

UniServe Science

Reading Supplements for
First Year Experience Discussion Forum: Generic Skills
and
Scholarly Inquiry in Science Teaching and Learning
September 30 – October 1, 2004
The University of Sydney

References are to material published in 2003 and 2004 that relates to research in university science education and generic skills.

Bibliographies prepared for previous UniServe Science Conferences are available online from <http://science.uniserve.edu.au/workshop/>

UniServe Science has compiled this bibliography from the Web and the following book and journals:

- Research and Supervision in Mathematics and Science Education
- EJSE: Electronic Journal of Science Education
- HERD: Higher Education Research and Development
- Medical Education
- IJET: International Journal of Educational Technology
- Studies in Higher Education
- Learning and Instruction
- AJET: Australian Journal of Educational Technology
- iJMEST: International Journal of Mathematical Education in Science and Technology
- Educational Technology & Society
- Assessment and Evaluation in Higher Education
- J Res Sci Teach: Journal of Research in Science Teaching
- University Chemistry Education

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Abramovich, S. and Brantlinge, A. (2004) Technology-motivated teaching of topics in number theory through a tool kit approach. *International Journal of Mathematical Education in Science and Technology*, **35**(3), 317 – 333.

This paper shows how the computational and graphical capabilities of spreadsheets allow for interactive analytic and geometric constructions from numerical modelling of homogeneous Diophantine equations of the second order. Suggested activities, designed for prospective teachers of mathematics and made possible by what is referred to in the paper as the tool kit approach, enable one to revisit classic mathematics concepts within the framework of computerized mathematical experiment.

Albanese, M. A. (2004) Treading tactfully on tutor turf: does PBL tutor content expertise make a difference?. *Medical Education*, **38**(9), 918 – 920.

The problem-based learning (PBL) tutor is one of the most important elements in PBL. How the tutor functions can either allow the PBL process to flourish or crush it by any number of diabolical means. Thus, selection and training of tutors is a critical component of PBL. Gilkison contrasts observations of PBL process in groups having a content specialist as tutor vs. those with a noncontent specialist tutor, generally concluding that the PBL process is more adhered to by the nonspecialist. Mifflin argues that Gilkison's results add to the confusion about whether or not tutors need to be content specialists, because Barrows would most likely have had clinician tutors as standard practice.

Baillie-de Byl, P. (2004). An Online Assistant for Remote, Distributed Critiquing of Electronically Submitted Assessment. *Educational Technology & Society*, **7**(1), 29 – 41. [<http://ifets.ieee.org/periodical/issues.html>]

This paper outlines the architecture for an online assessment management system implemented at the University of Southern Queensland. The system assists teams of academics in the management and marking of electronically submitted student assignments in large-scale classes. The system designed to provide a flexible yet structured method for providing feedback to students also offers semi-automatic file handling and grade recording. The system, Classmate, allows a team of markers to access and mark student assignments through a web interface designed to parallel paper-based marking systems. An online authoring tool replaces the red pen on paper analogy. A pilot study conducted on the use of Classmate has found the system to be of use in providing students with consistent feedback, allowing traditional assignment interactions and reducing trivial and repetitive assignment marking tasks.

Bodner, G. (2003) Problem solving: the difference between what we do and what we tell students to do. *University Chemistry Education*, **7**(2).

It is slightly over 30 years since I was first asked to teach something known as 'general chemistry' at the University of Illinois. Without any idea of what went into that course, the order in which topics should be taught, or the amount of time that should be devoted to each topic, I asked a couple of senior colleagues what they did when they taught this course and tried to do the same.

During the course of that first semester, I found that I enjoyed teaching and that the students enjoyed having me as their instructor. Everything was going well until I made the mistake of analyzing the students' answers to the exams I gave them. I was shocked; or, in the language of Jean Piaget, utterly disequibrated. In spite of clear, concise, well-organized, and well-delivered lectures, I found that bright, hardworking science and engineering majors couldn't solve 'simple' problems on topics that had been taught - and taught well!¹ Thus, it shouldn't be surprising that one of the topics I became interested in as a beginning researcher in chemical education was problem solving.

Over the course of about 20 years, the author has worked with roughly a dozen graduate students pursuing M.S. or Ph.D. degrees in chemical education whose studies focused on different aspects of problem solving. It is the results of these students' work that serves as the basis for this paper.

Bowyer, P.K. and Blanchard, C.L. (2003) Multimedia based enhancement of the science of oenology in the distance education learning environment. *Australian Journal of Educational Technology*, **19**(3), 323 – 338. [<http://www.ascilite.org.au/ajet/ajet.html>]

Multimedia has been investigated regarding its utility as an enhancement mechanism, primarily for distance education students in the first year university course *Wine Science 1* at Charles Sturt University. The resource consisted of a series of *QuickTime* movies outlining oenological chemical analysis experiments to be conducted during the block teaching, on campus portion of the course. They were created using Apple Computer's *iMovie* software and were delivered via CD as a new component of the print based materials package commonly used in distance education supported courses. 80% of the students were able to make use of the multimedia files to prepare for the practical component of the course before on campus attendance. When surveyed regarding the value of this learning resource enhancement, the vast majority of these students agreed that effective learning, understanding and, notably, relaxation were all significantly enhanced.



Boyle, T. (2003) Design principles for authoring dynamic, reusable learning objects. *Australian Journal of Educational Technology*, **19**(1), 46 – 58. . [<http://www.ascilite.org.au/ajet/ajet.html>]

The aim of this paper is to delineate a coherent framework for the authoring of re-purposable learning objects. The approach is orthogonal to the considerable work into learning object metadata and packaging conducted by bodies such as IMS, ADL and the IEEE. The ‘learning objects’ and standardisation work has been driven largely by adding packaging and metadata to pre-constructed learning artefacts. This work is very valuable. The argument of this paper, however, is that these developments must be supplemented by significant changes in the creation of learning objects. The principal aim of this paper is to delineate authoring principles for reuse and repurposing. The principles are based on a synthesis of ideas from pedagogy and software engineering. These principles are outlined and illustrated from a case study in the area of learning to program in Java.

Burton, R. (2005) Multiple-choice and true/false tests: myths and misapprehensions. *Assessment & Evaluation in Higher Education*, **30**(1), 65 – 72.

Examiners seeking guidance on multiple-choice and true/false tests are likely to encounter various faulty or questionable ideas. Twelve of these are discussed in detail, having to do mainly with the effects on test reliability of test length, guessing and scoring method (i.e. number-right scoring or negative marking). Some misunderstandings could be based on evidence from tests that were badly written or administered, while others may have arisen through the misinterpretation of reliability coefficients. The usefulness of item response theory in the analysis of academic test items is briefly dismissed.

Clarkeburn, H.M., Downie, J.R., Gray, C. and Matthew, R.G.S. (2003) Measuring ethical development in life sciences students: A study using Perry’s developmental model. *Studies in Higher Education*, **28**(4).

The scheme devised by Perry is appropriate to measure the development of the ways that students approach complex information during young adulthood. This article describes the development of a methodology to study students’ understanding of meta-ethical concepts, which has been the less studied element of Perry’s model. It is important to understand students’ levels of ethical development in order to design teaching to support their ethical development. A Meta-ethical Questionnaire was devised and implemented together with an ethics education programme at the Institute of Biomedical and Life Sciences at the University of Glasgow. From the results it was found that students’ meta-ethical development is a natural process in young adulthood, though male students progressed later than female students. Tailor-made ethics teaching may provide support for this development.

Conrad, M. and French, T. (2004) Exploring the synergies between the object oriented paradigm and mathematics: a Java led approach, *International Journal of Mathematical Education in Science and Technology*, **35**(5), 733 – 742.

While the object oriented paradigm and its instantiation within programming languages such as Java has become a ubiquitous part of both the commercial and educational landscapes, its usage as a visualization technique within mathematics undergraduate programmes of study has perhaps been somewhat underestimated. By regarding the object oriented paradigm as a medium for conceptual exploration (rather than merely as a tool) the aim is to show how the close conceptual links between object orientation and certain mathematical structures such as rings and groups can be more fully realized, using a ready-made public-domain Java package.

Damoense, M. (2003) Online learning: Implications for effective learning for higher education in South Africa. *Australian Journal of Educational Technology*, **19**(1), 25 – 45. [<http://www.ascilite.org.au/ajet/ajet.html>]

Over the last decade there has been an augmenting shift away from the conventional teaching and learning to modes where the Internet now plays a key role. E-learning is increasingly forming an integral part of course delivery and instruction, and is reshaping traditional learning world wide.

This paper outlines the shift from traditional learning to online learning practices. Then it discusses the use of technology, particularly the Internet, to support and enhance effective learning based on the principles of engagement theory. It considers relevant studies within the context of technology based learning, and highlights important experiences and findings. The paper indicates that technology based pedagogy and an effective online learning environment are crucial to support and enrich effective learning outcomes. The paper considers implications for South African higher education in the 21st century. Integrating the Internet as part of a curriculum is proposed, to instil our learners with lifelong skills.



Del Carlo, D.I. and Bodner, G.M. (2004) Students' perceptions of academic dishonesty in the chemistry classroom laboratory. *Journal of Research in Science Teaching*, **41**(1), 47 – 64.

Although the literature on both academic dishonesty and scientific misconduct is extensive, research on academic dishonesty has focused on quizzes, exams, and papers, with the virtual exclusion of the classroom laboratory. This study examined the distinctions undergraduate chemistry majors made between academic dishonesty in the classroom laboratory and scientific misconduct in the research laboratory. Across the spectrum of undergraduate chemistry courses, from the introductory course for first-semester chemistry majors to the capstone course in instrumental analysis, we noted that students believe the classroom lab is fundamentally different from a research or industrial lab. This difference is so significant that it carries over into students' perceptions of dishonesty in these two environments.

Dochy, P., Segers, M., Van den Bossche, P. and Gijbels, D. (2003) Effects of problem-based learning: a meta-analysis, *Learning and Instruction*, **13**(5), 533 – 568.

This meta-analysis has two aims: (a) to address the main effects of problem based learning on two categories of outcomes: knowledge and skills; and (b) to address potential moderators of the effect of problem based learning. We selected 43 articles that met the criteria for inclusion: empirical studies on problem based learning in tertiary education conducted in real-life classrooms. The review reveals that there is a robust positive effect from PBL on the skills of students. This is shown by the vote count, as well as by the combined effect size. Also no single study reported negative effects. A tendency to negative results is discerned when considering the effect of PBL on the knowledge of students. The combined effect size is significantly negative. However, this result is strongly influenced by two studies and the vote count does not reach a significant level. It is concluded that the combined effect size for the effect on knowledge is non-robust. As possible moderators of PBL effects, methodological factors, expertise-level of students, retention period and type of assessment method were investigated. This moderator analysis shows that both for knowledge- and skills-related outcomes the expertise-level of the student is associated with the variation in effect sizes. Nevertheless, the results for skills give a consistent positive picture. For knowledge-related outcomes the results suggest that the differences encountered in the first and the second year disappear later on. A last remarkable finding related to the retention period is that students in PBL gained slightly less knowledge, but remember more of the acquired knowledge.

Fadigan, K.A. and Hammrich, P.L. (2004) A longitudinal study of the educational and career trajectories of female participants of an urban informal science education program. *Journal of Research in Science Teaching*. **41**(8).

The purpose of this longitudinal case study is to describe the educational trajectories of a sample of 152 young women from urban, low-income, single-parent families who participated in the Women in Natural Sciences (WINS) program during high school. Utilizing data drawn from program records, surveys, and interviews, this study also attempts to determine how the program affected the participants' educational and career choices to provide insight into the role informal science education programs play in increasing the participation of women and minorities in science, math, engineering, and technology (SMET)-related fields. Findings revealed 109 participants (93.16%) enrolled in a college program following high school completion. Careers in medical or health-related fields followed by careers in SMET emerged as the highest ranking career paths with 24 students (23.76%) and 21 students (20.79%), respectively, employed in or pursuing careers in these areas. The majority of participants perceived having staff to talk to, the job skills learned, and having the museum as a safe place to go as having influenced their educational and career decisions. These findings reflect the need for continued support of informal science education programs for urban girls and at-risk youth.

Fellenz, M.R. (2004) Using assessment to support higher level learning: the multiple choice item development assignment. *Assessment & Evaluation in Higher Education*, **29**(6), 703 – 719.

This paper describes the multiple choice item development assignment (MCIDA) that was developed to support both content and higher level learning. The MCIDA involves students in higher level learning by requiring them to develop multiple choice items, write justifications for both correct and incorrect answer options and determine the highest cognitive level that the item is testing. The article discusses the benefits and limitations of the scheme and presents data on the largely positive student reactions to the scheme. The development of the MCIDA also serves as an example for how traditional summatively oriented assessment procedures can be developed into tools that directly support student learning.

Florence, M.K. and Yore, L.D. (2004) Learning to write like a scientist: Coauthoring as an enculturation task. *Journal of Research in Science Teaching*, **41**(6), 637 – 668.

This multiple case study examined the coauthorship process in research laboratories of different university departments. The study focused on two cases comprising five writing teams, one in biochemistry and microbiology and four in earth and ocean sciences. The role of the research supervisor, the role of the student (graduate and postgraduate), the



interaction of the supervisor and the student, the activities and processes inherent in the coauthorship process, and the student's beliefs, expertise, scientific writing, and entry into an academic discourse community were documented utilizing multiple sources of data and methods. Several activities and processes were found to be common across all coauthorship teams, including aspects of planning, drafting, and revising. Elements of scientific and writing expertise, facets of enculturation into scientific research and discourse communities, academic civility, and the dynamics of collaborative groups also were apparent. There was healthy tension and mutual respect in the research groups as they attempted to make sense of science, report their results clearly and persuasively, and share the responsibilities of expertise. The novice scientists came to appreciate that the writing, editing, and revising process influenced the quality of the science as well as the writing.

Hadjileontiadou, S. J., Nikolaidou, G. N., Hadjileontiadis, L. J. and Balafoutas, G. N. (2004). On enhancing on-line collaboration using fuzzy logic modeling. *Educational Technology & Society*, 7(2), 68 – 81. [<http://ifets.ieee.org/periodical/issues.html>]

Web-based collaboration calls for professional skills and competences to the benefit of the quality of the collaboration and its output. Within this framework, educational virtual environments may provide a means for training upon these skills and in particular the collaborative ones. On the basis of the existing technological means such training may be enhanced even more. Designing considerations towards this direction include the close follow-up of the collaborative activity and provision of support grounded upon a pedagogical background. To this vein, a fuzzy logic-based expert system, namely Collaboration/Reflection-Fuzzy Inference System (C/R-FIS,) is presented in this paper. By means of interconnected FISs, the C/R-FIS expert system automatically evaluates the collaborative activity of two peers, during their asynchronous, written, web-based collaboration. This information is used for the provision of adaptive support to peers during their collaboration, towards equilibrium of their collaborative activity. In particular, this enhanced formative feedback aims at diminishing the possible dissonance between the individual collaborative skills by challenging self-adjustment procedures. The proposed model extends the evaluation system of a web-based collaborative tool namely Lin2k, which has served as a test-bed for the C/R-FIS experimental use. Results from its experimental use have proved the potentiality of the proposed model to significantly contribute to the enhancement of the collaborative activity and its transferability to other collaborative learning contexts, such as medicine, environmental engineering, law, and music education.

Heinrich, E. (2004). Electronic Repositories of Marked Student Work and their Contributions to Formative Evaluation. *Educational Technology & Society*, 7 (3), 82 – 96. [<http://ifets.ieee.org/periodical/issues.html>]

The educational literature shows that formative assessment is highly conducive to learning. The tasks given to students in formative assessment generally require open-ended responses that can be given, for example, in essay-type format and that are assessed by a human marker. An essential component is the formative feedback provided by the marker that needs to assist the student in recognising knowledge gaps and in formulating steps to close these gaps. The concepts of 'electronic repositories of marked student work' introduced in this article suggests an approach to support learning from formative assessment. At the core of this concept lies the realisation that the artefacts submitted by students and assessed by markers are a valuable resource. This resource should not just be used by the submitting students but should be made accessible to future students studying the same concepts. These students can learn from the artefacts and the formative feedback attached to these artefacts. Self- and peer-assessment, important concepts closely linked to formative assessment, can be integrated with the repositories to develop the students' subject knowledge, to enhance their critical thinking skills and to familiarise them with assessment procedures. This article develops the concepts of electronic repositories of marked student work. Special emphasis is put on reviewing the educational literature on formative assessment and on binding the concepts introduced into the literature findings.

Herrington, J., Oliver, R. and Reeves, T.C. (2003) Patterns of engagement in authentic online learning environments. *Australian Journal of Educational Technology*, 19(1), 59 – 71. [<http://www.ascilite.org.au/ajet/ajet.html>]

The use of authentic activities within online learning environments has been shown to have many benefits for learners in online units and courses. There has been renewed interest in the role of student activities within course units, as constructivist philosophy and advances in technology impact on educational design and practice. Courses based on these principles have been used successfully across a wide variety of discipline areas. In spite of the growing evidence of the success of authentic learning environments, they are not without their problems. In this paper we discuss patterns of engagement that have emerged from our own research on authentic learning tasks, in particular, the initial reluctance to willingly immerse in learning scenarios that some students experience, and the need for the suspension of disbelief before engaging in the task. The paper proposes ten characteristics of authentic activities, based on educational theory and research, which have been used as criteria for the selection of existing online units or courses for in depth investigation. The paper includes a short review of the literature, a description of the research and some preliminary findings and identification of issues related to the necessity for students to willingly suspend disbelief in order to fully engage in learning scenarios based on authentic tasks.

Holt, D., Rice, M. and Armatas, C. (2003) The emergence of an online learning community in first year tertiary studies in psychology, *Australian Journal of Educational Technology*, **19**(2), 161 – 175.

The introduction of an online supported, resource based learning environment into a large, multi-modal first year psychology unit led to the spontaneous development of a small, but active, learning community. While off campus students were more active online contributors, many other students "observed" these interactions, not actively contributing but finding the discussion postings valuable to their learning. Overall, use and perceived value of the online communication facilities were related to how confident students were that they had an appropriate study strategy, with off campus and older students reporting greater confidence in their study approach. The results highlight that the nature and function of learning communities for large, multi-modal foundation units are quite different to those typically articulated in the literature and are worth further investigation.

Johnston, L. and Miles, L. (2004) Assessing contributions to group assignments. *Assessment & Evaluation in Higher Education*, **29**(6), 751 – 768.

We report the use of a combination of self- and peer-assessment in an undergraduate social psychology laboratory course. Students worked in small groups on a self-directed empirical project that they each wrote up independently as a laboratory report. Marks for the written assignment were moderated by a contribution index measure based on the self- and peer-assessment measures. Our analyses indicated that: (i) students took the peer-assessment process seriously, clearly differentiating between group members on the contributions questionnaires; (ii) students show a self-bias, rating their own contribution to the group task higher than that of other group members; (iii) for a large majority of students the contribution index resulted in very little moderation of the final assignment marks; (iv) there was a strong correlation between the contribution index and the overall assignment score. Implications for the assessment of group work are considered.

Kravicik M., Kaibel, A., Specht, M., and Terrenghi, L. (2004). Mobile Collector for Field Trips. *Educational Technology & Society*, **7**(2), 25 – 33. [<http://ifets.ieee.org/periodical/issues.html>]

Current e-Learning is based on learning management systems that provide certain standard services - course authoring and delivery, tutoring, administration and collaboration facilities. Rapid development of mobile technologies opens a new area of m-Learning to enhance the current educational opportunities. Field trips are a relevant part of the curriculum, but for various reasons it is often difficult to organize them. The aim of the RAFT project is development of a system that would enable virtual field trips. One mobile learning application prototype created in this project, called Mobile Collector, enables data gathering and annotation in the field, together with real time collaboration. The application supports learner-centred education in real world context.

Langan, M.A., Wheeler, P., Shaw, E.M., Haines, B.J., Cullen, R.W., Boyle, J.C., Penney, D., Oldekop, J.A., Ashcroft, C., Leckey, L. and Preziosi, R.F. (2005) Peer assessment of oral presentations: effects of student gender, university affiliation and participation in the development of assessment criteria. *Assessment & Evaluation in Higher Education*, **30**(1), 21 – 34.

Peer assessment provides a useful mechanism to develop many positive qualities in students studying in higher education (HE). Potential influences on peer-awarded marks include student qualities such as gender, HE background (e.g. university affiliation) and participation in the development of the assessment criteria. Many studies that have investigated peer assessment have placed great emphasis on marks from a single tutor, or very few tutors, from a single university. This study examined grades awarded by 11 tutors (affiliated with four universities) to oral presentations delivered on a residential field course by second-year undergraduate students from two universities studying environmental or biological disciplines. Student assessors awarded marks of fairly high precision (correlating strongly with tutor grades) but averaged 5% higher than their tutors (i.e. of only moderate accuracy). Marginally higher marks (*circa* 1.6%) were awarded by student assessors to speakers studying at the same university. Gender influences were detected as males tended to grade other male speakers very slightly more highly than female speakers. Marks from females were unaffected by speaker gender. Students who participated in the development of the assessment criteria did not achieve higher grades for their presentations. However, when these 'participants' were assessing, they awarded lower marks than their peers (i.e. closer to, but not as low as, those awarded by tutors). Lower marks were also awarded during the middle of sessions, possibly resulting from factors associated with motivation and attention of speakers and markers. Overall, the potential biases in marking by naive assessors examined in this study may influence the validity of marks generated by peer assessment schemes, but the experience of this type of assessment had positive effects on those involved.



Lim, B-R. (2004) Challenges and issues in designing inquiry on the Web. *British Journal of Educational Technology*, 35(5).

The purpose of this study is to discuss major issues in designing inquiries on the web. Instructional designers face a lot of difficulties and challenges to deal with in the course of designing inquiry experiences for learners in the online environment, a complex and ill-structured learning environment. Facilitating inquiry or using an inquiry-based learning approach on the web has both advantages and disadvantages. Instructional designers need to acknowledge the design issues arising in each and every phase of the design process. Utilising appropriate design strategies, instructional designers can provide positive learning experiences for their online learners. For this purpose, three representative cases in the context of teacher professional development were examined and six major issues were identified as follows: (1) seeking a balance between a system-generated guide and human facilitator, (2) visual representation of the inquiry process, (3) motivating learners with the right question, (4) engaging learners in various learning activities, (5) guiding the inquiry process with various scaffolds, and (6) maximising learning by coordinating resources, tools and the community of inquiry. This study explains each issue in great detail and provides possible guides for instructional designers to handle the issue.

Lipponen, L. and Lallimo, J. (2004) Assessing applications for collaboration: from collaboratively usable applications to collaborative technology. *British Journal of Educational Technology*, 35(4).

The continually increasing number of applications said to facilitate collaboration makes it very difficult for educators to identify and evaluate the ones that are suitable for educational purposes. In this paper we argue that from the educational point of view, it is meaningful to make a distinction between collaboratively usable applications and collaborative technology. Collaboratively usable applications are systems that can be used for collaboration, whilst collaborative technology is technology that is especially designed to support and establish collaboration. To distinguish between these two kinds of technologies, we propose four criteria for collaborative technology: its design is grounded on some explicitly argued theory of learning or pedagogical model; it relies on the idea of groupware; it provides procedural facilitation; and it offers representational and community-building tools.

Madson, M., Melchert, T.P. and Whipp, J.L. (2004) Assessing student exposure to and use of computer technologies through an examination of course syllabi. *Assessment & Evaluation in Higher Education*, 29(5), 549 – 561.

A syllabus analysis instrument was developed to assist program evaluators, administrators and faculty in the identification of skills that students use as they complete their college coursework. While this instrument can be tailored for use with a variety of learning domains, we used it to assess students' use of and exposure to computer technology skills. The reliability and validity of the instrument was examined through an analysis of 88 syllabi from courses within the teacher education program and the core curriculum at a private Midwest US university. Results indicate that the instrument has good inter-rater reliability and ratings by and interviews with faculty and students provide evidence of construct validity. The use and limitations of the instrument in educational program evaluation are discussed.

McLuckie, J. and Topping, K.J. (2004) Transferable skills for online peer learning. *Assessment & Evaluation in Higher Education*, 29(5), 563 – 584.

Efforts to enhance learning through peer interaction in an electronic forum are now commonplace. However, facilitation and moderation of such a forum by academic staff can be of limited effectiveness and very time-consuming. The skills required by peer learners to effectively manage such distributed discourse for themselves have rarely been clearly identified. This paper compares the social, organizational and cognitive characteristics of effective peer learning interactions in face-to-face and online environments (with particular reference to peer tutoring and peer assessment). This leads to a specification of transferable skills for online peer learning, at the macro and micro levels, with commentary on areas needing particular attention. The implications for assessment of such online distributed discourse process skills are explored with reference to professional practice and future research.

McNaught, C., Burd, A., Whithear, K., Prescott, J. and Browning, G. (2003) It takes more than metadata and stories of success: Understanding barriers to reuse of computer facilitated learning resources. *Australian Journal of Educational Technology*, 19(1), 72 – 86. [<http://www.ascilite.org.au/ajet/ajet.html>]

A national study in Australia in the late 1990s explored barriers to the adoption and reuse of computer facilitated learning (CFL) in Australian universities. These barriers will be summarised. One of these barriers is that it is hard to find information on courseware that is educationally sound; usually such courseware is expensive to produce and so reuse is especially desirable. However, even when information and access to electronic courseware exists, reuse may still not occur. Two cases will be described to illustrate the complexity of reuse. These cases are: 1) a collection of 169 plastic surgery websites; and 2) an international consortium of veterinary microbiology resources based on a well-evaluated case study design. Some strategies for improving reuse are suggested.

Murphy, E. (2004) Recognising and promoting collaboration in an online asynchronous discussion. *British Journal of Educational Technology*, **35**(4).

This paper reports on a study involving the identification and measurement of collaboration in an online asynchronous discussion (OAD). A conceptual framework served for the development of a model which conceptualises collaboration on a continuum of processes that move from social presence to production of an artefact. From this model, a preliminary instrument with six processes was developed. Through application of the instrument to an OAD, the instrument was further developed with indicators added for each process. Use of the instrument to analyse an OAD showed that it is effective for gaining insight into collaborative processes in which discussants in an OAD do or do not engage. Use of the instrument in other contexts would test and potentially strengthen its reliability and provide further insight into the collaborative processes in which individuals engage in OADs. Analysis of an OAD using the instrument revealed that participants engaged primarily in processes related to social presence and articulating individual perspectives, and did not reach a stage of sharing goals and producing shared artefacts. The results suggest that the higher-level processes related to collaboration in an OAD may need to be more explicitly and effectively promoted in order to counteract a tendency on the part of participants to remain at the level of individual rather than group or collaborative effort.

Myers, C. B., Bennett, D., Brown, G. & Henderson, T. (2004). Emerging Online Learning Environments and Student Learning: An Analysis of Faculty Perceptions. *Educational Technology & Society*, **7**(1), 78 – 86.
[<http://ifets.ieee.org/periodical/issues.html>]

New educational technologies and online learning environments (OLEs) are infiltrating today's college classes and campuses. While research has examined many aspects of this permeation, one research gap exists. How do faculty perceive the learning experience in courses that use OLEs compared to courses that do not? One important factor that may influence faculty perceptions are their reasons for teaching with OLEs. This paper seeks to understand how faculty perceive OLEs as a function of their reasons for teaching with this educational technology. This paper also investigates whether faculty evaluations of OLEs differ based on gender and by years teaching. The results of the analysis reveal several noteworthy patterns. First, it appears that favorable opinions about the learning experiences in online learning environments are not because faculty are motivated to learn about new technologies per se, but because they want to update their vitas and teaching skills. Second, the results suggest that it may be harder to convince older and more experienced faculty to use new technologies compared to younger and less experienced faculty. These results apply to both male and female faculty and provide practical implications for universities and support services on how to recruit and then support faculty who implement educational technologies.

Nicol, D.J. and Boyle, J.T. (2003) Peer instruction versus class-wide discussion in large classes: A comparison of two interaction methods in the wired classroom. *Studies in Higher Education*. **28**(4), 457

Following concerns about the poor conceptual understanding shown by science students, two US research groups have been experimenting with the use of 'classroom communication systems' (CCSs) to promote dialogue in large classes. CCS technology makes it easier to give students immediate feedback on concept tests and to manage peer and class discussions. Improvements in conceptual reasoning have been shown using these methods. However, these research groups have each piloted different discussion sequences. Hence, little is known about which sequence is best and under what circumstances. This study compares the effects of each sequence on students' experiences of learning engineering in a UK university. The research methods included interviews, a survey and a critical incident questionnaire. The results demonstrated that the type of dialogue and the discussion sequence have important effects on learning. The findings are discussed in relation to social constructivist theories of learning and in relation to the implications for teaching in wired classrooms.

Norton, L. (2004) Using assessment criteria as learning criteria: a case study in psychology. *Assessment & Evaluation in Higher Education*, **29**(6), 687 – 702.

In this paper it is argued that the current trend of making assessment criteria more explicit in higher education may have a deleterious effect on students' learning. Helping students to concentrate on assessment criteria paradoxically means that they may take a strategic approach and end up focusing on the superficial aspects of their assessment tasks, rather than engaging in meaningful learning activity. One solution might be to re-conceptualize assessment criteria as 'learning criteria' using Biggs' principle of constructive alignment in curriculum development and delivery. To illustrate how this can work in practice, a case study is presented detailing the development of a counselling psychology module over several years to progressively incorporate a text-based adaptation of the problem-based learning approach. Student evaluations of the approach are presented together with some examples of feedback given on students' work to demonstrate the effects on students' understanding and functioning knowledge



Orsmond, P., Merry, S. and Reiling, K. (2004) Undergraduate project work: can directed tutor support enhance skills development? *Assessment & Evaluation in Higher Education*, **29**(5), 625 – 642.

Students' perceptions of their skills development and the overall value of their undergraduate project work were evaluated using data derived from questionnaires. Thirty-nine students completing their second year of study (i.e. prior to the commencement of project work) and 42 students completing their third-year project work took part. Thirteen tutors also completed questionnaires. They were asked to give their perceptions as to what skills project students developed and what attributes of project work enhanced both students' personal development and students' assessment grades. Results showed a shift in students' perceptions of the types of skills reinforced, developed and assessed within project work during the course of their third-year project. Their perceived views did not fully coincide with tutors' perceptions of student skills development, although evaluation of both the assessment and personal importance of particular aspects of project work showed some interesting relationships between students and tutors. The diversity of opinion shown in these results may be due to lack of clarification of assessment criteria rather than a 'hidden curriculum'. For example, the distinction between presentation of work and scientific writing may not be clear from an initial reading of the criteria. The outcomes of this study, with particular reference to the relationship between scientific writing and thinking, have implications regarding tutor and student discussion, the development of marking criteria and the use of plenary project support sessions.

Peat, M. and Franklin, S. (2003) Has student learning been improved by the use of online and offline formative assessment opportunities? *Australian Journal of Educational Technology*, **19**(1), 87 – 99.
[<http://www.ascilite.org.au/ajet/ajet.html>]

For almost a decade we have been providing a large group of first year, undergraduate biology students with both offline (paper based) and online assessment resources to support them in their learning. This paper reports on an investigation of the students' use of these assessment resources, as well as their perceptions of the usefulness of these resources to their learning. The research plan enabled us to investigate any correlations between use or non-use of the assessment resources and final performance in the course. The results show that while the majority of students use and find useful both offline and online assessment resources, use has no differential impact on final learning outcomes.

Salmon, D., & Jones, M. (2004). Higher education staff experiences of using web-based learning technologies. *Educational Technology & Society*, **7**(1), 107 – 114. [<http://ifets.ieee.org/periodical/issues.html>]

Given the drive in higher education institutions to employ web-based learning (WBL) technologies in their curricula, this article sets out to address the question of how staff experience the incorporation of such technologies into their educational practice. The study focuses on an initiative involving four institutions in South and West England that aimed to encourage the strategic development of WBL resources in health and welfare professional education programmes.

Thirty-three higher educational staff from a range of organisational locations took part in a qualitative process study. The findings suggest that while staff were enthusiastic about their engagement with WBL they experienced problems embedding their project work within their organisations, managing their time and obtaining institutional recognition for their work. Such findings represent a challenge to commentaries that emphasise "technological illiteracy" or "technophobia" amongst staff as barriers to WBL implementation. The study favours an analysis that emphasises how WBL initiatives are incorporated into existing higher education managerial, decision-making and reward structures.

Scholz, R.W., Steiner, R. and Hansmann, R. (2004) Role of internship in higher education in environmental sciences. *Journal of Research in Science Teaching*, **41**(1), 24 - 46.

The benefits of a compulsory internship in environmental science education were investigated with respect to the three institutional goals of university education: (a) training for research, (b) professional education, and (c) general natural science education. A survey examined which student qualifications are improved by an internship complementary to traditional university education. The survey assessed 14 qualifications of students participating in a compulsory 15-week internship in the 5-year diploma program at the Swiss Federal Institute of Technology (ETH Zürich). Pre- and postinternship questionnaires of 478 students and 293 supervisors are included. Results indicated that internships enhance general abilities and key qualifications, such as communication skills, report writing, organization of work, information acquisition, and the ability to operate independently. This suggests that internships are of high value to professional education. However, internships also seem to promote salient qualifications of complex environmental problem solving which are relevant for the development of research capabilities in environmental sciences.



Shin, N. and Chan, J.K.Y. (2004) Direct and indirect effects of online learning on distance education. *British Journal of Educational Technology*, 35(3).

This paper presents an exploratory study that investigates the effects of online learning on distance education students in an open university context. Two hypotheses are posited: (1) a direct relationship exists between students' involvement in online learning and distance learning outcomes, and (2) an indirect relationship exists between these two domains via the mediating variable of an institutional Transactional Presence (TP), that is, a student's sense of the availability of and connectedness with an educational institution. Student learning achievement, satisfaction and intent-to-persist are used as indicators of outcomes of distance learning. The analysis of data garnered from 285 distance students reveals multifaceted relationships between students' engagement in online learning, their perceptions of institutional TP and the three learning outcome variables. Besides the findings, the paper will discuss factors affecting students' engagement in online learning in relation to different requirements, that is, optional or compulsory online use as well as the level of the course (undergraduate or postgraduate).

Smith, G.G. and Ferguson, D. (2004) Diagrams and math notation in e-learning: growing pains of a new generation. *International Journal of Mathematical Education in Science and Technology*, 35(5), 681 – 695.

Current e-learning environments are ill-suited to college mathematics. Instructors/students struggle to post diagrams and math notation. A new generation of math-friendly e-learning tools, including WebEQ, bundled with Blackboard 6, and NetTutor's Whiteboard, address these problems. This paper compares these two systems using criteria for ideal math-friendly e-learning systems. NetTutor's Whiteboard is, apparently, the only system allowing two-way communication of both diagrams and math notation between instructor and students. This paper also summarizes a case study of two community college mathematics courses (calculus and algebra) using NetTutor over two semesters. Pilot studies, interviews and experimental problems revealed that NetTutor's Whiteboard is effective for 2-way communication of diagrams and math notation in college courses. Learning difficult concepts was comparable to face-to-face courses.

Trigano, P. C. and Pacurar-Giacomini, E. (2004) Toward a Web based Environment for Evaluation and Design of Pedagogical Hypermedia, *Educational Technology & Society*, 7(3), 21 – 37.
[<http://ifets.ieee.org/periodical/issues.html>]

We are working on a method, called CEPIAH. We propose a web based system used to help teachers to design multimedia documents and to evaluate their prototypes. Our current research objectives are to create a methodology to sustain the educational hypermedia design and evaluation. A module is used to evaluate multimedia software applied in educational context. We structured a knowledge base composed from a list of evaluation criteria, grouped in six themes: general feeling, technical quality, usability, scenario, multimedia documents, and didactical aspects. We insisted on multimedia particular aspects: we thoroughly studied the specificity of multimedia documents (investigating various fields such as photography, typography, picture semantics, cinema...). We also evaluated the way multimedia elements are gathered to prepare the reading acts. We finally determined specific criteria for pedagogical aspects, associated to the previous approaches. A global questionnaire joins all these modules. In this paper, we present the first two modules, EMPI and SP/UL/FC (a method for designing pedagogical hypermedia) , and an application of distant teaching (and distant learning), commenting the first results of this experiment. We conclude by a short presentation of the third module, on which we are still working.

Tsaparlis, G. and Zoller, U. (2003) Evaluation of higher vs. lower-order cognitive skills-type examinations in chemistry: implications for university in-class assessment and examinations. *University Chemistry Education*, 7(2).
[<http://www.chemistryeducation.org>]

The absence of sufficient, convincing, research-based documentation is often quoted as an argument against any change in the currently dominant lower-order cognitive skills (LOCS)-type examinations. Our aim with this paper is the fostering of higher-order cognitive skills (HOCS) learning, based on three relevant research studies: two conducted in Greece, and one in Israel. A different pattern of students' performance was revealed on examination questions requiring HOCS compared with that on questions requiring LOCS. A high performance on the latter does not necessarily guarantee a high performance on the former, and the reverse may also be the case. A 'high-stake' examination, used for entry into higher education in Greece, was found to select the best LOCS-performing students! Alternative forms of examination, such as the 'take-home exam', proved to be useful mainly for the enhancement of university students' active participation in courses, their self-directed, independent study, and the cultivation of their HOCS through the inclusion of questions requiring HOCS, dealing with material not covered in class. In a related Israeli study, conducted within an introductory freshman general and inorganic chemistry course, it was found that, given a free choice between HOCS- and LOCS-type questions, the top performing students preferred to answer questions requiring LOCS, in spite of proclaiming their preference of those requiring HOCS.

Tsia, C-C. (2004) Beyond cognitive and metacognitive tools: the use of the Internet as an 'epistemological' tool for instruction, *British Journal of Educational Technology*, 35(5).



This paper argues that Internet-based instruction should not be only perceived as a cognitive tool or a metacognitive tool; rather, it can be perceived and used as an epistemological tool. When the Internet is used as an epistemological tool for instruction, learners are encouraged to evaluate the merits of information and knowledge acquired from Internet-based environments, and to explore the nature of learning and knowledge construction. This paper further asserts that Internet-based instruction is perceived as a way to help learners develop advanced epistemologies. On the other hand, developmentally advanced epistemological beliefs can facilitate the practice of Internet-based instruction.

Volkman, M.J. and Zgagaz, M. (2004) Learning to teach physics through inquiry: The lived experience of a graduate teaching assistant. *Journal of Research in Science Teaching*, **41**(6), 584 – 602.

This investigation examines the difficulties encountered by one graduate teaching assistant as she taught *Physics for Elementary Education*, a large-enrollment, inquiry-based science course taught at a public Midwestern university. The methodological approach of hermeneutic phenomenology served as the lens to investigate the research question, “What is the lived experience of a graduate teaching assistant as she learned to teach physics through inquiry to elementary education students?” We summarize the findings in terms of the blending of two conceptual frameworks: orientations to science teaching and professional identity. We learned that fundamental beliefs about the nature of science support certain orientations, and if those beliefs remain unchallenged, then the orientation is unlikely to change. Finally, we discuss implications for strategies that may assist college-level instructors with changing their orientation to teaching science.

Williams, J. and Jacobs, J. (2004) Exploring the use of blogs as learning spaces in the higher education sector. *Australasian Journal of Educational Technology*. 20(2), 232 – 247. [<http://www.ascilite.org.au/ajet/ajet.html>]

‘Blogging’ - a contraction of the term ‘web logging’ - is perhaps best described as a form of micro-publishing. Easy to use, from any Internet connection point, blogging has become firmly established as a web based communications tool. The blogging phenomenon has evolved from its early origin as a medium for the publication of simple, online personal diaries, to the latest disruptive technology, the ‘killer app’ that has the capacity to engage people in collaborative activity, knowledge sharing, reflection and debate (Hiler, 2003). Many blogs have large and dedicated readerships, and blog clusters have formed linking fellow bloggers in accordance with their common interests.

This paper explores the potential of blogs as learning spaces for students in the higher education sector. It refers to the nascent literature on the subject, explores methods for using blogs for educational purposes in university courses (eg. Harvard Law School), and records the experience of the Brisbane Graduate School of Business at Queensland University of Technology, with its ‘MBA blog’. The paper concludes that blogging has the potential to be a transformational technology for teaching and learning.

First Year Experience Discussion Forum Generic Skills Bibliography (2003 – 2004)

- B-HERT (2001) The Critical Importance of Lifelong Learning. *B-HERT Position Paper No. 4*, February 2001 [http://www.bhert.com/Docs%5Cpolicy4.doc]
- B-HERT (2002) Enhancing the Learning and Employability of Graduates: The Role of Generic Skills. *B-HERT Position Paper No 9*. [http://www.bhert.com/Position%20Paper%20No%209.pdf]
- DEST (2002) Employability Skills for the Future (March 2002) *Commonwealth of Australia*. [http://www.dest.gov.au/ty/publications/employability_skills/final_report.pdf]
- DEST (2000) Employer Satisfaction with Graduate Skills. *Commonwealth of Australia*. [http://www.dest.gov.au/archive/highered/eippubs/eip99-7/eip99_7pdf.pdf]
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Barrie, S. (2004) A research-based approach to generic graduate attributes policy. *Higher Education Research and Development*, **23**(3), 261 – 275.

For many years universities around the world have sought to articulate the nature of the education they offer to their students through a description of the generic qualities and skills their graduates possess. Despite the lengthy history of the rhetoric of such policy claims, universities' endeavours to describe generic attributes of graduates continue to lack a clear theoretical or conceptual base and are characterized by a plurality of view-points. Furthermore, despite extensive funding in some quarters, overall, efforts to foster the development of generic attributes appear to have met with limited success. Recent research has shed some light on this apparent variability in policy and practice. It is apparent that Australian university teachers charged with responsibility for developing students' generic graduate attributes do not share a common understanding of either the nature of these outcomes, or the teaching and learning processes that might facilitate the development of these outcomes. Instead academics hold qualitatively different conceptions of the phenomenon of graduate attributes. This paper considers how the qualitatively different conceptions of graduate attributes identified in this research have been applied to the challenge of revising a university's policy statement specifying the generic attributes of its graduates. The paper outlines the key findings of the research and then describes how the university's revision of its policy statement has built upon this research, adopting a research-led approach to academic development. The resultant two-tiered policy is presented and the key academic development processes associated with the disciplinary contextualization of this framework are considered. The discussion explores some of the implications of this novel approach to structuring a university's policy, in particular, the variation in the relationship between discipline knowledge and generic attributes which was a key feature of the qualitative variation in understandings identified in the research.

Barnett, R. (2004) Learning for an unknown future. *Higher Education Research and Development*, **23**(3), 247 – 260.

What is it to learn for an unknown future? It might be said that the future has always been unknown but our opening question surely takes on a new pedagogical challenge if not urgency in the contemporary age. Indeed, it could be said that our opening question has never been generally acknowledged to be a significant motivating curricular and pedagogical question in higher education. Be all this as it may, the question (What is it to learn for an unknown future?) surely deserves more attention than it has so far received. After all, if the future is unknown, what kind of learning is appropriate for it? The preposition 'for' carries weight here.

The preposition implies an education in which—in our presenting case in point—a sense of an unknown future is probably evidently present; or, at least, serves as a major organizing principle in the design of the curriculum and in the enacting of the pedagogy. If future-as-unknown was missing either from the curriculum or from the pedagogy in some way not far from the surface, we could hardly say that we were in the presence of a learning 'for' an unknown future.

Generic skills may seem to offer the basis of just such a learning for an unknown future. Generic skills, by definition, are those that surely hold across manifold situations, even unknown ones. I want to suggest, however, that the idea of skills, even generic skills, is a cul-de-sac. In contrast, the way forward lies in construing and enacting a pedagogy for human being. In other words, learning for an unknown future has to be a learning understood neither in terms of knowledge or skills but of human qualities and dispositions. Learning for an unknown future calls, in short, for an ontological turn.



Bath, D., Smith, C., Stein, S. and Swann, R. (2004) Beyond mapping and embedding graduate attributes: bringing together quality assurance and action learning to create a validated and living curriculum. *Higher Education Research and Development*, **23**(3), 313 – 328.

With increasing importance being placed on the development of generic skills in higher education, institutions are espousing, as part of their mission and objectives, which generic skills their graduates achieve, and teachers are being required to document how their courses and programs support the development of those skills and attributes. The mapping of opportunities for development of graduate attributes in the planned curriculum thus plays an important role in relation to quality assurance and reporting processes, and embedding these opportunities in curricula may ensure alignment between the espoused curriculum and the taught curriculum. But are these processes enough to ensure that what is espoused and enacted through the curriculum is aligned with what students experience and learn? This issue is addressed here through a case study of a team of university teachers at one Australian institution who went beyond the mapping and embedding of graduate attributes in their courses of study, and engaged in a process of action learning to create a valid and living curriculum for the development of graduate attributes.

Crebert, G., Bates, M., Bell, B., Patrick, C-J. and Cragolini, V. (2004) Developing generic skills at university, during work placement and in employment: graduates' perceptions, *Higher Education Research and Development*, **23**(2), 147 – 165.

This paper presents findings from Stage 4 of the Griffith Graduate Project. Graduates from three Schools within Griffith University were surveyed to determine their perceptions of the contributions that the learning contexts of university, work placement and post-graduation employment made to the development of their generic skills. All graduates involved in the project had experienced work placement as a formal part of their undergraduate studies. Supplementary data from focus group discussions held with employers and graduates are also included. Findings showed that while graduates recognized the contribution university had made to their generic skills development, they greatly valued the experience of learning in the workplace during placement and subsequently in employment. The importance of teamwork, being given responsibility, and collaborative learning emerged as the most important factors for effective learning in the three contexts under consideration.

Gilbert, R., Balatti, J., Turner, P. and Whitehouse, H. (2004) The generic skills debate in research higher degrees. *Higher Education Research and Development*, **23**(3), 375 – 388.

Generic or transferable skills as outcomes of research higher degrees have been the subject of considerable development and debate in universities in recent times. The development of generic skills has been motivated by the belief that there are skills which all graduates should possess, and which would be applicable to a wide range of tasks and contexts beyond the university setting. This paper reviews these developments and debates drawing on a literature from the USA, the UK, with particular reference to Australia. It cites examples of generic skills programs and considers evidence of students' responses to them. Reviewing criticisms which have been levelled at the idea of generic skills in research higher degrees, the discussion identifies a number of questions which need to be addressed if this development is to succeed.

Leggett, M., Kinnear, A., Boyce, M. and Bennett, I. (2004) Student and staff perceptions of the importance of generic skills in science, *Higher Education Research and Development*, **23**(3), 295 – 312.

In the discussion of the inclusion of generic skills in courses, the voices of employers, universities and government have been clearly heard. However, the undergraduate student voice has been largely missing. This paper outlines the results of a survey of staff and undergraduate students. Part A of the survey asked participants to rate a set of skills in terms of their importance. Part B of the survey asked participants to add other skills that they considered important. The student results demonstrate significant year effects. For example higher-order skills such as critical thinking are rated more important at third year than at first year. Comparisons of the staff data and student data show that student perceptions match staff perceptions more closely at third-year level than at first year. When all the results are considered in the broader context of our courses, there appears to be a strong link between students' perception of the importance of skills and the degree to which the skills are assessed.

Moore, T. (2004) The critical thinking debate: how general are general thinking skills? *Higher Education Research and Development*, **23**(1) 3 – 18.

This paper takes up the issue of whether the skill of critical thinking in university education is best thought of as a broad universal generic skill or rather as only a loose category taking in a variety of modes of thought. Through the linguistic analysis of some sample texts, I argue that the discourse of general thinking programs should not be thought of as a generalist discourse at all, but in fact a quite specific one. The implications both for the teaching and testing of critical thinking are considered in the light of this position.