Evaluation of the Robot Competition

Aimhigher Lincolnshire & Rutland

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Robot Competition 2005/2006 - Activity Evaluation

1. Activity description
The Robot Competition is an activity offered to some schools in Lincolnshire and Rutland and it involves teams of young people (mainly girls in Year 9/10) designing and building robots, which they then enter into a competition at an end of project event.

The Robot Competition has certainly developed in its second year of operation. Last year six schools in Lincolnshire were engaged in the activity, whilst this year fourteen schools have successfully participated, which means that 84 young people have benefited from this Aimhigher funded opportunity.

Initially, eighteen schools (including four pupil referral units) displayed interest in the Robot activity, with fourteen committing to running the initiative in their institutions in 2005/2006. From the participating schools, fourteen teams (each made up of six young people) were established in November 2005 and the project was due to end in July 2006. The competition event, which in 2006 was held at the RAF Waddington Air Show, signifies the end of the activity

2. Activity aims and objectives
The aim of the Robots Competition is to raise the awareness of participating young people in relation to engineering opportunities, and primarily seeks to encourage females into engineering.

It was hoped that at least 12 schools would participate. In fact, 14 schools have produced teams (and robots!) in 2006.

3. Activity operation
Key to the smooth running of this project is the co-ordination by the project worker and the involvement of two external engineers who separately visit each team (totalling 8 visits per team between them) to assist with the project planning and management and with the actual building of the robots. A visit is made to each team once a month and each visit lasts between 1-2 hours.

Role of the external engineers:
Visits from the engineer consultants involve the following elements:
- Taking in a completed robot for the pupils to see
- Producing a list of components from which each team chooses the parts they want for their robot
- Ordering and delivering the chosen components to each team
- Explaining competition criteria – i.e. robot weight limits, size limits
- Explaining event specification – i.e. the gradients of the ramps that the robots will need to climb.
- Discussing design principles – asking questions of the teams, working with them to translate their ideas into designs, and then helping them with the technical realisation of their ideas.

Each engineer gives his contact details to the participating teams so that the teams can contact them if necessary in between visits.

One of the engineers is also an Aimhigher project worker. He plays a supporting role to the teams from an engineering point of view, but he also has responsibility for much of the project organisation, co-ordination and management. This involves him setting up visits to the schools, talking with them about what their needs are, liasing between the schools and the main engineer, sorting out component shortages, and co-ordinating the Robot Competition as part of the RAF Waddington Air Show.

Role of the schools
Each school must supply a named member of staff who will be responsible for the project.

Once the engineers have approved the basic robot design, the schools then follow a schedule as outlined below:
- Decide what parts they will need
- Order parts
- Once the parts are delivered the building of the robot commences
- Once completed the robots are tested
- The robots compete at the competition event

4. Method of evaluation
The researchers visited three participating teams (two of which were based at the same pupil referral unit, and the other that was based at a school). The research team made two visits to the pupil referral unit and one visit to the school. Both sites had run the Robot Competition last year as well.

Pupil referral unit context
The pupil referral unit works with young people that have either been excluded from school or are at risk of being excluded. Those that have been excluded attend the unit on a full-time basis, and those at risk of exclusion attend on a part-time basis. A number of the full-time students had formed one team, and a number of the part-time students had formed another team (representing their mainstream school – although all work on the project was conducted whilst at the PRU). The students have a mixture of behavioural, academic or SEN (special educational needs) issues. The students work with staff on a number of 'hands on' projects such as building workbenches, boats, kit cars, etc. The Robot activity is incorporated into the unit's weekly programme, rather than being run during lunchtimes or after-school. During the evaluation visits interviews were conducted with three members of staff and focus groups were conducted with six of the participating students (all male).

School context
The school visited as part of the evaluation is an 11-16 school with approximately 300 pupils, which is situated in a rural coastal area with an extended catchment area that includes Cleethorpes, Grimsby and Mablethorpe. The Robot activity is run during lunchtimes. The research team interviewed the school's Aimhigher co-ordinator and conducted a focus group with five of the participating Year 9 pupils (3 male and 2 female).

As well as visiting three of the fourteen participating teams, the researchers conducted telephone interviews with both external project engineers.

5. Positive outcomes of the project:

Benefits experienced by participating students include:

- Improved team working skills – evidence that some had learnt to interface better with and support other team members.
- Improved commitment – evidence that students were persevering and 'seeing a project through' where they had not done this previously.
- All students talked about how proud they felt in relation to what they had achieved so far – i.e. designing and building a robot from scratch.
- Extension of their technical knowledge – metal work, electronics, etc.
- Students at the school expressed that they liked learning more informally and in a smaller group than usual.
- All students spoke positively in regard to the fact that they have a real say over the robot design.
- The project has given all teams the opportunity to interact with and compete against other schools. All students were looking forward to the competition event, and saw it as a chance to show off their robots. This opportunity was seen as being particularly important for the students from the PRU as the event affords them the chance to mix with the public (both adults and young people) in a positive context.
- For the PRU students, the fact that they won two of the three trophies in the first year of the competition had given them a sense of pride and achievement, which had transformed into a positive 'reputation' that they were keen to keep. The desire to keep this reputation became a driver for their participation this year.
- Whether they win in the competition or not, each team has produced a robot which they can take back to their school post-competition. This concrete output as a result of the project demonstrates the progress made by the teams.
- Other implicit learning takes place through the activity's process. The PRU staff described this as 'stealth learning'. For example, the students develop their maths skills when they are measuring, conducting trials to see how long batteries last, etc.
- Staff talked about how involvement in the project had aided students' concentration. They had seen that the students had learnt how to think processes through better.
- Students get to understand the full process of building a robot from design to competition. They experience all the constituent parts of the process. As a result the majority of students see that engineering can be useful and fun.

Wider positive impacts of project:

- The engineers reported that at the beginning of the project many pupils (especially female students from rural areas) said that they were happy to take up retail work in local shops on leaving school. However, at the end of the project, the majority of these same students were saying that they were now thinking about going on to college.
- Project engineers stated that the main aim of Aimhigher is to encourage people into HE, and they said that this project is tackling an important stage of education that potentially paves the way for students to see HE as an option in the future. They saw one of the main roles of the project to get pupils who are sitting their GCSEs to consider going on to college as a next step. The Robot project appears

to be an input that contributes to students wanting to progress on to FE, as highlighted by one student 'I'm not sure if I want to go on to do engineering but I've now decided that I want to go onto college to do construction'. The school and PRU staff and the engineers felt that the Robot Competition has turned out to be an inspiring project for many of the young people. It was suggested that participation has opened up the thinking of students who would not have thought of doing anything practical, or on a design side, in relation to future avenues. It was suggested that this project has helped them to think outside the box; it has encouraged them to think about design work and some of the girls have even made links between designing a robot and designing clothes. It has inspired some participants to consider options beyond those they were looking at before.

- Students felt that working with the engineers, as external adults who were not teachers, was a valuable element of the project. It was felt that the engineers were positive role models and made the students take the activity more seriously.
- The competition element was seen by all as being crucial to the project. This element provided the opportunity to take students 'out' of their usual contexts. This was seen as a good way to broaden the students' experiences (a mixture of aspiration raising and informing students about what opportunities are out there). All the school staff that we spoke with and the engineers felt strongly that the competition element is what adds value to this project. The fact that the building of the robot is for a purpose (i.e. to compete and to try to win) provides extra motivation for the majority of students.
- Both the school and the PRU found Aimhigher's provision of resources, expertise and organisation in relation to the competition event invaluable.
- For the PRU in particular the project produced added value because the activity was embedded in their day-to-day practice, rather than being seen as an additional extra curricular project. This project is especially good for such schools as it is important for the students to see tangible results quickly so as to keep them motivated and the Robot competition project fits these criteria. The PRU had also felt that other Aimhigher activities were not suitable for their students, either because the projects were too long term or simply not appropriate for their students.
- One of the reasons this project is popular and successful with students is because all participants are excited and enthusiastic about the activity. All the students we spoke with had a clear understanding of what the project is trying to achieve and were able to competently communicate what they were working towards. It was also evident that the Robot Wars' TV profile had been a motivating factor for most students.
- All the students and staff we spoke with said they have enjoyed being involved in the project and described their participation as a very positive experience.

6. Issues for consideration

- Targeting students has been quite difficult in practice. The engineers felt that some schools had assembled a team of female participants (Aimhigher's main target group for this project), but when the engineers asked some of the participants what they wanted to do post-16, many expressed interests in hairdressing, health and beauty, and languages, and were explicit in showing no interest in exploring engineering as a potential progression pathway. The engineers felt that where this was the case, the Robot project becomes more of a superficial activity, and the wider impact is lessened. The engineers preferred to work with students (male or

female) who showed some interest in finding out more about engineering and its potential in relation to further education and career paths.

- Schools have fed back that sponsoring a team of boys and a team of girls from each school would have provided some internal competition and increased the drive and motivation in participating students.
- Pro-active management by the schools/PRUs appears to increase benefits for the participating students – i.e. encouraging and supporting pupils to manage the meetings, take minutes, write letters, order parts, etc. is important as learning is implicitly incorporated into these activities. Also, having to make a robot from scratch involves the use and development of many key skills (including Maths, English, IT, science) and the majority of students are improving these skills whilst participating in this project. However, it was noted that good and regular project facilitation by an adult (usually a teacher) is key to these benefits being maximised. There were also examples of the engineer making monthly visits and then returning 4 weeks later to find that no progress had been made. This was felt to usually be down to the teacher in charge not having the time to spend on it – either because they were off sick, or were given more pressing priorities to attend to like exam preparation/invigilating. Ultimately, the success of each team is due to how much time, how knowledgeable and how committed the teacher involved is.
- At present the project tends to end with the competition event, with certificates of participation presented to each student at the show. The engineer suggested that it would be useful to hold a follow-up meeting with each team post-event to find out what the students liked and disliked, what they have learned, etc. It was also felt that a formal reflective session at the end of the project would be a useful way to formally acknowledge what skills have been developed through the project process.