

# Be it Resolved: Scientists and Engineers must Debate to Create a Better and Peaceful World

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**Abstract**—Scientists and engineers have influenced and transformed the world in both constructive and destructive directions. Since politicians and executives are decision makers, undoubtedly, to a larger extent, they should share the major blame for many destruction. However, we believe, it is also the inability and hence the silence of scientists and engineers (SEs) equally contributed to the cause. Therefore, it is the time for SEs to take an active role in shaping the future for our generations to have a peaceful world.

As computing is influencing every aspect of our life, computer scientists and engineers (CSEs) have a major role to play in this mission. For that, they must to be trained on creative thinking and effective communication. Debating and technical writing are two most powerful ways to acquire these skills, and they are generally touted as requirements mainly for arts, management, and social science students. We advocate the need for training CSEs on debating skill so that they can effectively promote a peaceful world. The big question is how to include debate in core technical courses? To answer that, we will share our experience of having debates in some core computer science courses.

**Keywords**—*soft skills; debate skill; creative thinking; socially responsible scientists and engineers; socially responsible computer scientists.*

## I. INTRODUCTION

For humans, learning comes naturally. At young age, we could learn many complex tasks such as picking up a language, riding a bicycle, swimming, etc. quite easily, irrespective of our social, economic, or ethnic background. We are blessed with unending curiosity, and we keep learning many basic life skills with little to no effort. With proper support and effort, learning new things should not be so difficult. If that is not the case, we need to re-evaluate the effectiveness of our current approaches to teaching and learning. Since education has the greatest ability to influence and shape our society

positively or negatively, teaching and learning cannot be taken for granted until it is proven effective.

The world has changed so much in the recent past and is expected to change at a faster rate in the future. Education has to catch up to stay relevant. The accelerated change can be attributed in a large extent to the growth and applications of computer science. In the past, knowledge was available only in books. Now, due to the advancement of computing technologies, it is available at our fingertips. As a result, change and growth are fast in all dimensions including society, technology, environment, etc.

As scientists and engineers have been busy devising tools and solving mostly technical problems, policy makers have started to gain enormous control in shaping the world mostly driven by money and power. This has taken the world in some catastrophic directions. A well known example is global warming and its impact to humanity. Now the question is how do we steer this trend so that the world could be a peaceful place to live. The part of the answer, we believe, is that scientists and engineers should not only be good at devising tools and solving problems. We should do more by effectively educating the public to be aware of their good and bad, and hence influence policy makers to devise policies towards constructive and peaceful directions. Debate is a skill required to achieve that goal.

## II. DEBATE AS AN ACTIVE LEARNING TECHNIQUE

Debate hones several important life skills. Debate is not only a necessary skill to win arguments, it is also an effective learning technique. For most, it is fun. Knowingly or unknowingly, we debate all the time. Before we outline the benefits of debates, we reproduce its definition from [13]: “A debate is an equitably structured communication event about some topic of interest, with opposing advocates alternating before a decision-making-body.” It has several important keywords that

need to be emphasized. A debate must be equitably designed. It brings the aspects of fairness and equality to the forefront. It must be structured to control time and the communication pattern, and that, in turn, will help to prepare and sharpen strategies and arguments.

One of America's leading debate proponents, Robert Branham, lists four characteristics of argument for a true debate [13]:(i) *development* of ideas and positions (involves description, explanation, and demonstration); (ii) *clash* (refuting ideas); *extension* (defending ideas against refutation); and (iv) *perspective* (derive essence or sum of ideas and arguments and relate it to a larger question at hand). During the developmental phase of a debate, students are forced to deeply examine and conduct research on the topic at hand. This process involves applying logic, reason, and analysis to formulate an idea or opinion. Then, they must construct a plan to unify their positions. This requires leadership, teamwork, and effective coordination and communication. In essence, debate is a dynamic learning process involving taking a position, expressing a point of view, contemplating alternates, looking for connectivity, and more importantly, being calm and composed to keep the team engaged.

Debate has a long list of benefits [1], [3], [7], [9]–[11], [13], [14]. Some important benefits are that it: (i) enables participation and involvement; (ii) enforces the participants to provide response; (iii) engages the participants in independent thinking; (iv) forces the participants to pay attention and listen; (v) compels participants to analyze, create logical connectivity, and expose inconsistencies and contradictions; (vi) heightens the participants' mental alertness and quick thinking; (vii) encourages the participants to deconstruct and articulate ideas; (viii) forces the participants to think on their feet; (ix) sharpens spontaneity; (x) helps participants to reduce fear and anxiety; (xi) increases participants' clarity, encourages critical thinking, and builds self confidence; (xii) helps to understand different modes of influence (e.g., persuasion), and hence, prepares to apply and resist appropriately; (xiii) provides opportunities for the participants to understand and appreciate different points of view on the same issue and different solutions to the same problem; etc.

### III. DEBATE IN COMPUTER SCIENCE

When the concept of having debates in a computer science course was brought to the attention of others, the immediate reaction was: How do you have debate in a highly technical subject like computer architecture

and organization? From our experience, as computer science courses are enriched with creativity, powerful ideas, techniques, and theories, incorporating debate in computer science courses is easy and highly relevant.

Obviously, debate can be used to gain a deeper understanding of the important subject matters and big topics. The skills developed through such exclusive debates can implicitly help group works that are the norm in computer science projects. Debating is a dynamic process. First, it can be used to learn technical matters. Then, through the experience gained, personal and professional skills can be cultivated and enriched throughout the study period. For example, in computer science, designing, building, testing, and managing systems quite often involves group work. The debate processes could be effectively applied to execute these tasks involved in the courses.

#### A. Impact of Debate in CS Education

Since debate involves higher-order critical thinking skills such as defining the problem, building arguments, researching for evidence, assessing the credibility of sources, identifying and challenging assumptions, recognizing inconsistencies, prioritizing the relevance of multiple viewpoints, etc., its impact on overall development of cognitive and communication skills is evident [1]–[3], [9], [13], [14]. In addition to deepening the understanding of the subject matter, debate has the potential to enrich social skills such as receptiveness, respecting others' view, helping each other, convincing others, etc. Such social skills are valued as vital not only for success in most careers [12], but also for life in general [6], [10], [13], [15]. Therefore, we believe that the impact of debate on computer science education need not be different [6], [8], [15]. Though we have not collected any formal survey or feedback from the students who participated in the course debates, we did receive informal and anecdotal feedback. The reactions from the students were highly positive, confirming our initial belief.

When debate was introduced in Fall 2014 into our operating systems course, the initial reaction from several students were mixed; they reluctantly agreed. Some openly doubted its use in the computer science courses, particularly highly technical subjects like operating systems. For them, only social science students needed debating skills, and also only social science topics could be debated. Some wondered what kind of topics from core course like operating systems could be debated. Slowly, this nebulous feeling started to fade once they

started their research on the topics. The competitive nature brought enthusiasm among students about the idea of debating, and at the end, most students liked it. A few international students for whom English was their second language understood the benefits of debate, but expressed reservation due to their language difficulty. However, once debate became an integral component of some of our courses, it became one of the trademarks of our teaching style. Students now have accepted it and many explicitly appreciate the idea of debate and the technical report on the topic. Some even consider them as the main strengths of the course. In our view, debate not only helped students to enrich their skills and understand the topics deeply, it also left them with a positive memory about the experience.

#### IV. CONCLUDING REMARKS

Since its birth in the mid 1940s, computer science has grown as an attractive discipline encompassing science, engineering, art, business, and everyday life [4]. In the scientific domain, it has emerged as the “fourth great domain of science”, after physical, life, and social sciences [5], [6]. In the modern world, it is hard to imagine anything in our day-to-day life that does not touch computing in some sort. Computer science has all the motivations to be learned and engaged with.

As computer science has influenced and influencing the world in every aspect, it is also our responsibility to steer the world in the positive direction. That requires us to become better debaters as well.

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