

# **LEGO MINDSTORMS ROBOTS COMPETITION FOR WEST VIRGINIA K-12 STUDENTS**

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**Abstract** Since 2003 West Virginia University, WV Logan County School District and WVU student intelligent Robots Club has hosted the Lego Mindstorms Robots Competition for K-12 students for West Virginia High, Middle and Elementary Schools. This annual event is attempting to promote K-12 kids for MSET (Math, Science, Engineering and Technology).

In the past several years, this event attracted enthusiastic interests from k-12 WV schools. Every year there were more than 15 schools and 300 kids come to the event; they spent a whole day for competition, demonstration and tours of engineering and technology labs in WVU.

The event has caught attention from government education agents, private education foundations and industrial sectors. The sponsor pool of the competition has been growing up year-by-year, which includes the WVU, WV State Agency, Toyota Inc, Parallax Inc, WV Education department, WV Logan County School District, WV Tech Prep Foundation, Appalachia Education Lab and etc.

This event provide WVU students, particularly, the members of the students robots club, a great opportunity to serve the community and learn the skill to organize, promote and help k-12 school teachers and kids who are enthusiastic to learn new cutting-edge technology.

In this article, the short history, organization methodology and strategy, competition format, college student involvement, follow-up feedback and future plan will be discussed.

The next competition, The 6th Lego Robots Competition for High, Middle and Elementary Schools in WV will be held on May 2008.

### **Motivation from WVU**

In 2000 and 2001 summers, WVU professor, Dr. Wei Cao, as a NASA Research fellow, joined the Bus Tour with his NASA colleagues, which was aiming to promote science and technology for the k-12 kids in their early ages. The bus tour was a big success. The kids watched the shows conducted by NASA scientists and engineers, and did the experiments by themselves under the supervision of NASA bus crew. Those shows and experiments covered the wide range of NASA research projects, such as model shuttle launch, model wind tunnel, turbo engine experiment, satellite communication ground station and other advanced technology from NASA.

A particular Lego Mindstorms Robot show drew much attention from the kids. And the NASA colleague told the kids that this small robot is mimic version of the real robots sent to Mars. They both used the same scientific and technology principles. And that the Lego Mindstorms Robots was invented by MIT learning lab, which aims to teach the science and engineering principle for k-12 kids.

Dr. Wei Cao shared his experience with department chair, Prof. Tom Minnich, and other colleagues. All of us were moved by the success of the show and felt that for WV schools, which were very lagging behind in the dramatic changing technology age in many aspects, Lego Robots should be an excellent tool for promote MSET (Math, Science, Engineering and Technology) in WV.

### **Learn from Others**

We had learnt that many prestige engineering schools, such as Purdue, CWRU and Penn State, even brought Lego Robots into college curriculum. However, at that time, there is no any schools in WV had used Lego Robots neither for college curriculum nor for k-12 off curriculum activities.

Motivated by the prospective future we decided to bring the Lego Robots in the class and assigned a group of students using it as a project for microprocessor class in fall 2000. The project was a great success, which proved that Lego Robots was a powerful mechanism for promoting MSET for k-12 kids. And all of us were confident that we could move on to deliver this interesting and creative learning tool to k-12 kids using a competition format.

Through NASA colleagues, we found out that Lego Robots Competition had been adopted by many agents from other states. For example, since 1999, NJCate had used NFS funding to conduct the Lego Robots Competition in NJ area. It was heard that NJCate was preparing to recruit several schools around US to join the NFS project to further promotion. However, when approaching the organization committee in NJCate, we were told that the recruit was already completed in year 2000, which had picked up several schools as partners around US.

It was very disappointed at the beginning. However, after expressing the strong needs from WV kids and our enthusiasms to learn how to organize the competition with first hands experience; the organization committee invited Dr. Cao to join their competition in 2002 summer as a group co-advisor to work with a high school group. During the four-day event, Dr. Cao worked with high school administrators, teachers and students together and went through all the details from all the aspects of competition. That really was a great turning point to get competition started.

### **Rough Start and Success of 2002**

We proposed the first competition on May 2003 to WVU administration. And a \$1,000 WVU internal grant was awarded for the general expense of the competition. However, the obstacle was lacking of manpower for the while preparation. In order to overcome the problem, we decided to turn to students for help. He recruited and formed a project team, which made of interested students, some faculty members and staff. In order to honor those students, we decided to issue them community service credit for appreciation.

The enthusiasms from students astonished all the parties involved. Those students used their spare time to finalize the competition events and brought their own tools to build three completion boards in very short time, which included tracking lines, passing through woods and golfing game to be ready for competition on time. Later on, those students became the core of the then established Robots Club.

### **Motivation from Logan School District**

Ms. Peggy Vince, as the director from Logan School District had been involved in FIRST Robot Competition since year 1998. She played an active role to recruit high and middle school students, parents and industrial sponsors to team up and join regional and national FIRST events since then every year.

One thing bothered her most was that the FISRT competition was too expensive, each team needs \$10k for each year. Even many kids were jointed the fund raising for the competition, the complexity and heavy equipment involved had kept many younger students away from actual activity for designing and building the robots.

She was looking for some events, which can directly attract more students; provide the simplicity to allow them put hands-on. She believes that will make the great popularity possible among all ages of k-12 kids.

When the 2003 Lego Robots Competition in WVU for high and middle schools was announced around, Ms. Peggy Vince felt right away that it was a great opportunity she had been looked for a long time. She formed several teams from Logan School District and jointed the 2003 competition.

### **Success of 2003 and Team Up**

The 2003 competition was very successful and there were more than 15 schools and 300 kids come to the event; they spent the whole day for completion, demonstration and tour of advanced engineering and technology labs in WVU.

The success further boosted the enthusiasms from both WVU and Logan County School District. Since then all of us had worked together as a wonderful team to push this event to a new higher level year after year. In last 5 years, we have done the following things:

**(1) Enhance the sponsor pool:** The reputation of the competition was spreading around quickly and many schools, industrial enterprises, government agency and non profile organizations have jointed in as sponsors, such as WVU, Toyota Inc, Parallax Inc, WV State Agents, WV Education department, WV Logan School Distinct, WV Tech Prep Foundation, Appalachia Education Foundation and etc.

**(2) Encouraging the girl student participation:** The organization committee set up the rule, that each team must have 1-2 girl members. This mandatory requirement worked out very well,

some schools even had all-girl team and those girls competed with boys shoulder by shoulder with great enthusiasms and same level even better level of capability.

### **Students Organization play Critical Role**

In 2004, a group of enthusiastic students, the organization committee worked with WVU student government to establish the WVU Student Intelligent Robots Club. Since then, the member students of the club have played the critical roles and the whole competition relies on the student support more and more.

**(1) Handle the Routine of Competition** Our competition is free of charge and open for all the k-12 schools and kids. We have very limited funding to cover the food and other basic expense. All the people worked as volunteer base. Student of the Robots Club played actively in handling the routine of competition every year. They built the database, sent out the announcement letters, maintained the website, trained k-12 school teachers and served as judge and staff for the competition. Through those activities, the students have learnt many from organizing the event, team together and working with kids.

**(2) Training school teachers and increase participants base:** In each year, the organization committee of competition authorized the student robots club to offer twice training sessions for k-12 school teachers: one for spring semester and another for fall semester. School teachers will be invited to WVU campus and spent half of day or one while day with students and faculty to learn all the details to build and program Lego Robots. Those training increased the participation bases in great deal in the past years

**(3) Write special curriculum for middle school teachers and kids:** Based on the training experience, the student robots club members had realized that the teachers and kids, particular ly in the middle schools, they need some kind of well-written curriculum, which can help them during the school year. Working with teacher of St. Patrick Middle the members of the student robots club have developed a complete curriculum design project, which includes 10 lessons and labs. That new curriculum soon became a favor co-curriculum or extracurricular program among the middle schools.

**(4) Work with industrial sector:** During the past five years, the member students of the club have been worked with several industrial sectors that sponsor our competition. For example, the Parallax, which is a big player for educational robots, the Toyota, where the robots are used intensively, Appalachia Education Foundation Laboratory and others. Those cooperative experiences enhance those students' scope of real world cutting edge technology and make connection to the industry that will benefit our students with bright future.

### **Looking for Future**

The competition has been gone through many challenges and the organization committee has planed more in the future for k-12 kids in WV.

(1) We are going to add Stamp Robots into competition. Stamp Robots in higher level which will meet the knowledge level and interest level for high school senior students.

(2) We are going to invite more elementary school kids to attend the competition as observers, which will educate those young kids to gain the interest for MSET in very early age.

(3) We are going to add more social events for the competition day, such as swimming pool party, model airplane show and etc. We are going to make the competition day as an annual happy and merry day for all the kids.