

2010

# Support Mechanisms for Early, Medium and Longer-Term Use of Technologies

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## Recommended Citation

Mendoza, Antonette; Stern, Linda; and Carroll, Jennie, "Support Mechanisms for Early, Medium and Longer-Term Use of Technologies" (2010). *ACIS 2010 Proceedings*. 73.  
<http://aisel.aisnet.org/acis2010/73>

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## Support mechanisms for early, medium and longer-term use of technologies

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### Abstract

*In this paper we examine the support mechanisms that encourage and support early, medium and longer-term use of technologies. In two longitudinal studies, we examine use of a Learning Management System and the software application EndNote in an educational setting. Our findings suggest that providing classroom-based training for users may be a good mechanism encouraging adoption and early use. However, in the medium and longer-term, access to a variety of support mechanisms are necessary to encourage and support the appropriation process. Findings from these studies reveal that, in the medium and longer-term, localized one-on-one support, peer-support and availability of advanced training in the form of one-on-one contact with the trainer at critical time periods are key factors in encouraging productive use and avoiding rejection of the technology in the longer-term.*

### Keywords

Adoption, appropriation, support mechanisms, adaptation, training

### INTRODUCTION

Organizing a road map to facilitate effective use of technologies in an organization is difficult when one is unaware of how and why people derive value from longer-term use of technologies (Tyre and Orlikowski 1994; Majchrzak, Rice, Malhotra and King 2000; Chu and Robey 2008). The benefits delivered by a technology cannot be realized unless the technology is accepted and used over time. Effective use must persist well after the initial adoption of the technology in order to enable individuals, and the organization as a whole, to achieve productive outcomes. Yet, there has been little exploration of the journey from early encounters with a technology through to longer-term use, and the ways that productive and effective longer-term use can be facilitated.

Much of the Information Systems literature on adoption and acceptance has assumed that there is a relationship between the influences that support adoption and actual technology use and training (David and Bostrom 1983; Leitheiser and Wetherbe 1986; Lee, Kim and Lee 1995; Compeau and Higgins 1995). Yet, there is a lack of a clear understanding on how, when and what support mechanisms act as facilitating conditions for longer-term use of a technology. This lack of knowledge emphasises the need for a longitudinal research approach to capture how and why users adopt and then adapt a technology in the longer-term in an organizational setting.

We define technology appropriation as: *"the way that users evaluate and adopt, adapt and integrate a technology into their everyday practices"* (Carroll, Howard, Peck and Murphy 2002). This paper is a part of an ongoing research program focussed on understanding and supporting the process of appropriation (Mendoza, Stern and Carroll 2005; 2007). In two longitudinal projects, we have examined the process of appropriation by users of a Learning Management System and EndNote at a tertiary institution (Mendoza et al. 2005; 2007; 2008). Our previous findings suggest that the process of appropriation is incremental over time. Multiple plateaus of temporary stabilization occur during longer-term use of a technology. In addition, findings from our previous study reveal that rejection of a technology may take place long after adoption.

In this paper we extend our previous work by investigating the support mechanisms that enable productive use of an ICT in an educational setting. The underlying question addressed in this paper is: *How do support mechanisms enable and encourage early, medium and continued longer-term use of a technology?*

We begin with a discussion of the theories relating to the process of technology adoption and use, followed by the research design and methodology. The research findings are then presented and their implications are discussed. The paper concludes by presenting some avenues for future.

## RESEARCH BACKGROUND

Adoption and acceptance literature have focussed on measuring the correlation between user training, attitudes, motivation, amount of system usage, performance and user satisfaction of individuals (Davis and Bostrom 1983; Lee, Kim and Lee 1995; Rogers 1995; Keil, Lyytinen and Schmidt 1998; Gallivan 2001). In addition to users' prior beliefs about their IT, it has been suggested that training affects perceptions and usage during *initial* use of the technology (Compeau and Higgins 1995; Karahanna 1999). However, support mechanisms for continued longer-term use of technologies are less understood.

The literature of technology diffusion and adaptation suggests that adaptation of practices and customization of the technology take place, followed by changes in expectations and user needs over time (Tyre and Orlikowski 1994; Mendoza et al. 2008). User training is an important factor, among others, that can facilitate adaptation of a technology (Orlikowski 1994; Majchrzak et al. 2000). Further, studies focussing on the role of formal training suggest that users learn to use a technology from "informal consultants" or "lead users" in addition to formal training (Sein, Olfman and Bostrom 1999). Yet, facilitating effective longer-term use has been daunting experience among managers, IT professionals and trainers (Gallivan 2001). Little is known about the kind of support mechanisms that encourage the process of appropriation at critical periods of technology use.

Social factors are shaped by the social context in which learning occurs and influence skills development, attitudes and user motivation to adopt and use a technology. Formal training has been suggested as important in user adoption and acceptance of a technology (Gallivan 2001). Some studies have highlighted the need for providing users with training material or manuals similar to users' actual job content and conditions to help better learning, retention and subsequent motivation to use the technology (Gist, Schwoerer and Rosen 1987; Fitzgerald and Cater-steel 1995; Simon and Werner 1996; Simon, Grover, Teng and Whitcomb 1996). In recent years, most IT training research has focussed on refining formal training content and methods (Gallivan, Spitler and Koufaris 2003). Yet, there has been little exploration on ongoing-training and support mechanisms to encourage satisfactory and productive longer-term use of technologies *after* technologies are implemented. Little is also known about when and how to make training more relevant and what other support mechanism could help users continue using a technology over time. It is therefore important that studies examine how and why users appropriate a technology and what support mechanisms enable and encourage longer-term use of technologies.

We set out to gain a deeper understanding on how people adapt and use a technology over time and the role of training and support mechanisms in the process of technology appropriation.

## RESEARCH METHODOLOGY

This study investigates the support mechanisms that encourage and enable productive longer-term technology use. Our objective for the project was to understand the process of technology appropriation and the role of support mechanisms from adoption through to longer-term use. A longitudinal study was therefore selected in order to investigate these changes over time. In the first case study, we examined users of a software application called EndNote. The case study was undertaken between January 2005 and June 2005 at the University of Melbourne. EndNote is a bibliographic software package that allows users to search online bibliographic databases, organize their references and images, and create bibliographies in documents. We were able to access users of EndNote from their first encounter with it to later periods of use. EndNote is a software application that researchers use in their research practices, and was entirely new to most participants.

In the second case study, we examined users of a Learning Management System (LMS). The LMS case study was undertaken between January 2006 and March 2008 at the University of Melbourne. We chose users of the LMS because the university had introduced this new system to support teaching and learning among staff and students. After pilot studies in 2005, a rollout plan for 2006 and 2007 was set in place by the university, where all subjects would become available to the LMS and all staff would be faced with the decision about whether to adopt and use the technology. Centralized training courses were set in place by the university, to aid academic staff interested in learning to use the LMS.

With permission from the facilitators of the EndNote and the LMS training courses conducted at The University of Melbourne, one of the researchers attended 5 EndNote training courses and ten LMS training courses. Participants for the case studies were recruited at these courses. In the EndNote case study, fourteen participants (9 female and 5 male) agreed to take part in the study. Twelve out of the 14 participants had no prior experience

using the software. They were studied from their initial encounter with EndNote after training (1-2 weeks) across twenty weeks of use. The participants were postgraduate students (13) and research fellows (1) respectively. In the LMS case study, twenty three participants (7 female and 16 male) agreed to take part in the study. The participants were academics in the institution. None of them had prior experience with the LMS, but 15 out of the 23 participants had previously used technology-based learning systems such as WEBRAFT (9) or had developed their own web pages as a communication tool in their teaching practice (6 participants).

Case study	Time-line (weeks)	Techniques	Issues explored
EndNote	1 – 2	Interview	<p><b>Weeks 1-2</b></p> <ul style="list-style-type: none"> <li>- Attitude and expectations during their initial encounter.</li> <li>- Post hoc recollection of reasons for attending training and the decision to adopt technology</li> </ul> <p><b>Weeks 3-4</b></p> <ul style="list-style-type: none"> <li>• Users' experiences and expectations while using the technology.</li> <li>• Likes and dislikes about the technology</li> <li>• Support needed.</li> </ul> <p><b>Weeks 7-8</b></p> <ul style="list-style-type: none"> <li>• Role of the technology in users' teaching practices.</li> <li>• Experience with the 'look and feel' of the interface.</li> <li>• Features used to suit their needs.</li> <li>• Reasons for electing to use specific features.</li> <li>• Expectations of support required and received</li> </ul> <p><b>Weeks 16-20, 24, 32, 36, 44 and 66</b></p> <ul style="list-style-type: none"> <li>• Changing expectations, experiences and needs of participants.</li> <li>• Likes and dislikes about the technology and its features.</li> <li>• Reasons for continued use of the technology.</li> <li>• Factors that encourage or discourage continued use.</li> <li>• Expectations of support required and received.</li> </ul>
	3 – 4	Focus group Scrap book	
	7 – 8	Participant observation Scrap book	
	16 – 20	Follow-up interview Participant observation Scrap book	
LMS	1 – 2	Interview	<p><b>Weeks 1-2</b></p> <ul style="list-style-type: none"> <li>• Role of the technology in users' teaching practices.</li> <li>• Experience with the 'look and feel' of the interface.</li> <li>• Features used to suit their needs.</li> <li>• Reasons for electing to use specific features.</li> <li>• Expectations of support required and received</li> </ul> <p><b>Weeks 16-20, 24, 32, 36, 44 and 66</b></p> <ul style="list-style-type: none"> <li>• Changing expectations, experiences and needs of participants.</li> <li>• Likes and dislikes about the technology and its features.</li> <li>• Reasons for continued use of the technology.</li> <li>• Factors that encourage or discourage continued use.</li> <li>• Expectations of support required and received.</li> </ul>
	3 – 4	Focus group Scrap book Interview	
	7 – 8	Participant observation Scrap book	
	16 – 20	Follow-up interview	
	24		
	32, 36, 44 and 66	Follow-up interviews	

Table 1: Summary: data collection timelines, techniques and issues explored in the two case studies

A multi-method research design was used, described in our previous studies (Mendoza et al. 2005; 2008). Interviews, focus groups, participant observations and scrap books were used to capture and triangulate participants' perceptions and expectations with the technology and support mechanisms and track their perceptions and actual experiences with the technology and the support they received during continued use of the technology. Table 1 summarizes the data collection timelines, techniques and issues explored in the two cases.

All interviews and focus groups were audio-recorded with the consent of the participants. In addition, the first-named researcher made field notes at interviews, focus groups and observations. All data were coded. Descriptive codes were used to generate general and specific themes. Diagrams and a time ordered matrix were also used to display, analyse and refine the themes from the data (Miles and Huberman 1994; Langley 1999).

In the next section, we present the data related to support mechanisms that encouraged technology appropriation by users of Endnote and LMS. The process of technology appropriation and the influences that encouraged and discouraged Endnote and the LMS users in both case studies have already been described and presented earlier (Mendoza et al. 2005, 2007; 2008). The results from both case studies are organized and presented as one.

Data are categorized into early, medium and longer-term use of technologies. In this study, *early use* is defined to be the period when users are introduced to a technology (includes the training program) and 1 – 2 weeks of using it. It is a time when they make the decision whether to adopt the technology or not. *Medium-term use* is defined to be the period when users evaluate and start adapting their practices to suit the technology and adapt the technology to suit their every day work practices. In this study, medium-term use is the period between 3- 4 weeks use of the technology up to 20 weeks. *Longer-term use* is defined to be the period that captures routinization in technology use and thereafter when users continue using the technology. In this study, longer-term use is the period from 24 to 66 weeks of technology use.

## RESULTS

In both case studies, most participants perceived that it was a requirement by the university or the students (LMS case study) or the supervisors and peers (EndNote study) that they adopt the technology. This is similar to *subjective norm* defined as a person's perception that most people that are important to him/her think that he/she should or should not perform the behaviour in question (Davis 1989; Viswanath et al. 2003). Some LMS participants perceived that they had no choice but to adopt and use the LMS because their prior practices might not be supported in the future. This is similar to *relative advantage*, the degree to which adopting or using the

information technology is perceived as being better than using the practice it supersedes (adapted from Rogers 1995). Subjective norm was noted as an important influence encouraging early, medium and longer-term use of the technologies.

## **Early use**

### **Classroom-based training course**

In both LMS and EndNote case studies, participants were recruited at training programs. Participants attended a two-hour centralized classroom-based training course organized by the University, on how to use the technology. The facilitator of the training programs provided a demonstration on how to use various features of the technology. During the training programs, participants were encouraged to trial and play with the features in LMS and Endnote. Assistance was provided when needed.

### **Manuals and instruction sheets**

In weeks 1 and 2 after the training, participants in both case studies were trialling, exploring and learning to use and change their existing practices to suit EndNote or the LMS, not in the training environment but in their everyday study/work environment.

Users of both technologies used the instruction sheet and user manual provided to them during training and their personal notes to assist them during this period. As participants adapted the LMS and EndNote by personalizing or customizing both technologies to fit their research practices or adapted their practices, some participants ran into problems. They found the technology to be unintuitive and not easy to learn to use. Participants expressed frustration when the manuals or instruction sheet given to them did not help them trouble shoot when they faced obstacles. For example, one of the participants said, "... *they provide you with the manual, but sometimes manuals do not help you trouble shoot, there are certain areas where the manuals do not address*". One LMS user commented that the manual was useful initially, "...*one of the good things about the manual is that it shows you the screen you should be looking at and that's always reassuring...but- I think you'd only need that for a short time*" but time was important and that an on-line help would be useful while learning to use the technology rather than looking at the paper version of the manual, "*I need a help manual, that comes on-line with me... because people like me don't have time... I found that the manual isn't that helpful, you look in the manual, you have to actually go page by page through a bunch of steps*".

### **One-on-one contact with trainers, peers and lead-users**

A prominent influence noted in weeks 1 and 2 was the ability for the EndNote participants to contact trainers whenever needed. It helped them resolve some of the problems at this early stage. Three participants contacted the trainer from the training sessions to further explore the technology. For example, one of the participants said, "*I think for me this was the time to identify those problems and ring up whenever I need assistance...this is what I have been doing...identifying the grey areas, identifying areas that I'm not too familiar with, and seeking assistance*".

Despite facing problems while learning and adapting practices to suit participants teaching practices, the ability to contact peers or lead-users for support emerged as positive influences at this time that encouraged participants to use the LMS. Participants resolved problems that they encountered during this early, by contacting lead-users and peers in the department, "*There's an informal group of people in our department who are using LMS and we met...and people who already knew about it were telling new people like me things that we needed to know*".

## **Medium-term use**

### **One-on-one contact with trainers, peers and IT support staff**

In weeks 3 and 4, while expectations were lowered and frustrations were building up, it was noted in both case studies that most participants had adapted to the technology to suit their immediate needs. They chose features that best suited their research/teaching practices at the time and rejected other features.

In weeks 3 and 4, EndNote users expressed difficulty in learning to use EndNote, "*One of my expectations of EndNote was that I could just search around the database and find everything and download it into my computer, but could not...I was put off by it...I didn't do anything about it*". The inability of the technology to guide the user through the steps made frustrated participants, "*If you find out eventually what to do and you repeat it enough of times, then you can learn to do anything really. It takes so long, I find myself consciously trying to remember the steps*". Despite frustrations and lowered expectations about what EndNote could do for them, with the support and help from trainers, users continued to perceive benefits of using the technology. The availability of one-on-one contact with trainers helped them resolve issues and fix some of their problems. For example one participant had problems downloading information using EndNote, "*I got only the first reference*".

*from the ones I marked. That was a problem”, and contacted the trainer for help, “The [Trainer] said ‘down load the additional filter from the university web site’. The lack of easy adaptability of the LMS forced some participants to contact the trainer in some cases to resolve customization problems, “...when you want to change your entry points...it wouldn’t work for me... I rang her [trainer] about it and then she said, “Oh, you have to press refresh and do this and do that and then it’ll happen”.*

In addition to contacting trainers, participants in the LMS case study (in weeks 3-4) resolved problems by contacting peers. For example one participant contacted her peer when faced with a problem, *“Once they’ve completed the quiz, it then gives you your mark ...and it tells what the correct answer is but, if they’ve got it right, it gives feedback, but apparently LMS wouldn’t give feedback on the incorrect answer...I spoke to [peer] who’s worked with it a lot and she said it actually doesn’t give the correct feedback”.* Without help from peers or training, the lack of ease of learning to use features provided by the LMS acted as a hurdle for further appropriation, *“I’m slightly more intimidated by the idea of things I wanted to do with it... just because I see how it’s not intuitive, I’m just wondering...I’m just repressing it for now and I’ll deal with it in the break and I hope people will be around to help”.*

It was also observed in the LMS case study (in weeks 3-4 and again in 7-8) that the ability to undergo a *“...one-on-one tutorial with one of the LMS people”* to resolve problems helped a few participants. Some of them contacted the trainer and local IT support staff for support and problem resolution. For example some participants said, *“I wanted to have a banner up and that’s when I contacted the support person for that”* or *“...academic IT support person has been very supportive and my colleague next door because she has used it before, if you go and ask her something there is help readily available and we are not waiting for someone outside”.* It was interesting to note that the inability to resolve issues due to a lack of support was a hurdle for a few participants *“...it’s not sort of working intuitively...there’s no-one in my department I can have a word with, I’m just totally working on my own”.*

The lack of IT support staff or peers and the lack of time to further explore the LMS were themes that emerged as negative influences. It was observed in weeks 7 and 8, that one participant stopped using the LMS because she did not see the benefit of using it, *“I’m not using it for my teaching...a simple two minute task which is all it should be, but for me it’s not a two minute task...it’s not intuitive for me to use...there is no reward for my investment in time to use it”* and did not have IT and peer support to help her with using the LMS, *“We don’t have any support—technical assistant to help us...if there were a group of us in the dept using it and say common let’s do it together...that might be better...I’m isolated and with a reasonable teaching workload it’s not happening”.* However, the inability to resolve existing problems even after contacting the help desk support by LMS users (in week 16-20) was a negative influence expressed by four participants who decided not to use the features and work around them. This is reflected in comments such as: *“she did not know how to solve the problem, so I don’t use the feature”* and *“I had spoken to the help desk for a couple of thing and I did not find that it worked very well”.* In weeks 7 and 8, participants complained that the lack of ease of learning to use the technology due to usability issues was a hurdle. Manuals did not help them resolve their problems, *“Some of the features could be more detailed, like if you get stuck it should be able to tell you then and there, how to go about it... I was reading the manual several times, its quite detailed but if you don’t know what the problem is, then it does not make sense”.*

### **On-line tutorials, HELP feature and classroom-based advanced training courses**

The availability of on-line tutorials helped some users of EndNote to resolve issues and fix some of their problems. For example one participant used the on-line tutorial to learn to use features, *“I found myself running back again to those on-line tutorials”.* Some LMS users expressed frustration about the lack of a clear understanding of what some of the feature were meant to do and the lack of a HELP feature to guide them, *“... I have not found a HELP on it. Say I want to do something, say, how to find posts, to tell me where to look for, that’s not there....Learning to use was awkward and not intuitive”.*

Advanced classroom-based training courses were attended by some participants in both LMS and EndNote cases (in weeks 16-20) to resolve some of their existing problems which they had faced while using the technology earlier-on. For example one of the participants said, *“...a few niggling things were bothering me, so I went for this training course”* or *“Things like these- the importing and exporting...with the training it made it easy. This filter thing is not something that I would have known if I had not gone for the training”.*

### **Longer-term use**

#### **Contacting trainers, peers, one-on-one IT support and advanced training**

At 24 and 44 weeks, it was noted that participants once again selected and integrated new features provided by the LMS, into their everyday teaching practice. A new semester in their teaching practice had commenced. It

was a period when participants were setting up their subjects on the LMS for the semester. Most participants attended advanced training program to learn to use the new features or to resolve problems they had encountered, instead of using the manual provided to them, *"I went to training on assessment and communications...because it wasn't at all clear whether to use pool or test manager"*.

While the initial training attended by participants was class-room based, in weeks 32 and 36, they expressed preference for a further one-on-one training from a local IT support person rather than a centralised training approach, to further use the LMS *"Well, I have done the basic training...I found it was just much better to have one-on-one, ask particular things that I need to know rather than sitting through 3 hours of training and there are couple of people outside LMS-IT, local IT support...it's just been easy to have them here"*.

Further, the inability to contact a trainer to resolve problems was a negative influence noted during longer-term use. Participants expressed frustration when the IT-online help could not provide support to them when they had problems using the LMS, *"I actually called IT helpline and it was a waste of time... I find that it is really frustrating there isn't expertise to support us"*. Participants continued to express the need for support from trainers to resolve issues and teach them how to use new features provided by the LMS. Some participants expressed frustration with the lack of such support from the trainer, especially when participants lacked time. For example one of the participants said, *"I actually wanted instant feedback from someone who knew the system and when I phoned the IT staff and asked for specialized help, they could not help me"*.

It was interesting to note that participants who had once rejected the LMS (as seen in weeks 3-4, 7-8 and 16- 20) had started using it again (66 weeks). Two participants who had stopped using the LMS earlier in the study were once again using the LMS in a limited way because they perceived it necessary they use the LMS. They continued to resolve their prior problems with the help of peer support in setting and running the LMS, *"I'm using a research assistant to whiz through the LMS... we both work together"*. It was also noted the lack of peer support discouraged a few participants from using specific features. For example one participant commented that he did not want to use the "grade book" feature because his peers had faced problems with it, *"I didn't use the grade book, I was planning to...I got that mail from my colleague...about the problems he had with it... grade book would obviously have been useful...except it isn't quite"*. A few (4) had resolved problems with some of the features that were rejected earlier in the study. They either attended an advanced training session, *"I attended a course on using the QUIZ and Grade book...it was straight forward"* or had a one-on-one support from IT-support staff, *"I went to the drop-in centre for help"*. In one case, a participant simply worked around the problem, *"The groups are set up by others in the department...it is all integrated... It works and that's good...I don't have to worry about setting it up"*.

### Summary of the findings from the case studies

Figure 1 illustrates the various support mechanisms used by users of EndNote and the LMS during early, medium and longer-term use in supporting different activities. The mechanisms not only encouraged and supported expectations of usefulness and ease of using various technologies; it also encouraged creation of perceptions of future benefits, subjective norm and relative advantage. In addition, activities that were enabled and encouraged by the support mechanisms were the ability to learn to use the technology, adaptability issues (ability to adapt practices and customization), problem resolutions and sharing knowledge and experiences.

## DISCUSSION

In this paper, the research question, *"How do support mechanisms enable and encourage early, medium and continued longer-term use of a technology?"* is addressed. Based on the findings from the study, Figure 1 illustrates a support mechanism framework that shows mechanisms that were used to enable and encourage users in performing activities during the early, medium and longer-term use of technologies.

Our study suggests that early on, when users are faced with the decision whether to adopt a technology, a classroom based training program could influence the formation of perceptions and attitudes about the technology supporting other studies (Raymond 1990; Venkatesh 1999; Xia and Lee 2000; Mendoza et. al 2005). In this study, it was noted that all users of both EndNote and LMS had attended a training program and were provided with a manual and information on the benefits of the technology and how some of the features it possessed could be used. After the initial training, users of both EndNote and LMS expected the technologies to be useful, easy to use, easy to learn to use and easy to customize and they expected to change their practices. We therefore suggest that an initial classroom based training program provides an introduction to the technology and some of its features in a context-isolated teaching facility in the presence of a trainer. It helps create expectations and perceptions about a new technology that includes benefits of using it, the effort involved in learning to use it and the ability to seamlessly adapt it in the work environment.

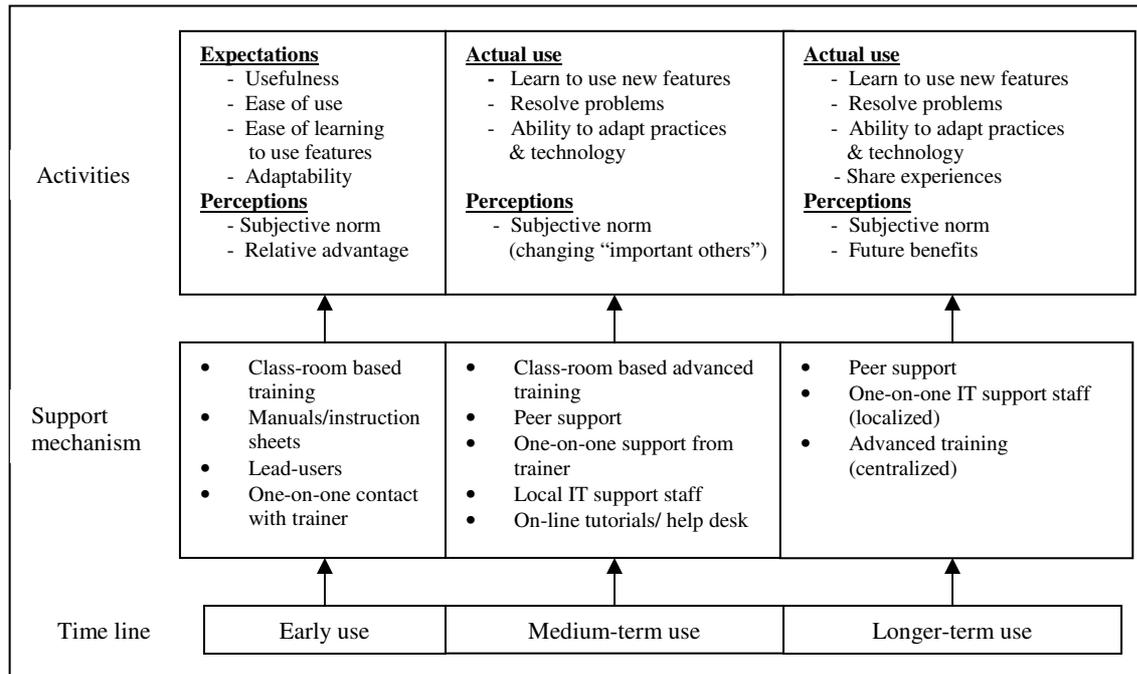


Figure 1: Various support mechanisms enabling appropriation during early, medium and longer-term use

In addition, our study shows that providing users with an initial classroom based training and a manual may not always be the only support to encourage technology use. Subjective norm and a strong support in the form of lead-users, one-on-one contact with trainers and peers enable early use. Users of both EndNote and LMS perceived that lead-users, supervisors, the organization and/or students expected them to use the technology. Further, findings from both case studies showed that user's expectations could be influenced by relative advantage supporting some studies (adapted from Rogers 1995). The study, therefore suggests that in the short-term, an effective classroom based training, manuals and a strong support from lead-users and peers could enable and encourage adoption and early use of the technology supporting prior studies (Fitzgerald and Cater-steel 1995; Sein et al. 1999).

*Is it sufficient however, to provide a classroom-based training during implementation of a technology and then assume people will continue using the technology to its full-potential over time?*

Our study strongly suggests that providing a classroom-based training and manuals for users during the implementation stage alone may not be sufficient to support persistent medium and longer-term use of technologies. Our findings suggest that training needs are broader than a class-room based training session or formal training.

A variety of support mechanisms have to be set in place for users as they continue to appropriate technology over time. In both our case studies, during medium-term, as users of EndNote and LMS appropriated practices or customized the technology in a specific work environment, they were faced with problems while learning to use *new* features to suit new events or activities that arise after initial stages of use. Manuals were not a preferred support mechanism among users supporting other studies (Seddon and Calvert 2006). Instead they learned about new features through self-discovery or help from peers. On-line help within the technology may be more effective than manuals while learning to use the technology and adapting it over time, especially when manuals are not easy to read and users do not have time to read them. For example, one of the EndNote participants expressed the need for an on-line help feature to resolve problems and to learn to use new features. Findings from the study also showed that users of EndNote and LMS contacted peers or had one-on-one talks with trainers. Some users attended more than one advanced training courses to help resolve pre-existing issues and further adapt the technology to suit ongoing activities. They simply wanted to fix specific problems especially when time was a valuable commodity in their work practices. We therefore suggest that providing ongoing access to support, such as advice from experts or further training may be valuable for users through an initial dip in expectations. It is important that support be provided for users to "pull" in rather than being "pushed" on to them.

In the longer-term, as users get comfortable with using the technology and changing their practices to suit the technology, they further adapt the technology to suit “new” needs and activities. Mutual adaptation continues to take place in different forms: users not only adapt to the technology and adapt the technology to suit needs but also combine prior practices involving other technologies with the new technology. This study shows that supporting mutual adaptation as they learn to use new features and resolve problems involves providing users with a variety of support mechanisms in the form of peer-support, support from lead-users, local IT-support staff, one-on-one contact with a trainer, on-line help or even ongoing advanced class-room based training programs.

Failure to provide a variety of support mechanisms could lead to rejection of features provided by the technology and sometimes even rejection of the technology in the longer-term. It is important that trainers, managers and IT professionals be aware that the way others perceive and use a technology, termed as “others use” (adapted from Compeau et. al. 2007) could act as a disruptor for further exploration and use of a technology, long after adoption. A negative word of mouth or comments from peers may discourage selection of features, triggering rejection of some features before users even trial it. In the LMS case study, for example, it was observed that one of the users did not want to use one of the features provided by the LMS because his peers had faced problems with it (noted in week 24). This is consistent with previous findings in the behavioural literature suggesting that a negative information source exerts much stronger effect than positive information sources (Galletta, Ahuja and Hartman 1995; Gallivan 2001). A negative comment made by somebody can exert a significant effect on a user’s attitudes towards the software even after a significant period of use.

The lack of a social network among users, IT support staff and peers in providing help and problem resolution when needed, could trigger resentment and lead to rejection of a technology (one of the participants’ rejected the technology in weeks 3-4 of the LMS case study). The inability to resolve some problems even after contacting a trainer or help desk support, had encouraged some EndNote users to reject some features and work around the technology especially when they were busy with their regular work-related activities (noted in weeks 16-20).

In the longer-term, as users become experienced and more comfortable with using the technology, it might be important that users be encouraged and supported to see further benefits of the technology. Providing users with support mechanisms that demonstrate new attributes of usefulness phased over a period of time could encourage effective use of technologies. Both the LMS and EndNote case studies have shown that usefulness was noted as a strong influence among users of EndNote an LMS throughout the study supporting previous findings (Karahanna et. al. 1999; Mendoza et al. 2005, 2008; Fidock et al. 2006). As suggested in our previous work, users re-evaluate and continue changing their expectations over time and new attributes of usefulness emerge (see Mendoza et al. 2008). We therefore suggest that it is crucial that advanced training be provided at critical periods of technology use (see also Meta-group 2003) to support and encourage further use and avoid stagnation of a technology.

We also suggest that access to a variety of support mechanisms, throughout the periods of exploration and stabilizations in technology use, may be a key factor in encouraging productivity and user satisfaction. Users may be provided with a variety of support mechanisms to choose from, to help them resolve different problems at varying time periods of use. Some users preferred a personalized one-on-one training or a local IT support staff rather than attending a centralised classroom-based training to explore new features in the LMS and resolve problems or even gather ideas of further appropriation.

## CONCLUSION

Successful management of new technologies is a complex process that involves planning and executing management interventions that will encourage productive and persistent use of new technologies. This study has detailed the support mechanisms used in two longitudinal case studies investigating the adoption and use of new technologies.

Our findings suggest that it is important that a combination or variety of support mechanisms be offered at critical time periods to encourage and support the appropriation process. In our case studies, providing training for users during the implementation stage alone was not sufficient to support persistent and longer-term use of the technology. Ongoing training at critical time periods, in the form of one-on-one contact sessions with the trainer or a local IT support staff, in addition to class-room based ongoing training courses encouraged productivity and satisfaction. Access to a variety of support mechanisms, throughout the periods of exploration and stabilizations, may be a key factor in encouraging productivity and user satisfaction. Formal classroom based training may be a good mechanism in encouraging adoption and initial use. However, in the medium and longer-term other support mechanisms influence further use and user satisfaction. Formal class-room based training may not be sufficient as users prefer customized support and peer support to resolve issues faced with

using the technology. Peer support and social networking can encourage productive longer-term use of a technology.

It is therefore important that trainers, managers and information systems researchers gain deeper understanding of changing influences on longer-term use of different technologies and set in place a variety of support mechanisms to encourage continued satisfactory and productive longer-term use of technologies. Our future research focuses on adoption and longer-term use of different technologies by user-groups and individual users in different environments. Further, we plan to test and extend our understanding of support mechanisms and work towards developing normative guidelines to help trainers and managers in encouraging efficient use of technologies in organizations.

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