

Undergraduate Zoologists in the Grade 1-6 Classroom: Content Specialists and Curriculum Enhancement

By Anthony P. Russell, George B. Bourne, Robert M. R. Barclay and Edward C. Yeung
Department of Biological Sciences, University of Calgary

In 1997 we taught, for the first time, a course in Elementary School Curriculum Enhancement. That course has been offered every year since then (with one exception), and has served between four and six schools at a time. It involves an unusual and very rewarding partnership between the Department of Biological Sciences of the University of Calgary, the Calgary Board of Education, the Calgary Catholic School District, and the Science Hotline of the Calgary Science Network. We report on our experiences here because this has been a very successful enterprise that has added a new dimension to our zoology (and biology) teaching, and has provided an exciting capstone experience for highly motivated senior undergraduates.

We believe that there is opportunity to partner in this way across the country to provide undergraduates with interesting integrative challenges and to make a major contribution to the "return to community" theme that is heavily promoted at universities today. We have found that placing zoology/biology undergraduates into elementary schools as resident scientists for an entire university session has helped us to raise the profile of our program and provide the public at large (the elementary students speak enthusiastically to their parents about the scientists they are working with) with direct exposure to the structure and relevance of contemporary zoology.

Undergraduates in zoology programs seldom are able to benefit from experiences where their knowledge has utility beyond ex-



Resident scientist Mark Pho and one of his partnering teachers present some of the finer points of zoology.

aminations and term papers, and seldom are able to interact with the broader community in situations where their training and knowledge have immediate currency. Our involvement of undergraduates in a curriculum enhancement course has been a successful way of providing such opportunities.

How the Course Came About

Early in 1997 the Science Hotline of the Calgary Science Network approached the Department of Biological Sciences hoping to develop a partnership of volunteers to help the public and Catholic school boards to implement a new science curriculum mandated by the Province. One of us (APR) was Head of the Department of Biological Sciences at the time and concluded that the use of volunteers was unlikely to be effective in a sustain-

able way. The challenge, however, was attractive and so it was decided to develop a course to involve undergraduate students and to employ their energy, ingenuity and knowledge to build a sustainable and focused partnership.

The impetus on behalf of the Science Hotline and the school boards was the recognition that very few Grade 1-6 teachers are trained as science specialists, and consequently the introduction of the new, theme-based science curriculum had created considerable disquiet among teachers. We saw this as an opportunity to use undergraduates as content specialists and to partner with teachers to enhance their understanding of science. This change in curriculum was the catalyst that prompted us into action, but it is obviously not necessary for

such changes to occur to initiate such a partnership.

Developing the Partnership

Our course was designed to enhance early experiences with science in elementary schools, recognizing that there is a heavy emphasis on zoology and biology in the elementary school curriculum. Our undergraduate scientists were challenged with exploring their conceptual, integrative and interactive skills to bring about the desired enrichment. The undergraduate students have the role of scientific content specialists in the schools, and provide the scientific context for General and Specific Learner Expectations (GLE and SLEs)

(Table 1) for a teacher or a team of teachers in designated schools.

Working with the school boards and the Science Hotline, partner schools are identified on an annual basis, with the expectations being that high-needs schools (those in areas of the city with a preponderance of lower income households) are preferentially targeted, and involvement in a given school typically is for one university session (to ensure that as many schools as possible can be involved). The undergraduate resident scientists help develop conceptually-based modules that meet specific SLEs, and do this by conducting research, making presentations to teachers, and presentations to elementary classes. It is expressly stressed that

the undergraduate resident scientists are not trainee teachers, and that their involvement is primarily content based.

As a result, their involvement and contribution is focused upon developing ideas for delivering the curriculum in exciting, innovative and scientifically robust ways. They must carry out appropriate research and spend an extensive block of time each week at the school. The goal is for the students to create hands-on exercises/material that will remain at the school to be used by teachers in subsequent years. Benefit to the school thus continues beyond the period in which the resident scientist is directly involved.

Table 1

Zoologically-based 'Specific Learner Expectations' in the Alberta Elementary School Curriculum			
(*Denotes SLEs in which zoology is not necessarily the focus but in which zoological examples are used to illustrate principles.)			
Grade	Curriculum Topic	Grade	Curriculum Topic
1	Seasonal Changes	4	Waste and our World*
1	Building Things*	4	Wheels and Levers*
1	Senses		
1	The Needs of Plants and Animals	5	Wetland Ecosystems
2	Exploring Liquids*	6	Air and Aerodynamics
2	Buoyancy and Boats*	6	Flight
2	Hot and Cold Temperature*	6	Evidence and Investigation*
2	Small Crawling and Flying Animals	6	Trees and Forests*
3	Building with a Variety of Materials*		
3	Testing Materials and Designs*		
3	Hearing and Sound		
3	Animal Life Cycles		

Course Structure

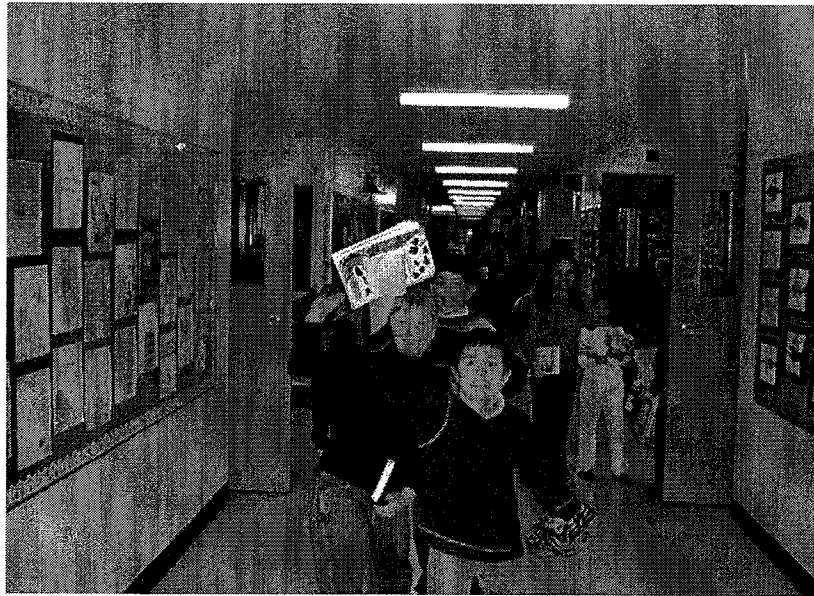
Undergraduates involved in this partnership have formal course requirements. They are expected to dedicate between nine and 12 hours per week to the course, about half of which is spent in the partnering school. The other half is spent on

graduate scientists develop their modules, and act as conduits to other faculty members, graduate students and staff, who have specialized knowledge that will assist in the development of the modules. As such, the course becomes a Department-wide enterprise. Feedback from the partnering elemen-

Student Recruitment

As the students in this course will be ambassadors of the university in their interactions with the schools, we exercise care in selecting undergraduates for the course. We invite high-achieving third year undergraduate students to an information session to outline the goals and objectives of the course. Interested students are then requested to submit an application for admission to the course (based upon the realization that we will accept no more than six or seven students in an academic year).

The application process is fashioned like a job search. Students must submit a statement of interest, an outline of their potential contributions, strengths and skills, an outline of their motivation for wanting to be involved, and the names and addresses of two referees (usually faculty members or graduate teaching assistants). The applications are reviewed by us, a short list drawn up, and final selections made. Interest is high, and each year we receive many more applications than there are places available.



Enthusiastic students leave the classroom for a field exercise, fired up about zoology.

research and preparation, and on the attendance of weekly discussion groups involving all students registered in the course and all involved faculty members. Undergraduates are required to keep a diary documenting their experiences and the ways that their ideas are developing, to write a term paper that discusses in detail the concepts underlying the specific SLEs developed, and produce a narrative report of their experience.

The faculty members teaching the course facilitate weekly discussions. These are designed to encourage collaboration among the students so that they work as a team. Faculty members provide ideas and resources as the under-

tary school teachers is used as part of the assessment process.

One objective of the course is that costs must be minimized – undergraduates are encouraged to think, not simply spend, their way to solutions. A principle of the course is that, beyond the course fee, undergraduates will not incur out-of-pocket expenses. A modest budget for travel costs to and from the schools, and for supplies, is negotiated with the Department and Faculty of Science beforehand. We have found that a budget of \$500 has been adequate to run the course for a session. The time of faculty members and elementary school teachers is donated to the course.

Reactions

All partners involved have reacted very positively to this initiative. Our own students learn a great deal about themselves as the course unfolds, and think deeply about integrating the knowledge that they have gained throughout their undergraduate career. The partnering teachers benefit greatly from the insights the undergraduates provide, and learn to look at the SLEs in a new light.

We, the faculty members involved, delight in seeing our students blossom in this new situation, and enjoy working in a partnership that provides a different way for us to serve

both the university and the community. The elementary school students are simply enthralled at having a scientist working in their midst. A few quotes give the flavour of these reactions:

Undergraduate Scientists

"I sincerely believe the children benefited from my work in the classroom, not only directly through my work, but also as a role model."

"I feel honoured to have used my training and immense interest in zoology to have improved the quality of science education in schools."

Elementary Teachers

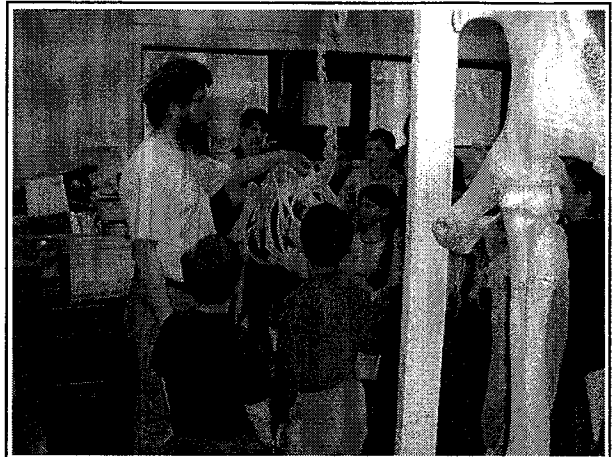
"As elementary generalists, we are not always aware of the expertise out there to help us make sense of the curriculum objectives in science and technology."

"The materials and ideas brought into the classroom would be extremely difficult to arrange as a classroom teacher."

Elementary Students

"I hope to become a great scientist. Bet you will. My interest is mostly differences. Like the bone with calcium and the bone without calcium."

"It was awesome. I liked everything we did. I really liked the natural structures. I learned that eggs can be hard..."



Resident scientist Sara Hechtenthal (arrow) brings one of her partnering classes to the University of Calgary Museum of Zoology.

Summary

Our curriculum enhancement course has turned out to be an effective means of increasing scientific expertise in the elementary school classroom, and in fostering interest in science at an impressionable stage in young student's lives. Undergraduate scientists, using their expertise, provide a return to the community, are a valuable resource to elementary school teachers, and learn that they are apprentice scientists who serve as role models in the classroom. This is especially the case for female undergraduates. Our students are encouraged to think and interact in ways that are not typical in science courses in general, and thus reflect on what they have learned, and why, during the course of their degree program. The course measures up well against the recommendations of the Boyer Commission (1998), and fulfills six of the ten

ways to change undergraduate education (Table 2).

Such a course has been used as a catalyst for generating interest in such partnerships across campus. As zoologists, we are fortunate that so many science curriculum topics at the elementary level are conducive to exploration using animal-based models and principles. These

are attractive to school students, and are more easily understood by them, because of the empathy they have for animals.

Reference

The Boyer Commission. 1998. Reinventing Undergraduate Education: A Blueprint For America's Research Universities. <http://notes.cc.sunysb.edu/Pres/boyer.nsf>



Table 2

<u>Boyer Recommendation Number</u>	<u>Principle</u>
1.	Make research-based education standard.
4.	Remove barriers to interdisciplinary education.
5.	Link communication skills with course work.
7.	Culminate with a capstone experience.
8.	Educate (graduate) students as apprentice teachers.
10.	Cultivate a sense of community.