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Developing students as researchers – it's all a muddle

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Research can be a bit of a mystery to undergraduates who can be rather startled / worried / anxious / upset when they first realise that there are things that their lecturers do not know. There is a surprising expectation that University lecturers are experts in their subject, whereas in fact University lecturers are experts at exploring what is *not* known about their discipline. Most researchers spend their lives developing ideas and exploring their validity. It is normal for these ideas to evolve very significantly during the course of the project as new information comes to light. One of the main functions of a University is to explore complicated matters and tease out the many dimensions and 'truths' involved. Most academics are trying to sort out the muddled understandings that exist in their subjects.

The challenge for academic staff is to give students, who are accustomed to very structured school experiences, the confidence to work in these unexplored areas of the disciplines, and to appreciate and to contribute to the muddle. If in addition a little corner of science is sorted out that is an absolutely brilliant bonus outcome. Hence the focus in every degree discipline on critical reasoning, exploring through practical problem-based activities in the laboratories and field, and collating evidence from different authorities through the library research. Throughout the research cycle communication is vital; talking and writing about the work, the failures, mishaps and successes, sharing the information with colleagues as research progresses and producing a final report. Excellent final reports are usually the product of many drafts, such that experienced researchers know to start drafting the final report in the first week.

Making the research \leftrightarrow teaching links clear, the hallmark of university teaching, challenges staff to harness the capacity of students, and to work with them to explore really interesting discipline problems. Students working as geologists, biochemists and mathematicians, rather than students as listeners at lectures where someone talks about geology, biochemistry or maths. The majority of students prove to be resourceful and critical users of electronic information and in some cases contribute to and edit entries on World Wide Web sites such as Wikipedia. Developing critical understandings of any part of your discipline is initially uncomfortable. It feels very different from school-based reliance on textbook content. Engagement with electronic discussion boards, whether set up by academics for a

module through the University's VLE, or via Facebook, Twitter or alternative social networking groups, can act as a crucial stage in developing the research confidence to discuss and evaluate your own work and understandings of the academic muddle.

Research is primarily about conversations however they are mediated. Discovering how to use the language of that discipline is part of the university experience, so that criticism can be made and taken on board in an acceptable and supportive academic manner. Developing objectivity and evaluative skills are all part of the research process in practice.

Being able to publish through *The Plymouth Student Scientist* is an accolade in its own right, confirming the value of student research and student excellence in research. It is also a significant part of the conversation between researchers of all generations. The papers here are of equal value to academic researchers in this and other universities as they are to undergraduates thinking about research projects for their final year. The papers provide a significant resource for new undergraduates and for those thinking about access to the University. They present a tangible opportunity to inspire undergraduates to undertake research in a way that academic papers and journals, no matter how erudite, cannot. Academic papers and journals often feel removed from the student experience. Academic authors have significant time, funding, laboratories, research assistants and collaborators in other universities and countries enabling them to produce their papers. The undergraduate project, by contrast, must be completed in a short time-frame and with much more limited support and resources. The great value of the papers in *The Plymouth Student Scientist* is that they are written by undergraduates and are therefore within the real-world experience of other undergraduates: this is inspiration in itself. All the authors are to be warmly congratulated on their achievement, and the personal development that came through the process of researching in their own particular muddled area of their discipline.

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