Title: Fostering engagement with academic communities of practice: a new role for librarians.

Author/s Names:

Joann Cattlin, Melbourne Graduate School of Education, The University of Melbourne, Parkville VIC 3010.

Paul Mercieca, School of Business IT and Logistics, RMIT University, Melbourne VIC 3000.

Presenter/s Name: Joann Cattlin, Melbourne Graduate School of Education, The University of Melbourne, Parkville VIC 3010.

E-mail address: joann.cattlin@unimelb.edu.au **Phone:** +61 3 90358694

Abstract:

Academic librarians are under pressure to continually adapt services and resources to meet the changing needs of academic staff and students and respond to the wider availability of unmediated digital information (Jaguszewski & Williams, 2013). Many university libraries are responding by pursuing new methods of client engagement by providing more targeted and personalised library services (Tiffen & England, 2011). This paper presents findings from a small study of the information seeking approaches of 13 academics teaching mathematics in a range of Australian universities. It finds that while academics have direct access to more information than ever before, they are also time poor, face many challenges as teachers and are under increasing pressure to change their approaches to teaching. Findings suggest that communities of practice could be effective in supporting access to information about teaching. Librarians have the opportunity to foster such communities and to support the information gathering and sharing of the communities of practice.

Introduction

Librarians are being urged to innovate and look for new opportunities in the changing landscape of higher education. University libraries have changed their approach to provision of wide range of services in recent years in response to not only the revolution in information, but also the changing budgetary and performance pressures within institutions. Librarians have had to adapt their approaches to liaison and service provision with often fewer library staff, and increased expectations of tailored liaison support across a more diverse range of disciplines. While efforts to establish relationships with academics have always been fraught with obstacles, the increased workloads and performance pressures on academics combined with extensive unmediated resources available, means libraries are under pressure to demonstrate their value (Council of Australian University Librarians, 2013).

In this climate it can be daunting to contemplate yet another potential outreach activity. This paper identifies an opportunity for academic libraries to play a key role in facilitating communities of practice (CoPs) in universities to support development of teaching practices. It will present a case study of academics teaching

mathematics in Australian universities that highlights an unmet need for information and proposes a role for libraries based on trends in library engagement with academic communities and application of CoP theory within universities.

Background

> *The library of the future, whether the physical space or its digital resources, can be the place where you put things together, make something new, meet new people, and share what you and others bring to the table. It's peer-to-peer, hands-on, community-based and creation-focused. (Martin, 2015).*

Most libraries are grappling with what the future holds. Academic librarians are under pressure to continually adapt services and resources to meet the changing needs of academic staff and students and respond to the wider availability of unmediated digital information (Delaney & Bates, 2015; Jaguszewski & Williams, 2013). Many university libraries are responding by pursuing new methods of client engagement providing more targeted and personalised library services (Tiffen & England, 2011). These services and initiatives cover a wide range of specialized teaching, research and information management services and tools including digital repositories, data management tools, research metrics, IT software and hardware support, information literacy programs and curriculum resources. Innovations are characterized by disintermediation and providing services that are user-centric (Sputore, Humphries, & Steiner, 2015). Many commentators see more effective collaboration, which not only utilizes the library's existing skills and connections, but builds new and innovative solutions and services to meet client needs (Neal, 2010; Pham & Tanner, 2015; Sputore et al., 2015).

One area where university libraries have had limited involvement has been the provision of information to support academics in developing their use of technology, pedagogical tools and research in scholarship to support teaching practices. A search of the literature reveals that librarians are well placed to support the work of university teaching and learning centres and individual academics (Bradley, 2009; Yoshida, 2014). Librarians also have an interest in developing their own teaching practices and ensuring their approaches are aligned with those of academics (Otto, 2014). Some have identified this as an area of potential expansion for libraries drawing on librarian's ability to 'enable',

> *If they learn from librarians about the addition of new resources that are aimed at improving the pedagogy of their discipline, faculty are likely to see the interest and knowledge of the librarians as a stimulus for even more efforts for shared attention to teaching and learning' (Otto, 2014 p. 87).*

Some see the potential for libraries to play a key role in supporting change in curriculum and pedagogy, which positions the library more securely within the university and at the same time supports the needs of staff.

> *The library can work with academic departments to develop use cases for new types of student work and the facilities, equipment, and services required, and integrate this work into the planning process (Lippincott, Vedantham, & Duckett, 2014).*

Indeed teaching academics are presented with an increasing number of challenges as they face pressure to build their skills in using online and blended modes of teaching, be rated highly by students as good teachers and develop adaptive responses in teaching students who are struggling and failing (James, Krause, & Jennings, 2010; White, 2007). In addition, Australian academics need to address quality frameworks such as the Excellence in Research for Australia (ERA) research framework that tends to rely on bibliometric measurement of journal output as an indicator of research and academic quality (Smith, Crookes, & Crookes, 2013). However ERA recognized outputs and prescribed publication patterns tend to be more highly valued in academic promotion than teaching, and therefore there may be little incentive for academics to spend time to developing new teaching practices (Cretchley, 2009; Probert, 2014). Therefore while developing new methods of teaching is expected, academics have limited time to devote to this.

In such an environment, academics may not be aware of the teaching and learning support that can be available to them. While information may be circulated by groups within an institutions, such as a Learning and Teaching unit or academic professional development program, this can have limited reach or is targeted to particular academic groups, such as new staff or early career academics. Such information may also be too general to address discipline specific challenges (Chalmers, 2010; Luzeckyj & Badger, 2008; Wood et al., 2011). Academics who attempt to research teaching and learning can often find this time consuming and the language and research is not accessible due to differences in discipline approaches to research (Gibbs, 2013).

It has been traditional for academics to learn their teaching skills 'on the job', 'by observing teaching from the reciprocal position of a student, observing and communicating with their colleagues, and experientially, that is, by doing it'(Dunkin, 1995 p. 22). While universities may encourage new academics to complete some educational courses, such as a graduate certificate in tertiary teaching, the expectations for this, and how this is managed, varies between universities. The reality is that academics are specialists in their own discipline and most do not consider teaching to be a topic they would research, complete further studies in, or consult the library for information and support. Viskovic (2006) suggests that academics 'linked their [teaching] practice very rarely to teaching and learning publications [but rather] sometimes to ideas from courses or workshops and often to the influence of colleagues.' (p.330). Colleagues play a significant role as a source of mentoring and information about teaching, particularly in establishing the expected modes of professional behavior and expectations in university teaching (Silver, 2003). Thus access to information about teaching practice and policy tends to be through more informal channels rather than through the literature of teaching research/practice.

Mathematics as a case focus

This paper presents a case study of academics teaching undergraduate mathematics and their access to information relating to teaching practices. There are particular challenges for academics teaching mathematics and statistics in

undergraduate degree programs. Many students struggle with undergraduate mathematics. The fact that mathematics is taught mainly as a service subject across many degree programs means that classes are large and the compulsory nature means students have varying degrees of motivation, different backgrounds and applications for the mathematics.

There is a growing body of research on new approaches to teaching that academics could use to address students' lack of knowledge and skills (Speer, Smith, & Horvath, 2010). However teaching of mathematics is still traditionally conducted in lecture format, written on a white board or projector, with limited interaction between students and dense content (Alsina, 2002; Greiffenhagen, 2014). At the same time there are expectations that mathematicians (and other academics) will use new formats for teaching, such as blended, online or flipped classrooms (Berrett, 2012; Jungić, Kaur, Mulholland, & Xin, 2015). In recent years universities have integrated some digital technology into instruction and assessment, but there are significant challenges in implementing these and many are unconvinced they are effective learning tools for students (Coupland, Dunn, Galligan, Oates & Trenholm, 2016). This presents many challenges if academics have little information to support them in this process of educational change.

The information seeking behavior of academics reveals an experience of learning on the job and reliance on colleagues as being the first, and often only, source of information for teaching support. Research into information seeking behavior that explore the most effective ways of providing information indicates that networking and CoPs are a key source of information for academics in relation to their discipline knowledge (Borgman et al., 2005; Tenopir, King, Spencer, & Wu, 2009). In such an environment, can CoPs be effective in supporting access to information about teaching, and if so, where can academic libraries engage with such a practice?

A number of studies have indicated that CoPs in universities can be effective in supporting information sharing, staff development and building interdisciplinary collaboration (Cox, 2013; Pharo, Davison, McGregor, Warr, & Brown, 2014). While there is evidence that communities are effective in higher education, the uptake has been slow, which may be due to decline collegiality in universities, discipline and faculty silos and lack of active facilitation or resourcing (Hort et al., 2008; Nagy & Burch, 2009). As information providers, academic librarians may need to determine what role they can take in either facilitating the take-up of CoPs or in engaging with them as part of their liaison type roles.

Librarians could potentially play a key role in facilitating CoPs focused on developing teaching and in particular, supporting pedagogical change to embrace technology. Librarians are urged to follow the needs of their users to identify what new services are needed, to support growing digital literacy and to 'leverage' their skills and expertise and go beyond supporting faculty and students (Peet, 2015). However others see the library's role as important in facilitating organizational change and repositioning itself, through capitalizing on the library's connections with the faculties and students and creating new collaborations (Rowley, 2011; Ward, 2013).

This paper presents a case study of academics teaching undergraduate mathematics to illustrate an unmet need for information and the potential of librarian facilitated CoPs to support development of teaching practices, information sharing and collaborative problem solving. It highlights an opportunity for libraries to expand their services already provided in support of teaching, through building supportive relationships and mediating resources.

Methodology

This paper reports on the findings of a qualitative study involving semi-structured interviews with 13 mathematicians and statisticians involved in teaching and research in Australian universities. The study used a phenomenological approach to analyse the interviews and identify what information mathematicians needed about teaching, how they accessed it and their awareness of the information sources available.

The focus for this study developed from the researcher's work on a learning and teaching grant which explored the role of first year coordinators in mathematicians[1]. In the course of the project it became clear that many mathematicians did not regularly seek out or access information they needed to support them in developing their teaching. The anecdotal evidence suggested that while there were a range of resources available they often did not meet the information needs of mathematicians. This led to a separate study of the ways that mathematicians accessed information to support the development of their teaching expertise.

The principles of 'purposeful selection' (Maxwell, 2012 p.89) were used to select a range of interviewees to represent a cross section of mathematicians in universities as far as possible from both genders, different states, urban and regional campuses and representing the different types of universities (i.e. Group of Eight, Australian Technology Universities, Innovation Research Universities and regional universities). Participants were identified from the public staff lists for schools and departments of mathematics. Individuals who were identified as having teaching responsibilities for undergraduate subjects were invited to participate.

Invitations were sent to 41 academics and of those 13 agreed to participate. The gender balance of interviewees was 4 females and 9 males, with a range of experience from less than 5 years teaching to more than 20 years. Participants came from a range of universities from six states, representing institutions from the Group of Eight, Innovative Research Universities, Australian Technology Universities and regional universities.

Interview transcripts were recorded, transcribed and coded using a web based analysis tool (Dedoose) to identify the main themes and issues as outlined in the following sections of this paper. The interviews were semi-structured and included the core questions listed at Appendix 1. The interviews differed in the order the questions were asked to allow a flow in conversation.

[1] The presenter was the project manager on the First Year in Maths project, funded by the Office for Learning and Teaching. The case study presented in this paper was undertaken separately, as a requirement for a minor thesis in the Master of Information Management at RMIT University.

Results

The study found that mathematicians appear to have a strong culture of self-reliance and their information seeking about teaching was largely passive and informal, such as accessing tacit knowledge from colleagues, accidental discovery and referrals. Their preparation for teaching consisted mainly of their own experiences as a student and learning on the job as a tutor. In developing their teaching as lecturers, most relied on guidance from colleagues, attending local seminars or conferences and adhoc referrals of articles from colleagues. Many expressed a preference for attending conference presentations, seminars and workshops over reading. They found listening to presentations provided broad information about current research as well as practical examples and the opportunity to network with others (Table 1).

Table 1. Sources of information on teaching used by interviewees.

Interviewee	Seminars/ Conferences	Colleagues/ Other Academics	Researching literature	Formal training
A	✓	✓		
B	✓			
C	✓	✓	✓	✓
D	✓	✓		
E	✓	✓		
F	✓	✓	✓	
G	✓	✓	✓	
H	✓		✓	✓
I	✓	✓		
J	✓	✓		
K	✓	✓	✓	
L	✓	✓		✓
M		✓		✓
Total	**12**	**11**	**5**	**3**

The interviewees tended to feel that as new academics they had been initially ‘thrown in the deep end’ of teaching to some extent, most starting teaching with very few skills, no training or instruction on running tutorials or lectures and learnt through a process of trial and error. For one it was a case of ‘if you sink you sink’ (Academic M). The lack of information or guidance in preparing for tutoring for another was evident, ‘I don’t really remember even talking much to anybody about it’ (Academic L).

Four participants had attended a formal training course in higher education teaching, with the length and content varying between a few weeks to a semester. Three found their course useful, particularly for introducing them to the broader literature and educational theory, which they felt informed their teaching. One found theirs to be of limited use, due mainly to the lack of mathematics related examples and generic level of advice.

Most taught classes in the manner they had observed other staff using, or had experienced themselves, and the general expectation was 'you've experienced it so you can do it' (Academic H). In a few cases they received some short term mentoring and support from other staff, but felt they were expected to develop their own approach with the course materials provided. The main source of information these interviewees had in their early career were colleagues and their own experiences as students.

> *' most people in a university will be relying on their colleagues or just anybody that they know in their community who might have done something a bit differently, people from different universities, that's it really, just word of mouth'. Academic A*

When participants were asked where they looked for information about teaching, most expressed an unmet need for practical, discipline specific information (Table 2). Eight had found, or still did find, it difficult to know where to start looking for information, being unfamiliar with the resources and research available. The majority also expressed a lack of time to conduct research into teaching practice, and even those who could locate articles found little time to read in depth. Four felt the quality and applicability of the research they had found to be limited, as research into teaching was not seen as being as rigorous as that applied to their own discipline area i.e. not evidence based.

Table 2. Unmet information needs

Interviewee	staring point for research	practical information relevant to teaching maths	evidence based research	quick to find/interpret
A	✓	✓		✓
B				
C	✓	✓		
D	✓	✓		✓
E	✓	✓		✓
F	✓	✓		✓
G		✓		✓
H		✓		✓
I	✓		✓	✓
J	✓	✓		
K		✓	✓	
L		✓	✓	✓
M	✓	✓	✓	
Total	**8**	**11**	**4**	**8**

One of the key findings of this investigation was that the interviewees relied heavily on colleagues and other people as sources of information to support their teaching development and practice. They cited reasons for this as being the reliability of

information from colleagues, their proximity and ease of access and the information they provided generally being practical and specific to mathematics. In some cases the culture of their academic department had been a strong positive influence, where teaching was highly valued and there was a strong 'local culture' emphasizing 'good teaching practice, encouraging active learning' (Academic A & E). This was reflected in the expectation that all staff would be interested in teaching practices, took part in regular informal discussions, tutors took part in an induction program and were mentored by subject coordinators.

> *'in the staffroom at lunchtime……the conversation it was all about who was teaching what and how the students were going and what sort of things they were doing in their classes. It was really important.' Academic A*

The investigation, in many ways, reflects the findings of research associated with social learning theory, which suggests that people learn from observing, mimicking and interacting with those around them and developing a specialized knowledge is part of this participation (Bandura & McClelland, 1977; Wenger, 2000).

This style of learning and information seeking could be supported through the processes of a CoP. Wenger identified CoPs as the foundation of a social learning system, which occur in many aspects of life, are often informal and unstructured, based on social groups with a common purpose or interest and develop organically (Wenger, 1998). Wenger suggested that the nature of interactions in these communities and networks constituted effective learning, knowledge transfer and knowledge development that was highly productive when it occurred in workplaces (1998). CoPs exist apart from the hierarchical structure of a workplace, and can therefore cross boundaries that may normally inhibit exchanges of ideas, information and problems. Wenger stated that;

> *'Over time, a history of learning becomes an informal and dynamic social structure among the participants, and this is what a community of practice is (Wenger, 2010 p.2)'*

As the participants of this study relied on their colleagues, instead of the formal literature and theory associated with the practice of teaching, it is suggested that these participants could benefit from discipline-based CoPs. The more informal nature of a CoP is sharing awareness, issues and practical examples of teaching and curriculum development may be a way to support teachers who have a strong discipline understanding, but need guidance in changing models of content delivery.

But what does this mean for academic and liaison librarians? The implications of these findings for libraries are that academics within this particular discipline have an unmet need for information and support which could be addressed through their preference for networking, attending presentations and accessing targeted information. Librarians could play a key role in supporting this information networking for information access, especially if they can assist in facilitating, or engaging with, the notion of a CoP.

Discussion

This study supports and encourages the role that academic and liaison librarians have in networking with academic staff. The study certainly acknowledges the current practice of liaison librarian, to be at the place of the academic, to engage in program/course teams and to maintain a strong physical presence within the academic schools. However, the outcome of this study also suggests that there may be opportunities to extend such service through other avenues, including the fostering or participation within CoPs.

Identifying an information need

The information needs of academics in relation to developing their teaching practices could provide librarians with an opportunity to establish new connections, building on existing liaison links. Despite having a wealth of information at their fingertips, academics are often overwhelmed, particularly when faced with seeking information in new area. This is particularly important in the case of information and resources on teaching practices, which is not part of academics usual disciplinary research and therefore unfamiliar. This study identified that the information needs of academics may not be best served by the self-service model, and that personal connections are key.

All interviewees from this study gave examples of the role of other people in providing them with information and guidance about teaching. These people were those that were accessible in their workplace and others from external networks who they met by chance or had sought out. Contact occurred through informal discussions, workshops or seminars, mentoring relationships, attendance at conferences, participation in research projects and informal sharing of resources or advice.

Many indicated a lack of time inhibited their efforts to access information, they preferred personal interaction, over research and reading. Some also indicated they were unfamiliar with where to locate quality information about teaching, while others felt discouraged by the fact that the research they had read was not useful or relevant to their needs. Their approaches to seeking information were also shaped by their preference for discipline specific and practical information, as opposed to research findings in other disciplines or educational theory. These limitations meant information seeking was often frustrating and fruitless.

What did not explicitly come out in the study, however, was an indication of the library as playing a part in the informal information networks that the academics had established. This may be an indication of mathematicians' limited use of the library for supporting teaching and research, as the discipline does not require the range of resources used by many other disciplines. However it did highlight that academics do have information needs beyond their disciplinary area, and may be unfamiliar with the types of resources and assistance available in the library.

Library staff, especially liaison librarians, have a networking advantage in that they have the opportunity to see what a range of academics are doing in the teaching and

research and could thus be another information conduit for sharing practical ideas. It is suggested that academic library staff could be the facilitators that support the development of CoPs that the interviewees saw as part of their teaching learning experience.

A role for libraries in creating communities of practice within universities

There are examples of CoPs operating in universities and academic libraries as mechanisms for cross disciplinary and inter-departmental development of first year programs, academic support, technology and blended learning (McDonald & Star, 2014; Warhurst, 2006). Librarians have demonstrated their ability to build their own CoPs, develop new skills and be open to innovative solutions (Belzowski, Ladwig, & Miller, 2013; De Jager-Loftus, Midyette, & Harvey, 2014). CoPs involving academics are a natural extension of their outreach and engagement efforts and provide an opportunity for deeper connections with academics to increase the profile of the library (Belzowski et al., 2013).

The literature indicates the potential for libraries to contribute to, or initiate new CoPs, by:

- Acting as the champion for CoP development.
- Testing interest in CoPs by using their liaison contacts as an initial network into schools.
- Fostering CoPs across discipline and faculty silos by drawing together academics who have addressed similar teaching issues from different discipline perspectives. This extends the informal networking that was identified by this study of mathematicians.

The role of the librarian as information provider, curator and instructor can be extended through their active participation in discipline or school based networks. Libraries already engage with academics through a range of formal and informal connections. In many institutions the foundations for developing existing liaison roles into facilitation roles for CoPs already exist, e.g. embedded librarians, liaison librarians who attend School/Faculty meetings, tailored information literacy training for staff/students and curriculum material development.

CoPs supporting teaching and learning, which are facilitated by library staff, would provide academics with access to targeted information and resources needed to support their teaching, scholarship of teaching and learning and professional development. Teaching and learning unit staff would also play a part within the CoP by providing support with specific training, access to grants for research and ongoing professional advice.

There is always the possibility that some academics may rebel against ‘non-academics telling them what to do and how to teach’, but the notion of a CoP provides the opportunity for shared practice. Liaison librarians can assist in facilitating the development of such communities, draw in expertise from across schools or faculties and can be a link between academic teaching practice and the

support services of different parts of the university. The librarian plays the key role in linking the wide range of services and information available, by providing the institutional and discipline context, identifying information needs and mediating connections.

The experiences of establishing a CoP at University of Southern Queensland (USQ) (McDonald, 2014) suggests that a champion is usually needed to help establish and facilitate interest in a CoP. Such a person is important in identifying potential opportunities for a CoP, for promoting and facilitating the initial meetings of such practice. The USQ experience suggests that an initial invite to potential participants, preferably from across disciplines, can support the development of a regular (monthly) CoP gathering. Librarians may have the opportunity to take on this role using existing links they have established with departments (for example with library information literacy programs). These departments could act as the initial start to the development of a CoP. In essence, the library could act as the facilitator and champion that supports access to information for different academic communities.

Libraries leading institutional responses on teaching quality.

Some university libraries are already actively supporting teaching quality and academics researching in Scholarship of Teaching and Learning (SoTL) through providing webpage links to resources, facilitating training in teaching technologies and supporting networks of academics. There are different approaches by universities in this area such as:

- The **University of Technology Sydney Learning futures**, which provides resources, workshops and information about developing teaching resources using video, digital information literacy.
- The **University of Melbourne library teaching and learning** resources page on library website which provides links to services across the university and differentiation of liaison roles as research support and teaching support.
- The **University of Sydney library** which provides links to the University teaching scholars' network and relevant literature.

Each of these examples illustrate how libraries have developed resources and contextualized services provided by the university to support teachers. It is suggested that this expertise could also be extended by adopting the networking and sharing processes of CoPs. Also an unexplored element is the existing teaching and learning working groups and committees at Faculty and School level which guide policy and practices in teaching and assessment. These groups provide a potential collaborative forum for librarians to establish local connections and assess discipline specific needs and interests.

Conclusions

This paper indicates that library facilitated CoPs to support teaching in universities could enhance the library's contribution to the institution, in much the same way as innovations in bibliometrics, grant application and research services have done. While the case study identifies an unmet need for information and support amongst mathematicians, further investigation is needed to determine the extent of this need within other discipline area. While CoPs have been successful in supporting collaboration and information sharing in universities, they need to be facilitated and supported in order to flourish. Librarians' approaches to liaison and broad connections across universities mean they are well placed to facilitate personal connections, determine information needs and mediate available resources. This would extend existing roles of liaison librarians, embed the library within institutional approaches to teaching and enhance the professional contribution of librarians.

References

Alsina, C. (2002). Why the Professor Must be a Stimulating Teacher. In D. Holton, M. Artigue, U. Kirchgräber, J. Hillel, M. Niss, & A. Schoenfeld (Eds.), *The Teaching and Learning of Mathematics at University Level* (Vol. 7, pp. 3-12): Springer Netherlands.

Bandura, A., & McClelland, D. C. (1977). Social learning theory.

Belzowski, N. F., Ladwig, J. P., & Miller, T. (2013). Crafting identity, collaboration, and relevance for academic librarians using communities of practice. *Collaborative Librarianship, 5*(1), 3-15.

Berrett, D. (2012). How 'flipping'the classroom can improve the traditional lecture. *The chronicle of higher education, 12*, 1-14.

Borgman, C. L., Smart, L. J., Millwood, K. A., Finley, J. R., Champeny, L., Gilliland, A. J., & Leazer, G. H. (2005). Comparing faculty information seeking in teaching and research: Implications for the design of digital libraries. *Journal of the American Society for Information Science and Technology, 56*(6), 636-657.

Bradley, C. (2009). The scholarship of teaching and learning Opportunities for librarians. *College & Research Libraries News, 70*(5), 276-278.

Chalmers, D. (2010). Progress and challenges to the recognition and reward of the Scholarship of Teaching in higher education. *Higher Education Research & Development, 30*(1), 25-38. doi:10.1080/07294360.2011.536970

Council of Australian University Librarians. (2013). *CAUL/CONZUL Top ten issues is academic libraries*. Sydney: CAUL.

Coupland, M., Dunn, P. K., Galligan, L., Oates, G., & Trenholm, S. (2016). Tertiary Mathematics Education. In *Research in Mathematics Education in Australasia 2012-2015* (pp. 187-211). Springer Singapore.

Cox, M. D. (2013). The impact of communities of practice in support of early-career academics. *International Journal for Academic Development, 18*(1), 18-30.

Cretchley, P. (2009). Are Australian universities promoting learning and teaching activity effectively? An assessment of the effects on science and engineering academics. *International Journal of Mathematical Education in Science and Technology, 40*(7), 865-875.

De Jager-Loftus, D. P., Midyette, J. D., & Harvey, B. (2014). A Community of Practice: Librarians in a Biomedical Research Network. *Medical reference services quarterly, 33*(1), 60-74.

Delaney, G., & Bates, J. (2015). Envisioning the academic library: a reflection on roles, relevancy and relationships. *New Review of Academic Librarianship, 21*(1), 30-51.

Dunkin, M. J. (1995). Concepts of teaching and teaching excellence in higher education. *Higher Education Research and Development, 14*(1), 21-33.

Gibbs, G. (2013). Reflections on the changing nature of educational development. *International Journal for Academic Development, 18*(1), 4-14.
Greiffenhagen, C. (2014). The materiality of mathematics: Presenting mathematics at the blackboard. *The British journal of sociology*.
Hort, L., Higgins, D., Kiley, M., Roberts, P., Pike, M., Hays, J., . . . Trevitt, C. (2008). *Promoting Teaching & Learning Communities: Institutional Leadership Project* Retrieved from Canberra:
Jaguszewski, J., & Williams, K. (2013). New roles for new times: Transforming liaison roles in research libraries.
James, R., Krause, K.-L., & Jennings, C. (2010). *The first year experience in Australian universities*: Canberra: DEEWR.
Jungić, V., Kaur, H., Mulholland, J., & Xin, C. (2015). On flipping the classroom in large first year calculus courses. *International Journal of Mathematical Education in Science and Technology, 46*(4), 508-520.
Lippincott, J., Vedantham, A., & Duckett, K. (2014). Libraries as enablers of pedagogical and curricular change. *Educause Review Online*.
Luzeckyj, A., & Badger, L. (2008). Literature review for Preparing Academics to Teach in Higher Education (PATHE). *Unpublished Research report. Flinders University, University of South Australia & Bond University, funded by ALTC. Retrieved January, 20*, 2011.
Martin, C. (2015). Who says libraries are dying? They are evolving into spaces for innovation. *The Conversation,* (19 August, 2016). Retrieved from https://theconversation.com/who-says-libraries-are-dying-they-are-evolving-into-spaces-for-innovation-44820
Maxwell, J. A. (2012). *Qualitative Research Design: An Interactive Approach: An Interactive Approach*: Sage.
McDonald, J. (2014). *Community, domain, practice: facilitator catch cry for revitalising learning and teaching through communities of practice* (1922218790). Retrieved from Sydney: file:///C:/Users/jcattlin/Downloads/McDonald,%20J_NT%20report_%202014.pdf
McDonald, J., & Star, C. (2014). Learning and teaching professional development:An Australian community of practice case study. *Learning Communities Journal, 6*, 27.
Nagy, J., & Burch, T. (2009). Communities of Practice in Academe (CoP-iA): understanding academic work practices to enable knowledge building capacities in corporate universities. *Oxford review of education, 35*(2), 227-247.
Neal, J. G. (2010). Advancing from Kumbaya to radical collaboration: redefining the future research library. *Journal of Library Administration, 51*(1), 10.
Otto, P. (2014). Librarians, Libraries, and the Scholarship of Teaching and Learning. *New Directions for Teaching and Learning, 2014*(139), 77-93.
Peet, L. (2015). Academic Libraries Look Toward the Future *Library Journal,* (August). Retrieved from http://lj.libraryjournal.com/2015/07/shows-events/ala/academic-libraries-look-toward-the-future-ala-annual-2015/#_
Pham, H. T., & Tanner, K. (2015). Collaboration Between Academics and Library Staff: A Structurationist Perspective. *Australian Academic & Research Libraries, 46*(1), 2-18. doi:10.1080/00048623.2014.989661
Pharo, E., Davison, A., McGregor, H., Warr, K., & Brown, P. (2014). Using communities of practice to enhance interdisciplinary teaching: lessons from four Australian institutions. *Higher Education Research & Development, 33*(2), 341-354.
Probert, B. (2014). *Why scholarship matters in higher education*. Retrieved from
Rowley, J. (2011). Innovation for survival: From cooperation to collaboration.
Silver, H. (2003). Does a university have a culture? *Studies in Higher Education, 28*(2), 157-169.
Smith, K. M., Crookes, E., & Crookes, P. A. (2013). Measuring research 'impact'for academic promotion: issues from the literature. *Journal of Higher Education Policy and Management, 35*(4), 410-420.

Speer, N. M., Smith, J. P., & Horvath, A. (2010). Collegiate mathematics teaching: An unexamined practice. *The Journal of Mathematical Behavior, 29*(2), 99-114.
Sputore, A., Humphries, P., & Steiner, N. (2015). Sustainable academic libraries in Australia: Exploring 'radical collaborations' and implications for reference services: Citeseer.
Tenopir, C., King, D. W., Spencer, J., & Wu, L. (2009). Variations in article seeking and reading patterns of academics: What makes a difference? *Library & Information Science Research, 31*(3), 139-148. doi:http://dx.doi.org/10.1016/j.lisr.2009.02.002
Tiffen, B., & England, A. (2011). Engaging with clients and personalising services at UTS Library: measuring the value for libraries and their clients. *The Australian Library Journal, 60*(3), 237-247.
Viskovic, A. (2006). Becoming a tertiary teacher: learning in communities of practice. *Higher Education Research & Development, 25*(4), 323-339.
Ward, D. M. (2013). Innovation in Academic Libraries During a Time of Crisis.
Warhurst, R. P. (2006). "We Really Felt Part of Something": Participatory learning among peers within a university teaching-development community of practice. *International Journal for Academic Development, 11*(2), 111-122. doi:10.1080/13601440600924462
Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*: Cambridge university press.
Wenger, E. (2000). Communities of practice and social learning systems. *Organization, 7*(2), 225-246.
Wenger, E. (2010). Communities of practice and social learning systems: the career of a concept *Social learning systems and communities of practice* (pp. 179-198): Springer.
White, N. R. (2007). 'The customer is always right?': Student discourse about higher education in Australia. *Higher Education, 54*(4), 593-604. doi:10.1007/s10734-006-9012-x
Wood, L., Vu, T., Bower, M., Brown, N., Skalicky, J., Donovan, D., . . . Bloom, W. (2011). Professional development for teaching in higher education. *International Journal of Mathematical Education in Science and Technology, 42*(7), 997-1009.
Yoshida, A. (2014). Information Literacy and Research Development Skills: Advancing Librarian's Participation in Pedagogical Research. *Qualitative & Quantitative Methods in Libraries*(4).

Appendix 1 – Interview Questions

1. Can you give me a brief overview of your background in teaching mathematics?
2. How did you develop your teaching practice?
3. How is teaching supported in your current university?
4. When you are considering changing some aspect of teaching, or a problem arises, where to do you go to for information?
    a. If their own experience is the 'resource' – what did they do when they were starting out. How did they build that experience?
    b. If they are inexperienced – are they aware of what they could access if a problem arises.
    c. If not relevant, due to their background, what do others do in their department?

5. Do you have a group of colleagues that share your professional interest in teaching?
6. Do you research teaching in mathematics using databases, online journals, websites?
    a. What was most useful?
    b. How did you use it?

7. Have you attended any workshops or conferences related to teaching?
8. Have you been involved in any teaching and learning research grants (internal or external to your institution?)
9. Are you part of any association, organisation or network related to mathematics or teaching?