THE MOBILE LIBRARY AND STAFF PREPAREDNESS: EXPLORING STAFF COMPETENCIES USING THE UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY MODEL

ABSTRACT

This paper presents preliminary findings of a study investigating the current state of preparedness of staff at institutes of technology and TAFE libraries across Australia and New Zealand in relation to delivering services through mobile technologies. In particular, the skills, knowledge and competencies of staff in relation to mobile technologies are discussed, as well as the specific on-the-job training required to develop confident and capable staff in a mobile environment. A slightly-modified version of the Unified Theory of Acceptance and Use of Technology (UTAUT) model was tested as a predictor of behavioural intention and use behaviour. Initial analysis of data revealed a range of themes relating to technical functionality, management, service delivery and adaptability as important to staff skills and knowledge.

INTRODUCTION

The increased use of mobile technologies in instructional delivery and the increased investments by educational institutions (fiscal, physical and human) in the development of flexible learning environments are impacting on all aspects of library planning and procedures. Mobile technologies are characterised by their small size and portability. Mobile devices can include smart phones, tablets and netbooks, but usually exclude laptop computers. Mobile libraries or m-libraries (the terms used in this paper) involve the delivery of library services through these devices. A review of the literature reveals relatively little reported research on the impact of mobile service delivery on libraries and, in particular, on staff members from the viewpoint of planning, processes and professional development and, secondly, in analysing the link between acceptance and use of technology innovation with the outcomes and goals of institutional capability development.

The purpose of this study was to examine the current state of preparedness of Technical and Further Education (TAFE) and institutes of technology libraries to deliver mobile services within a framework of innovation and technology adoption. The study examined how staff responded to the concept of the mobile library, their perceived levels of confidence and capability within this environment, and how best to address any gaps identified in a systematic and replicable manner able to inform strategic planning processes. A number of potential technology adoption frameworks were examined to determine the most appropriate as a predictor for behaviour change and acceptance of technology. As a result, the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh, Morris, Davis and Davis (2003) was used in this study as a framework within which to assess the technology adoption and acceptance aspect of capability development within an academic library setting.

LIBRARIES AND MOBILE TECHNOLOGIES

The mobile library concept occupies similar territory to mobile learning; a territory where technology expertise meets academic expertise and where clearly defined communities of practice are just starting to emerge (Traxler, 2008). The development of library services to mobile devices began relatively unobtrusively in the medical library sector with the need for both up-to-date information and mobility in a health service environment (Donghua, McCarthy, Krieger & Webb, 2009; Gentry, 2011; León, Fontelo, Green, Ackerman & Liu, 2007). Initiatives slowly began to filter into the public and academic sectors (Douch, Savill-Smith, Parker & Attewell, 2010; Educause, 2008) with momentum gathering pace as studies revealed that high numbers of students attending tertiary education owned mobile devices (Booth, 2009; Wishart & Green, n.d.). Mobile library initiatives also began to feature across campuses; evident in the range of activities reported by Kroski (2008, p. 41), which included mobile versions of OPACs, subject guides and opening hours.

STAFF DEVELOPMENT IN THE TAFE AND INSTITUTES OF TECHNOLOGY SECTOR

Libraries of the TAFE and institutes of technology sector provide services to users who are often engaged in workplace learning and undertaking qualifications at certificate and diploma levels. Without the strong research focus of university libraries and the funding that this brings, TAFE and institutes of technology libraries are often severely restricted in their ability to acquire resources and retain staff (ALIA TAFE Library Advisory Committee, 2009). While staff development across the tertiary education library sector has been well

documented (see for example, Adams, 2009; Kealy, 2009; Zauha & Potter, 2009), studies into staff development in TAFE and institutes of technology libraries are sparse and have concentrated on reviewing performance measures and identifying more general skills (Bannister & Rochester, 1997; Costa, 2007; Kloppenborg & Lodge, 2010). A lack of comparative data in relation to staff development in TAFE and institute of technology libraries has led to comparisons being made against British and USA experience (Bannister & Rochester, 1997).

THE UTAUT MODEL

The UTAUT model has been applied in a variety of settings relating to the intended use of technology and facilitating conditions. The model identifies a range of factors including: Performance Expectancy; Effort Expectancy; Social Influence; and Facilitating Conditions, which impact upon behavioural intention and use behaviour. Consistently, studies have revealed that academic staff cite poor facilitating conditions (including inadequate technical support) as barriers to information and communication technologies integration into their professional practice (Groves & Zemel, 2000; Teo, 2009).

The UTAUT model employs "four constructs that play a significant role as direct determinants of user acceptance and usage behaviour" (Venkatesh et al, 2003, pp. 446-447):

> Performance Expectancy – degree to which an individual believes that using the system will help him/her to attain gains in job performance,
> Effort Expectancy – degree of ease associated with use of the system,
> Social Influence – degree to which an individual perceives that important others believe he/she should use the new system,
> Facilitating Conditions – degree to which an individual believes that an organisation and technical infrastructure exists to support use of the system.

The first three constructs determine Behavioural Intention; and Behavioural Intention plus Facilitating Conditions determine Use Behaviour. Each of the constructs comprises a distinguishing set of criteria. One of the strengths of the model is its focus upon usage (Use Behaviour) as a key dependent variable. The four key moderators of relationships – Gender, Age, Experience, and Voluntariness – serve to exert varying degrees of influence upon the constructs.

The UTAUT model has been tested by a variety of researchers across a range of studies with the aim of contributing towards the validity and empirical applicability, or otherwise, of the constructs and variables (Bram et al., 2011; Dulle & Minishi-Majanja, 2011; Ho, Chou & O'Neill, 2010; Liao, Yu &Yi, 2011; Shin, 2009; Venkatesh & Zhang, 2010). The model has proved robust yet flexible and studies undertaken to date have involved a variety of modifications of the original model with recommendations of further investigation.

The model was selected from a range of theoretical models as a result of its comprehensiveness, proven ability to adapt to a variety of studies and to demonstrate meaningful results, and its focus upon "complex and sophisticated organisational technologies [as opposed to] relatively-simple, individual-oriented information technologies" (Venkatesh et al., 2003, p. 427).

Previous studies employing technology adoption models have focused on specific technologies planned for adoption, an examination of the attitudes towards the adoption, and the indication of future behaviour. In order to test the model for the present study, the features of the UTAUT model were extended to determine technology training requirements for librarians. A modified version of the UTAUT model was employed to examine what skills and competencies and specific training participants believe are required to enable them effectively to develop and deliver mobile technology services. The model covered the three contexts of technology adoption that were fundamental to the study: environmental; technological; and individual.

The study utilised the four determinant constructs and incorporated minor modifications to the key relationship moderators; Age included years of library service, and Experience included both position within the library structure and self-assessed competence in the use of mobile technologies. These modifications were considered relevant to the interpretation of data in anticipation that length of service, rather than chronological age, would have greater relevance upon the adoption of technology innovation; and position within the library plus technology competence would be of particular relevance to context and environment. Position, meaning job position within the library structure, was anticipated as influencing all four determinant constructs. Competence, employed in the specific context of mobile technology usage, was anticipated as having influence upon

Performance and Effort Expectancy and Social Influence. Voluntariness was not specifically included as a discrete question in the surveys and this moderator emerged in responses to questions on training required and delivery mechanisms.

METHOD

TAFE and institutes of technology libraries across Australasia were the focus of investigation. The New Zealand government funds nineteen Institutes of Technology and Polytechnics (ITPs) which provide professional and vocational education and training ranging from introductory studies through to full degree programmes (New Zealand. Ministry of Education, 2009). Australia has fifty-eight Colleges/Institutes of Technical and Further Education (TAFE) offering a range of qualifications from non-degree based courses, which lead to employment-based training, to degree-level awards. Strong articulation pathways between this sector and the higher education sector (universities) are frequently in place (Commonwealth of Australia, 2009).

Two survey instruments, reviewed by an invited review panel, were designed for staff. A semi-structured questionnaire comprising twelve open-ended questions was employed for direct interviews with the library staff (either in person or using Skype, video conferencing or telephone). The second, a short, structured, web-based (SurveyMonkey), questionnaire gathered data on library services currently delivered online by the participants' library. This questionnaire was modelled on a section of a 2008 online survey constructed and used by Char Booth for her research on student interest in emerging library technologies at Ohio University (Booth, 2009).

The primary staff survey comprised two main sections, all open-ended, semi-structured questions. The first section contained six questions looking at general technology adoption by the library and requiring participants to provide their demographic information. The second part contained six questions which probed specific skills and training aspects involved in delivery to mobile technologies.

Recruitment of participants came from across the New Zealand Institutes of Technology and Polytechnics (ITP) and Australian TAFE sectors. In total, fourteen libraries agreed to the participation of the three library staff. The sample population included library staff at eight of the ITPs and six of the larger TAFEs (identified with library staffing numbers greater than ten). This was to ensure that the participants worked at libraries with sufficient staff to make planning for mobile implementation a possibility. A non-probability, purposive sampling method was employed and participants were selected on the basis of their current type of employment within a vocational education sector library. Three professionally-qualified library staff from each participating library were interviewed on an individual basis (n=42), including the library manager (or equivalent and coded as 1), one staff member who had involvement with systems or IT (coded as 2), and another qualified staff member (coded as 3) whose duties did not include either of these responsibilities.

It was anticipated the research approach taken would ensure wide data collection opportunities and produce knowledge on different levels; that is from an individual point of view, from a collective viewpoint, and from a management planning perspective. Each participant was asked to complete a brief online questionnaire (responses, n=34) prior to their interview. A link to the online questionnaire and the interview questions were emailed to participants in advance.

The responses collected were analysed using the grounded theory approach, applying open coding initially to begin developing relationships between the various components of interview responses. The data were examined and re-examined, and deconstructed into a range of "themes". The question "What skills, knowledge and competencies would be required of library staff in order to work effectively in mobile technology environments?" produced forty-two themes in the first analysis. For the purposes of this study, the researcher defined *skills* as specific definable characteristics required to complete a task. *Knowledge* was defined as a comprehension of interrelationships between information-specific concepts, and *competencies* was defined as demonstrated ability and understanding within the information environment. The second question "What specific on-the-job training is required by library staff to acquire the skills, knowledge and competencies to effectively develop and deliver mobile services?" provided thirty-nine themes in the initial analysis.

A second stage of analysis employed selective coding to reconstruct connections between the numerous themes and gather them into high-level, core categories. The themes that emerged from the skills/competencies question were unified into three central categories: *technical*, *management*, and *adaptability*. The themes that emerged from the training question were also able to be unified into three central categories: *technical*, *service delivery*, and *competence*. The results of these analyses are reported in a forthcoming publication (Saravani & Haddow).

Because the UTAUT model of technology adoption can be used to predict intended behaviour it was employed at the stage of open coding to test its applicability to the deconstructed data. The UTAUT model has been demonstrated to be a strong quantitative framework and its suitability to inform a qualitative approach to technology adoption was examined. The three most frequently cited themes from the open coded responses for each of the questions above were selected, and one theme from each is discussed in detail following.

RESULTS AND DISCUSSION

The question on skills, competencies and knowledge required by librarians produced forty-two themes during the data coding stage. These were wide-ranging, from emphasis upon knowing what various devices students use (n=10) and knowledge of different file formats and functionalities (n=2), through to willingness to try things out (n=11) and, more specifically, technical skill requirements such as web-based technology skills (n=2), operating systems knowledge (n=5), and knowledge of compatibility issues (n =1). The five most frequently-cited competencies were: competence in using different mobile devices (n=19); willingness to try things out (n=11); knowledge of devices students are using (n=10); skills to enable library resources/services to be accessible on mobile devices (n=9); and ability to link new technologies with new opportunities (n=8).

One of the three themes selected for assessment against the UTAUT model was *Knowledge of devices students are using* (n=10) and, from the responses analysed, this was interpreted to include: library staff being aware that these devices will influence the expectations of students regarding library service; and that students may not distinguish between "traditional" library queries and technology queries and in turn will expect library staff to be knowledgeable regardless of device being used or the query type.

To determine its suitability as a framework for predicting user behaviour, the four constructs of the model were applied to deconstruct the theme. Each of the constructs includes a defining set of criteria. Individual participant responses within the theme were assessed against each of these criteria to determine their fit. For example, Performance Expectancy contains "perceived usefulness", "extrinsic motivation" "relative advantage" and "outcome expectations" (Venkatesh et al., 2003, p. 447). As illustrated in Table 1, participants' responses (for example M2) fell into more than one construct. This is to be expected, as the nature of qualitative data is such that different interpretations are available to the researcher.

Table 1. Knowledge of devices students are using

Performance expectancy
A1: *Staff would need to be knowledgeable in what devices students are using*
C3: *Need to be competent in the use of whichever technology we are providing service for*
H3: *When teaching, we need to know how to use the device so we can make things easier for the students*
Effort expectancy
L1: *They need to have a good understanding of technology and how people use it*
L2: *with our wireless access … not even half our staff who feel comfortable assisting someone trying to get started in that mobile environment*
M2: *Some of it is thinking in a different way*
N2: *some knowledge or skill around assisting students with connecting to these services on their devices*
Social influence
D2: *We don't want to be on the back foot when someone asks how to use the phone*
G1: *They would need a general knowledge of all systems and all the questions likely to come up*
Facilitating conditions
M2: *At the beginning of 2009 we had most of the staff trained on how to assist students on wifi*
N1: *Skills that staff need are different from what was needed five years ago - we have to be in the student space*

Once again, the interview responses were examined and re-examined against the construct criteria. The analysis included assessment against the definition and items associated with each partial criterion (Venkatesh et al., 2003, p. 452). For example, Social Influence, which is a direct determinant of behavioural intention, contains "subjective norm", "social factors" and "image" as partial criteria. The response *We don't want to be on the back*

foot when someone asks how to use the phone was analysed as indicating the participant felt they were expected by 'important others' to be familiar with technology their users were bringing into the library, an indication that social factors were important. This theme provides an interesting example of the variety of responses. The constructs were assessed using the moderators described earlier. The moderator Position, as a component of Experience, demonstrates the effect of moderators on the constructs in predicting behavioural intention and use.

Library managers' and systems librarians' responses met the criteria of the Effort Expectancy, Social Influence and Facilitating Conditions, no librarians offered responses that were relevant to these constructs. However, librarians and a library manager gave responses relating to Performance Expectancy. From this analysis it appears that library managers and systems librarians believe that: skills and competencies related to the ease of use and complexity (Effort Expectancy); and 'important others' expect them to use or be familiar with the system (Social Influence); with facilitating conditions and compatibility (Facilitating Conditions), will influence how library staff intend to change their behaviour towards accepting service delivery to mobile devices. It is possible that library managers may be more focused on institutional strategic objectives regarding communication technologies and expect staff to demonstrate engagement with these objectives. Systems librarians are also likely to have an awareness of the technology environment within which they work and will have an understanding of the complexity involved in adopting new technology-related skills.

Librarians demonstrated greater interest in perceived usefulness and relative advantage (Performance Expectancy) in developing skills to enable mobile service delivery. This finding may be a result of librarians having more direct, front-line involvement with library users and being more focused on the direct advantages of being knowledgeable when approached by library users. Such findings provide an understanding of intention and behaviour of various positions within the participating libraries. If, for example, no respondents had offered responses that related to criteria on compatibility (Facilitating Conditions) then it is possible to interpret this as evidence of respondents feeling unsupported by the organisational and technical infrastructure around them, which then impacts on acceptance of the technology innovation. On the basis of the responses in Table 1, it might be speculated that training staff on devices being used by students will lead to a change in staff behaviour and that the various criteria could be considered useful as a predictor of librarians' intention to adopt mobile technologies. This information has the ability to inform planning capability development.

The second aspect of staff capability, specific on-the-job training required by library staff to acquire the skills, knowledge and competencies to effectively develop and deliver mobile services, was also examined. Data coding produced thirty-nine training themes. These ranged from hands-on working with a range of mobile devices (n=13), comparison of device functionalities (n=3), developing resources in appropriate file size (n=2) to matching essential technology with users (n=1) and integration with the library management system (n=2). The five most frequently cited training requirements were: hands-on working with a range of mobile devices (n=13); using an e-book reader (n=9); creating mobile-friendly web pages (n=8); applications for iPhones, mobile devices (n=8); and no current training or plans to introduce (n=6).

One of the themes selected for assessment against the UTAUT model was *Training on creating mobile-friendly web pages* (n=8) and this was interpreted by the researcher as providing access to library resources for a range of devices, possibly with the involvement of other areas, such as the IT department.

The UTAUT model was tested in the same manner as described in the example above with criteria from the four constructs of the model being used to deconstruct the theme. It will be noted in Table 2 below that for the moderator Position, only two of the three positions included in the study are represented.

Table 2. Training on creating mobile-friendly web pages

Performance expectancy
D1: *Creating mobile-friendly web pages*
L1: *Developing mobile-friendly web pages*
Effort expectancy
A1: *An understanding of the different ways our resources can be accessed including mobile friendly web pages*
E1: *Training on creating mobile-friendly web pages would be the one that we need*
Social influence
D3: *Web pages - software that is used for creating mobile friendly pages will need to be shown and explored by staff*

E1: *I wouldn't expect Library staff to need to know how to develop web applications for mobile devices*

Facilitating conditions
B3: *The mobile site has been started but hasn't been taken too much further because of other priorities*
C1: *convince the IT department to get the web page mobile-friendly, this is a priority*

Once again, the interview responses were read and re-read against the construct criteria. As an example, Effort Expectancy, which is a direct determinant of behavioural intention, contains "perceived ease of use", "complexity" and "ease of use" as partial criteria (Venkatesh et al., 2003, p. 450). The response *Training on creating mobile-friendly web pages would be the one that we need* was analysed as indicating the respondent felt that they believed this type of interaction with the technology would be clear and understandable, that learning to use the technology would be worth the effort and that, overall, the system would be easy to use (2003, p. 451). As for the first example above, the analysis included assessment against the definition and items associated with each partial criterion. Each response within the theme was analysed in the same way, with the results shown in Table 2.

Using the UTAUT construct criteria and assessing the impact of Position as a component of the moderator Experience upon these, training on creating mobile-friendly web pages was considered important by two of the three Position layers, library managers and librarians. Systems librarians did not regard this as required training for developing effective mobile service delivery competencies. This result suggests that systems librarians view other training needs as more important. The variation in response depending on position could be explained by library managers regarding service delivery of primary importance in any professional development their staff undertake, followed by developing competencies to ensure such delivery is effective. Higher level planning may remove their focus from specific technical requirements involved in attaining the goal of effective development and delivery of mobile services. Initial data coding revealed systems librarians rated technical training and competence required to attain the stated goals as highest, with training focused upon service delivery lowest. Responses from librarians indicated service delivery training as being considered most the critical aspect of training. Assessment using the UTAUT constructs has confirmed the initial coding approach and demonstrated the potential of the model for predicting an aspect of technology adoption, that is the planning of effective capability development for library staff.

CONCLUSION

Initial assessment of this selected data set revealed the UTAUT model included criteria that enabled the findings to be assessed at a level of detail greater than the original deconstructed themes that emerged in the open coding process. This facilitated fine-grained analysis and appeared, even within the confines of testing a single moderator in this early stage of data interpretation, to offer potential for the application of such a model to explain factors influencing take up of technology innovations. What has been demonstrated is that the model is useful for analysing issues involved in the identification of skills and competencies, and specific training to achieve an understanding of predictors of actual usage of technology. This has the potential to provide information based upon the constructs and moderators that will allow prediction of success in technology adoption by librarians.

A note of caution on these preliminary results relate to acknowledging that the model has been extensively and successfully employed across a range of quantitative studies in the commercial, technological and telecommunications industries. Its application in a study that centres primarily on qualitative data carries the risk that the benefits derived from use of the model will be diminished without a standardised approach to data collection and analysis. There is, nevertheless, a great deal to be gained in such detailed analysis using the UTAUT model.

This initial analysis explored the factors influencing technology innovation, specifically those relating to skill identification and training requirements. The study findings have practical implications for managers in the education or information management environments as it illustrates key factors influencing the success of developing staff capability and also implementing technological innovation.

These findings will serve to inform managers planning professional development of the range of outcomes that participating staff may be focused on, depending upon their position within the library or comparable unit. It is also has the potential to provide an improved understanding of the various types of contributions and expectations of participants in collaborative projects.

Further analysis is being undertaken with the aim of producing a clear framework for libraries to work from in developing staff in the mobile technology environment.

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