Peer-Assisted Study Sessions (PASS)

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Students studying science at university are faced with a barrage of diverse courses which are becoming increasingly complex. There is no doubt that contemporary biology is exciting and challenging: advances in molecular biology, in particular, are reshaping our knowledge of the natural sciences. However, the 'cutting-edge' of science requires strong foundations. In an attempt to unravel the complexities of science and provide holistic perspective by bridging disciplines, level-1 science students at the University of Queensland are offered supplemental instruction in the form of Peer-Assisted Study Sessions (PASS). Groups of 20 students meet weekly with two PASS leaders (level 2/3 students) who facilitate active cooperative learning in a friendly social environment. The students undertake a variety of fun activities designed to consolidate core conceptions, construct meaning, challenge and extend knowledge and understanding, and practice examinations. They experience university collegiality and scholarship from an academic and lay perspective and form associations lasting beyond graduation. PASS participants achieve higher marks and experience greater satisfaction with their educational endeavours by this personalized and social constructivist approach to higher education.

Enrolling level-1 students are faced with a bewildering array of courses at university, many jargonized and difficult to interpret. Course selection can be agonizing, especially when it is flavoured by idealistic views and false impressions. The mad scientist and nutty professor stereotypes have largely given way to media images of scientists working in exotic locations, making exciting breakthroughs, and solving gruesome crimes. It is often difficult to reconcile the preconceptions and expectations of students with reality. Modern biology is exciting and challenging. New organisms are being discovered, cell life and death are being explored, and unique molecules are being synthesized. In the history of the Earth, most scientists are currently alive today. Advances to our knowledge are being made with regular frequency so it is natural that science changes with time. Boundaries between traditional disciplines become blurred as common technologies emerge. Scientists working on organisms in the '70's moved to cell biology in the '80's and molecular biology in the '90's. This transition has been spectacular. More than ever before, students are required to understand molecular processes which underpin life sciences, biomedical research and biotechnological applications.

Our approach to biology has also changed: early descriptive studies identified organisms; experimental and analytical studies then examined smaller components; integrative studies have recently attempted to reconstruct the 'big picture'; and contemporary studies are now entering a new descriptive phase, this time aimed at molecules. Molecular biology has become fundamental to our probing of science. Microbes are being manipulated, genes are being sequenced, and organisms are being cloned. Indeed, many genome projects are nearing completion, thereby signalling the dawn of proteomics - studies on gene products. Protein studies are set to dominate the next decade and students will require state-of-the-art molecular knowledge and computer skills. While technological advances have generated greater complexities in science than ever before, they have also provided valuable tools for science education. Information technology is opening up the classrooms, allowing a shift from fixed classes to flexible delivery and distance education.

Course design can be difficult because students vary considerably in their backgrounds. There is generally good continuity between the science curricula of primary and secondary schools, especially for the 'enabling' sciences (chemistry, physics, and mathematics) and natural sciences. However, it is enigmatic that many university students enrolling in science have not formally studied biology. For them to understand the 'cutting-edge' of science requires strong foundations; students need to begin with basic concepts and fundamental knowledge. One solution adopted at my university has been to create a biology smorgasbord: i.e. to offer broad interdisciplinary courses to first year students so that they can sample everything. This strategy has four advantages: it gives students a holistic conception of biology; it establishes a level playing field; it provides them with sufficient information to make informed choices; and it defers their need to choose a more specified field of interest until later in their degree.

Mainstream students select eight first-level courses spanning all major disciplines in biology: Chemistry A, Chemistry B, Microbial Biology, Plant Biology, Genetics & Evolution, Molecular Biology, Animal Biology and Human Biology. Each course runs three one-hour lectures and one three-hour practicum each week. Timetabling becomes a logistic problem when faced with enrolments of 1,200 students. This necessitates repeating each lecture up to 4 times as lecture theatres only safely hold 300 students. Each practical session may have to be run up to 12 times to accommodate all students. This leaves academics little time other than to deliver core material and they certainly cannot cater to every student's needs. Nonetheless, it has become clear that students require supplemental instruction to come to grips with the voluminous material that confronts them. Ideally, extra tuition should be tailored for individual students to provide a personalized approach to their educational needs. Such instruction should not introduce new material but should simply concentrate on explaining core conceptions and knowledge that leads to better comprehension and deeper understanding. Preferably, this ought to be done in a non-threatening social environment where students can confidently voice their concerns. Rather than implement a tutorial system (which are mostly teacher-centred and content-focussed) run by junior academics, a system of voluntarily-attended peer-assisted study sessions (PASS) was introduced (to ensure that learning was student-directed and student-centred). Within each course, groups of 20 first-level students meet weekly with two PASS leaders (second- or third-level students) to consolidate fundamental concepts and knowledge recently presented in lectures and practical classes. To date, the PASS program is now offered for ten first-level courses to around 7,000 students and involves some 200 PASS leaders who are paid to run two PASS sessions each week. The overall cost has been calculated to average ~$30-35 per student per semester (which is at least one fifth cheaper than running conventional tutorials). Nonetheless, money is not the primary concern as greater emphasis is placed on desirable student outcomes, such as social induction, participation, deeper learning, better understanding, engagement with the discipline, and, ultimately, better performance.

The PASS paradigm epitomizes the social constructivism model of education whereby small groups of students meet and interact to construct meaning. Participating students develop and enhance many qualities, including philosophic, psychologic, metacognitive, cognitive, social, and personal skills. The objective is not just to make better scientists but also to make better people. Small group teaching and learning personalizes the educational experience which counteracts the impersonal nature of large classes in large universities. Regular meetings with small groups also eases the transition of students from school to university and gives them the ability to develop friendships and networks with fellow students. It builds student confidence, self-assurance and promotes interpersonal skills and social interaction. Peer facilitation of the group is mandatory to provide a non-threatening social and intellectual environment in which the students can admit ignorance and misconceptions and seek information, advice and remediation.

By virtue of their age, PASS leaders are approachable at many levels closed to older academics. All PASS leaders have mastered the particular course during the previous year and are sympathetic to, and empathetic of, the students' plight. The PASS structure is not totally devoid of academic influence as it is a three-tiered system whereby academics direct PASS leaders in knowledge processing and learning strategies.

PASS leaders are selected on the basis of their academic performance in the course the previous year as well as their motivation, enthusiasm and communication skills as perceived at interview. They attend developmental workshops to acquire necessary knowledge and skills and familiarize themselves with available support services. Leaders are given a workbook containing administrative information, duty statements, guides to teaching and learning, study tips and schedules. To ensure familiarization with content, PASS leaders re-attend most first-level lectures as well as meet with academic staff in briefing workshops twice each semester. They have free and ready access to all course resources and are provided with a PASS guide which summarizes the content of each lecture, suggests learning activities, gives mastery questions and provides extension material. All PASS leaders work in pairs so they share the workload which can be intensive, both mentally and physically. In this way, they support each other, present a unified front and facilitate feedback on process and performance. As well, leaders are encouraged to participate in formal student evaluation of teaching schemes to obtain feedback on process and performance (valuable data in any curriculum vitae). They also meet in focus groups to share strategies and make appointments with academic staff for personal counselling. Overall, they comprise a highly motivated and engaged workforce and they derive considerable personal pleasure and vocational training during their terms as PASS leaders.

The principles of action learning are applied to PASS and the cornerstones of every session are the leader-generated activities. These curriculum-based activities are designed to elicit student involvement and communication in an atmosphere of cooperative and collaborative learning. The objectives are to align student learning with course objectives by consolidating fundamental conceptions, applying knowledge, enhancing understanding and promoting social interaction. The PASS leaders have devised a range of 'consolidation' activities, such as pictionary, bingo, crosswords, wonderwords, sale-of-the-century and jeopardy, which facilitate not only knowledge recall and recognition but also association and deduction. They have also developed a range of 'challenge' activities, such as brainstorming, concept mapping, flow charts, debates, labelling diagrams, and fill-in-the-blanks, to apply and extrapolate information in an integrative manner. PASS participation is not subject to summative assessment, nor should it be! Attendance is voluntary and students do not compete for marks. However, PASS plays a vital role in formative assessment by preparing students for examinations by providing trial questions, model answers and timely feedback.

Staff and student surveys of the value of PASS in students' educational experiences have consistently yielded quality outcomes. PASS participants achieve higher marks, experience less anxiety and report greater satisfaction with courses. Programs show increased retention rates of students with concomitant deep understanding and multidisciplinary perspectives of course objectives. Students experience university collegiality and form networks of colleagues lasting beyond graduation. In a PASS environment, they acquire good learning skills and their social involvement helps them to develop better life skills. PASS students appreciate the personalized approach to their education and view it as value-adding to their education at university.