Comparing the Effectiveness of Different Robotics Programs

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A Rookie's Account of Botball – Haochuan Ni

Being successful in any particular area requires the firm grasp of the core conceptual challenge. For example, the first computers required manipulation though cumbersome assembly language on punch cards, thus these machines were inaccessible to the average Joe. Now the proliferation of graphic user interfaces and software editors meant that everyone can create their own programs. Yet computer science, the science of solving problems through computer programming, is a topic that encompasses all programming languages. From assembly to PHP, the art of problem solving remains the same. Similarly, the challenges in math, science, and engineering hold for any robotics competition, including Botball and the FIRST Robotics Competition, or FRC.

However, Botball's lower scale competition and easily manipulatable parts promotes greater freedom for students as they pursue their solutions to this challenge. But this doesn't decrease the competition's intensity and competitiveness.

As a veteran of a larger scale robotics competition, FIRST Robotics Competition, I have prior experience in the math and physics behind creating a robot. The greater accessibility of Botball doesn't make it any less challenging; like FRC, Botball has its own set of technical obstacles that must be surmounted. For example, this year's game provides participants with a

plethora of possible game strategies to pursue, and each possible strategy may have an abundance of methods to execute it.

FRC's larger, more complicated robots require the close collaboration between students and adult mentors to create an effective design. As a result, the more experienced adults typically have greater leverage on the design and construction of the robot. While this restricts the students' freedom in pursuing their own ideas, it also allows them to learn the knowledge of building a robot without having to go through the process of trial-and-error. Conversely, Botball's modular parts such as LEGOs encourage the students to explore their concepts for themselves, and these parts give them more leniencies in learning through the trial-and-error method. Thus, these two competitions present different levels of involvement for adult mentors. Yet, despite these differences, adult mentors from both competitions play important roles assisting the students in creating a successful robot design.

Compared to FRC, prototyping and mechanical testing is much easier and more accessible in Botball. Because the latter competition involves machines made from modular toy parts, it is very simple to build and disassemble machines with little or no tools. With a few simple pins, a person can easily build a plow that can push game pieces around. I found it very easy to simply hop right in and start exploring the ideas that would bubble in my head about the competition after reading the rules. Costly custom-made parts of FRC robots limit the hands-on prototyping that Botball permits. As such, FRC requires a careful computer-aided design to prevent pieces of wrong dimensions.

The core objective of Botball, however, is the same as that of any robotics competition: engineering an effective design. Stock LEGO parts and easy construction makes this competition more accessible to the general public, but to create an effective design is a challenge that all

young engineers relish and take joy in tackling. Whether the building blocks are LEGOs or aluminum plates, the math and physics remain the cornerstones that define a successful robot.

From FRC to Botball, from Roomba to welded chassis, from snapping pins together to milling bars of aluminum, robotics promotes creativity and offers practical application of math and science outside of classrooms. Botball is an effective entry level robotics competition that captures the essential challenge of engineering while enabling newer, less experienced children to pursue their goals in science and technology.

A different approach to documentation – Brian Axelrod

One of the distinguishing features of Botball compared to FRC is documentation. In Botball there are three periods of documentation each requiring an average of three documents. These periods last 2 to 3 weeks.

The documentation is meant to ensure that the teams keep track of the evolution of the robot. However we have found that it does not ensure that for several reasons. One is that the prototyping friendly nature of Botball there are a great many designs tested and they are constantly evolving. This quickly grows into something that is hard to keep track of. Another major reason is that nobody wants to document instead of build, there is no motivation for most members to document. In the end the ones most likely to do the documentation are the ones that really want the team to succeed overall, rather than the average member which is interested in doing purely robotics.

Documentation is very important in the real world however, especially if one needs to reproduce a product. Since Documentation is so important in the real world Botball should still have documentation. One of the ways that Documentation would be better is if there were two

periods instead of three. Another possible solution is to have the final documentation due after the regionals, this way we would not only have time but we would also be documenting the final product.

References

Barak, M., & Zadok, Y. (2009). Robotics projects and learning concepts in science, technology and problem solving. *International Journal of Technology & Design Education*, *19*(3), 289-307.

Barker, B., & Ansorge, J. (2007). Robotics as Means to Increase Achievement Scores in an Informal Learning Environment. Journal of Research on Technology in Education, 39(3), 229-243.

Bers, M. (2007). Project InterActions: A Multigenerational Robotic Learning Environment. Journal of Science Education & Technology, 16(6), 537-552.

Callaghan, V., & Chernett, P. (1998). A Network-Centric Approach to Computer Science Education and ResearchBased on Robotics. Computer Science Education, 8(2), 100.

Chambers, J., & Carbonaro, M. (2003). Designing, Developing, and Implementing a Course on LEGO Robotics for Technology Teacher Education. *Journal of Technology & Teacher Education*, *11*(2), 209-241.

Sullivan, F. (2008). Robotics and Science Literacy: Thinking Skills, Science Process Skills and Systems Understanding. Journal of Research in Science Teaching, 45(3), 373-394.

Sullivan, F., & Moriarty, M. (2009). Robotics and Discovery Learning: Pedagogical Beliefs, Teacher Practice, and Technology Integration. *Journal of Technology & Teacher Education*, *17*(1), 109-142.

Verner, I., & Ahlgren, D. (2004). Conceptualising educational approaches in introductory robotics. *International Journal of Electrical Engineering Education*, *41*(3), 183- 383. Trajkovski, G. (2007). Robotics: a reference guide to the new technology. *Choice:*

Verner, I., Waks, S., & Kolberg, E. (1999). Educational Robotics: An Insight into Systems Engineering. *European Journal of Engineering Education*, *24*(2), 201.