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Going the distance in Canada

Athabasca University sets the pace out West in its approach to distance learning chemistry.

ATHABASCA UNIVERSITY (AU) is located in the town of Athabasca, Alberta. In addition to the main facility in Athabasca, AU also has 'learning centres' in Edmonton, Calgary and Fort McMurray – three of the larger urban centres in Alberta – as well as a network of 'examination centres' throughout the province (see *Fig 1*). Although based and funded in the province of Alberta, AU is modelled on the Open University (OU) in the UK[1,2] and is devoted to increasing the accessibility of university-level education to all Canadians. With *ca* 14 000 students, AU has *ca* one tenth of the undergraduate population of the OU.[3] AU courses are mainly home-study with telephone tutor support, and formal entry-level requirements are kept to a minimum. However, unlike the OU, AU has a year-round registration policy which enables students to begin a course on the first day of any month.

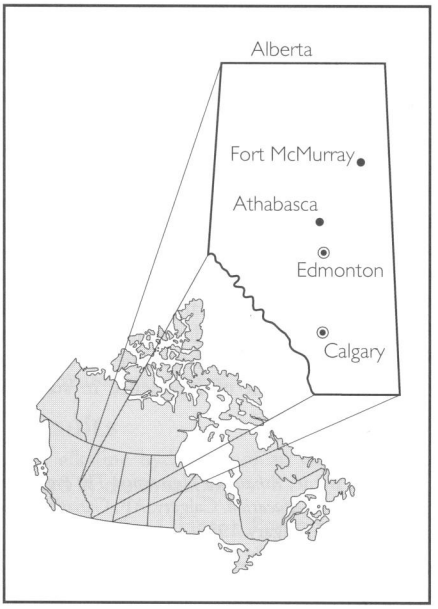
The chemistry course

While AU does not offer a degree in chemistry, chemistry courses form part of the general BSc. There are two introductory chemistry courses (first year), two organic chemistry courses (second year), an environmental chemistry course (second year), and an introductory biochemistry course (third year). The theory component of these courses is print-based, with 'telephone-tutor' support. When students register on a course they receive a 'course package' which includes all the instructional materials – *eg* textbooks, study manuals *etc* – that are needed for the theory component, and instructions on the various administrative procedures. The theory components of AU chemistry courses all have supportive study guides to accompany the text, providing maximum support to the students. With the exception of a few foreign language courses, all AU courses are written in English. To ensure that our course materials are of the highest quality, they have been developed by a team which includes a course manager, author(s), a subject matter expert, an editor, a visual designer, and an instructional designer.[4–6]

Students are allowed a six- or 12-month contract period to complete a course at their own pace, during which they must hand in assignments and do laboratory work. They take midterm and final examinations when they are ready. The examinations are 'closed book' and are taken at one of the university's examination centres where they are invigilated.

Each student has a 'telephone tutor' whom he or she may call (toll free) at certain specified times – usually one evening per week. Chemistry tutors usually have a group of 32 students on a given course. This one-to-one tutor–student interaction can be an important factor in motivating students to complete a course. With year-round enrolment, a tutor will have students who are at various stages of the course. Telephone tutors also have several other duties, including marking assignments and laboratory reports, scheduling students into available laboratory sessions *etc*. Most AU tutors are employed on a part-time basis, and many concurrently hold academic positions with other tertiary institutions. Unlike tutors in many other disciplines, chemistry tutors often meet their students during laboratory sessions.

Fig 1 Location of Athabasca University in Canada.



Role of laboratories

A good laboratory component is essential to the overall success of any first- or second-year university chemistry course. Many of our students register on these courses with the intention of transferring the credits obtained to other institutions. Since AU chemistry courses have creditable laboratory components, they can be readily transferred to other universities or colleges.[7] Other institutions in Canada that offer distance learning chemistry courses with no laboratory component do not receive recognition or credit for their courses at the university level.

The cost of delivering laboratory courses has become a major concern for many, if not all, college and university chemistry departments.[8] In addition, the 'distance teacher' faces major problems in trying to synchronise laboratory activities with the material presented in the theory component of the course – a problem which is intensified at AU because of the institution's policy of allowing year-round registration. The fact that the locations at which AU offers its laboratory sessions are separated by large distances merely compounds these problems. The difficulties in providing students with adequate laboratory experience is probably the main reason why some universities do not offer distance learning science courses.[9]

In addition to reinforcing one or more of the concepts covered in the theory component of the course, each experiment should stimulate the students' interest and maximise their learning experience. The tutor must also be able to deliver the experiments in a timely and effective manner. At AU, a one-semester course requires the student to do a total of 32 hours of laboratory work. A student attending a traditional North American university does approximately the same amount of laboratory work in 10 weekly three-hour sessions.

Currently, the laboratory components of our courses are delivered in three ways: through campus-based labs, through regional labs, or through home-study labs.

❖ The campus-based lab consists of a week-long session at our Athabasca campus – this arrangement is favoured by most of our out-of-province students because this enables them to complete the laboratory component in one trip.

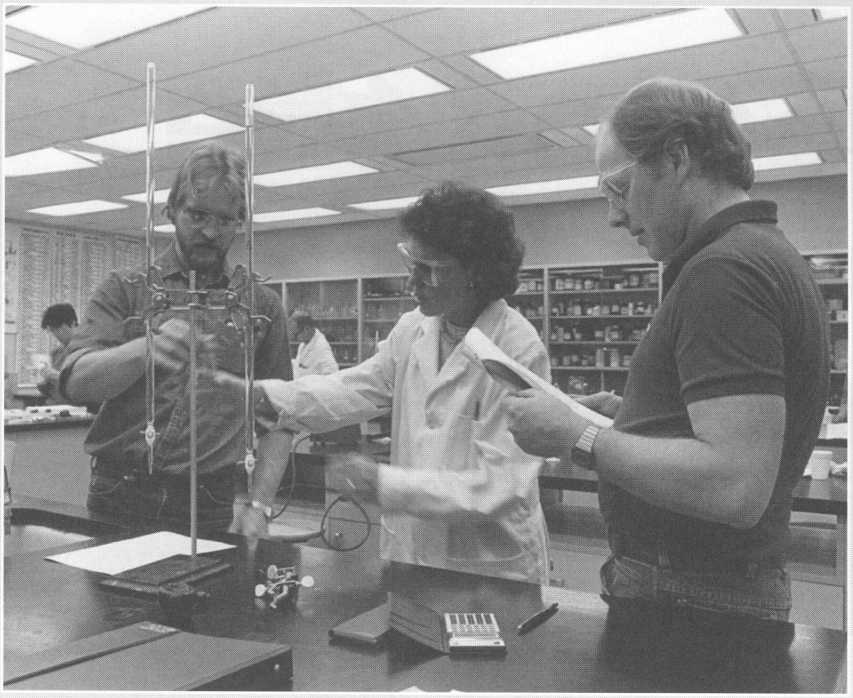
❖ The regional-based labs are run on weekends throughout the year in Alberta's two major urban centres, Edmonton and Calgary, where AU has the use of teaching laboratories in some tertiary institutions. Students living in Edmonton and Calgary account for *ca* 75 per cent of our chemistry students and not surprisingly these students generally prefer this mode of delivery. (The concept of offering concentrated laboratory sessions as part of a distance-education science course has also been used by a number of other institutions.)[9–11]

❖ The home-study lab[12] has recently been introduced by AU in its first-year chemistry course to reduce the time spent by students in the laboratory. The Transportation of Hazardous Goods laws in Canada,[13] however, do not permit us to give 'full-size' chemistry kits to the students. We have, therefore, turned to using microscale experiments that require minimal amounts of chemicals. Using a combination of specially designed microscale experiments[14] with an accompanying video guide, and some household chemicals and equipment, students can do some of the experiments – *eg* on calorimetry, quantitative determination of phosphorus, physical and chemical properties of solutions, and identifying aqueous cations – in their own homes.

(The campus-based labs and the regional-based labs are similar to the residential school system of the OU and compact several experiments into a shorter time than would be the case in a traditional university course.)

New technology

The use of new technologies to facilitate student learning is very exciting.[15] Several AU courses are already on the Internet and our chemistry courses will be available in this format within the next year. However, we are also investigating the use of other technologies in chemistry, such as computer assisted learning (CAL), computer mediated instruction (CMI) and interactive CD-ROM technology (CDi-ROM). Recently, we have introduced computer simulated laboratories using CDi-ROM technology as a pilot project in the second half of our first-year chemistry course. We have combined good laboratory simulations available through CDi-ROM[16] with a text package to keep track of students and set on-line quizzes. The use of these simulations reduces actual hands-on laboratory work by *ca* 30 per cent in this course. Currently, students carry out laboratory simulations at work stations at regional learning centres, but we hope that they will eventually be able to do this at home using CD-ROM technology or via the World Wide Web. Effective use of educational technology can partly offset the negative effect of such factors as isolated study and concentrated laboratory work. The goal in using such methods is not to replace traditional laboratory work with simulated experiments, but rather to provide the student with a better idea of what to expect upon entering the laboratory and thereby make more efficient use of valuable laboratory time.



Students attending a regional laboratory session on a weekend.

Why choose AU?

When David packed up his skates and equipment to go to the World Speed Skating Championships in Japan in 1993, he took along some extra reading material – his Athabasca University Chemistry 217 course. Being able to take his studies on the road with him was an important factor in his choice of university. Martha, a full-time dental hygienist and a mother of three children, needed an organic chemistry course to complete her pre-medical studies. Although she lives in a major city that boasts a university and several community colleges, she took her course through Athabasca University because it gave her the most flexibility in study time and laboratory hours. While his wife works outside the home, Sam studies as a full-time student through Athabasca University. This arrangement gives him time to manage various seasonal businesses, take care of his two young sons, and work toward his BSc. By registering in chemistry courses offered at a distance, these three students have taken advantage of Athabasca University's unique structure and mandate to meet their educational goals.

Conclusion

The provision of a creditable university-level chemistry course using distance learning methods presents educators with several challenges, not least of which is the necessity of providing students with adequate laboratory access. Although AU's operational model parallels the OU in several ways, our year-round registration policy, strict transportation laws, and greater distances requires its own distinctive approach to delivering chemistry courses at a distance. With the increased availability of new educational technologies, distance educators have the opportunity to design chemistry courses which could provide their students with a wider range of learning aids than is encountered by many students in traditional institutions, while at the same time providing an equivalent amount of experience in standard laboratory practice.

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