taking such a course and successfully gaining interest in the subject matter. This goal was fulfilled and brought to light even more questions that must be answered.