

TEACHING EXTERNAL PHYSICS STUDENTS

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ABSTRACT

Traditionally students would turn up at the first physics lecture of the semester, be given a Study Guide and told to purchase a text book and laboratory manual. They would then be well equipped to work their way through the unit. There were perhaps one or two students that could not manage to get to a laboratory session, and allowances were made for them to catch up during non-teaching weeks. Some students even moved out of commuting distance, missed out on lectures and had to complete a residency for their laboratory work. This made studying more complicated for both the students and the unit coordinator. It also disadvantaged country students and working students who were studying part time. Over the years Murdoch University physics has strived to address this situation, and a structure has evolved that facilitates the learning of students who cannot attend the campus. These students are said to be studying in the external mode. The intent of this paper is to illustrate the evolution of the strategies now used with our external physics students. It is written in a narrative style sharing experiences rather than empirical results.

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THIRTY FIVE YEARS OF EVOLUTION IN EXTERNAL TEACHING

Murdoch University has been successfully teaching physics to students in the external mode for over 35 years. At first the number of students studying in this mode was small, and the materials they were given amounted to little more than a text book, study guide, experimental kit and the phone number of their supervisor or tutor. Now, the number of students studying in this mode, especially in first year, is well over 300, and the complexity of the offerings has increased accordingly. As the number of external students increased, and the offering across semesters and study periods multiplied, the teaching methods evolved to meet the challenge of providing a quality learning experience for the students without any face-to-face interaction.

Studying completely in the external mode means that students can work where they are without any requirements for on-campus attendance. They have flexibility and can fit their studies in with the rest of their life. Our external student population comes from diverse locations, city, country, interstate, off-shore and over-seas. They also have interesting and diverse backgrounds. Some of our students are in the armed forces and take their studies with them to do in their off duty hours. Others are in remote locations such as farms, mining camps and oil rigs. Still others have disabilities that make attending the campus with any regularity impossible. Others have jobs that keep them moving from place to place and even overseas, while a few study from within the confines of the prison system.

How then do we provide a quality learning experience for all our varied external students? The answer is flexibility, availability and a focus on student learning rather than staff teaching. The questions that we ask ourselves are of the type: "What resources and activities can we provide to facilitate student learning of the required content, skills, abilities and attitudes?" We align the outcomes we wish the students to achieve with the materials and facilities they have access to, and the assessment tasks they are asked to complete. This is not a new concept and, as previously mentioned, we have been doing it for 35 years. We have continuously pushed the boundaries of technology to assist us in this endeavour.

Traditionally study in the external mode meant that at the beginning of semester a student would receive a study guide, which gave them information about the content they had to study and the assignments, they bought a text book and got on with it. Every so often the student would mail off an assignment and, if they were lucky, it would be returned with a mark and a few comments a few weeks later. There were no hands-on activities and minimal contact with classmates, tutor and unit coordinator. Students had no idea how they were going with respect to their classmates and, unless they were very self motivated, there was a higher than average chance that they would not complete the unit and either withdraw or fail.

Murdoch University adopted a different approach in the early days of external teaching in physics by developing laboratory kits for experimental work at home and assigning a personal tutor to every external student. These innovations produced much better student outcomes and retention rates.

Since the mid 1990s it has been reasonable to assume that students have been able to access a personal computer, either at home, at the local library or their workplace. Therefore, to supplement the material provided in textbooks and study guides, we have sent out lecture and experiment-related material to students, at first on floppy disks and then CDs. As bandwidth and browsers improved, e-mail and the Internet became the main lines of communication. We now have extensive material for each unit on individual websites shared by internal and external students.

The unit website is part of a learning management system (LMS) which allows several modes of interaction with our students. It contains the standard content of the “Unit Information and Learning Guide” as well as the PowerPoint slides and audio-recordings of the lectures. We are also starting to take “YouTube” type videos of the lecture demonstrations to add to the site. Early feedback from the students suggests they like these as it enables them to put a face to the voice and name of the lecturer. The website is also a useful place to put a FAQ section for common questions which can then be addressed in an informal way outside of the study guide, which, it appears, few students read as evidenced by the questions that they ask. Photos, videos, experimental data and information can be uploaded to the website by staff and students, both internal and external, about labs, demonstrations and other activities pertaining to the unit. It allows students to post their results and see the results of other students thus allowing students to make a comparison of their work with the work of others. The laboratory data posted by staff is supported by descriptions, photographs and video walk-through demonstrations. Links can also be provided on the unit website to external information that the students can access like YouTube, podcasts of lectures and material from other universities, physics applets (physlets) and websites that have good physics reference material.

The website and associated asynchronous discussion area allow the external student to communicate with the rest of their classmates about the content and learning experiences related to the unit. Some students have been able to use the discussion board to organise face-to-face study groups if they find there are other on-line students in their geographic area. There have also been instances of students posing physics questions that are not directly related to their assignments, which have then resulted in extended discussions on these topics. One student in particular was interested in aeronautics and led a couple of long discussions. Only a small subset of the students participated but there would have been many more quietly reading. The discussion board effectively reduces the student’s isolation and gives them a rapid response to the “where do I find...”, “how do I do...” sort of questions. It also gives them more than one source of information about the content and practical aspects of the unit. They experience what it is to be part of a community of learners as opposed to a learner in isolation.

Another part of the LMS allows students to submit their assignments electronically. Their assignments therefore never get lost and there is a record of when they were submitted, marked and returned. This is extremely useful for students in-transit, between accommodation, changing jobs, moving between cities and even between countries. In the assignment submission area the students will find a link to TurnItIn (iParadigms 2011). This reference checking software can be used to highlight parts of a written assignment that has not been referenced correctly before it is submitted for assessment. While electronic submission is the preferred method of submission, for all the reasons just given, it is also possible for students to send their assignments to the external studies administrative area via e-mail, fax and even post.

It might seem strange to expect physics students to submit an assignment for reference checking however one of the main assignments in the first year physics unit is “A Scientific Report on the Physics of a Situation”. It is not a laboratory report, it is a report about a real-world observation that the student has made, and their explanation of the underlying physics. This report is intended to highlight, to the students, the different thought processes of a novice, physicist or engineer, and an expert. The concept is based on work by Carl Weiman (2009) and leads the students through the thinking and writing process of an expert, and, at the end, asks them evaluate the quality of their work. This assignment seems to capture the imagination of the students and affords them the opportunity to share a little of their life and experiences with the unit co-ordinator and tutor. For example there have been reports on thermal expansion of naval cannons and kayaking around

Hobart. One student was even able to change procedures in the industry where he worked because of his study of liquid flow rates through different sized tubes.

Finding the right person to be a personal tutor for external students is very important. External tutors are not glorified markers. If they do their job well they can make a great difference to the completion, retention and pass rate of the external students. External tutors need to initiate the discussion with students to remind them of up-and-coming deadlines, they need to reply quickly with well thought out answers to student questions, and there should be a maximum of two weeks turn around for marking. External tutors need to check up and see if students are well if they have not heard from them for a while, or if the student fails to hand in a piece of assessment. If the students are having problems other than with the content of the unit then the tutors can at least inform the student about the support mechanisms and options available to them within the university e.g. equity, counselling, deferred assessment, withdrawal dates and how to contact their unit coordinator. Often a short "How are you going?" will help to sort out small difficulties before they become too big to cope with.

Physics has a practical, as well as a theoretical, aspect and this necessitates hands-on activities. We have developed experimental kits that are sent out to external students at the beginning of semester. They contain enough equipment so that the students can undertake experiments that, if completed properly, give an equivalent, or in some cases better learning experience to that of internal students. In the first year class the kit contains simple materials for experiments in mechanics, buoyancy and electronics. In second year the modern physics kit contains equipment to do spectrometry, the Frank-Hertz experiment, and a black box developed in-house that enables students to determine Planck's constant using light emitting diodes.

Not everything in physics can be experienced in a hands-on way so both internal and external students use the Real Time Relativity simulation developed at the ANU by McCalman, Searle, Savage, and Williamson (2009) to investigate the effects of relativity on objects moving at high velocities. The feedback from both internal and external mode students about this easily downloadable package has been extremely positive.

Examinations for external students often prove to be a headache. Not all students can attend recognised examination centres. Murdoch University overcomes this obstacle by allowing students to nominate a responsible member of their community as their examination supervisor. Students have therefore sat their examinations off-campus under the watchful eye of the captain of their ship or submarine, or have been supervised by the local constabulary, justice of the peace or school teacher. If students are within an 80 km radius of an examination centre they are expected to attend that centre, so this discourages local students from sitting examinations off campus. However, if the student is physically incapable of attending the examination, alternate arrangements can still be made.

Our ability to offer a quality learning experience in the external mode has not gone unnoticed by the internal students who will sometimes choose to study a unit externally to avoid clashes with other units, or to fit the units they wish to do, around the work they have to do to survive.

One final comment concerns the physics community discussion site. All students who are enrolled in physics or engineering units have access to this site. When it was first created it became a focus of the community, both for internal and external students, and generated a great deal of discussion about particular and general aspects of physics. The amount of traffic on the site decreased dramatically when that cohort of students graduated and has not recovered, possibly due to an increase in alternate social networking options, such as Facebook and Twitter.

STUDENT FEEDBACK

The following unsolicited feedback is from two of our recent students. The comments capture the transformative impact on their lives, of studying in the external mode.

I was in Perth last week to attend my Graduation on the Tuesday night. Unfortunately I was only able to do a quick trip to Perth but it was fantastic to be able to go out to Murdoch to pick up my regalia and finally see the place I'd been sending all my work to over the last 10 years.

Initially I hadn't expected to be able to attend and was just going to receive my degree in the mail, but after attending the ceremony and being able to walk up on stage to receive the award I am so glad I flew over. It was so much more fulfilling than walking out to the letterbox one day to find an envelope for me.

I'm not sure who the best person is to receive this email but I just wanted to let someone know that for the entire time I was studying through Murdoch the support and help available to me as an external student was fantastic. I can't think of anything that could have been done better. Studying externally has its own difficulties but for me at least the experience has been well and truly worthwhile, and it's due to the people at Murdoch that this is the case.

I was the external student working away on the mine-site. After 6 yrs study I now have a degree in physics with a major in energy studies. I can't believe that I passed electromagnetism (I got 79% for it!!!! Almost a distinction). I am now working for an energy efficiency company in Perth called XXXX. It is challenging work and at times is very overwhelming but at least I am now home every night. There are several tutors/lecturers/unit-coordinators that I have to thank and you are one of them, so thank you for your help over the last 6 yrs. As well as physics concept help, you were a good motivator when I started getting the shits with the whole thing especially with the mature age/ external study/ fitting study in with family life etc.

CONCLUSION

This paper pulls together a spectrum of the approaches used by the authors to facilitate student learning in the external mode. Not all of the units offered to external students in the physics program at Murdoch University have all of the above attributes. While this paper makes it appear that teaching external students is a well thought out and organised process, the reality is that it has evolved through trial and error, student feedback, and reflection on our own teaching practices.

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