

Start a Robotics Elective at Your School

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Desert Robotics: Teams 08-0083; 08-0086; 08-0087; 08-0088

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1. Robotics Program at Palm Desert Middle School

Palm Desert Middle School, located in Palm Desert in Southern California, has four elective robotics classes available to its 6th - 8th students:

Beginning Robotics: Two classes for 6th grade

Beginning Wheel Robotics: One class for 6th - 8th grade (Each quarter the students change to a series of elective classes including Beginning Robotics. This is for students that either haven't chosen a particular elective or want to experience more than one during the year.)

Advanced Robotics: One class for 6th - 8th grade

The elective classes are taught by Reggie Clark. Mr. Clark also teaches the ASB class. Palm Desert Middle School is part of the Desert Sands Unified School District. The school has offered the robotics elective classes for three years. There is also an after school class for the four Desert Robotics Botball Teams [3] coached by Linda Reynolds, Reggie Clark, and Jonathan Reynolds.

2. Development of the Program

The initial idea for the program came from a lunch meeting where the principal was introduced to Botball from another school. After seeing how the program works the principal at PDMS, Sallie Fraser, decided that she would like to have the Botball program at PDMS. The original idea was to set up an after school program featuring robotics, but limited funding made that impossible. Instead the idea was introduced to have robotics set up as an elective class available to all grades, 6th - 8th. Mr. Clark ran a Botball club after school so students could participate in the Botball Tournaments. Linda Reynolds, a technology consultant for Desert Sands Unified, helped with Botball. Now, there is a formal after school program funded by the City of Palm Desert which includes enrichment classes, including robotics, and curriculum tutoring classes for students at PDMS. Reggie Clark, Linda Reynolds, and Jonathan Reynolds coach the after school Botball team under the program.

In an interview Mrs. Fraser stated that the robotics program was chosen to replace an existing tech lab because she could see the end of that program coming. The lab was just too costly to operate and maintain and the students had lost interest in the tech lab. whereas, there was great interest in a robotics program. The tech lab was reduced from an original 5 sections to just two. Phasing out the old tech lab allowed the introduction of robotics as an elective class. The robotics electives were not decided upon by committee, but, rather, just through collaboration between the principal and teachers involved.

The development of the robotics program was driven by student interest. There was talk of just offering a GATE (Gifted and Talented Education) class, but then the decision was made to open the class to all students at the school that showed an interest. The only criteria is for the advanced robotics class. A teacher recommendation is needed to sign up for that class.

Mrs. Fraser feels that the robotics classes are one of the few pure GATE programs offered at the school because it affords the students total creativity while demanding total preciseness. It also is a ‘ Sky’s the Limit’ class because of the open-ended project approach. It also entails writing, thinking, math, science, and problem solving. The class follows the total design process allowing students to imagine, create, evaluate, and reinvent.

One aspect of the class that Mrs. Fraser loves is that some students on the shy side who might not normally come forward are given the chance to really shine. She stated that 95% of teaching is getting the message across to the students that “they can do it.’ In a regular class tied to standards, grades, and testing you lose some of the kids. But in robotics they have a chance because they do it on their own. There is no right or wrong answer, just learning.

3. Curriculum

Mr. Clark uses LEGO® NXT Mindstorms robotics kits for the elective classes. Curriculum comes from Carnegie Mellon University National Robotics Learning Center. They have curriculum for both middle and high school classes. You can find information about their program at <<http://www.education.rec.ri.cmu.edu/roboticscurriculum/>>.

The software being used at PDMS is the Robotics Engineering Volumes 1 & 2. These include “Introduction to Mobile Robotics” and “Guided Research.” (See picture 1)



Picture 1: Carnegie Mellon University Robotics Curriculum [2]

The program is quite extensive and includes a teacher's disk with lessons and worksheets. There are also other software programs available from Carnegie Mellon for classroom instruction. The lessons cover appropriate curriculum standards:

Math

Diameter, Circumference, Angles, Graphs and tables, Linear relationships, Scaling and models, Ratios & proportions, Unit conversions, Averages, Boolean logic, Spatial reasoning, Patterns

Technology

Purpose of technology, Technology relationships, Systems, Design tradeoffs, Troubleshooting, Sensors, Performance, Boundaries, Mechanical elements, Controls

Science

Hypothesis & evidence, Experimental design, Observations & predictions, Data analysis & acquisition, Measurement, Error analysis, Amplitude and frequency, Light and reflectivity, Color and perception, Spatial graph model, Ultrasonic waves, Speed, distance & power

Communication

Brainstorming solutions, Reasoning with evidence, Explanatory composition, Documenting processes

(Excerpts from the Carnegie Mellon Robotics Academy site [1])

4. Plans for the Future

Next year the school will continue to support the robotics elective classes. To make room for all of the students wanting to be in robotics, the after school program will be split into two groups, Beginning Robotics and Advanced Robotics. This will allow students who are interested in both robotics and other electives, such as Band, to still be a part of the program. The Beginning Robotics class will include basic building and programming but with a focus on other activities related to robotics. These would include web design, animation, multimedia, presentation, and computer graphics.

The after school program will still feature Botball and the elective classes will be a more general introduction to robotics using the Carnegie Mellon software with the NXT controllers and incorporating Interactive C and the XBC controllers. (Great use of old XBCs and Handyboards.) The school has already registered 4 teams for next year's Botball program. Along with the teams from another middle and high school, this brings the total Botball teams for Desert Robotics to seven. The principal wants to have two girls teams next year, so recruiting them will be a priority.

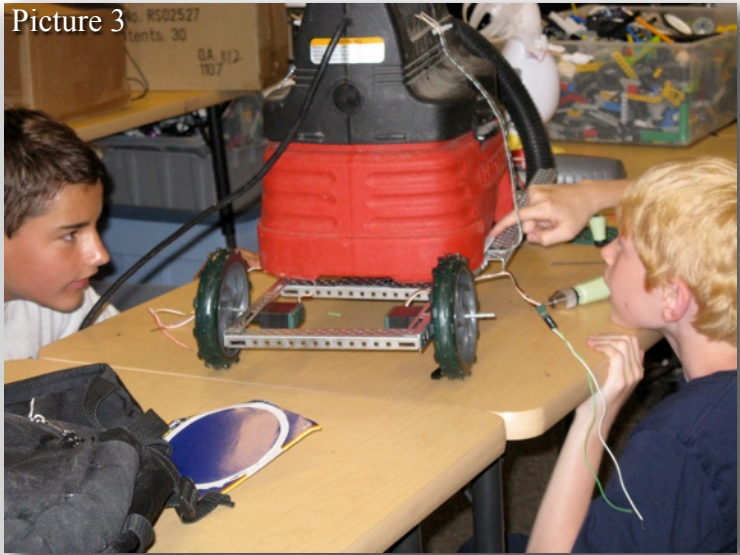
4. Class Environment

Mr. Clark's elective classes are a busy place. Kids are all over working on independent projects along with the class curriculum. There are robots of every kind everywhere. Containers full of LEGO pieces dot the room while large storage bins with sorted LEGO stand near the entrance. To actually explain the room, you have to see it, so below are some candid shots of the room with a short explanation of what's happening:

Picture 2



Picture 3



Rex works on his LEGO vacuum system (Picture 2) and then gets some input from fellow student Parker. (Picture 3)

Picture 4



All kinds of storage containers are used to store the LEGO pieces, the Create bases, and the controllers. The bins (Picture 4), house the LEGO and the shelves (Picture 5) is home to the Create robots in progress.



Picture 5



Picture 6



Picture 7

Behind the white boards there are shelves for storage (Picture 6) and below them are locking cabinets for student robots. (Picture 7)



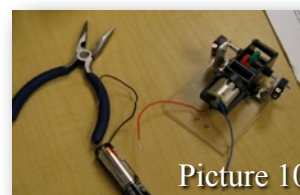
Picture 8



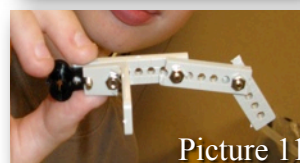
Picture 9

There are also many different types of robots in the classroom. Students can do independent research and learning projects with these. The four legged robot is a big favorite with the kids. (Picture 8). Many kids have their own private projects. Parker (Picture 12) is working on building a robotic hand. He is drilling holes in the plexi-glass to mount the fingers. (Picture 11) He had to assembly a battery pack (Picture 10) and wire the hand to work with a toggle switch.

To keep all the LEGO organized is a big job. The kids work at it, but sometimes we just need some help. Volunteers come in to help sort and organize. (Picture 9)



Picture 10



Picture 11



Picture 12

5. Comments

Students:

As I started robotics I was very interested in Math and Science, and throughout the year I wanted to learn more and more. I was set to be the Builder because I seemed to be very good at figuring out problems. What I did was not just to put LEGO together, but to design a fully functional robot that had to withstand pressure and anything else it had to deal with. The programmer mostly had to deal with programming, but programming the XBC is no laughing matter. Instead of putting already built programmed blocks, we had to deal with programming from scratch and write out the whole code like writing an essay, but in numbers. I would have to say this was one of my greatest choices in life so far.

Robotics has been a fun elective. It taught me teamwork, engineering skills, and leadership.

Robotics has been a very fun experience for me. I made many new friends, and the experience taught me a little self-discipline. There have been many great experiences along my time in Robotics, and I'm glad I chose this and not computer science.

I've benefited from the program in many ways. I've learned team work. Robotics has made a difference in what I have decided to do in life. It helped me narrow down my choices of career paths. Now it will be something in computer engineering or software design. Being in robotics helped me to get into a private high school.

Team Coach: In the after school robotics class, students are building, block--by-block out of hundreds of pieces, robots that are only limited by their imagination, determination and programming. These two things, robots and LEGO, though being created for fun, as well taking on challenges in competitions, also have the secret side effect of learning and teaching. Not just on how to build, program, or strategize, but to work together on a team, learning from each other, the successes and the failures. Both of these are equally important, however sometimes the failures more so; the finding out how and why things went wrong, it gives added incentive to work harder next time. Also, the outcome or the result of all the work done is sometimes less important than the journey to get to that point. All the lessons learned along the way, though the accomplishment of having a robot do what you programmed and built it to do is also very satisfying. Building robots in the end works on both the logical side and creative side of learning, both are needed to make a successful robot. There are no real guides on how to build a robot to accomplish all the tasks for the competition. While building and programming one must find out what are the best goals to go for and how to accomplish them. Keeping in mind the motto or basic guiding principle to 'keep it simple' makes the process of robotic work more focused, and more on how to be able to do something and do it well, than going after the other goals.

6. Conclusion

From all reports, the robotics program at Palm Desert Middle School has been a huge success. Botball was a big factor in starting the program and we plan to have many more students participating in the years to come. Maybe you can start a robotics elective program at your school. It may be a big undertaking, but the benefits are great.

Bibliography

1. Carnegie Mellon University Robotics Academy: <<http://www.education.rec.ri.cmu.edu/roboticscurriculum/>>
2. <http://www.education.rec.ri.cmu.edu/previews/nxt_products/robotics_eng_vol_1/rob_eng_1_prev.gif>
3. <www.botball.org>