Children Learning From Team Robotics:

RoboCup Junior 2000

Educational Research Report

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Abstract

RoboCup Junior (Jr) is a division of the international RoboCup initiative. It involves children participating in various competitive and cooperative robot challenges. Experience at three international venues shows that these challenges generate great excitement and interest from both children and adults. We question whether there is any educational value in these challenges, and this report presents results of a study we conducted in conjunction with the third international event – RoboCup Jr 2000. Our tentative conclusion is that there is enormous educational value for children involved in team robotics, both academically and in terms of their personal development.

1 Introduction

It seems self-evident that we must educate our children to understand the technological world in which we live. One technology that is becoming widely applied across many domains and in many subtle forms is *robotics*. Most of our machines and computer systems are getting "smarter", and as they do, the distinction between them and the robots of science fiction lessens, in the eyes of the observer. Indeed it may be difficult for an outside observer to distinguish the real mechanisms engaged for controlling robots, the materials used, etc. from fantastic images already implanted in his mind. This has been described as the frame-of-reference problem in autonomous agent design [Pfeifer and Scheier, 1999, pp. 112]. Today, many instances of automation (also in the form of robots) are rapidly spreading throughout our daily life, and it is growing increasingly important that the average citizen becomes comfortable with the notion of interacting with robots. Our view is that the more society and our children know about robots and technology, the better.

The RoboCup (www.robocup.org) initiative, founded at the International Joint Conference on Artificial Intelligence (IJCAI) in 1997 by Hiroaki Kitano, is an international effort whose purpose is to foster artificial intelligence and robotics research by providing a standard problem where a wide range of technologies can be integrated and examined [Kitano, 1997]. The ultimate goal of RoboCup is to produce, by the middle of the 21st century, a team of fully autonomous humanoid robot soccer players capable of winning a soccer game against the (human) world champions. A similar, but much less demanding, artificial intelligence landmark was passed in 1997 when IBM's Deep Blue computer defeated world champion Gary Kasparov at chess. RoboCup differs significantly from computer chess – agents act in a real-time, dynamic environment, where decisions must be made with incomplete information, control of various components may be distributed and communication between agents is an important factor.

While the RoboCup initiative serves the research community, at the same time it provides an understandable and approachable environment for bringing discussion of robotics technology to the level of the lay person. Such is the focus of the international RoboFesta movement, which started in Japan in 1998 (www.robofesta.net, www.robofesta-europe.org). RoboFesta puts forth the belief that it is necessary to be pro-active in making children – and society in general – comfortable with science and technology, by making technological subjects exciting and attractive through organised, approachable robot games.

In Paris, at RoboCup-1998, Henrik Hautop Lund introduced the notion of *RoboCup Jr* and demonstrated robot soccer players embodied in a simplified and familiar – LEGO – platform [Lund et al., 1999]. Since then, three official (and a number of unofficial) events have followed where children have participated in robot games. The first was in Stockholm in 1999 when Lund *et al*. tested their LEGO-based robot soccer game [Lund and Pagliarini, 2000]. They developed a special electronic soccer ball that emits infrared light and can be seen by LEGO robots more easily than the flourescent-colored balls typically used by the senior RoboCup leagues.

Figure 1. Autonomous football-playing robots

Subsequently, another RoboCup Junior event was held in Amsterdam in May 2000 [Kröse et al., 2000]. Nearly 60 children attended a one-day workshop where they formed teams and, using LEGO robotics equipment and computers for programming, designed and created soccer robots. Although the children knew nothing about the LEGO robotics system at the start of the day, they quickly learned how to program sequences of high-level commands, such as making their robot 'chase the ball'. By lunchtime, the children had working hardware and software. In the afternoon, a competition was held, and by the end of the day, prizes were distributed to the champions.

The atmosphere in Amsterdam was electric, but one could not help asking: "what are these children learning from this activity?" It would be too easy to say that, because they are interacting with technical things, they are learning something worthwhile.

Yet this has been the conventional wisdom as children use computers. Computers are an important part of our world: *true*. When children do anything with computers they are learning about them: *true of some things and not of others*. Therefore, every moment that children spend with computers has education value: *false*. In her recent book, Jane Healy [1998], a specialist in educational computing, suggests that no more than 10% of the available software for children has any educational value.

In this report, we question the same "obvious" relationship between robot games and the possibility of any genuinely useful educational outcomes. We present results of a study conducted at the first international RoboCup Jr tournament, which was held in Melbourne, Australia in September 2000, as part of RoboCup-2000. About 40 teams of children, 8 to 19 years old, participated in three robot challenges. Like Amsterdam, Melbourne too was electric, and some of the entrants were stunning, especially the newest challenge – a creative "dance" program.

Figure 2. Children with their dance robots

We interviewed twelve of the teachers who entered teams in the tournament in Melbourne, with the goal of investigating the educational value of RoboCup Jr. Based on their responses, we make observations and tentative conclusions. Our conclusions are tentative because first, twelve is a very small sample, and second, the sample is biased based on how the respondents were selected – the respondents were teachers who believed in the initiative because they chose to enter the tournament. In addition, this particular group of teachers was heavily biased towards high technical competence – most teach science and/or technology curriculum; several have degrees in engineering.

However with these caveats, we believe our results show that a robot competition can have very high educational and personal development outcomes, as well as fulfil requirements of local curricula. These results may extend to robot competitions other than RoboCup Jr, as discussed in section 5.

2 Background

In 1994, Tom Snyder wrote:

> No matter what we do, a huge infusion of technology is coming to education. It doesn't matter if it works or not, whether we make mistakes or not. It's coming because so much money is behind it. And because that infusion of technology is inevitable, it would be nice to start adding some new perspectives about technology in the schools. It's just possible our decisions about technology in schools are not being guided by the instincts of our best teachers. Right now, we run the risk of being blinded by science. [Snyder, 1994]

More than twenty years ago, Seymour Papert linked technology with Jean Piaget's *constructivist* theory of education to produce LOGO (or "turtle geometry"), a simple programming language that allows young students to learn geometry through computer-aided exploration. Papert published these ideas in his book Mindstorms: Children, Computers and Powerful Ideas [1980] and introduced the notion of

constructionism – which states that children learn best when they are actively involved in building something that is meaningful to themselves[1].

Coincident with the introduction of LOGO, the birth of home computers spawned a burgeoning market for educational software. Subsequently, personal computers were purchased for use in most schools, and educational technology began to infiltrate the majority of classrooms. Today, schools are being networked at a rapid rate, giving teachers and students direct access to the World Wide Web.

Yet despite all the vast and varied hardware and software introduced during the last two decades, the order of magnitude improvement in student performance that many expected as a result of integrating technology in the classroom is still not evident. There are many reasons for this shortcoming. Some believe that the educational software has exploded too fast, without enough pedagogy behind the software or developmental psychology supporting schools' technology integration decisions [Healy,1998]. As well, "once [net] connections are established, many teachers find a shortage of quality software tools and curricula to make use of them." [Bruckman,1997] And there are also practical issues: "computer software and hardware become obsolete every 30 months, too swift a change for most schools to handle economically." [Gonzalez,2000]

Most learning systems have not been successfully deployed in practical environments, in spite of expensive resources and years of research. Kinshuk and Patel [1997] cite two primary reasons for this failure: (1) the underlying methodologies for developing most learning systems were not designed from an educational viewpoint, and (2) the development of most learning systems has left out the needs of teachers and students. Anderson, *et al.* [1995] agree, stating that their extensive efforts building intelligent tutoring systems were too focused on their own needs as researchers, and they made no attempt to address the curricular needs of teachers.

Yet no one is ready to admit defeat while the powerful allure of a successful marriage between technology and education looms. "Children assimilate information and acquire skills with astonishing speed when playing video games. Although much of this gain is of dubious value, the phenomenon suggests a potent medium for learning more practical things." [Brody,1993]

Or, as Eliot Soloway wrote, "Oh, if only kids were as motivated in school as they are in playing Nintendo." [1991] Many believe that the secret to education is motivating the student. Researchers in human learning have been trying to identify the elements of electronic environments that work to captivate young learners. Thomas Malone conducted comprehensive studies in the late 1970's and early 1980's and outlined several key factors that make electronic games intrinsically motivating. These are challenge, fantasy and curiosity. Challenge involves games having an obvious goal and an uncertain outcome. Fantasy, particularly intrinsic fantasy, involves building the educational task into the game so that the skills being learned are an inherent part of the game's fantasy. Curiosity involves "novel and surprising" elements, both sensory and cognitive. Additionally, Malone states that interaction with other humans contributes positively to students' motivation. [Malone,1981]

Meantime, Howard Gardner put forth his "theory of multiple intelligences", which describes each human mind as a unique combination of talents expressed across a wide range of cognitive spheres. His book Frames of Mind [1983] has been extremely influential in the field of education and has helped drive the trend in classrooms toward teamwork and projects that encourage and motivate different children with different needs.

It appears that RoboCup Jr may bring together many of these ideas. The involvement of classroom teachers helps integrate the initiative effectively into curriculum. The motivational aspects of challenge, fantasy and curiosity are neatly encompassed in the robot soccer game. The emphasis on teamwork allows children with a variety of interests and abilities an opportunity to pick their own challenges while contributing to the progress of the whole. The results presented in this report show that these goals – identified through research into the current and historical state of the integration of technology and education – may be successfully met through the RoboCup Jr initiative.

[1] In the robotic context, the notion of guided constructionism was introduced in educational robot soccer projects [Lund, 1999].

3 Sampling, bias and generalisation

RoboCup Jr 2000 was advertised in newspapers and by word of mouth. It was also propelled by two very active and supportive local community members: Brian Thomas, a high school science teacher and local chair of RoboCup Jr 2000, and Heather Safstrom, a local supplier of Educational LEGO. The pool of teachers from which we selected the sample presented here is obviously very biased, and they may be more technically competent, energetic and adventuresome than most. The best teachers will be good teachers under any circumstances, and we must be careful of any claims we make from our responses. Thus, our sample was selected from what we believe to be a very biased subset of the population of all teachers.

The selection of the teachers to be interviewed was quite opportunistic. Before we began, we had a list of all the teams entered and their teachers. During the two days of the tournament, we approached teachers when they were not busy with their teams and asked them to be interviewed. The interviews took about forty minutes each, so if a teacher told us their team was competing in twenty minutes, we did not interview them at that time. Sometimes, this meant forfeiting an interview. So the guiding principles for selecting the teachers were that we could find them in the crowd and that they were available. In this respect, we have no information on how representative these teachers were of all the teachers at the competition. However, it is worth noting that of the 13 schools who had teams participating in the soccer challenge, we interviewed teachers from 9 of them.

The results of our study are thus too limited to generalise. We do not know if the events observed in Melbourne would apply to New York, London, Tokyo or anywhere else. However we can still obtain useful systematic knowledge from our study and can use the process and results as the basis for continued examination in future – as we intend to investigate related events in New York, London and Tokyo, and other places around the world.

Although the results do not necessarily generalise to all other teachers all over the world, they show that team robotics had certain characteristics for our special group of teachers and students. There is remarkable consensus among the teachers, and this suggests that there may be some underlying trends that may generalise over a larger, more comprehensive sample.

Finally, we note that certain systematic trends were observed from this biased sample in Melbourne. If these trends generalise to other places, this could be a very important result, and so suggests the need for further research.

Figure 3. Robot sumo: the robots compete to find and occupy the dark circular area.

4 Results

For the purpose of this paper, and given the nature of our data, we give a brief overview of the responses in Table 1.

subject number	1	2	3	4	5	6	7	8	9	10	11	12
number of years teaching	**2**	**n/a**	**15**	**n/a**	**15**	**32**	**26**	**12**	**3**	**20**	**32**	**10**
gender	**F**	**F**	**M**	**M**	**M**	**F**	**M**	**F**	**M**	**M**	**F**	**M**
1. RoboCup preparation:												
• in school	**N**	**N**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**N**	**Y**
• outside school	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**?**
• part of curriculum	**N**	**N**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**N**	**Y**	**Y**	**Y**
2. Educational value of RoboCup Jr	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**0**
3. Will you compete next year?												
• locally	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
• International	**?**	**?**	**Y**	**Y**	**Y**	**Y**	**0**	**0**	**Y**	**Y**	**0**	**Y**
4. Is robotics already in your curriculum?	**N**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
5. Influence on behaviour of children	**0**	**?**	**Y**	**Y**	**Y**	**?**	**Y**	**Y**	**?**	**Y**	**Y**	**?**
6. Influence on other schoolwork	**?**	**0**	**Y**	**Y**	**Y**	**Y**	**Y**	**?**	**Y**	**?**	**Y**	**Y**
7. Influence on teamwork	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
8. Motivation	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
9 Skills learned:												
• academic	**Y**	**0**	**0**	**0**	**Y**	**Y**	**Y**	**0**	**Y**	**Y**	**Y**	**0**
• personal development	**Y**	**Y**	**0**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**0**	**Y**

Key: **Y =** yes (positive), **N =** no (negative), **?** = not sure, **0** = no explicit answer, **n/a** = not applicable

Table 1. Overview of the responses

The data in Table 1 is abstracted from the transcripts of the interviews contained in appendix B. From this fast and incomplete analysis, we make the following observations:

- **Most of the teams worked both inside and outside the classroom.**
- **In most cases, some form of robotics was already part of each school's curriculum.**
- **Less than ten percent of the participating children were girls, but most teachers surmised that expansion of the dance challenge may encourage girls in future.**
- **It is speculated that RoboCup Jr may help with numeracy and literacy.**
- **All of the teachers would like to compete locally next year and most would like to participate internationally (although budgets will naturally limit this).**

Additionally, we draw several tentative conclusions:

- **All of the teachers thought RoboCup Jr had educational value.**
- **About half of the teachers thought the children who participated behaved better during their preparation for the competition than they did during other classroom activities.**

- **Most teachers thought RoboCup Jr was helpful in other areas of their students' schooling, although some related concern expressed by a few parents and other teachers about time taken away from other lessons in order to prepare for RoboCup.**

- **All of the teachers commented on the beneficial lessons in regard to teamwork resulting from their students' participation in RoboCup Jr.**

- **All of the teachers reported that the RoboCup Jr competition itself was a motivating factor, particularly because: it is an international event, it imposes an absolute deadline and it gives children an entry-level role in the complex and stimulating field of robotics research.**

- **Most of the teachers thought participation in RoboCup Jr helped their students improve their technical skills.**

- **All of the teachers thought participation in RoboCup Jr contributed positively to the personal development of their students.**

Figure 4. Creativity and teamwork: major components of RoboCup Junior

5 Discussion

More than one of the respondents in our survey commented that the international context of RoboCup Jr, and the fact that the young entrants participated alongside the senior competitors – some of the top robotic scientists and engineers in world – was a tremendous motivating factor for them and their students.

Currently RoboCup Jr is LEGO-based and attempts are being made to develop other platforms that are also suitable for school children. Some teams used LEGO without modifying it in any way, others made considerable mechanical and electronic developments of their own, including spinning mechanisms for kicking and non-standard sensors.

In Melbourne, most of the participants were boys; indeed, less than ten percent of participants were girls. No girls attended the robot soccer or sumo tournament (though a few helped the team prepare at school but were unable to attend the tournament). Girls did participate in the dance challenge, which was restricted to primary age children (12 years and under). This increased participation could either be due to the creative nature of the dance challenge, the younger age group, or both.

Today it is generally accepted that girls and boys are different. However, we do not think that these differences should necessarily mean that boys do robotics and science, and girls don't. The dance challenge in Melbourne showed that (at least younger) girls will engage in robotics, and they appear to extend the field into creative areas which boys do not. We would like to develop and encourage this direction. Without doubt, some of the most creative and innovative aspects of RoboCup Jr 2000 were exhibited during the dance challenge.

Based on the experiences with RoboCup Jr and interviews with teachers, it is difficult to assess what components of the RoboCup Jr project are essential for educational success. Indeed, we may speculate that the results obtained with RoboCup Jr may transfer to other educational robotic projects, e.g., some of the robot games in the RoboFesta event. Here we mention the FIRST LEGO League (FLL) (www.legomindstorms.com/fll/), since this competition is already engaging 10,000-20,000 children especially in the USA, as well as Singapore, China, Denmark and Norway.

A comparison with FLL is compelling, since both RoboCup Jr and FLL have (thus far) used the same hardware platform, LEGO MINDSTORMS. While we cannot conclude as yet whether the use of specific hardware and software tool plays a major role in the results obtained, we can compare these two robot projects which use the same platform. The 1999 FIRST LEGO League Survey Feedback [Lund and Pagliarini,2000] provides numbers that seem similar to those obtained here, namely:

- 97% of coaches said FLL increased children's interest in science and math
- 95% said FLL provided information to children about careers in technology fields
- 77% of FLL teams were formed as an extra-curricular activity
- 12% used FLL to teach the following curricula: science, math, writing, reading, history, social studies
- 24% of those who used FLL to teach curricula also used it to teach other "soft skills" (e.g., time management, public speaking, group dynamics, computer science, engineering, technology)

Hence, we should be cautious when interpreting the results of the present study. The results may indicate that educational robotic projects with appropriate construction toys can be highly educational, rather than indicating that the RoboCup Jr task itself is the essential ingredient for achieving educational benefits. Some of the aspects shared with FLL are that both projects use a specific construction toy and involve easy-to-use programming environments. As well, both centre around friendly but competitive events that offer motivational factors such as deadlines and opportunities to share technology with others.

One element that RoboCup Jr provides over FLL is the fact that it sits at the entry-level to the senior division of the overall RoboCup initiative. Several teachers commented on the value of sharing the venue between junior and senior leagues. The experience of attending a high-quality, international research forum served to introduce the students to possible career paths and showed them directions that they might not otherwise see until (at least) partway through their undergraduate education.

Finally, we note that the enthusiasm and positive outcomes we present here may be a manifestation of the "Hawthorn Effect". In its simplest form, this means that intervening in a social system can in itself produce positive changes, because the people in that system may be encouraged by the extra and unusual amount of attention they are receiving. The term comes from a socio-economic study of the Hawthorn Plant of the Western Electric Company in the 1920's-30's when researchers observed an increase in productivity amongst workers, which might be explained by the fact that the workers liked being studied [Mayo,1945]. In the present case, the Hawthorn Effect may underlie the positive outcomes reported by the teachers: the unusual attention and extra resources experienced by the children might in themselves have been responsible for the positive outcomes.

6 Conclusions

Our study has shown that – for the teachers we interviewed in Melbourne – RoboCup Jr is very positive in many respects. Of these we highlight the following:

- RoboCup Jr fits in with existing robotics curriculum.
- RoboCup Jr is seen to be highly educational.
- RoboCup Jr is highly motivating for participants.
- RoboCup Jr advances both academic and personal development skills.
- RoboCup Jr may help with numeracy and literacy.
- RoboCup Jr teaches teamwork and tolerance of others.
- RoboCup Jr may attract girls into robotics, as well as boys.

If these attributes generalise to other teachers in other school systems, it could be seen that RoboCup Jr is a very positive educational initiative. We emphasise that our conclusions are tentative since they are based on such limited data.

The next international RoboCup Jr tournament will be held in Seattle (USA) in August 2001, at RoboCup-2001. A follow-up study will be conducted at that time.

Figure 5. RoboCup Junior - Melbourne 2000

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Appendix A. RoboCup Junior Questionnaire

Elizabeth Sklar [EIS], Jeff Johnson [JHJ] and Henrik Hautop Lund [HHL]
RoboCup Jr 2000
Melbourne, Australia
2-3 September 2000

Notes:
[1] We went through the questionnaire below with teachers participating in RoboCup Junior.
[2] Part I was completed on paper by the interviewee.
[3] Interviews for Parts II and III were video-recorded for subsequent analysis by EIS.
[4] JHJ took notes during the interviews and EIS later transcribed the video tapes.
[5] RCJ is an abbreviation for RoboCup Junior.
[6] Jr is an abbreviation for Junior.

The Questionnaire:

Name
Contact Details
Email

I. Please tell us briefly about your background and team:

1. How long have you been teaching?
2. Do you teach at a public or private school?
3. Do you teach at a co-ed or single-sex school?
4. What age groups(s) do you teach?
5. What subjects do you teach?
6. How many children are on your team? What are their ages and genders?

II. Please tell us how you have used the RoboCup Jr initiative in your teaching.

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum?
2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.
3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?
4. Do you generally include robotics in your curriculum?

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?
6. Has this robotics project helped (or hurt) students in other aspects of their schooling?
7. Has this robotics project influenced the way your students work in teams?
8. Has this robotics project helped motivate your students? If so how?
9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.
10. Can you identify essential elements of the Mindstorms platform?

11. Other comments.

Appendix B. Answers to RoboCup Junior Questionnaires

JHJ's notes and EIS's transcriptions of the interviews follow. The transcriptions have been edited to fit the questions. Some answers are repeated under different questions. Mostly the recorded comments are verbatim. Sometimes they have been changed for fluency in reading. Very occasionally information was added from memory, beyond the notebook record – these notations were verified during observation of the video. Some information may have been lost during the transcription process. Some responses in the written record have been omitted as repetition. A small number of recorded comments may have been considered not relevant.

Twelve transcripts follow. The first ten were video-recorded, so notes taken were corroborated by video observation. The last two were not video taped, so some errors in transcription may be present.

The results presented in section 4 (above) summarizes these questionnaires.

Name	***name withheld***
Contact Details	***details withheld***
Email	

1

I. Please tell us briefly about your background and team:

1.	How long have you been teaching?	**2 years**
2.	Do you teach at a public or private school?	**public**
3.	Do you teach at a co-ed or single-sex school?	**co-ed, secondary**
4.	What age groups(s) do you teach?	**12-18 yrs in systems tech - yr 9's & yr 10's**
5.	What subjects do you teach?	**maths, systems tech, science**
6.	How many children are on your team?	**7**
	What are their ages and genders?	**male, yr 9's**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both? If in school, how have you integrated the project into the curriculum?

Lego robots are part of the class curriculum, but RoboCup Jr has been an extra activity this year. Participation occurred after school and in lunchtimes. We received the RoboLab equipment six weeks ago. I plan to integrate RoboCup Jr into the curriculum next year.

Note that boys and girls are in separate classes for this curriculum. Because of the timing of the RoboCup Jr tournament this year, girls were unable to participate – we only received the equipment 6 weeks ago, and this was during the boys' turn at the robotics curriculum. However, girls have less experience with Lego, so they may have had a harder time. The dance challenge would help get girls involved - but also girls are interested in soccer, so once they have the experience with RoboLab, they may want to do soccer as well.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

We learned about RoboCup Jr through advertisements in the newspapers. We had just bought RoboLab. Our assistant said, "Let's do RoboCup" and I said, "okay". We went to a workshop run by Heather Safstrom [JHJ: of Moore Ltd - an educational supplier of Lego]**.**

The educational value of RoboCup Jr is fantastic! The kids learned more in the last six weeks than all of their time with Control Lab [JHJ: probably a term or more]**.**

The kids really worked as a team. There was no fighting. The very limited timeframe played a large part.

Yesterday everyone was down about their perceived levels of work and the ability of the robots. Then they saw that the other teams were about the same, so they were very encouraged.

The kids learned a lot but don't know it. They learned how to use their hands *and* program a computer. They learned about gears and power, weight and reflected angles. They reinforced maths and science learned in other lessons and saw that they could apply what they learned.

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

RoboCup Jr will definitely be part of the curriculum next year. We've already picked the subject. It will be easy to integrate it into the curriculum. I'm not keen to do it outside of school, because it is very time-consuming.

Some girls said they wish they could have done it, so hopefully next year we will have girls on our team.

Next year, I will try to change some of the finer points. I'll try to get the students to write everything down. I'll have them draw their robots in 3-D – to teach graphics skills. I'll encourage them to modify the robot's body before programming it.

4. Do you generally include robotics in your curriculum?

Yes, robotics is part of our Systems/Technology curriculum. We have been using Lego Dacta Control Lab during the last year, as part of our curriculum. This is a one-year systems technology curriculum, where students learn about design, construction and programming. I set deadlines and specific tasks. The students work in groups of up to 4 children. They work at their own pace, two students per robot kit. They start with simple tasks and introduce each sensor (touch, light, temperature) individually. Then we do mazes, first using a timer (to know where to turn), then using light sensors. Then we build boom gates and work towards integrated systems (in the second term). Each team builds a machine and they will all get integrated into one large system. For example, the boys opted to build a quarry; the girls chose to build a winery. Other options were to build a construction site or a hospital. Building a greenhouse is a good project. We can build robots to take pH samples, record temperatures, etc. We're still getting the data logging component.

Next year, we'll use RoboLab for year 9 and Control Lab for year 10. We will integrate RoboLab into this course.

Everything we use for robotics curriculum is Lego.

I assess the curriculum in stages. The students are given a set of guidelines. I assess their design and their workbooks, their construction and programming. The need to communicate their work is most important. Finally, I assess and critique the outcome.

I haven't looked directly for improved maths and science from this, but I believe it has helped generally.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

I had about 23 students – about 12 approached me and I selected 8. I handpicked "good" students. But they are all doing it because they like it. When we get back, they will do presentations at our school about RoboCup Jr.

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

It has impacted on students' time, e.g., some students have tennis lessons, etc. They have too much to do and don't have 3 hours/week to participate.

The involvement had a huge impact on students' lives. They had to organise their time and integrate faculties.

7. Has this robotics project influenced the way your students work in teams?

Absolutely! They did work as teams with Control Lab.
Now they say things like: "your program is better – we'll use yours"

8. Has this robotics project helped motivate your students? If so how?

The project helped them focus. They knew that they were representing the school. The project is obviously task-oriented. There was pressure to succeed. Boys like competitions – if it climaxed [like this] every year it would be good.

It helps them get the skills.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

[JHJ: Not asked explicitly. This taken from other answers]

The educational value was fantastic.
Teamwork was a positive aspect.
Another positive aspect was that kids learned a lot but didn't know it.
Also, they learned how to organise their time better.
They experienced a great learning curve.
Kids reinforced maths and science learned in other lessons and that they could *apply* what they learned.

10. Can you identify essential elements of the Mindstorms platform?

I haven't been using LEGO enough to comment. But the school has to be convinced – it's very expensive.

Control Lab is restrictive because everything has to be attached to the interface box. Programming interface is more "manual" than RoboLab.

1. Other comments.

[none]

Name ***name withheld***
Contact Details ***details withheld***
Email

2

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **Lab Technician** [EIS: lead teacher was sick]
2. Do you teach at a public or private school? **Private**
3. Do you teach at a co-ed or single-sex school? **Co-ed, primary and secondary**
4. What age groups(s) do you teach? **In the school, there are ages 5 -18**
5. What subjects do you teach? **Science**
6. How many children are on your team? **2 here (of 8)**
7. What are their ages and genders? **16 years (6 boys and 2 girls participated)**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching.

1. Have your team members participated in school, after school, or both? If in school, how have you integrated the project into the curriculum?

Mainly after school. The kids found out about it. We got money for the kit. They have spent the last two weeks building and testing the robots. We only provided the equipment. The students did all the rest.

A classroom teacher (physics) was involved, but he is sick today.

I'm not aware that robotics is part of the curriculum.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

Yes, the kids learned a lot. Maybe not so much about robotics as about organisational skills and taking responsibility for different tasks.

For example, this morning they lost their computer programme. At 8:00am, they were downloading the RoboLab CD onto a laptop so they could re-write the program on the way here.

They learned a lot about research – you get an idea and you try something. Then you build from what you've learned and don't have to start all over.

They learned a lot about programming, robotics, teamwork, organisation, getting the robots and learning from their mistakes. The teachers only provided the equipment – the kids did everything else.

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

The kids are very keen to participate again next year. They only had two weeks to prepare this year, so they are really here this year in preparation for next year, to get experience, to know more about it for next year.

[EIS: Are other kids in the school aware of the team this year?]
I'm not sure. Team meetings were announced on daily bulletins, so other kids might have heard about it that way. Posters were put up around the school.

The primary school principal has just bought a class set of Mindstorms, so maybe they'll be interested in participating next year.

4. Do you generally include robotics in your curriculum?

I am not aware that robotics is part of the curriculum.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

The school does a lot of theatre productions, and there is an annual fete. These other projects are usually guided, unlike this – which was very beneficial. The kids had the freedom to explore for themselves what they could do.

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

[not asked explicitly]

7. Has this robotics project influenced the way your students work in teams?

I think that the teamwork was not very successful in our case, but maybe that was because the kids were not all free at the same time. There were 8 kids total involved, but they never met all at once, so some groups would pull apart what previous groups had done. The kids would leave notes on the robots saying: "please don't unmake!" It did get better – it was only 2 weeks!

8. Has this robotics project helped motivate your students? If so how?

Yes. They are very eager. I know most of the kids because they are St John's Ambulance cadets (which I run). They have been really keen and enthusiastic.

But they have to talk to budget holders.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

[not asked explicitly]

Yes, the kids learned a lot. Maybe not so much about robotics as about organisational skills and taking responsibility for different tasks.

They learn a lot about research – you get an idea and you try something. Then you build from what you've learned and don't have to start all over.

They learned a lot about programming, robotics, teamwork, organisation, getting the robots and learning from their mistakes. The teachers only provided the equipment – the kids did everything else.

10. Can you identify essential elements of the Mindstorms platform?

[not asked explicitly]

11. Other comments.

The kids initiated their participation and came to the teachers asking to participate. The school bought the RoboLab kits and the kids worked after school.

Name *name withheld*
Contact Details *details withheld*
Email

3

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **15 years**
2. Do you teach at a public or private school? **Catholic secondary (independent)**
3. Do you teach at a co-ed or single-sex school? **boys**
4. What age groups(s) do you teach? **15 -18 years**
5. What subjects do you teach? **Information technology (IT) and mathematics**
6. How many children are on your team? **4**
7. What are their ages and genders? **2 boys: 16 years; 2 boys: 17 years**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching.

1. Have your team members participated in school, after school, or both? If in school, how have you integrated the project into the curriculum.

The team participated both in school and out of school.

I introduced robotics into the curriculum. Year 10 does robotics (Systems). We have Control Lab in the school. I borrowed the RCX bricks, the ball and field from RMIT 1½ weeks ago.

I asked for volunteers and got 6. Two had to drop out due to time constraints. Now, more kids want to do it, after seeing what this group has done.

I would like to include RoboCup Jr in the curriculum, if I get the money.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

We teach "systems" or programming, in year 12. The RCJ robotics provides a good introduction to programming and guides students in the right direction. It starts at year 10 and moves on to more programming by year 12.

RCJ is good for learning about building and as a guide to programming. It works to encourage year 10, 11 and 12 towards computer science.

The value of RoboCup Jr is two things. Number one teamwork, number two patience.

As a teacher, I think teamwork is very, very important. And I can see them, the way they cooperate, so they can work as a team.

RCJ is much better than any other activity, build/communicate – this is not just pass/fail.
Compared maths competition – here they still learn, even if they are not successful.

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

Definitely. The kids can't wait for next year. But it depends on the money. Two teams implies that we need 4 or 5 RCX bricks. Maybe we can get a sponsor – the right sponsor – and have three teams. I'd like to participate in the international competition – if we could get the money to go.

[JHJ: camera turned off]

Money is a problem. Today I asked my principal for $5 each for the 4 students' transportation and lunch. He said no, so I paid the $20 myself, out of my own pocket.

The principal does not support technology. I may go to another school.

[EIS: Why do you think there were so few girls?]
I worked with girls in the past and I want to go back.
Girls are better at design multimedia/web page design and dance.

Can use these things to promote the school.

[JHJ: camera turned back on]

4. Do you generally include robotics in your curriculum?

Yes. I introduced it. I did robotics as part of my masters degree in engineering. It comes under IT. I brought Control Lab into the curriculum 3 years ago.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

Oh yes. It has helped them learn about the following:
- **teamwork**
- **patience – improved behaviour in general, which helps in the rest of their lives, not only with schoolwork. The students are more calm as people, less frustrated than they used to be in the past.**
- **respect for other people – they talk and listen to each other.**
- **problem solving – for example, the kids say "why didn't it kick the ball?" or "why didn't it turn right?". Then they have to find out why.**

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

Communication is a good aspect – between each other, how they talk to each other.

They learned how to get themselves more organised – who does what.

Most of the time they worked by themselves, 3-4 days of 1½ days per week. They spent about 10 of the days without teach supervision. They spent about 15 hours in total on preparation for this event.

7. Has this robotics project influenced the way your students work in teams?

- **teamwork**
- **patience – improved behaviour in general**
- **more calm as people, less frustrated**
- **respect for other people**

[see answer to question 5 for more details]

8. Has this robotics project helped motivate your students? If so how?

Yes, there is
- **a lot of motivation**
- **a lot of challenge**
- **meeting different people/schools, different levels, different abilities, different skills**

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

The positive aspects are:
- **patience**
- **teamwork**
- **communication**

- **listening to each other**

They learned respect for people when they talk and listen, especially at this age. This kind of communication lesson, they need at this age.

10. Can you identify essential elements of the Mindstorms platform?

[not asked explicitly]

11. Other comments:

I am teaching visual basic.

We borrowed the RCX bricks from RMIT University. The kids wanted to do it. We didn't have the money. I emailed RMIT, and they lent us the kits.

We had good results, which implies that money may be forthcoming (for next year).

LEGO Dacta parts can be used with RCX; it has pieces (bricks) and motors. But we need RCX's, sensors and wheels.

To integrate RCJ into the curriculum, I want to start in year 10 so I have 3 years to work and can do really big projects with programming, robotics, etc.

Name ***name withheld***
Contact Details ***details withheld***
Email

4

Interviewee is not a teacher. He worked 25 years senior management at a company that does training and trouble-shooting. He runs a business selling robot kits to schools. He attends fairs per year promoting robots. 4 years ago started. Kids designed web page for two robots.

I. Please tell us briefly about your background and team:

1. How long have you been teaching?	**private education company**
2. Do you teach at a public or private school?	**Not applicable**
3. Do you teach at a co-ed or single-sex school?	**Not applicable**
4. What age groups(s) do you teach?	**6 - 18 years**
5. What subjects do you teach?	**Robotics**
6. How many children are on your team?	**3 boys**
What are their ages and genders?	**12 - 16**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

Kids have been working flat out for six months, in school and outside school.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

There has to be an attraction, something to aim for. It's a very big educational process.

Kids have been working flat out, in school and outside of school.

One week before, one of my students called me parents wouldn't let him out of school to come to RoboCup. They didn't think it was educational. But there was so much PR prior to the event, particularly on the part of the chair (Brian Thomas) – the student called me back and said: "Mum and Dad will let me go". Then his parents got up at 4:00 a.m. and drove him to the bus – that's how much support they are giving him now.

RCJ helps publicise the curriculum. It helps the parents understand the educational value and their kids' world. It shows exciting things with computers and machines (e.g., a computer will not make a cake – you can use the computer to store a recipe and even make a shopping list, but you still have to make the cake).

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

Yes. I would like to go to Seattle and RoboFesta [JHJ: in Japan]**.**
I think that next year we will use Elekit and add sensors to it.
My kids need a platform with more memory [JHJ: than RCX]**.**
My students don't like LEGO programming. They wanted to use procedural language instead.
The programming must be simple – but it must be suitable for the student. Either GUI or procedural is preferred.
[EIS: do you know about Andreas Birk, who wants to use non-LEGO hardware?]

4. Do you generally include robotics in your curriculum?

Robotics is full of curriculum. I don't think I've ever come back from a school program without fantastic excitement.

e.g., we give a robotics lesson and teach kids to build a robot that can lift a cup. But building robots so play soccer is more exciting for the kids.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

We had a child with Downs Syndrome who was part of a group. It turned out that that child was the one who could control the robot best. The others could build the best. The Downs syndrome child felt 100% part of team – best controller [JHJ: hand control?]**.**

Another instance was with a project to build a robot that could lift a cup. There was another "special" child who created something so far ahead of other children that the teacher brought other teachers in to see. They were amazed.

We also use Robotix, which is a learning curve product.

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

[not asked explicitly]

7. Has this robotics project influenced the way your students work in teams?

[not asked explicitly]

One child on the team is in grade 6. Another is a secondary school student who is coming as part of his work experience [EIS: a local graduation requirement that kids work in a business for a small number of hours while in secondary school]**.**

8. Has this robotics project helped motivate your students? If so how?

The team trialled several machines. Their main problem was having enough memory [EIS: on the RCX]**. Also, it was a big constraint getting within the size limits** [JHJ: physical size of robot]**. The team didn't like the LEGO programming interface that comes with the Mindstorms, or the Control Lab. Instead, they found a procedural (visual) language from web, and they are using that. They needed two blocks because of memory problem. They found a sonar sensor on the web, interfaced to a LEGO brick. The team found that the communication between the two blocks was too slow.**

Kids were already motivated – yes, RCJ helped provide a goal.
Friends are aware and more keen.
They want to go to Seattle and RoboFesta [JHJ: Japan 2001]**.**

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

[not asked explicitly]

10. Can you identify essential elements of the Mindstorms platform?

[not asked explicitly]

Will do next year with Elekit, Y02 programmable robot. Elekit was too (physically) large for this year's size limits. This is the main competition on the market for LEGO Mindstorms. But they [EIS: Elekit] **need to add sensors. The team needs more memory** [JHJ: than RCX]**. They don't like LEGO programming interface – used a procedural (visual) language instead that they found on the web. Programming must be simple – suitable for each student.**

10. Other comments:

Parents have trouble with kids on computers all the time. With RCJ they see the link between the computer and machines.

Name ***name wittheld***
Contact Details ***details withheld***
Email

5

I. Please tell us briefly about your background and team:

1. How long have you been teaching?	**15 years**
2. Do you teach at a public or private school?	**private**
3. Do you teach at a co-ed or single-sex school?	**co-ed**
4. What age groups(s) do you teach?	**12-18 year olds**
5. What subjects do you teach?	**science/biology/robotics/human powered vehicle**
6. How many children are on your team?	**3 teams, 2 + 4 + 4**
What are their ages and genders?	**all boys, 16-17 years old**

[EIS: were any girls interested?]
Robotics does not attract girls. They think it is too mechanical, too dry. I don't think it has enough human element to attract girls.

Robotics is an optional unit in our curriculum. The students that are here are from the Robotics class of this or last year.

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

We started 5 weeks ago. During the last 3 weeks, we spent 5 x 70 minutes/week in class, plus lunchtimes and Mondays and Wednesdays after school. Towards the end, I let the kids take the kits home (so they could do more).

Robotics is a unit that the kids can take at year 10 for a whole semester. It is optional.

Integrated into curriculum?
Yes. Some of the kids in the class are doing RCJ, others are doing things with control lab. I gave the kids the choice of doing RoboLab soccer or Control Lab and another project. Most wanted to do Control Lab – they thought soccer was interesting, but many thought it was too complex, too abstract or beyond their abilities. Maybe it was too open-ended – but for some kids, that is the attraction – the "pioneering" aspect. Some kids could not commit to coming to Melbourne today.
[EIS: this is a good opportunity to do an immediate comparison between RoboLab and Control Lab, as well as soccer/RCJ versus other projects]

We invested in RoboLab for this opportunity – all the kids who are using RoboLab are doing soccer. Some kids did RoboLab but did not come to RoboCup Jr competition (because they had other commitments or because their robots weren't ready).

[EIS: can you make an immediate comparison between the Control Lab group and the RCJ group?]
- **the soccer (RCJ) gives an absolute deadline**
- **RCJ was well publicised – we come from a small town, and to be able to come and participate in a big international event was a huge draw for these kids.**
- **great enthusiasm**
- **Internationalism motivates the local children.**
- **The children see this level of complexity, in an international context and they tag onto the bottom end of it. They see a path which they could follow.**
- **I want kids to see what they can do, outside of the small agricultural town in which they live.**

[EIS: what about Jeff's proposal for instructions and quickstart?]
As it is, it gets the kids more involved (without instructions and quickstart).

The one word I would use is "pioneering". I said to these kids, in five weeks time you will be in the public eye, in Melbourne, playing sophisticated robotic soccer. They had to figure out so much for themselves – that was a huge draw for them.

[EIS: What does Control Lab Group think now?]
We'll give a demo next week and explain what was achieved. I expect lots more kids will want to be involved.

[EIS: there are still some weeks left of term. What will you do now?]
Sumo might be a good challenge. It uses a combination of speed, power, gearing and strength.

We'll do some basic stuff to fill in holes – there was a great rush in getting ready for the event.

I'll let them negotiate projects – kids love open-endedness. You define a problem on paper, something you want to build a robot to overcome, and we'll negotiate the project.

With RCJ, I don't have to be with magic.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

Has RoboCup added anything? Yes, but self-learning.

What are the key educational elements?

- **absolute deadline – with academic work, if your work is late, you lose marks. The kids say "well, so what?" RCJ provides an absolute deadline, and there is embarrassment and disappointment if you don't make it.**
- **organise as teams – I coached them to form teams with different members filling in roles so they had to rely on each other as a team. Roles were:**
  - **good programmer**
  - **good constructor**
- **they learn from each other**
- **they cooperate working**
- **Their rate of learning is accelerated.**

Robotics is good for other skills.

I had one whole day to work with all the teams at once and the teams exchanged ideas and helped each other and learned from each other. There are very few situations where this occurs, especially with mixed year 10's and 11's.

They got so much out of the day. They are just buzzing!

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

YES!

Our school is beginning to put international events together. It would be great to get to Seattle – that would be excellent. We should get backing – miles ahead of where school is now.
Billeting would be a good part.

I would hope to learn:

- **personal: self reliance, goal setting, teamworking**
- **science: good too**

Next year, I'll allow more time. I'll have more introductory stuff and tone down the excitement – maybe it was a bit too intense this year because we had so little time.
I'll introduce tools to use first.

Mostly, I'm thrilled at the outcome and I would not change much.
Maybe I'd get more recognition for the team by having more parents come in.

Next we'll do year dance (if it is extended to older children) – get more girls involved. Performance might draw them.

Have to "sell the sizzle, and not the sausage".
The atmosphere here gives the kids a focus, a reason for their learning.
Kids much better at learning if they see a purpose.
If we can sell the dance, that would get the girls in.

One parent who has complained in the past many times that her child hasn't been stretched was so grateful and full of praise for this project. Her child has become focused and motivated.

4. Do you generally include robotics in your curriculum?

Yes. [EIS: see above]

How do you do curriculum assessment?
It's a real challenge to assess. Some kids do well in some aspects and not others. I diversify what I assess, which helps.

- **Students are assessed on the Control Lab through occasional tests. A written exam at the end is a school policy.**
- **They are tested on knowing about gear ratios, etc.**
- **real world application/project -- assessed**
- **They are given a criteria sheet. Your model should be able to do A, B and C. They are assessed on the basis of:**
  - **construction**
  - **smoothness of operation**
  - **programming, level of complexity of programming**

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

Yes. There are a couple of kids on the team who usually become invisible. These kids have gotten involved and have gotten the teacher's attention. They are kids who are known as the "Smart Alec" and the "Village Idiot" – they can be a nuisance in general. But here they have got so focused on this. Now they see what they can do, that they can be useful. We have assemblies at our school and kids who have made achievements are put on the stage and applauded – generally this is kids who do sports or debate, etc. These two kids have probably never been on the stage before – but now they have a reason to be recognized.

We [the school] **attend sports events, but this** [RCJ] **captures the imagination of the community.**

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

Some of the other staff have complained that the kids involved in RCJ have too little time for their subject [negative] – [child was] **not in my class!**

It has helped their communication skills improve.

[EIS: The kids could write essays about their RCJ experience and give them to the English teacher -- to placate that situation.]

That's a good idea – I'll take that back. I'd like to see the kids make a web page on this.
Maybe get pen-pals in Seattle.
[JHJ: There's also a geography lesson – now they will know where Seattle is.]

7. Has this robotics project influenced the way your students work in teams?

It has helped them organise themselves as teams. I coached them to make groups with kids who could take on different roles so that they had to rely on each other as a team. The roles were:
- **good programmer**
- **good constructor**

They had to learn from each other.
They learned to cooperate working together.

8. Has this robotics project helped motivate your students? If so how?

Compared to theatre and sport?
We (our school) are involved in those activities – they are very safe.

This captures the imagination of our community.
This was an international high-tech event. We took part, and we did well!

The kids that we brought here would not normally be mentioned in assembly (sports/debating)
Now we can celebrate these kids.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

[not asked explicitly]

positives: "all the good stuff"
- **they learned to organise as teams**
- **they learned from each other**
- **robotics good for other skills**
- **they learned self-reliance**
- **they leaned about goal setting**
- **they experienced self-learning**
- **programming**
- **mechanics – all the good science**
- **but the personal development has been the greatest aspect.**

negatives:
- **may have detracted from other subjects (students not in class),**
- [JHJ: but may be compensations, as discussed English etc.]

10. Can you identify essential elements of the Mindstorms platform?

LEGO – flexibility, RoboLab/Control Lab
Even for dullest kids, when you offer something after five minutes they are lost, but this goes through to the end.

10. Other comments:

The one word I would use is "pioneering". I said "here are the components, here are the resources, now go for it." It brings out the resourcefulness in the kids. They learned what to do when they are not spoon-fed – these are life skills.

Some kids learned more in four weeks than in six months.

They learn technical stuff, but also "like modelling industry".

I am dis-spirited by the ordinary. A project must be exciting, something relevant to where they are going.

We had another project – a human-powered vehicle. An ex-student now employed by General Motors came to visit. He said that he learned more in school than he does now. With these projects, they learn the whole process – in industry, you probably just do one piece of the puzzle.

They progressed so much, so rapidly, on their own and helping each other. They didn't consult me too much, which is unusual.

These are life skills – this is what we want to say they learned at our school. Not that they are high-quality parrots. That's not what education should be about.

This is a project opportunity – the whole engineering process.

Name ***name withheld***
Contact Details ***details withheld***
Email

6

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **32 years**
2. Do you teach at a public or private school? **private**
3. Do you teach at a co-ed or single-sex school? **co-ed**
4. What age groups(s) do you teach? **years 6 - 12, ages 11 - 17**
   [EIS: and primary?]
5. What subjects do you teach? **cross-curriculum**
6. How many children are on your team? **5**
   What are their ages and genders? **boys 11-15, sumo** [EIS: and dance?]

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

There are 35 students in our school, 20 students in grades 3-6.
Robotics is taught in school as part of the science programme.

We had cross-age teams. Each team had two kits (four all together). The older kids helped the younger ones. Some built and some programmed. In the end, the kids combined their programs (to get something long enough for the dance competition).

This was our first time using RoboLab. We've had it in the school for 8-9 months, but hadn't really done something with it. RCJ gave us the motivation to do something with it. It was the first time we had to work towards deadline. We had the motivation to finish.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

The process has been fantastic.
The children have gone so far in such a short time.
They work well if they have something to aim for.
They were very focused on the robotics.

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

Yes, I'd love to.

[EIS: what would you change?]
I'd like for the kids to be better at record keeping and having design briefs. We started doing this at the beginning, but we got slack as time got tight.
They came a long way in a short time.
At first, they didn't know what's a dance. They had to learn to program in sections. After 3 or 4 years of participating, there will be a body of knowledge.

[EIS: how do you do assessment?]
Since it is part of the curriculum, it will be part of the children's reporting. We look for outcomes achieved:

- **technical**
- **working as team**
- **very engaged**
- **motivating/exciting**
- **working together**
- **on target**

4. Do you generally include robotics in your curriculum?

Robotics is taught in school as part of the science programme.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

Changed attitude to other studies?
Not too much. They love coming to school – so they can work on the robots.
With difficult kids – marginally – it is very hard to measure.
With LEGO, they were terrific in that session – but it hasn't helped in other sessions. I see these kids all day long.

We did it for most of the term, 10 weeks.
[JHJ: how many hours per week?]
1½ at start to 3 at end, on average 2 hours/week.

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

[not answered explicitly]

7. Has this robotics project influenced the way your students work in teams?

- **worked as team**
- **working together**
- **learn about each other**
- **can work with each other**

8. Has this robotics project helped motivate your students? If so how?

It has been very engaging, very motivating and exciting.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

positive:
- **Technical things:**
  - **quicker with LEGO**
  - **how shapes work**
  - **wheel based things**
  - **structures that hold together**
  - **programming: loops, subprograms**
- **Things about themselves:**
  - **what they can do, what they are capable of**
  - **kids involved in a programme – they specialized**
  - **rebuilding the robots all the time**
- **Things about each other:**
  - **can work with each other**

negative**:**
I had to draw the year 3's along (7 - 8 year olds). They were not as involved.
Some kids were active. Others were quiet, but still enjoyed it.

We stretched the year 3's – dragged them along a bit. They weren't as involved, but also because they're the youngest in a multi-age classroom. But they still learned a lot.

Overall:
I haven't had time to sit down and reflect on it all – to do any thoughtful assessment of the project.

10. Can you identify essential elements of the Mindstorms platform?

Many kids are already familiar with LEGO and Duplo. They can build on it and use it in other ways.

With the assembly, I was surprised how quickly the kids picked it up.

The programming is nice.

It does what it is supposed to do – it is expensive but it's reasonably priced.

We added to Technik and Dacta. We didn't have to purchase new kits, otherwise we would not have done it.

10. Other comments:

We got training from Heather (Moore Education).

Name ***name withheld***
Contact Details ***details withheld***
Email

7

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **26**
2. Do you teach at a public or private school? **public**
3. Do you teach at a co-ed or single-sex school? **co-ed**
4. What age groups(s) do you teach? **yr 7-12, 12-18 year olds**
5. What subjects do you teach? **systems-tech/automotive/electronics**
6. How many children are on your team? **six**
   What are their ages and genders? **15/16, boys**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

We had 3 robots for 2 teams. They participated as part of class.

New things take time to get into school. This year robotics was approved.

We just had 6 weeks for programming. The building went okay.

The class has 22 kids, and the others [EIS: the ones who didn't come to RCJ] **made robots also. The kids with complete robots were selected to come -- the ones that could perform a function in the soccer. We didn't think it would work, that we'd be out in the first round. I didn't think we'd go, but the kids rose to the occasion.**

To have an autonomous robot, that was a challenge for them.

Some kids took the brick and programmed at home. They worked in lunchtimes and took time out of other courses. The school was very supportive. The school supports (outside) competition. It is important to have the kids feel that they are doing something for the school.

There are no girls in the robotics class. This came so quickly. Girls have the perception that robots is to do with robotic arms - they are intimidated. We will have girls next time. Next year we may have primary/middle/secondary kids.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

We already had the curriculum. RCJ was a vehicle to focus. It gave us a common aim.
now, some of lads are more into league football.

They had to go through a sequence of events, RoboCup was at the end of the session.

They needed a carrot. For their next project, I told them that they could build "warbots" – turn other robots over. It teaches them to build robots that can lift and roll over. Not a smash'em, bash'em. This is the whole group.
There is an opening for that sort of competition [EIS: rescue]**.**
Rescue where the victim is an egg [JHJ: I think EIS suggested this]**.**

Curriculum is actively associated with RoboCup.
We had 6 weeks. I said here's the computer/program/book. Think about various strategies – like go to the ball – and figure out how the program will work.

They looked at various styles of robot. We studied various arms, animal forms of movement, the balance, biped to move? Larger feet? Issues such as weight transfer.

The RCX has only 3 inputs and 3 outputs. So they have to expand their minds – now they are multiplexing. Minimum amount inputs/outputs – stretches the mind. It extends the kids in electronics area.

[EIS: How do you do assessment?]
Follow through curriculum assessment CSF2 [EIS: a local assessment standard]
They have to do an investigation – robot themes, e.g. industry, medical
They have to give an oral report to the class and a written report.
Design – reason why strategy chosen, strength-function
Production – program (also program design)
Can become complicated – lose the plot occasionally
Amazed at what kids came up with.
But they can be lazy – they go for a quick fix.

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

YES!

[EIS: changes]
Get a brighter ball. The new [EIS: made by EK Japan] **one rolls easier. Not suitable for a small field.**
Maybe a larger field, so we can have more robots – like 4 robots per team.
Otherwise no, I wouldn't change much.

[EIS: technical ideas]
Maybe use TV for sensing, but that's not the way to go.
e.g. multiplex. Find ball/Find Goal/where in the field?
Either buy new sensors, or make sensors
Go into electronics. Amplify? How? Use light lens? Boost power?
Another problem, it draws too much current. It flattens the batteries too soon.
compromise/trial/design – they have to do this. They all try to help each other.
Innovation – nozzles on end of light sensors.

4. Do you generally include robotics in your curriculum?

We already had the curriculum. RCJ was a vehicle to focus. It gave us a common aim. Curriculum actively associated with RoboCup. There are no girls in the robotics class.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

Behaviour? Certainly – the ones who came. The kids are already thinking about what to do next year, not make the same mistakes. Their design and construction will become more complex

They decided the teams 3 weeks ago. They did most of the programming last week.
They had 8 weeks overall – time was very tight.

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

It certainly has not hurt.

[EIS: ways in which it has helped]
- **They look at things they had not looked at before**
- **previously no electronics**
- **looked at sensors previously**

- **will make them look at electronics**
- **new look at that field**
- **others will look at robotics**

7. Has this robotics project influenced the way your students work in teams?

YES! With some exceptions.
In a team of 3 or 4, one person may sit back and not do a great deal, especially when the team is too large.
Team broke up, and reformed – personality mismatch – even though they choose teams at start. They found out about themselves.

8. Has this robotics project helped motivate your students? If so how?

Yes. I had the same exact students in the mech class previously. They were obnoxious in that class. In the previous class, they were more intent on destruction, but here they were waiting at door, and after class they didn't want to go out.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

- **sportsmanship – they were beaten but had a smile on their face. They did reasonably. As good as anyone else.**
- **learned more about construction techniques. Sometimes things would fall apart on the field.**
- **engineering skills**
- **electrical skills**
- **programming skills – logical/sequencing**

[JHJ: Negative aspects?]
No, not really.
No negative aspects with the kids. Except on tight situations, when their game was coming up next. There was some discussion and it brings out the dominant personality – who is able to force the decision through. It brings out negotiation.

10. Can you identify essential elements of the Mindstorms platform?

Because of that [LEGO RCX brick]**, they could interface it to almost anything.**
Other companies make components that interface with LEGO.
Other comparable products are not prolific in the market.
But maybe that will change if/when the whole game will spread.
The only constraint is the size of the robot. They could even build the whole thing next year.

Name *name withheld*
Contact Details *details withheld*
Email

8

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **12 years**
2. Do you teach at a public or private school? **private**
3. Do you teach at a co-ed or single-sex school? **co-ed**
4. What age groups(s) do you teach? **years 7-9; 12-15 year olds**
5. What subjects do you teach? **science**
6. How many children are on your team? **11, two teams; 8 in teams, 1 ideas, 2 video**
   What are their ages and genders? **boys, 14/15 (3 girls - designing tee-shirts)**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

As part of a course called "Machine Mindstorms" it meets 1 ½ hours per week, during school.
The course runs for 20 weeks, from January to June.
It is an elective in year 9 (age 14/15). It meets for 1½ hours/week.
This term, they also prepared after school.

[JHJ: was the project integrated into curriculum?]
The challenge this year – pushing [JHJ: ?]**.**
This semester find black lines (to play soccer).

No they have seen other students, so playing soccer will be it.

I had students write down on a piece of paper how to get a robot to play soccer. They wrote down what are the rules, field size, etc. – the restrictions. But I thought about how to get it to find the ball, etc. Then I gave the students the problem and they ran with it. It was out of my hands.

There's another class called "Robotics". They can take in year 8, using ControlLab.
Next year, this course will be called "RoboCup", not the same as robotics.

[EIS: how do you do assessment?]
- **they have an Internet assignment: find how robots are being used today, e.g., Mars pathfinder, Robotics in Industry**
- **programming is assessed**
- **they make a presentation (Control Lab feature): instructions to a novice about how to make their program work (click on button and robot works; stop button; text to explain; instructions on how program works)**
- **maze challenges: first using timing control, then timing plus sensors, then just sensors. They are evaluated on their success in going through maze – good, getting stuck may not mean a B.**

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

The challenge.
It was mind-boggling to think we could actually get robots to play soccer.
Finding lines was okay. But could we actually play soccer – if so, how? What did we need to do to compete?
It sparked enthusiasm in me, and I passed it on to the students.
What would you get the robot to do? Rules?
Once I left it with the students, it was out of my hands.

[JHJ: educational value?]
The fact that they were able to come to participate.
These student were unassuming.
Now they can write about competing –
International Competition
Melbourne Exhibition Centre
University people there – that makes it very exciting.

The motivation of an international competition, in a large venue, alongside university students. Spending the whole day at competition was also very valuable. No animosity among competitors. It taught them responsibility. I didn't help with technical problems – they didn't ask for it. Only asked me for the keys and the equipment.

When I teach robotics, I'm a facilitator.

The deadline – hard and fast – was very important learning / motivating factor. Especially in middle school age, who aren't used to hard and fast deadlines.

They wanted to do it.
They could hear from other people [kids]
Whole day reflecting on what they have done.
Competition, but no animosity.

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

YES.

We don't compete enough/get out enough.
We should have made it a social event for kids to meet each other, biscuits and cordial [EIS: juice]**.**

I enjoyed working with students, enjoyed their enthusiasm.
They learned that it's okay to participate, that you don't have to win or get to the finals.

4. Do you generally include robotics in your curriculum?

Yes. [see answer to question 1].

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

There were no problems with them turning up.
Nor with packing up the equipment – they will come back on Monday lunchtime to sort out into tubs.
They said: "we'll get of us to do it, it will all be done".

They would ask "can we practice after school tomorrow?" and they would stay until 6:00pm – that is a lot of responsibility for them and from them.

RoboCup was their task, not mine. If they asked "What rules?" I said "Look it up." Then they'd ask how to interpret the rules. I'd say "you do it."
The only thing they needed my help for was keys, storage, and what time in could they get into the school. I didn't help with technical problem solving.

They would all turn up and stay until the end. They volunteered to help [EIS: after RCJ] **to clean up and restore kits** [EIS: because they got all mixed up in the hurry to get ready for the competition].

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

Now they say: "If I want to, I can do RoboCup at Melbourne Uni in 6 or 7 years. To do so I'll have to improve my maths". It makes them look ahead and think about how to get there.

It has not hurt music/choir/maths – lessons have *not* been skipped. They didn't ask to be excused from other classes or activities.

It has helped indirectly:
- **It has given them responsibility.**
- **They had to work as a team.**
- **It helped in the way they respond to things at home.**
- **They ask their parents "Can you pick me up at 6:00pm because I am doing something with a deadline?" Usually things are done where deadlines are rubber band, almost finished. But with this event, there was no such opportunity. It was an absolute deadline and they understood that and responded to it.**

Things like responsibility, etc. will have ramifications elsewhere – at home, for example.

7. Has this robotics project influenced the way your students work in teams?

Certainly. The teamwork was the biggest plus of the whole thing. Students learned how to work cooperatively. I didn't have to organize them. They worked out themselves what their strengths are, finding their own comfort zone. That contributes to their sense of satisfaction.

As time wore on, some students got the rules and event updates from the Internet by accessing the RCJ web site. They were still involved, even though they were not building.

I asked for volunteers -- who is interested in RoboCup? Not necessarily friends came together. This was their interest. They did not all know each other. I emailed them all. They formed into teams. Some kids built robots. They pulled the robots apart many times.

8. Has this robotics project helped motivate your students? If so how?

YES!

It's their motivation, their initiative which has been the greatest thing out of RoboCup – they didn't participate because they've been led or felt an obligation.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

Positive:
- **responsibility**
- **personal satisfaction – they didn't have to do this.**
- **that you don't have to be the best at something to get a lot of personal satisfaction from doing it.**
- **that different people have different strengths**
- **that it's okay just to be a fiddler – one kid would make bits, then others would try them.**

All the kids felt valued and needed. Some did more than others. None were disappointed

Negative:
Nothing. Except that I'm usually very organised in the way I run the classroom and keep the materials – the LEGO kits go back in the right places, and there is no borrowing from one LEGO kit to another. All this went out the window!

10. Can you identify essential elements of the Mindstorms platform?

The fact that we all had similar base was useful (up against time).
Had metal kicker – trouble attaching.

I'm not familiar with other platforms – or their limitations/advantages.
The LEGO brick is easy to turn on and off.

Name ***name withheld***
Contact Details ***details withheld***
Email

9

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **3 years**
2. Do you teach at a public or private school? **private**
3. Do you teach at a co-ed or single-sex school? **boys**
4. What age groups(s) do you teach? y**ears 7–12; 12-18 years old**
5. What subjects do you teach? **maths/science/robotics**
6. How many children are on your team? **2 soccer, 5 sumo**
   What are their ages and genders? **12/13/15 years (soccer), 12/13/14 years (sumo)**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

The teams participated some in school, mainly before and after and at lunchtime.
Although I teach a robotics class, RCJ was not part of the curriculum – it was done outside the classroom – it was "co-curricular". Though this way it was much more work for self and students.

But now I have a core group (of year 7-9's) and I hope now it will become a core part of the school program.

I make the curriculum and then say okay what am I going to use to teach the curriculum. From that I look for resources. LEGO isn't a major consideration. We do some actual electronics and building.

I send kids (year 9-10's) down to lower grade (4?) and get them to build robots with lower grades. I get my kids to teach what they've learned. It is very effective.

If I'd had girls and wasn't at a private school, with privileged kids who are used to having everything done for them… Here, they expected me to do more than maybe students at a public, co-ed school. I hope that in future years, I won't have to do so much.

Maybe I didn't reach out to all students in the school effectively. I did send email to all year 7-10 students, but ended up with mostly kids in my own class. But it would have been hard to have more kids in this first year.

I had about 25 kids involved in one way or another. I decided to "go broad" and expose more kids.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

I have taught robotics for 2 years. It's an option in the year 9-10 curriculum.

I have a robotics background from studying engineering.

I noticed RoboCup Jr in the newspaper and contacted Brian Thomas early on.

[JHJ: educational value?]
Without a doubt!
It has so much educational value. All areas of the kids' education and curriculum benefited:
e.g. lateral thinking
visualise process before programming

It is very, very educational. There are indirect benefits, e.g., working in teams, learning patience.

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

Definitely locally.
The success of my team this year might make it possible to take abroad next year – Seattle, Japan, or both. It's conveniently timed to do both.

4. Do you generally include robotics in your curriculum?

It is an elective in years 9 and 10.
We make our own robots if we can – just using LEGO is not okay. The curriculum comes first. LEGO is not a major consideration. I decide what I want to teach and then find the materials to support that.

They learn about mechanisms, electronics, building and control. Technology is not a subject by itself.

[EIS: how do you do assessment?]
I look to see if the robot does the task.
They have program/build competitions.
Better engineering, build and programming gets higher marks.
They also write reports.
If it does what they want the robot to do successfully, then that makes up the majority of the mark. It's the number one thing.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

That's a tough one. It was out of the classroom with no assessment.
It taught them to be more responsible. They've got to be responsible for lots of LEGO.
In terms of behaviour – it made them more responsible at 12-14 years old. The Mindstorms kits, some took them home. Some rose to the occasion. They did the school justice.

At first I had 30 children. There were some problems. One kid demanded someone else's stuff, some were very nice. The teams formed, originally through friendships, separate year 7's, 8's and 9's (no combinations). The groups evolved and changed a lot over time. A lot of them learned to be more patient with each other. Some learned a big big lesson, to appreciate the efforts of others

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

It has definitely helped in terms of teamwork and patience.

Maybe it hampered but it did not hurt. It used a bit of class time and took away from the regular robotics curriculum, but this wasn't really a bad thing. The effect was minimal – the benefit was ten-fold to being in class.

All subjects benefit: maths, English, lateral thinking, benefits of programming, patience, teamwork, processing, understanding "process".

There are definite benefits to all areas of curriculum. Some kids rise to the occasion; others can't cope with it. This environment really highlights it.

7. Has this robotics project influenced the way your students work in teams?

Some struggle with teamwork. This project really highlights this.

Teamwork was influenced – w without a doubt. Working in teams. This is a split task. They learned to be patient with each other – which was hard for some and easy for others. There were some difficulties. This lesson has carried to all classroom areas.

8. Has this robotics project helped motivate your students? If so how?

Definitely. Some would stay until 6-7 p.m., if they could. They came in before/after school and at lunch times.

They have had negative moments, but they got past it.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

Learned:

- **whatever you put in you get out**
- **can see a goal when they do things – sometimes in the classroom it's difficult to see the goal. With RoboCup Jr, (the children) have their goal.**
- **there have to manage to work to time**

Positive (for me):
I got to work closely with the students for a long period of time. I got to know them very well.
It was very rewarding end result. It was such a thrill to be involved in a professional manner outside school, being able to work with other teachers to get to a single goal.

The students were given up-to-date information about a dynamic event – that was motivating for them.

Negative: (the students) have a lot on a silver platter. Girls have different attributes – they tend to hold the hand of a group. Retention was not as high as it would have been if I had had girls.
I expected a lot from students – they could have done more themselves.

[EIS: he's at an all-boys' school and wishes he were at a coed school. He was surprised that there weren't more girls.]

10. Can you identify essential elements of the Mindstorms platform?

I had avoided LEGO [in the past]. But the brick is a revolutionary leap forward. The program is transmitted through IR, and the brick can walk away – no cords or cables like the old Dacta.

The light sensors are absolutely essential. But they could make better sensors, e.g., to distinguish the elements on the field, ball, walls, other players, team mates. The light sensors make the competition.

I have not used the data logging yet. With Mindstorms, you can take it away [from the computer] and get data from the sensors, even without the data logging facility. It's a fantastic medium, e.g., for hydroponics; they can measure humidity and pH with motors and different sensors.

Name ***name withheld***
Contact Details ***details withheld***
Email

10

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **20 years**
2. Do you teach at a public or private school? **public**
3. Do you teach at a co-ed or single-sex school? **co-ed**
4. What age groups(s) do you teach? **13-18 year olds**
5. What subjects do you teach? **math/science/chem/plastics/electronics/systems**
6. How many children are on your team? **4 teams, 11 boys**
   What are their ages and genders? **2 x 12, 2 x 14, 16-17 rest**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

Both. It's integrated with the curriculum.
In systems course – basics of RCX programming, start with programming robotic arms.
Then RoboCup type exercise, programming the brick to do mazes, climb hills (rescue)
to control sensors, I/O, in order to play soccer games.

[EIS: how do you do assessment?]
I look at the extent to which student achieves various steps: control, sensing, I/O, programming skills, engineering and design of their project.

[EIS: what form is the assessment?]
Mostly ad hoc, going around the classroom and recording as students achieve. Reports are assessed as part of design. They did a report on each of the robots they built.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

[JHJ: Why RCJ?]
RoboCup soccer looked very exciting – it's a way take robots and the course outside school and meet other students.

The educational value and the amount of learning that has been done surpasses anything else I've seen in any other curriculum – not to mention the fun!

Kids are learning when they don't realise that they are learning – science, maths, problem solving, language skills, teamwork.

Organisation is a major factor for adolescents.
They have virtually run their own teams

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

Locally yes, and abroad.

[JHJ: will you change what you did?]
Hmmm... I'm trying to think of what went wrong. Not too much. I might pursue the media more aggressively. Maybe go to MP's more aggressively for support. Another 6 months' warning for the schools would have meant double the participation

4. Do you generally include robotics in your curriculum?

Both. It's integrated with the curriculum.
In systems course – first they learn the basics of RCX programming. Then they do a RoboCup type exercise. They do mazes and climb hills (like rescue). They use sensor I/O to play soccer games.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

They have learned how to take more control of themselves and what is going on. They have had to take more initiative. They have improved their organisational skills – it is a great foundation for later. I feel that every student has matured at a higher rate then they would have normally.

Most were good, most stayed on as a group. I expected one or two to drop out, but they stayed on and stayed motivated. One pleasing aspect was most of the teams picked up 1-2 more people as they progressed.

The only problem was to get them to organise themselves, to think about what the robot was doing.

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

They've certainly missed out on classes because of it, but I don't think it has hurt them.
They have had greater enthusiasm in other classes to hurry up and finish other work so they could come and work on robots. They have shown a more positive attitude toward others.

It has helped with math and science problem solving. They have improved in explaining and thinking things out.

They've been using their minds so aggressively. They've had to work a lot harder. They have gained an appreciation of what is going on around them, being able to explain and not just look at things at face value

It has definitely helped in communication skills. One group was going badly for 2 months. They had problems communicating with other members. They had not met before. But they resolved their issues and got into quarter final here.

7. Has this robotics project influenced the way your students work in teams?

Certainly. The winning team is one that worked exceptionally well as a team. They have all seen the result. Students who had trouble working in a team learned that working well in a team is the only way to achieve in these sorts of situations.

[JHJ: any problems with the teams?]
Some were poorly organised.
Some swapped information, gave each other positive reinforcement/criticism. The winning team really gelled as a unit.

8. Has this robotics project helped motivate your students? If so how?

Definitely, in an enormous sense. They turned up at lunchtimes, on weekends, after school. They worked at odd times.

It has given them teamwork skills and helped them in working with other people.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

On the engineering side, they have learned a lot about different aspects of robots: system control, problem solving.

But more importantly, they have learned about teamwork and working with others.

[JHJ: any negative aspects?]
There was a lack of support from [his schools'] **Education Department. They did not go out of their way to help.**

10. Can you identify essential elements of the Mindstorms platform?

The simplicity of programming of the RCX brick. It has consistent performance. Other interfaces are frustrating for students. Mindstorms allows its student to be individualistic in design and engineering of robots, allows students to be creative in other ways, to use sensors. Which is an enormous learning experience for them.

RCJ touches other parts of curriculum - science, problem solving, maths, communication skills, English.

They are investigating different types of sensors: electronic light sensors, amplifier circuit and integrating them with the LEGO brick. They came from electronic op-amps, year 9.

11. Other comments

A frustrating thing for me was when they only had to make a minor modification, but they quite often chose to start again.

As educational tool, RCJ one of the most revolutionary innovations, at least in this decade.

[JHJ: could it ever become ordinary?]
It's a possibility. A possibility that outside of school groups would pick up on it. Imagine that, being educated outside of school.

There something very special about robotics. Students to control those machines and doing what their controller intended them to do. There is an enormous challenge and sense of achievement.

Name ***name withheld***
Contact Details ***details withheld***
Email

11

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **32**
2. Do you teach at a public or private school? **private**
3. Do you teach at a co-ed or single-sex school? **co-ed**
4. What age groups(s) do you teach? **years 6-12; 11-17 years old**
5. What subjects do you teach? **cross-curriculum comp**
6. How many children are on your team? **5**
   What are their ages and genders? **boys: sumo**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

This group was extra-curricular. They focussed on the competition. All the participation was out of school hours – 2 days per week, 1.5 hours on Thursdays, over a 5-month period.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

It's the only one – we had purchased RoboLab from Heather.

[JHJ: educational value?]
Certainly. It gives the "geeks" an outlet, something to boost them compared to sport – a chance to shine.

Most have very forceful parents, who like to do things for kids. Only one kid really is geeky.

It has educational value for everyone. I doubt 4 from 5 had programmed before. One kid is mildly autistic. His parents were very nervous. They brought him to Melbourne before the event. Then the child was counting the days and spent all day here.

Socially it is good – competing was good – it's not just about winning.
Also the exposure to RoboCup is good – it gives them something to work for.

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

Next year – depends on my contract of employment. If I could do anything, I'd do this.

4. Do you generally include robotics in your curriculum?

Yes, robotics is in curriculum. We do RoboLab in years 6 and 7. We do team challenge in year 10.

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

One child was bad at co-operating. This taught him to be more co-operative, less self-dedicated.

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

Helped most decidedly.

7. Has this robotics project influenced the way your students work in teams?

Yes, most decidedly, it's a big plum.

8. Has this robotics project helped motivate your students? If so how?

Motivated, most decidedly. At 8:30 this morning, the robot was not working. But they got it going.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

They learned technically – not the physical design, more programming. They learned heaps. Prototype final program.

Yes, I'd do something different. I was low key. I'd have played it up more.

I was apprehensive. We travelled 750 km to be here. It cost the parents money. We played down. We could try again with more kids. It's too bad that not soccer was not also done for year 6.

10. Can you identify essential elements of the Mindstorms platform?

We got support from Heather and Moore Ed. Without them, we couldn't have participated. They held conferences and workshops.

Name ***name withheld***
Contact Details ***details withheld***
Email

12

I. Please tell us briefly about your background and team:

1. How long have you been teaching? **10 years**
2. Do you teach at a public or private school? **public**
3. Do you teach at a co-ed or single-sex school? **co-ed**
4. What age groups(s) do you teach? **10-12 year olds**
5. What subjects do you teach? **generalist, science**
6. How many children are on your team? What are their ages and genders? **2 girls 10/11 years, 2 boys 10/11 years**

II. Please tell us how you have used the RoboCup Jr initiative in your teaching

1. Have your team members participated in school, after school, or both. If in school, how have you integrated the project into the curriculum.

The whole class participated.
Time was tight for another tournament. It was right after the maths/engineering.

We used a jungle theme concept for the robots. They investigated: what do you find in a jungle? They learned that animals eat animals – there is an ecosystem – the cheetah and buffalo. Some kids did the music. Some kids did the backdrops. Some kids did the choreography. They got involved in other subjects – not just robotics. The music and images came from other places, e.g., North America. ¾ time spent was on dramatic/cultural research and preparation. Then they did the robots. The robots did not control the situation – it got them to do what we wanted. It was not software dictated.

Some kids went off on their own other stuff. Some did research on the Internet -- gardeners and bloom. They gained skills with dictionary/encyclopaedia/reasoning/remember/recall, problem solving – what to do if things didn't happen.

2. Why RoboCup Jr? Do you feel RoboCup Jr has any educational value? Please describe.

[not asked explicitly]

3. Will you participate next year? Locally? Abroad? If yes, how will you change what you did?

YES. Locally – abroad difficult.
Next time, we'll start earlier. It really needs six months. The kids need a break.

4. Do you generally include robotics in your curriculum?

Yes, we use robots for data logging.
Math heartbeat/temp
seemed too soft/too hard
analyse distance and time

Compared to other non-robotics projects or activities:

5. Has this robotics project influenced the behaviour of the children involved? If so, how?

This is a hands-on activity; kids like that.
Some kids were not interested.
Different teams did different things – like the music.
They could all find something to contribute.

6. Has this robotics project helped (or hurt) students in other aspects of their schooling?

CSF tied down. Correct theme – Olympian – could have followed that.

7. Has this robotics project influenced the way your students work in teams?

Motivate – certainly.

8. Has this robotics project helped motivate your students? If so how?

Teamwork – some kids had other things to do.

9. What do you think your students have learned as a result of participating in RoboCup Jr? Please outline the positive and negative aspects of your involvement in this initiative.

Negative:
There was too much to do

10. Can you identify essential elements of the Mindstorms platform?

No idea