Achieving Self-efficacy in the Virtual Learning Environment

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Abstract: *Virtual learning environments (VLEs) provide a seamless interface for organising online learning, and are proving indispensable in distance learning. The technological environments, though, are often adopted with little thought about pedagogical strategies, especially for students who may be adversely affected by the additional challenges of new technology. The mature age student, in particular, faces a barrage of factors, which may adversely affect their learning abilities. This paper explores factors that influence achievement of learning objectives by mature students. We propose a self-efficacy model which enables learners to attain self-efficacy in virtual learning environments. The model takes into account factors that impact specifically on mature students. We propose changes in learning as well as pedagogical strategies to accommodate the specific needs of mature students.*

Keywords: Virtual learning environments, self-efficacy, mature age students, pedagogical strategies.

Introduction

Developments in technology present an opportunity to change the way we educate. The Internet provides a wealth of information, attracting academics and students alike. The personal computer and ease of access to the Internet provide an opportunity to reach ever greater proportions of the population. As education embraces technology as a delivery vehicle, there needs to be a focus on the needs of the mature student, and the disadvantage they may experience as a result of the additional challenges of new technology (Meyer et al, 1997). Here we refer to mature age students as those over 40, who have been absent from formal education for a number of years, as many of these factors are more applicable to this age group. Some of the influencing factors discussed will be more evident in older adults such as deterioration of fine motor skills being most perceptible in persons over 60 (Peterson, 1996). However, these factors are included in discussions for two reasons. First, these changes can occur earlier as a result of life experiences or as a result of increasing frequency of injury or illness. Second, there are benefits for those who are not affected by such factors, e.g. through improved usability or better support services to all learners.

In this paper we focus on technological challenges to mature age students and factors that inhibit or enhance achievement of learning objectives. We propose a self-efficacy model for mature students to attain self-efficacy through technology generally and virtual learning environments (VLEs) in particular. Self-efficacy is particularly important to mature students as it equips them for life long learning.

Virtual Learning Environments

The term 'virtual learning environment' (VLE) is used to describe a server software, dedicated to the design, management and administration of computer-mediated learning, including delivery of course materials, support of course communications, student management, tracking and evaluation. The VLE is any groupware specifically developed for the educational context, that makes use of networking technologies and learning tools. These tools include conferencing software, e-mail, on-line references, search engines, multimedia presentations, interactive simulations and activities, shared whiteboards, asynchronous and synchronous discussion forums (Britain and Liber, 1999).

These new educational environments use extensive computer-mediated communication and collaboration during the learning process. The educational models used by course developers in these environments are, however, heavily influenced by traditional distance education methodologies. The emphasis in these pedagogical methodologies is on the delivery and exchange of documents and on knowledge management through asynchronous communications. VLEs, though, have the ability to place the learner in the centre of the virtual environment, rather than the learning materials. The environment provides learners with the facilities to manage their own learning experience. In this type of environment, learners are able to shape and develop their own knowledge and understanding in a context that is relevant to them.

Self-Efficacy

Self-efficacy is a construct developed by Bandura (1977, 1986, 1997) as part of his social-cognitive theory. Bandura (1986, p.391) defines efficacy as a "belief on one's capacities to organize and execute the sources of action required to manage prospective situations". Self-efficacy is part of our 'self system' that helps us to evaluate our performance. In other words, someone who believes he or she can do something is more likely to accomplish it than someone who does not have that belief.

People use self-referent thought to mediate between knowledge and behaviour. People use their self-reflection capacity to reflect on and evaluate their own experiences and thought processes. Through reflection, it is possible to construct new knowledge and thus alter thought processes and subsequent behaviour.

Perceived self-efficacy refers to one's impression of what one is capable of doing. This can come from a variety of sources, such as personal accomplishments and failures, and verbal persuasion. Verbal persuasion may temporarily convince us that we should try or avoid some task,

but finally it is our direct or vicarious experience with success or failure that will most strongly influence our self-efficacy. People with high self-efficacy choose to perform more challenging tasks, and persist longer at a task than people with low self-efficacy. Bandura speculated that this is because people with high self-efficacy tend to have more control over their environment. They manage and deal with their environment and therefore experience less uncertainty.

Research has indicated that self-efficacy beliefs are related to a range of problems, such as addition (Marlatt, Baer and Quigley, 1995), social skills (Moe and Zeiss, 1982), depression (Davis and Yates, 1982) and assertiveness (Lee, 1983). The self-efficacy theory has also been applied in educational research in the area of motivation and self-regulation (Pintrich and Schunk, 1995). Furthermore, there is a relationship between the self-efficacy beliefs of educators and their students' outcomes (Ashton and Webb, 1986). There is also support that self-efficacy can be enhanced through experience with technology. Eachus (1996) developed the Computer User Self-Efficacy Scale to evaluate students' beliefs in their abilities to use computer systems effectively. A positive relationship was found between self-efficacy and computer experience. The construct has also been used for various applications, including the management of remote workers and improving job satisfaction and effectiveness,

Older people are re-entering the educational system for a variety of reasons; for example, opportunties not open to them before, child-rearing years have passed, remote locations having access to distance education, and so forth. These mature students experience a range of emotions associated with competing with their younger counterparts. Added to these emotions is the daunting prospect of "catching up" with technology. However, technology, if used appropriately by the educator, can have a positive impact on the mature student. As the mature student works through technological achievements, he/she will develop a higher level of self-efficacy and is more likely to engage in, and maintain, life-long learning.

Self-Efficacy Model

The mature student faces a barrage of factors which may influence their ability to achieve self-efficacy in the VLE. To assist with the discussions a model has been developed (Figure 1) which, like the Internet, is a series of connected points (factors). The links between factors add much to the understanding of how the mature student may be affected and what we may do to assist.

As Figure 1 illustrates, the influencing factors (attitude, anxiety, cognitive change, physical change) impact personally on self-efficacy. The links between these personal factors can further increase the burden on the mature student (negative past experiences with technology and ageism). The inner layer forms a mesh of control factors that we may use to alleviate the disadvantage (awareness, peer support, training, structure, coping strategy, software, hardware, physical environment). However, through carefully designed teaching structures we can ensure adequate time to overcome fears. These control factors can provide general benefit, even to those that are not affected by the influencing factors. Each of these factors assists the achievement of self-efficacy

through four key areas (support, usability design, teaching and learning strategies). The key areas are the areas where pedogogical decisions can be made, implemented and the results measured.
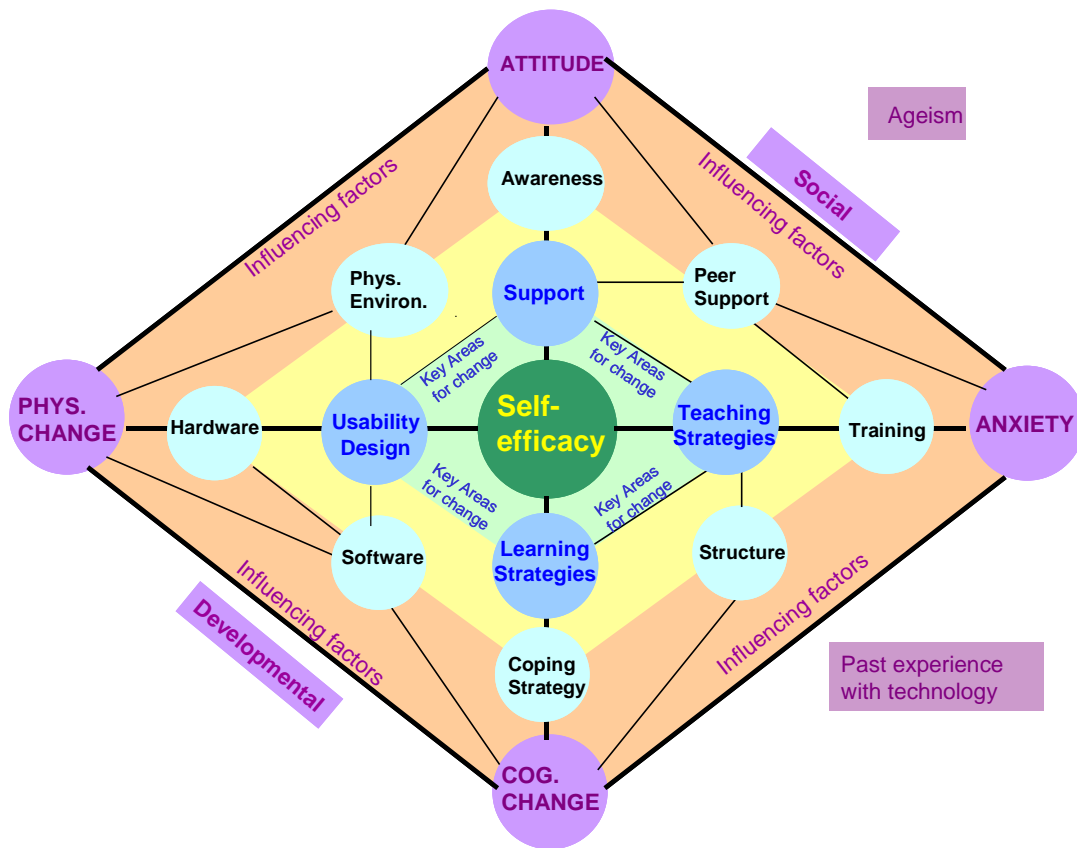
Figure 1. A model for achieving self-efficacy in virtual learning environments.

Factors of Personal Impact

Physical Change

Physical change is part of normal development (for a thorough discussion see Peterson, 1996). Some senses deteriorate steadily, beginning in early life e.g. vision and hearing. Others deteriorate rapidly in later years e.g. deterioration of fine motor skills are particularly noticeable in later adulthood. This may apply to operating a VLE, in the use of the mouse, where clicking on small icons can become more difficult.

Physical changes are not uniform across individuals, life experiences impact on individual deterioration. For example, after 40 years of age muscle fatigue increases, depending on fitness this can have implications on the ability to engage in a VLE for extended periods. The cumulative effects of life experience can result in exaggerated deterioration such as repetitive strain injury or serious hearing decline resulting from greater exposure to noise (Peterson, 1996).

Cognitive Change

It is well documented that with increased age there is an associated decline in a number of skills utilized in the learning of complex tasks. Divided attention, distraction, and disruption of short-term memory due to changing between perception, recall and response (Salthouse, Mitchell, Skovronek and Babcock, 1989) may make it difficult when following hyperlinks and returning to the original source. This may be more pronounced in older adults where such interference is more likely to reduce the acquiring and encoding of material (Craik, 1977). Given that the VLE aims to assist the acquiring and learning design which detracts from that will pose a serious disadvantage.

Anxiety

Computer anxiety is generally believed to be "…anxiety caused by interaction with the functional and mechanical aspects of computers (e.g. learning to use a computer)" (Worthington and Zhao, 1999). It is a concern that this fear or negative attitude may prevent mature students from the getting the most benefit out of the VLE, as avoidance is often a result. The fear of 'breaking something' may result in extra caution, so as to avoid errors and in an unwillingness to learn by experimenting (Meyer et al, 1998). These factors can greatly reduce the mature students self-efficacy in the VLE.

Worthington and Zhao (1999) also suggest that there may be "existential anxiety" as the broader implications of technology in society shake their certainty about their own value. Mature students are more likely to have returned to study after numerous years in the workforce and may see education as their only chance to compete with encroaching technology. This is supported by much research, which has associated age with anxiety (Ellis and Allaire, 1999).

Educators, the owners, and developers of the VLE are at risk with the same fears. An educator who is nervous about experimenting with technology will not use the VLE to facilitate creative solutions for attaining learning objectives; instead, the VLE will be a resource center and not a learning centre. Hesketh, Gosper, Andrews and Sabaz (1996) identified that educators feared that they lacked sufficient technical skills and technical support to teach in the VLE. They identified existentialist fears of threats to job security and technology drawing attention and reward away from teaching. These fears influence how educators use the VLE and support mature students and attribute to the attitudes towards VLE.

Attitude to Technology

Attitudes are the predispositions directed toward some object, person or event (Czaja and Sharit, 1998). It is generally accepted that a person's attitude will influence their willingness to accept and use technology. Hesitance to use technology is often associated with disinterest but may actually be an expression of no confidence in their abilities.

Attitude is affected by social context and by past experiences with technology. Beliefs that adults are too old to learn and not interested have two impacts. First, it undermines confidence that

they can do it. Second, it may keep the help they need out of reach (Ryan, Szechtman and Bodkin, 1992). Educators may have similar attitudes, affecting their ability to design and deliver creative learning solutions in the VLE.

Links Between Influencing Factors

The factors above are also linked in their impact on the mature student. Each of these impacts the mature student in a personal way. The combination of these factors may form a tightening web around the mature student. As each factor links with another it provides a clear target for intervention to prevent disadvantage. It is suggested that the influence on self-efficacy of linked factors will be greater than factors in isolation.

For example, previous positive computer experience has been negatively correlated to anxiety and attitude. As positive experiences increase then attitudes toward computers improve and fears subside. Research suggests that as anxiety decreases and attitude improves then interest increases, and such motivation assists the achievement of self-efficacy in the VLE (Dyck and Smither, 1994)

Control factors

Awareness

Awareness has a number of aspects. It includes raising the awareness of the mature student to the purpose and value of the VLE, ensuring the mature student is aware of how the technology is consistent with their needs. This awareness will help create a more positive attitude to the VLE (Czaja and Sharit, 1998).

Another aspect of awareness is challenging the stereotypes of ageism. Fellow students and educators can impede the mature student by perpetuating the beliefs that mature students can't learn new technology and have no interest to learn. Increasing awareness in educators of the issues experienced by mature students and a willingness to accommodate them in the VLE is critical to reducing anxiety and fostering a positive learning attitude (Morris, 1994).

Peer Support

Peer support, which involves the collaboration of mature students in the VLE, is important in creating a comfortable environment for the mature student. It frees them from feeling inadequate amongst younger students and provides opportunities for them to develop their own skills by assisting others. This is useful for reducing anxiety and improving attitudes towards VLE. Peer support is currently used with much success in Australian universities (McInnis, James and Hartley, 2000)

Training

Much of the research relating to anxiety and attitude reports strong correlation with experience (Dyck and Smither, 1994). Training is an effective way to ensure that mature students have positive experiences of the VLE. By providing additional training in the VLE environment the appropriate forum can be created to allow the mature students to familiarize themselves in an environment with adequate support. When given the opportunity to seek assistance anxiety will be greatly reduced. Applebaum and Primmer (1990) developed a model for training the computer anxious student that involves 4 steps: evaluation of needs, design, desensitisation and advanced training. This model is based on an organizational structure, however the principles are also likely to apply to an educational environment.

Training has critical implications for the educator also. Educators require training in the benefits and opportunities available in the VLE. Better VLE course design will enable the educator to be more responsive to the needs of the mature student. As the VLE presents new opportunities training for educators will better enable them to use the VLE to place the learner in the center and better manage their own learning experience (Hesketh et al., 1996).

Structure

Structure can have great impact on assisting with the challenges of cognitive changes experienced by the mature student. Teaching periods need to be structured to give the most opportunity for mature students to process information presented and to ask or respond to questions (Umiker-Sebeok, Thompson and Crosby, 1999). Encouraging flexibility in time and place of learning sessions to accommodate the other life demands of the mature student is also important. This can be best facilitated by structuring online modules to be no longer than two hours to avoid mental and physical fatigue can also aid in the encoding of information in a VLE (Morris, 1994).

These factors make the learning environment less challenging for the mature student, assisting in the reduction of anxiety and allowing opportunities to counter the effects of cognitive change.

Coping Strategies

There is much research suggesting that *overall performance* of mature students may not be affected by age in relation to complex tasks such as editing text in a word processor (Westerman, et al,1998). Common theories why age hasn't impacted performance are compensation and compilation. Compensation occurs when adults use other abilities or strategies to compensate for age related declines in other components of task performance, enabling them to achieve similar results as someone younger (Westerman et al., 1998).

The research of Miller and Stine-Morrow (1998) demonstrated the compensatory strategies used to overcome declines in working memory when reading online. It was found that older readers

spend more time to wrap-up after smaller units to accommodate processing declines. This has direct implications for the VLE, which will often use web pages to present course content.

Motivation is seen as an important factor in adjusting for cognitive changes of age. A positive and enthusiastic approach to learning greatly assists the achievement of self-efficacy in the VLE. Bandura (1986) suggests that success is often a result of much generating and testing of behaviours and strategies which requires perseverance and motivation.

Software

The user interface is the most important factor of a software application. This is the way that a user can operate the software and produce the desired results. Difficulty with 'driving' the software can greatly decrease performance of all users, particularly mature students (Nair et al, 1997). The user interface serves several roles, it presents information to be learned and it provides tools for moving around.

Presentation is important to user ability to learn information presented. Care should be used in selecting screen fonts, font size, use of colours to provide adequate contrast, larger icons with labels and to differentiate visited hyperlinks from other hyperlinks. The functionality built into software to adjust each of these will allow users to create a viewing environment that best suits them. Support should be given to ensure that users know how to adjust these settings for their own comfort (Nielsen, 1994). These features will address some cognitive as well as physical changes in development. Addressing these changes has implications on anxiety and attitude also.

Increased motor noise is experienced with increasing age. This makes it more difficult to click on small icons and research indicates that this effects even experienced older users (Walker and Worden, 1996). Given the critical nature of icons in web navigation changes to icon design should be implemented. Worden, Walker, Bharat and Hudson (1997) have suggested a number of ways that interfaces can be adapted. Most interesting was the notion of the 'sticky icon'. The sticky icon works by making it easier to stop the cursor. This requires a slight change in mouse usage and therefore would be ideal for the novice user to begin with. This feature requires developers to incorporate it into the actual design of the software.

Other issues that can be addressed through software and interface design include physical consistency in layout. Highlighting of important information is also very important in directing attention to reduce the information load.

Speed of mouse clicks, speed of cursor flashing, speed of scroll bars can all be adjusted to allow the mature student to become familiar with moving on screen. This information should be provided through support channels as part of user configurability training.

Hardware

Hardware changes can be most effective for physical impairments eg. loss of fine motor skills. The use of light pens as alternatives to mouse, specially designed keyboards with more space between the larger keys, larger screens for larger displays. These hardware changes can greatly reduce physical stress in the VLE as it increases user comfort (Umiker-Sebeok, Thompson and Crosby, 1999).

Physical Environment

The physical environment includes furniture and physical surroundings. Ergonomic furniture has many benefits, not only for mature students. It encourages correct posture that reduces muscle fatigue, which has been noted to increase with age. Adjustable height desks, chairs, keyboards and screens allow the mature student to establish a workspace that best suits their physical needs.

A learning environment free from distraction is important as older adults have greater difficulty filtering out irrelevant stimuli (Morris, 1994). This has implications for the student who must make use of computer labs on campus for access the VLE, policy makers should carefully consider the disadvantage that this may cause.

Relationships Between Control Factors

Many of the control factors are linked. Positive action on one factor may generate positive impact on another factor. For example, awareness is likely to have positive impacts through support and in how teaching strategies are implemented and how effective training is. Alternatively the lack of change for a particular factor may negate any positive attempts with another factor. Failure to address issues of awareness may greatly degrade the quality of support and general training given to students as educators act without consideration for the mature student.

Key Areas of change

The four key areas of change directly impact on self-efficacy in the VLE for the individual and for the body of students as a whole. Ignorance of control factors in these key areas will impact on self-efficacy

Support

Through support, educators can effectively contribute positively to improving attitudes towards VLE technology, reduce anxiety, provide useful information to assist with accommodating any physical difficulties and provide an avenue for assistance with cognitive changes (Czaja and Sharit, 1998). Support is critical to the attainment of self-efficacy in the VLE. Support provides the basis for awareness, and establishing other support structures such as peer support. Support also provides an

avenue for passing information to mature students regarding hardware and software configurations that may enhance their learning experience. All students, not only mature students can benefit from support initiatives.

Support initiatives should extend not only to students in the VLE but also the educators. Without training in the benefits and possibilities of the VLE the technology will only be used as an extension of the distance education methodologies. The benefits of the VLE focus on the ability to place the learner in the center of the learning environment. By increasing educator efficacy in the use of the technology all students will benefit from the creative solutions to achieving learning objectives that are possible. We train educators in their subject fields and train them in educational delivery. The VLE as an educational tool requires the same training, if students are to receive the greatest benefit (Hesketh, Gosper, Andrews and Sabaz, 1996).

Learning Strategies

Garner (1990) suggested that older adult learners might be able compensate for memory and processing declines by employing more effective learning strategies. Students benefit in training about such learning strategies because poor cognitive monitoring or routines might get the job done but they do not develop techniques to support deeper learning. Training in learning strategies should be incorporated into the VLE for the greatest effect as students often find it difficult to apply strategies to other contexts (Hattie, Biggs and Purdie, 1996; Cardinale and Smith, 1994).

Teaching Strategies

Teaching strategies through consideration of structure, training, the facilitation of learning strategies and creation of peer support is critical for ensuring that cognitive change, anxiety and attitude are effectively addressed. Physical change can also be addressed through structure of teaching sessions to minimise any factors that may interrupt learning. Teaching and learning strategies must me interwoven into the VLE to provide suitable real steps towards self-efficacy in the VLE (Jones and Jo, 1999).

The best teaching strategies naturally include investigation into which tools of the VLE are most effective for achieving learning objectives within that content area (Najjar, 1998). If the educator can not see the benefit and possibility of the VLE then they will not gain the full benefit of the technology, and will continue working within the distance education methodologies (Hesketh, et al, 1996). This will only further burden the mature student who will continue to struggle with accessing content, rather than giving them control over their learning experience. Although this discussion is outside of the scope of this paper, it will need to be considered within each instructional context.

Usability Design

Usability design incorporates consideration of all facets of technology, software, hardware and the interaction between them. Addressing concerns of usability of technology is not limited to the educational sector; commerce and industry have long struggled with the issue of usability vs aesthetics (Neilsen, 1994). What we can endeavour to do is keep the challenges of the mature student at the fore when making decisions on software and hardware. By designing the entire package based on these issues and delivering it with adequate training, mature students can be greatly assisted.

<u>Conclusion</u>

A web of linked factors contribute collectively to the achievement of self-efficacy in the VLE. Overlap of control factors and key areas of change increases the possibility of achieving self-efficacy. And with a sound pedagogical framework that enhances both educator and learner achievements with computer technology, self-efficacy beliefs will be increased. Consequently, self-efficacy in the VLE will leave the mature student better equipped to deal with technology generally and specifically for the purposes of sustained life long learning.

Many of these factors are experienced by educators, affecting the quality of their teaching and their use of the VLE to the benefit or detriment of the mature student. The better trained and supported the educator, the better they will be able to support the special requirements of the mature student.

This model of self-efficacy in the VLE has as much relevancy to commercial organisations as it does to educational institutions. This is particularly poignant given the lower costs of delivery for independent computer based training in organisational settings.

All learners can benefit from increased simplicity and ease of use. Students with special disabilities or special learning needs can achieve greater assistance and satisfaction given these initiatives. It is important that these issues have been raised initially in the context of mature learners. As Fozard (1996) states

> "…technology introduced at the present may be adapted to very differently by young and old people who have had different experiences, and, technology in turn, may alter the course of aging itself for both the young and old." (p.138)

Thus changing technology and aging form an important partnership given the increasing age of western society. As older adults embrace technology it becomes more crucial to minimize the impact of factors that may otherwise limit their potential to engage in virtual learning environments. In such a 'technologised' world, perhaps this will create a more supportive environment for mature adults to reach their potential more generally.

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