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Abstract: In 2004, the Australian Federal Department of Education, Science and Training funded a study into the impact of using remote telescopes in education in four educational jurisdictions: The Australian Capital Territory, New South Wales, Queensland and Victoria. A total of 101 science teachers and 2033 students in grades 7 - 9 provided pre-intervention data. Students were assessed on their astronomical knowledge, alternative conceptions held and ability to explain astronomical phenomena. They also provided information about the ways in which science is taught and their attitudes towards the subject. Teachers provided information about the ways in which they teach science. Both students (N=1463)1 and teachers (N=35), provided the same data after the intervention was completed. The return rate for students and teachers was 71% and 34% respectively. This represents the largest study undertaken involving the use of remote telescopes in education. The intervention comprised a set of educational materials developed at Charles Sturt University (CSU) and access to the CSU Remote Telescope housed at the Bathurst Campus, NSW. Outcomes showed that students had increased their astronomical knowledge significantly (F(1, 1173) =201.78, p < 0.001)2. There was a significant reduction in the students' alternative conceptions (F(1, 1173)=27.9, p < 0.001) and the students had acquired a significantly greater ability to explain astronomical phenomena (F(1, 1173)=25.66, p < 0.001). There was a significant concomitant increase in students' attitudes towards science in general and astronomy in particular. Discussion centres on the ways in which the use of remote telescopes can be harnessed to impact in positive ways the attitudes of students.

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Remote Telescopes in Education: Report of an Australian Study

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In 2004, the Australian Federal Department of Education, Science and Training funded a study into the impact of using remote telescopes in education in four educational jurisdictions: The Australian Capital Territory, New South Wales, Queensland and Victoria. A total of 101 science teachers and 2033 students in grades 7 – 9 provided pre-intervention data. Students were assessed on their astronomical knowledge, alternative conceptions held and ability to explain astronomical phenomena. They also provided information about the ways in which science is taught and their attitudes towards the subject. Teachers provided information about the ways in which they teach science. Both students (N=1463)[1] and teachers (N=35), provided the same data after the intervention was completed. The return rate for students and teachers was 71% and 34% respectively. This represents the largest study undertaken involving the use of remote telescopes in education. The intervention comprised a set of educational materials developed at Charles Sturt University (CSU) and access to the CSU Remote Telescope housed at the Bathurst Campus, NSW. Outcomes showed that students had increased their astronomical knowledge significantly ($F(1, 1173) = 201.78$, $p < 0.001$)[2]. There was a significant reduction in the students' alternative conceptions ($F(1, 1173)=27.9$, $p < 0.001$) and the students had acquired a significantly greater ability to explain astronomical phenomena ($F(1, 1173)=25.66$, $p < 0.001$). There was a significant concomitant increase in students' attitudes towards science in general and astronomy in particular. Discussion centres on the ways in which the use of remote telescopes can be harnessed to impact in positive ways the attitudes of students.

Introduction

The current study has its origins in the mid-1990s when the first author developed a remote telescope system using control techniques that were different to those then available. The system involved no special software acquisition or installation by the end user. The system was to be usable by students and their teachers in the primary (elementary) school and was built in part response to the research literature that had been appearing claiming that astronomy was badly taught in primary schools and that there were many alternative conceptions evident even after formal teaching had taken place (e.g., Dunlop, 2000; Rider, 2002). A range of educational projects centred on astronomy and addressing the educational outcomes of the primary science curriculum were written and evaluated during 2000. It was clearly evident at this time that teachers were afraid of the technology involved. During 2001, a second study was conducted with modified educational materials and an embedded professional development program on the impact of using these and the telescope on the educational outcomes achieved by the students (Danaia, 2001). It was apparent that the impact on children was highly positive and that they were motivated by the prospect of taking control of the Charles Sturt University (CSU) Remote Telescope to get images of celestial objects (Danaia, 2001; McKinnon, Geissinger & Danaia, 2002; McKinnon, 2005a).

Various reports commissioned by the Federal Department of Education, Science and Training (DEST) have revealed a disturbing trend in both primary and secondary science education in

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[1] N indicates the number of student and teacher participants providing both pre- and post-intervention data.

[2] The F is based on the variance of the means obtained before and after the intervention *divided* by the variance within the sample. If there is no difference between the pre- and post-intervention results then F=1. The "p" denotes the probability of obtaining the value of the F Ratio shown given the number of degrees of freedom given in the brackets. If the F-Ratio is large and the "p" value small, then there is a *significant difference* between the two results. Here, "$p < 0.001$" which means that there is less than 1 chance in 1000 that there is no difference between the pre-and post-intervention results. They are "significantly different".

Australia. Further, enrolments in science during the post-compulsory years of education have been steadily dropping and fewer students are going on to undertake science at the tertiary level. In short, the trend in Australia is similar to the trends in other countries. More specifically, the researchers report that the science taught in secondary schools is largely transmissive rather than investigative and that many students spend their science time copying notes that their teacher dictates or writes on the blackboard (Goodrum, Hackling & Rennie, 2000). The lack of practical work alienates students: they want much more of that. This depressing picture is described by the authors of the Australian DEST report as the *actual* picture of science education in the country. More importantly, the report paints a picture of what the *ideal* picture of science should look like. This picture consists of nine elements five of which relate to the science that should be occurring in the classroom.

Specifically, *ideal* science is relevant and inquiry based and where assessment is complementary to good teaching. The environment is characterised by enjoyment, fulfillment, ownership of, and engagement in, learning and there is mutual respect between the teacher and students. Three of the remaining four elements relate to teachers and their life-long professional development requirements, career paths, class sizes and the employment of appropriate pedagogies. The final element relates to the status that science and science education should be accorded within the society, within the school and within the curriculum (Goodrum et al. 2000; p. vii).

During 2003, DEST commissioned a research and development study to examine the impact of using remotely controlled telescopes in junior secondary science classes. They were interested by the motivational impact that the control aspect the CSU Remote Telescope had had on primary age students. The study developed educational materials for both students and their teachers. The learning package comprised a Student Workbook, a Teacher Guide supplemented by a CD-ROM, an interactive website, a communication forum and a professional development program for teachers. A concurrent research project was undertaken to investigate a number of features of science education five years after the Goodrum et al. (2000) study to see what had changed since its publication.

Pedagogical Approach

The learning package included access to, and control of, the CSU remote telescope and two digital cameras that students control online to take pictures of celestial objects they have decided to image. One of the cameras produces wide-angle images of the sky and the other one takes highly magnified images of celestial objects. The focus is on the students learning how to control the telescope and its cameras to take the astronomical pictures they want. In the process, they have to learn a reasonable amount of astronomy that is tied directly to their science curriculum, though the program does allow extensive cross-curriculum integration, e.g., in English, mathematics, health and the other sciences. Accompanying this system are two additional cameras: an infra-red camera that allows students to see that they are indeed controlling the telescope and an all-sky camera showing the night sky above the observatory.

The second component of the package is a CD-ROM containing software, images and PowerPoint presentations that support students and teachers in their quest to locate and capture images of celestial objects. In addition, a printed teacher's guide (McKinnon, 2004a) and accompanying student workbook (McKinnon, 2004b), provide an approach to teaching astronomy based on investigation (McKinnon & Danaia, 2005). The student book includes a series of projects that promote student-based inquiry in science. The learning materials are underpinned by a social constructivist approach to teaching and learning science. They provide students with the opportunity to undertake a range of practical investigations such as, building scale models of the Solar System, measuring the diameter of the Sun and investigating craters on the Moon as well as investigating the causes of the seasons, day and night and phases of the Moon.

The third component of the package is a Website that contains links to resources and a gallery of images that displays the work of students. Also provided are links to the Bureau of Meteorology and special events that are broadcast through video streaming, e.g., comet impacts and the transits of Venus and Mercury.

Method

A concurrent nested mixed method approach (Creswell, 2003; Tashakkori & Teddlie, 2003) involving a quasi-experimental non-randomized pre-test/post-test design (Shadish, Cook & Campbell; 2002) complemented by qualitative data was employed to investigate students' perceptions of junior secondary school science, teachers' perceptions of what happens in the science they teach to students, and students' knowledge of astronomy. In addition, semi-structured interviews were conducted with a small number of students and teachers and documentation collected from participating teachers related to the teaching and learning experiences they employed during the intervention.

Instruments

The perceptions of students were measured both before and after the intervention using the questionnaire developed by Goodrum et al. (2000) to provide a direct comparison with the data they had collected five years previously. This questionnaire was reverse engineered to produce a parallel version to measure the perceptions of teachers (Danaia, 2006). Four open-ended response items allowed both groups to respond to stimulus questions, e.g., "What do you like/dislike about science in your class?" The same instruments were employed on the post-intervention occasion with suitable changes made to the tenses of verbs to direct the attention of students and teachers to what had been happening during the intervention period.

The Astronomy Diagnostic Test (ADT) was employed to assess students' knowledge of various phenomena before the intervention and again at its conclusion (CAER, 1999, 2001, 2004). The ADT was modified to make it suitable for Southern Hemisphere administration and to elicit more data than the original. Specifically, four additional questions required students to draw and label a diagram that explained day and night, the phases of the Moon, the orbits of the Earth and Moon about the Sun and the seasons. Students were asked to explain, in writing, what their diagram meant (Dunlop, 2000). The remaining 21 multiple-choice questions of the ADT asked students to provide reasons for their choice of response. Analysis of the reasons given by students allowed an in-depth analysis of their alternative scientific conceptions as well as analyses of the complexity of their reasoning and quality of response.

Six schools were visited during the intervention period. During these visits, groups of students and individual teachers were interviewed using a number of focus questions to ensure that some common data were collected from each teacher or group of students.

Participants

The participants in this study were 101 science teachers and 2033 students in grades 7, 8 and 9 drawn from 31 public and private high schools in four educational jurisdictions on the east coast of Australia. Of the 2033 participants, 2016 provided usable responses on both pre-intervention instruments. Of these, 1463 students provided responses on the post-intervention occasion. This represents a return rate of 70.9% for the students. For the teachers, the return rate was lower. Of the 101 who agreed to participate in the study, 35 returned the post-intervention questionnaires and supplied data of what they had actually chosen to do from the compendium of projects supplied. Despite numerous emails, faxes and telephone calls requesting the return of completed instruments, the return rate for teachers was a disappointing 34.6%.

Teacher Professional Development

Fully funded professional development days were held in each jurisdiction for the participating teachers at which time the project was explained to them, consent forms were completed and they provided their first set of questionnaire perception data about the science they taught. At the conclusion of the session, the teachers were provided with enough copies of the ADT and student perception questionnaires to administer to their participating pupils. Teachers were instructed on how to administer these and asked to deliver the completed forms promptly, by post, to the researchers.

During the day, the various components of the project were covered: using the software in image processing; using the planetarium software; making judgments about the projects to do in consultation with their pupils; making contact with the telescope; using the instructional resources; documenting what they did during the intervention period; continuing to communicate after the day had ended; and, the administrative aspects to claim for travel etc. Systems had been set in place to allow the teachers to communicate with each other and with the researchers by email, telephone, fax and a Forum during the intervention period. The professional development was ongoing throughout the intervention period for the majority of teachers who chose to employ one or more of the various communication methods.

Data Reduction

A research team processed the completed questionnaires and readied them for data entry by an experienced operator at the host institution. Procedures were implemented to ensure that high inter-judge concordance was achieved on the analysis of students' alternative conceptions, the responses to the open-ended questions in both of the perception questionnaires. In all cases, the level of agreement was better than 95%. Thus readied for data entry, the experienced data-entry operator entered the coded data into a form suitable for analysis by the Statistical Package for the Social Sciences (SPSS v12.02).

Data Analysis

Thematic analyses of the written responses provided by students and teachers were undertaken to produce categories of response that could be analysed statistically. The same technique was employed with the interview data though these data were not analysed statistically.

Quantitative data were analysed using the statistical package SPSS v12.02. Multivariate analysis of variance (MANOVA) procedures with repeated measures on the occasion of testing were employed to compare the pre/post-intervention data. For the questionnaire designed to elicit students' perceptions about science, non-parametric procedures (cross-tabulation and Chi-Square) were employed to compare the pattern of responses in the 1999 data collected by Goodrum et al. (2000) with the 2004 data set. To reduce the likelihood of a Type I error given that 42 items were being compared in both sets of analyses, a full Bonferroni correction was employed. That is to say, the generally accepted p-value of 0.05 was substituted by the more rigorous p-value of 0.0012 (0.05/42). Repeated measures procedures were employed to compare the pre/post intervention perception data. Correlation analysis (Pearson) was employed to examine the commonality of perception between teachers and their pupils.

Students responses to the questions in the ADT were analysed at five levels: whether the answer was correct or incorrect; the alternative scientific conception(s) evident in the written response; the complexity of the written response using the Structure of the Observed Learning Outcome (SOLO) Taxonomy (Biggs & Collis, 1982; Biggs, 1995); the frequency of non-response; and, the quality of the written response using a hierarchical scale derived from the SOLO Taxonomy and whether the response was correct or not.

Results

It is not intended here to present an exhaustive analysis of all of the data that were collected in this large project. Rather, the aim is to present an overview of results as they relate to the aims of Commission 46. An exhaustive analysis is available in McKinnon (2005b) and Danaia (2006). Following this, the discussion will seek to extract what the authors feel is important for further action by the members of Commission 46.

Students' and Teachers' Perceptions of Science

The pattern of responses to the 42 items of the Secondary School Science Questionnaire in 2004 were compared with those reported in the Goodrum et al. (2000) study to determine the differences, if any, in students' perceptions of science. Only nine of the 42 items produced significant differences in the pattern of student responses. Students in the 2004 study reported an increased use of computers and the Internet in science compared with the 1999 sample. Despite the increase, only a small proportion of students reported that they used computers and accessed the internet in science on a weekly basis. That is, the majority of students reported using the technology less frequently than once per week and most used it less than once per month.

The results also suggest that in the intervening five years, teacher-directed experiments have become significantly more common in secondary school science classes, teachers more frequently use language that is easier to understand and more often than not, take notice of students' ideas in science. There still appears to be limited opportunity, however, in linking science in secondary school to outside the classroom with a high percentage of students reporting that they never experienced excursions or listened to guest speakers. A large proportion of students still report that they are rarely excited or curious about the science they experience at secondary school and feel that it lacks relevance. Despite the fact that there were nine items showing significant differences in the pattern of responses, only four of these could be considered to be in the "positive" direction, one that is desired by curriculum developers and science education commentators.

The same univariate analysis procedures were also used to compare the pre- and post-intervention student responses to the 42 rating scale items. The results show that now, for 36 of the 42 items, statistically significant differences were observed in the pattern of student responses from the pre- to the post-intervention occasion. The comparison revealed that the incidence of teacher-directed experiments had significantly reduced and that computer use had significantly increased.

The covariance of the change in response pattern with the introduction of the intervention is difficult to explain other than to attribute it to the components of the intervention. For example, in comparing the 1999 data with the pre-intervention 2004 data, it was found that there had been an approximate doubling in both the use of computers and the Internet. In comparing the pre- with the post-intervention data, there was a further factor of eight increase in both the use of computers and the Internet. This is not surprising given that the students had to use the Internet to execute many of the research projects, access the telescope system and use computers to process the images that they acquired during their observation sessions.

The Astronomy Diagnostic Test

Analysis of the pre-intervention ADT results revealed an appalling and depressing picture. Of the 25 items in the instrument, 14 can be considered to be knowledge outcomes of the curricula taught in primary school science and which is also covered again in Year 7 science classes in most educational systems. The mean score for all students was 4 correct out of 14. Mostly, they knew what caused day and night and many could describe the orbit of the Moon and the Earth about the Sun. Very few knew what caused the phases of the Moon or the Seasons and many (97%) thought that the Sun was overhead every day at noon (none lived within the tropics). One conclusion that could be drawn from these results is that the astronomy students are taught in primary school has made no impact. On average, the students possessed seven alternative conceptions that related to day and night, the seasons, the Moon phases, and the orbits of the Earth and Moon.

The number of alternative conceptions did marginally reduce as students moved through high school but even by Year 9, the mean number of alternative conceptions was 6.5. One has to conclude that even the secondary school astronomy education has little impact on students' alternative conceptions related to such phenomena as the phases of the Moon and the seasons.

Table 1 presents the overall results as far as the five dimensions of analysis of the data from the ADT are concerned. The table shows that students' astronomical content knowledge increases significantly for all of the year groups while the number of alternative conceptions about the astronomical phenomena decreases significantly. Of interest are the remaining three measures related to students' non-responses, the complexity of their responses and the overall quality of response when one is made. The pattern of the non-responses, complexity and quality of students' responses for Years 7 and 8 are similar while for Year 9 they are different.

Table 1: Summary of the ADT Outcome analyses

	Knowledge of astronomy	**Alternative conceptions**	**Non-responses**	**Complexity of written explanations**	**Quality of responses**
Year 7	** occasions ↑ ns sex	ns occasions ↓ ** sex f > m	** occasions ↓ ** sex f < m	** occasions ↑ ** sex f > m	** occasions ↑ ns sex
Year 8	** occasions ↑ ** sex f < m	** occasions ↓ * sex f > m	ns occasions ↓ ns sex	ns occasions ↑ ns sex	** occasions ↑ ns sex
Year 9	** occasions ↑ ns sex	** occasions ↓ ns sex	** occasions ↑ ns sex	** occasions ↓ ns sex	ns occasions ↓ ns sex

** indicates a highly significant difference **$p < 0.00067$.
* indicates a significant difference *$p < 0.003$.
ns indicates that the difference is not significant.
↑ indicates an increase from the pre- to the post-intervention occasion of testing.
↓ indicates a decrease from the pre- to the post-intervention occasion of testing.

While the Year 9 students' astronomical content knowledge showed a significant improvement they were less inclined to explain the reasons for their answers. One could entertain the idea that this may be a maturation effect for the Year 9 students. It is a well known fact, at least in Australia, that Year 9 students are "difficult" to teach. An alternative explanation for these results may be that by Year 9, the majority of students have already learned that science is boring and not to be entertained.

Teachers' and Students' Perceptions of Science

A correlation analysis of student and teacher perceptions of science proved revealing. Seven reliable and valid scales were extracted from the 42-item perception questionnaire computed using exploratory factor analysis on the student data and confirmed on the teacher data using confirmatory factor analysis. The scales allowed meaningful comparisons to be undertaken between the student data amalgamated for each class and the data supplied by that teacher. The scales are: perceived relevance; perceived difficulty; teacher-directed experiments; computer use; thoughts about what students need to be able to do; teacher's role; and, outside experiences. It is beyond the scope of this paper to describe these and the statistical techniques employed to check their reliability and validity. Nonetheless, it is sufficient here to state that all scales possess high validity and reliability (The authors may be contacted if such data are required.) The factors have been normalized on a common scale where 1=never and 5=almost every lesson.

Table 2: Summary of correlation analyses of student with teacher perception scales

Scale		Occasion 1			Occasion 2		
	Group	M	SD	r	M	SD	r
1. Relevance of science	Teacher	2.953	0.545	-0.079	2.746	0.751	-0.091
	Student	3.249	0.321		3.173	0.458	
2. Difficulty of science	Teacher	2.518	0.447	0.029	2.608	0.622	0.05
	Student	2.923	0.296		3.004	0.32	
3. Teacher-directed experiments	Teacher	3.934	0.485	0.108	3.775	0.65	0.201
	Student	3.902	0.46		3.411	0.637	
4. Computer use in science	Teacher	3.000	0.868	0.680**	4.163	0.624	0.215
	Student	2.446	0.825		3.342	0.625	
5. What students need to be able to do	Teacher	4.141	0.433	0.206	4.106	0.427	0.21
	Student	3.678	0.351		3.555	0.457	
6. Teacher's role in science	Teacher	3.783	0.517	0.298**	3.484	0.447	0.104
	Student	3.368	0.468		3.025	0.538	
7. Outside experiences in science	Teacher	1.684	0.354	-0.096	1.45	0.421	0.421**
	Student	2.495	0.998		2.939	1.062	

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (two-tailed).

The most noticeable feature of the correlation analysis (Pearson) is the lack of agreement between teachers and their students. Only two factors correlate on the pre-intervention occasion at a significant level: “computer use” and the “teacher’s role”. As far as “computer use” is concerned both the students and their teachers agree that they are used infrequently. There was a significant increase in the use of computers from the pre- to the post-intervention occasion. There is disagreement, however, as to “how much” with teachers perceiving that there has been much more of an increase in the frequency of use compared with their pupils. Both students and teachers agree on the frequency with which the teacher discharges their role in science classes. On the post-intervention occasion, however, the pattern of agreement has changed with the perceptions being no longer significantly correlated. With respect to frequency of the outside experiences, both teachers and students agree that there has been an increase but students perceive that this has happened more often than their teachers. What is clear from the analysis is that the perceptions of students and teachers differ quite markedly on what appears to be happening inside the same classroom.

Discussion

The brevity of the presentation of results above illustrates in brief the diversity of what appeared to be happening in the science classrooms. Nonetheless, it illustrates that significant changes in attitude towards science happened and which were accompanied by significant increases in students’ astronomical content knowledge. For the younger participants, there were significant increases in content knowledge, complexity of reasoning and quality of response accompanied by significant reductions in non-responses and alternative conceptions about certain astronomical phenomena. The impact of the intervention, however, seems to weaken with increasing grade level. The weakening effect may in part be due to the fact that students in the later grades have already experienced science and have already become alienated with it and the associated transmissive pedagogies employed to “teach” it. Perhaps the Year 7 students saw the intervention as a welcome relief in their short experience with the subject and engaged with it.

In these classes, the students enjoyed what they did, were enthralled by the prospect of taking images and having them delivered to them immediately over the Internet. They seemed to be engaged and enthusiastic about what they were learning. It was also evident from a deeper analysis of learning outcomes that those teachers who had a physics background or who were already interested in astronomy achieved the best learning outcomes. They commented positively on the learning materials and were enthused by the remote control of the telescope and the image processing that took place afterwards. The stark contrast in pedagogical style is best summed up by a comment one teacher made on the post-intervention questionnaire related to the fact that she “did not feel as if she was teaching the students and yet they seemed to be learning” and that it was really interesting to “see another way to teach science”. This begs the question of how she had been teaching science before though it may be inferred, from the very high proportion of students who claimed on the pre-intervention questionnaire, that they had to “copy notes from the blackboard”.

It was clear from this study that there was a range of pedagogies employed from transmissive ones where the teacher was in control all of the time to ones where investigation was the dominant approach. This was most clearly evident in the interview and open-ended question data collected from students and their teachers. The way in which science was taught led many students to express their disappointment and frustration. For example, at one school where three classes were involved, students complained about a number of aspects of the pedagogy. At interview, one student’s comments summed up the disappointment at not being able to take their own images where he said “We got there and *he* did it all and we were like … we chose what *he* took photos of, but *we* didn't do anything. We just *watched* him do it. So it was a bit disappointing - *really* annoying.”

It would appear that if Commission 46 wishes to have an impact on Astronomy Education then steps must be taken to address the pedagogical issues. The teaching of science needs to move beyond the transmissive approaches required by science curricula that “are a mile wide but an inch deep” (AAAS, 1990).

It was also clear that remote control of the CSU telescope was a motivating feature of the intervention. Pupils seemed to get a real “buzz” from driving the telescope, in controlling its cameras to get “their” images and processing these to show their parents and/or have them posted on the project website. This motivational aspect should not be ignored. Rather, it should be exploited to generate an even greater interest in the subject.

It is clear to us that using a remotely controlled telescope constitutes the *first* step in a developmental program that can end up with more senior students using robotic or completely autonomous telescopes to take images on a repeated basis where they wish to concentrate on the data extraction and the science contained in the picture. We say this for the following reasons. The students involved in this project had never done anything like this before. They had not had any prior experience with remote control observing and this aspect motivated them. The students and teachers all got a “kick” out of doing it. The specialist human support for such a system is expensive but a *necessary* first step at this period in time. More economical robotic systems can be used later where projects that require repeated observations are undertaken.

The developmental approach alluded to above has not yet been investigated but, with the advent of the Las Cumbres Observatory global telescope network, research can and will be undertaken to test the hypothesis that a love of astronomy can be engendered in more students. Perhaps they may even develop a life-long interest in science in general rather than the current situation where the majority have had it quashed by Year 9.

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Examples: Telescopes in Education; The CSU Remote Telescope Project; and The Faulkes Telescope. â€¢ Robotic Telescopes â€¢ User does not get to control the telescope, software does everything. â€¢ Examples: the Bradford Robotic Telescope (John Baruch, 1993); and The Faulkes Telescope. â€¢ Remote v Robotic telescopes in education â€¢ Both have a place. 2 The CSU Remote Telescope Current Observatory Tracks for the roll-off roof. Note the louvres.Â DEST Research and Development Report â€¢ The Eye Observatory Remote Telescope Project: Practical Astronomy for Years 7, 8 and 9. â€¢ PhD Thesis â€¢ Studentsâ€™ experiences, perceptions and performance in junior secondary science: An intervention study involving astronomy and a remote telescope. â€¢ Robotic telescopes in education. Astronomical Review, Vol. 13, Issue. 1, p. 28.Â The telescope is not a robotic device. It is controllable in real time with images being transmitted to the user also in real time. Visitors to the site are able to view what is happening at the telescope without being able to take control of it. This paper describes the project, the software control system and the related curriculum activities. Discussion centres around how to ignite students' and teachers' interest in science and how projects such as this one may lead to more exciting coverage of important topics in the primary and lower secondary schools. Send article to Kindle.Â Robotic telescopes in education. Astronomical Review, Vol. 13, Issue. 1, p. 28.