Online Learning Resources: Dos and Don'ts of an Institutional Approach

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Abstract

As part of its commitment to supporting low socio-economic students, Faculty of Science at Charles Sturt University (CSU) explored faculty-wide implementation of online resources to support its practical classes. In order to do so, review of freely available and commercially produced resources was conducted. In addition survey of staff and students' use and attitudes to online resources was performed. A number of freely available resources that supported some science subjects were identified on the World Wide Web. Most common barriers to faculty-wide implementation of these resources were limited scope, low quality and reliability. Four commercial platforms were reviewed and found to be of similar quality. Students and staff perceived these resources to be useful addition to the course, but several issues were identified. The issues raised by the staff included extra time to set up and administer online resources, loss of autonomy and limited customisation and equity of access among the students due to extra cost. Low take up rate among students in some subjects was a concern. Valuable lessons learnt during this review are discussed in this paper.

Background and Rationale

The use of online resources enhances a science educator's ability to provide a diverse range of rich learning experiences to a wide range of cohorts. This capacity is particularly important for universities with large distance (offsite) cohorts as the resources provide more flexibility (in terms of time and space) and a greater capacity to meet the needs of a variety of learning styles than traditional print packages and/or didactic lectures. Online resources also enable lecturers to increase the range of learning experiences available to a large class through the provision of virtual experiences that would be too costly or dangerous or inaccessible otherwise (Crisp, 2011; Mamo Namuth-Covert, Guru, Nugent, Phillips, Sandall, Kettler, McCallister, 2011) e.g. studying great white sharks off South Africa. Online/virtual resources can also provide students with the opportunity to experience and explore attributes of the most up-to-date scientific equipment. Very few, if any University in Australia can provide undergraduate students with access to the latest in proteomics, DNA analysis, spectrophotometry or medical imaging equipment. The online environment can provide a demonstration of these largely computer driven instruments as well as authentic outputs in the same format as any researcher using the equipment would receive. With the online resources we can give students in Dubbo the same experience as a student in Dubai or Dublin.

Given these advantages and affordances it is little wonder that there has been an explosion in resources and resource providers, so much so that a recent report on online resource development and use in north America suggested that "every day, a new programming online learning is announced," (Bacow, Bowen, Guthrie, Lack, & Long, 2012). Navigating the

available resources for a discipline can soon become an overwhelming task for academics and potential time waster for students whose time may be better spent reading textbooks rather than exploring a myriad of resources the quality and accuracy of which may be questionable. There are many ways the growth of online resources can be supported at an institutional level. For example: (i) Early adopters and champions can be fostered by their institution knowing that for every champion there will be several academics who have lost incentive or drive thanks to having adopted a resource that did not work or those that were used but were later removed by the provider or blocked by the institution, (ii) an institution can set a series of goals and guidelines and request that all courses or subjects meet those guidelines without providing more than basic support and a central learning management system (LMS), or (iii) an institution can take a centralised approach to resource/third party provider identification or resource creation. This paper looks at one institution's exploration of the third option.

The Faculty of Science pre-lab project was set up in November 2011 to improve student experience and outcomes through the use of online resources for those units of study that had a laboratory or clinical placement component. The use of online resources and pre class testing has been shown by others to improve student retention and performance in the laboratory (see Cain & Shephard, 2011). Further, virtual experiments and simulations are considered effective ways of preparing students for summative hands-on assessments (Crisp, 2011). The project was presented as a service to academics. The first phase focused on identifying subjects that would benefit the most and identified those resources and systems currently in use. Targeted subjects were those with high attrition and a high proportion of low socio-economic students. It was considered the introduction of online resources that increased student enthusiasm and engagement in these subjects would have the greatest impact on the student experience and success.

Phase one of the project also involved identification of available resources that were suitable for efficient incorporation into a faculty wide scheme. The ideal resource/s for such an institutional wide plan were identified as those that would provide consistent student experience (eg. the resource arrangement and access page was familiar across biology, chemistry, physics), be of minimal cost to students, have quality control processes, provide technical support and platform integration with university's learning management system. With this in mind the project officer was encouraged to review existing web resources as well as liaise with key commercial providers to identify a possible single system that could cover our foundation subjects and the range of desired resource types. The university's staff and student use and attitudes towards online resources were also investigated.

Data Collection

Non Commercial resources

A general web search for resources designed for tertiary science laboratory classes was conducted using standard search engines. This preliminary phase concentrated on free or low cost resources that could be incorporated easily into standard teaching practices, eg via web link. The review of these resources focussed on suitability of content (type, subject and level and whether the resource included support for laboratory-specific content), ease of use, available support, cost structures, currency and quality.

Commercial Platforms

Four commercial platforms were compared to determine which platform might fit the needs of the first year science subjects taught at CSU. As it is not the intent of this article to advantage

or disadvantage any commercial entity, the identity of the publishers in relation to any of the evaluation criteria will not be disclosed. The criteria used to assess the platforms were:

- extent of content (i.e. what percentage of content these resources cover within each subject)
- how specific are the resources for use in a pre-lab context
- does the platform allow modification/customization of the resources
- how easy the resources are to use from the lecturer's and student's perspective
- does the company that supplies the resources provide adequate support in setting up / using resources
- do the lecturers think that the resources add to their teaching
- what amount of feedback the lecturer gets about student learning
- do the students think that the resources add to their learning
- what amount of feedback do the student gets about their own learning
- how well do the resources integrate with the university's learning management system
- what is the best way to implement these resources so that the lecturers and students get most benefit out of their use
- is there any evidence that these resources improve student performance
- cost and sustainability of maintaining use of the resources
- equity of access to the resources

To evaluate the above criteria, we conducted meetings with the publishers and with those lecturers who taught first year science subjects and were already using one of the four commercially available platforms. Meetings with lecturers were designed to get their perspective of the educational value and ease of use of these platforms. We also conducted trials of the platforms to evaluate student patterns of use and their perception of how the use of these platforms affected their learning. The trials involved subjects that were already using the platform under investigation and thus the educators were familiar with its use and capabilities.

Results and Discussion

Non commercial resources

The reviewed resources that were freely available on the net fell into two categories:
A. resources produced and/or compiled by education or subject matter enthusiasts or
B. resources produced by non-commercial entities (example: university, research institution, typically receiving public funding). The advantages of these resources include ease of access and no or limited cost associated with using them. Several barriers to the use, however, were identified that meant none of the resources where seen as a possible faculty wide solution. Further, we identified six common issues that led us to group the resources into three clusters relevant to our aims, those not suitable, those with limited value in isolated applications and those considered highly valuable to be recommended to relevant staff resources. The six common issues were:

1. Quality of production
    - typically, when the resources are produced by educators who have interest in e-learning, the tools used for design are relatively basic, navigation can be bulky and not intuitive and the final product is of amateur quality (with few exceptions).
2. Narrow subject matter coverage

- the resources are usually produced for a particular discipline (eg: Chemistry, Biology, but not both), as it is often produced by individuals or networks with expertise in particular area.

3. Resource maintenance and reliability
   - the resources may not be maintained or updated, as availability of the creator and/or funding to support the resource is necessary to do so. It cannot be guaranteed that any particular resource will continue to be available to the students.
4. Ongoing support and training
   - Most of the freely available resources that were reviewed in the preliminary review only contained basic instructions on how to use them and did not come with ongoing support/ troubleshooting manual.
5. Error reporting
   - many of these resources do not have a strategy related to reporting/ correcting errors in the content. This may cause confusion among students if incorrect information is presented.
6. Adaptability
   - Only very few resources in this category came with a module or self authoring tool that allowed significant modification to the existing resources and/ or creation of a completely new resource. In addition, if such tool is available, covenants are usually placed on how the newly created resource can be used.

The unsuitable resources were normally deemed so due to format (eg required too much bandwidth), currency (not updated for 2 years or more), price structure, lack of contextualisation capacity (eg. all north American example and no space for Australian contextualisation, being non adaptable (unable to customise to set learning objectives), content being too limited for consideration at a faculty level (eg. biology labs online, a commendable resource for a limited number of topics ;www.biologylab.awlonline.com) or just too simple, eg. Scitex learning (www.scitexlearning.com). The Scitex resources which consist of a set of valuable and rich resources were identified as being more suited to the secondary education sector or bridging programs than a tertiary level course. The review identified two highly valuable non-commercial resources which, while not suited to a full faculty solution, should be recommended to the relative disciplines. The first resource is HHMI Bio Interactive – Howard Hughes Medical Institute Virtual Labs (http://www.hhmi.org/biointeractive/vlabs/). While limited in content, this resource provides free access to a host of integrated resources including lectures and associate materials from leading researchers and interactive virtual labs. The other highly recommended set of resources was that provided by the ChemCollective (www.chemcollective.org). Although Chemcollective's focus on chemistry limits it value in context of the aims of this project, the diversity of resources including virtual labs and the addition of scenarios that connect basic chemistry to real world situations made this collection stand out as one that should be recommended to our chemists. In addition, ChemCollective's virtual lab authoring tool deserves a mention, as this tool allows academics to modify and create their own experiments, thus making it possible to adapt the produced resources to an individual subject's curriculum.

Comparison of commercial platforms

All four platforms were currently in use in at least one subject at CSU. As previously stated, the commercial providers have not been directly identified, as it is not the purpose of this paper to advantage nor disadvantage any one provider. We are grateful to all of the commercial publishers who assisted with our investigations providing access to products in existence and in development as well as working to develop effective cost structures and platform integration solutions.

All four publishers provide some products that can partially cover or be adapted to support CSU laboratory classes. Further, they all make provision for customization/modification of quiz questions and addition of custom-made resources. At least one publisher provides opportunity to challenge answers to the questions it provides, if they do not appear correct. The challenged question is then removed and reviewed by their content experts. This level of quality assurance utilising a large pool of 'testers' (ie. Large number of students across numerous institutions) far exceeds the capacity of any in-house quiz tool.

All four publishers provide support and training for users of their platforms. Anecdotal feedback from our lecturers suggested that they were satisfied with the level of such support and that there was no difference in quality of support between different publishers. Training and support are important factors to consider as their availability has been linked to effective preparation of online learning environments (Twigg, 2005). Training and support provided by third party providers for both technical as well as pedagogical issues removes the pressure for having and maintaining institutional support systems.

When it came to cost and access of resources there were subtle differences between the publishers. Two of the publishers provide all students with access to the online resources for subjects when their text is prescribed; this access is regardless of an individual student's purchase of the text. The other two publishers only provide access relative to individual student commitment through student purchase of a text book with an associated code, or purchase of an isolated code or through institutional purchase of codes per students (with economies of scale possible relative to the number of subjects and or students involved). Due to equity issues assessments could only be tied to the providers of the whole class option as it ensures that all students have full access to assessment related resources regardless of their individual financial commitment.

Once we moved beyond the comparison of platform attributes and into discussion of use, attitudes and preferences, the difference between platforms was negligible. Further, many of the issues and concerns expressed are also relevant to any online resources. The issue of value raised an interesting dichotomy between value as an educational tool versus value to the academic as an ongoing or growing part of their teaching repertoire. The majority of lecturers involved with the project agree that online resources added to the quality of their course and/or student learning. However, some perceived the adoption of online third party resources would result in lack of intellectual autonomy in preparing and delivering their subjects. A review of the literature and discussion boards identifies this as a common concern around the globe. Interestingly, a recent review of 25 North American institutions by Bacow et al. (2012) when addressing such concerns noted that subjects delivered by interactions online learning without the ongoing presence of a human instructor are rare. Neither this project team nor the institution that instigated this project have considered the use of online resources as a replacement for teaching staff. Likewise, we do not consider it an option for award-bearing courses as effective education requires learning from feedback. While online

resources can imbed formative and summative assessment with instant feedback, an instructor of some kind is required for providing the holistic, individualised feedback students need to develop from novice to professional. Even strong advocates of the capacity of online assessment task to provide feedback that fosters higher level learning, note that teachers have a pivotal role in assessing divergent responses (responses that require a level of expertise to determine their value/accuracy in relation to questions without a single correct answer) (Crisp, 2011). In addition, anecdotally students frequently identify lecturers and tutors to be the most valuable contributors to their learning, rating them above online resources and textbooks.

The expression of concerns of loss of autonomy needs to be well managed and addressed at an institutional level as loss of autonomy has been identified as a factor in reduced job satisfaction amongst Australian academics (Winfield, Gillespie, Stough, Due, Hapuarachchi, & Boyd, 2003). To address this, institutions need to clarify their goals and strategic plans when encouraging the adoption of third party resources. There have been several studies that have demonstrated the negative consequences of either forcing staff to adopt online teaching and or failing to include their needs and concerns in the development of institutional strategies (Palloff & Pratt, 2001; Masalela, 2011). Teaching staff need to be provided with the agency to evaluate whether or not the use of third party resources is appropriate for their subjects. A critical area requiring staff and institutional collaboration is when considering the use of third-party resources to complement or replace laboratory exercises. In this context consideration must be given to the non-content related aspect of the laboratory or field environment. In particular, the role that interactions play in the development of critical thinking, scientific problem-solving and teamwork skills should be considered. Physical labs involve students working in pairs or groups thus enabling them to develop these skills. However, when online resource are introduced to improve the flexibility of delivery of a subject or provide greater access to laboratory concepts then the peer interaction element may be lost unless the environment is particularly rich or well designed. Therefore, a balance must be struck between introduction of online resources and loss of opportunities. Online resources provide students with freedom of time and place as well as a greater variety of experiences (for example, a virtual experience of using sophisticated scientific equipment can be available to all undergraduates, while it might not be ordinarily available to such a cohort in an average undergraduate laboratory due to cost or availability of equipment at their particular institution). However, by running experiments online rather than in the physical laboratory, opportunities may be lost to develop effective teamwork skills in a scientific environment, skills that can be crucial to working in research and commercial laboratories as well as in the field. This University, like other distance education providers, facilitates development of through both virtual group activities and intense laboratory classes (for example, four day residential schools) for students in their second and third years. For large first year classes or other situations where virtual lab might be considered appropriate (for example, due to the type of equipment the academic wants to students to use), multiuser virtual environments or virtual worlds as discussed by Mamo et al. (2011) may be a way of combining teamwork with the riches of virtual environment.

Discussion with students revealed a difference between student perception and student use of online resources. The majority of students contacted as part of this project saw at least some added value in use of online resources. However, that perception did not always translate into engagement. For one subject, only 10% of students registered to use the platform despite 50% of students having purchased the access code enabling them to register. Conversations with staff and students revealed that student engagement was related to level of resource

integration and/or promotion. Most lecturers in the subjects reviewed do not make use of online third party platforms compulsory for students because of equity of access. Investigation of subject delivery structure revealed that the resources may have been noted and recommended but why they were recommended or why the students should use them or how they related to the learning objectives was not made explicit. This importance of ensuring that students understand and appreciate the link between the resource and then learning objectives has been identified previously in relation to resources use at this University (Crampton, Ragusa, & Cavanagh, 2012; Crampton, Vanniasinkam, & Milic, 2010). Therefore, we would suggest that when selecting potential resources or systems, instructors should consider the availability of implementation guides or communities of practice related to those resources. One of the notable resources from our preliminary investigation HHMI Bio Interactive from Howard Hughes Medical Institute was highly ranked due to inclusion of curriculum implementation notes (Brokaw, 2012). This suggests the potential of a middle ground between the notion that resource needs to be fully embedded to achieve the best learning outcomes (Skillen, 2006) and use of standalone resources that students who engage with them perceive of some benefit (Carmichael &Farrell, 2012).

Students also raised the notion of mobile-based resources 'apps' and a desire for direction from staff as to what apps would assist them with their studies. The role of mobile-based resources were outside the scope of this project but the need to include them as a part of a holistic approach to online resources is becoming increasingly apparent. Any list of recommended apps or indeed any set of online resources would also need to be kept current. Such currency would potentially be beyond the workload capacity of an individual member of staff or design units reliant on 'soft funds' (Tynan & Barnes, 2011) and is perhaps something that the national discipline networks could be funded to take carriage of as a service to the disciplines and the nation's higher education sector. Interestingly, Bacow et al. (2012) go one step further in calling for cooperation at the national level between traditional competitors to develop a common foundational platform for the development and delivery of interactive online learning resources/experiences. They also note that the collaboration would need to continue to provide maintenance and upgrades but do not propose how that may be achieved, they just note that to continue with the customised approach "hundred flowers" (Bacow et al., 2012; p.29) is "foolishly inefficient".

Lessons Learnt

One: There is a wealth of free resources available to students that fit various learning styles and needs but there is a great diversity of quality. Students need to be given guidance on how to either evaluate resources or be provided with a maintained list of recommended/accessed resources.

Two: The time required for setting up and administering online learning platforms should be incorporated into the workload formulae. Several North American universities do provide staff with additional time and funds in recognition of the extra load involved in first translation of a traditional subject to an online offering (Bacow et al., 2012).

Three: If online resources are used in the subject, the lecturer should incorporate these resources into the subject. For example, links to the online resources may be provided from the lecture notes and study modules and resource use should be demonstrated in

class (during lectures or tutorials). Preferably, a proportion of the summative assessment should be administered via the online platform used by the subject.

Four: Teaching staff should be supported through the development of best practice guidelines for the creation and use of online resources. These guidelines should include case studies that illustrate best practice relevant to a broad range of disciplines and resource types. The need to better equip scientists to be effective teachers was recently raised by Anderson, Banerjee, Drennan, Elgin, Epstein, Handelsman, Hatfull, Losick, O'Dowd, Olivera, Strobel, Walker, and Warner (2012) who placed it at the top of their list of seven initiatives for improving the teaching of science at universities. This follows from an earlier survey of Australian academics by Kim and Bonk (2006) from which they noted a need for more training in most online pedagogy rather than technical competence. In regards to the experimental arena, Maiti, Mahata and Maiti (2011) noted, teaching experimental principals online requires a different approach and skill set to teaching them in a physical class room and thus if institutions seek to provide an online laboratory experience for their students they also have to ensure they provide staff with suitable training, time and resources to develop these new skills.

Five: Decision to use any educational resources to enhance any particular subject should be based on the needs of the subject and the students studying it. Teaching staff should play a major role in making this decision. This relates not just to the content and style of resources but also consideration of the desired level of customisation. Baclow et al. (2012) noted lack of potential to customize and request to teach from a predefined- package as two barriers to adoption of online learning systems in North America. They also noted the need to ensure staff have the WHY when being encouraged to embrace online modes of learning, this WHY should include evidence of the capacity of the mode to achieve the desired learning outcomes. Further research has demonstrated that good relationship between academics and administrators and active participation in decision making is related to academic job satisfaction (Bentley, Coates, Dobson, Goedegebuure, & Meek, 2012) – an aspect we are keen to promote.

Conclusion

Although we set out to create a faculty level common suite/system of approved online resources centred on the student experience and minimising their costs, the fact-finding stage of the project, as detailed here, has led us to forego the notion of a one size fits all or even a one size fits most. Although the single provider model would be the most cost effective thanks to economies of scale and pricing negotiations, it was clear from the first phase of this project that to do so would be to potentially reduce the richness of the student experience as guided by our discipline experts. The one provider model would not enable our diverse staff to create learning experiences that matched their experiences nor the appropriate learning environments for discipline specific life-long learning or professional development. Further, a one-provider model could hamper staff capacity to match their pedagogical preferences with their other skills, capacities and commitments. As we continue with this project we do so in a more purposeful manner mindful of the recommendations of Ragusa (2010) who emphasised the need to consider not only the purpose of the introduction of any new technology but at what expense the adaption of new technology would entail, not just in financial terms, and the consequences of any choice. For example, if we consider adopting a platform with the licensing structure, we should consider what would it lock us into or out of. We have also

become more mindful of the need to better incorporate staff perspectives both in terms of discipline perspectives and technological perspectives. Our future process will draw on the work of Uys, Dalgarno, Carlson, Crampton, & Tinkler (2011) who found a greater than expected uptake of e-learning technologies amongst CSU staff but also noted a need to engage with staff at different stages of technology adaption, both theirs and the institution's.

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References

Anderson, W. A., Banerjee, U., Drennan, C. L., Elgin, S. C. R., Epstein, I. R., Handelsman, J., Hatfull, G. F., Losick, R., O'Dowd, D. K., Olivera, B. M., Strobel, S. A., Walker, G. C., & Warner, I. M. (2011). Changing the culture of science education at research universities. *Science*, *331*(6014), 152–153. doi:10.1126/science.1198280

Bacow, L. S., Bowen, W. G., Guthrie, K. M., Lack, K. A., & Long, M. P. (2012). Barriers to adoption of online learning systems in U.S. higher education. Retrieved September 5, 2012, from http://www.sr.ithaka.org/research-publications/barriers-adoption-online-learning-systems-us-higher-education.

Bentley, P. J., Coates, H., Dobson, I. R., Goedegebuure, L., & Meek, V. L. (2012). Factors associated with job satisfaction amongst Australian university academics and future workforce implications. In P. J. Bentley, H. Coates, I. R. Dobson, L. Goedegebuure & V. L. Meek (Eds.), *Job Satisfaction around the academic world* (Vol. 7). Dordrecht: Springer.

Cain, A., & Shephard, E. (2011, July). Enhanced engagement in the undergraduate laboratory practical experience. Retrieved August 31, 2012, from http://discovery.ucl.ac.uk/1316644/

Carmichael, E., & Farrell, H. (2012). Evaluation of the effectiveness of online resources in developing student critical thinking: Review of literature and case study of a critical thinking online site. *Journal of University Teaching & Learning Practice*, *9*(1). Retrieved September 14, 2012, from http://ro.uow.edu.au/jutlp/vol9/iss1/4.

Crampton, A., Ragusa, A. T., & Cavanagh, H. (2012). Cross-discipline investigation of the relationship between academic performance and online resource access by distance education students. *Research in Learning Technology*, *20*(0). doi:10.3402/rlt.v20i0/14430

Crampton, A., Vanniasinkam, T., & Milic, N. (2010). Vodcasts! How to unsuccessfully implement a new online tool. In A. Ragusa (Ed.), *Interaction in Communication Technologies and Virtual Learning Environments: Human Factors* (pp. 118-129). Hershey, PA: Information Science Reference. doi:10.4018/978-1-60566-874-1.ch008

Crisp, G. (2011). Rethinking assessment in the participatory digital world- Assessment 2.0. *National Teaching Fellowship Final Report.* Australian Learning and Teaching Council. Sydney.

Brokaw, A. (2012). Use Howard Hughes Medical Institute resources to teach. Retrieved September 14, 2012, from http://www.hhmi.org/biointeractive/guides/.

Kim, K., & Bonk, C. J. (2006). The future of online teaching and learning in higher education: *Educause Quarterly*, *4*, 22–30.

Maiti, C. K., Mahata, S., & Maiti, A. (2011). Design and development of a cost-effective online electronic circuits laboratory. *Technology for Education (T4E), 2011 IEEE International Conference on* (pp. 221 – 224). doi:10.1109/T4E.2011.43.

Mamo, M., Namuth-Covert, D., Guru, A., Nugent, G., Phillips, L., Sandall, L., Kettler, T., & McCallister, D. (2011). Avatars go to class: A virtual environment soil science activity. *Journal of Natural Resources & Life Sciences Education*, *40*(1), 114–121. doi:10.4195/jnrlse.2010.0023u

Masalela, R.K. (2011). Implementing e-learning at the University of Botswana: the practitioner's perspective. *Online Journal of Distance Learning Administration* 14 (11)

Palloff, R.M. and Pratt, K. (2001). *Lessons from cyberspace classroom: The realities of online* teaching. San Francisco: Jessey-Bass

Ragusa, A.T. (2010). Communications and social interactions in a technology mediated world. In Ragusa, A. T. (Ed.). *Interactions in communication technologies and virtual learning environments: human factors.* Hershey, PA: IGI.

Skillen, J. (2006). Teaching academic writing from the "centre" in Australian universities. In Ganobcsik-Williams, L. (Ed.), *Teaching academic writing in UK higher education: Theories, practices and models.* Palgrave MacMillan, New York.

Twigg, C.A. (2005). Course redesign improves learning and reduces costs, policy alert. *The National Centre for Public Policy and Higher Education* June. Retrieved September 14, 2012, from http://www.highereducation.org/reports/pa_core/core.pdf .

Tynan, B. & Barnes, C. (2011). Web 2.0 and professional development of academic staff. In Lee, M.J.W. & McLoughlin C. (Eds.) *Web 2.0-based E-learning.* Hershey, PA: IGI.

Uys, P, Dalgarno, B., Carlson, L., Crampton, A.. & Tinkler, J. (2011). A 2010 snapshot of educational technology use by teaching staff of Charles Sturt University. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011*. (pp.1255-1269).

Winefield, A. H., Gillespie, N., Stough, C., Dua, J., Hapuarachchi, J., & Boyd, C. (2003). Occupational stress in Australian university staff: Results from a national survey. *International Journal of Stress Management, 10*(1), 51-63.