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Technology assisted education: An overview of success factors

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Abstract

This paper elaborates on the role of digital and web technologies in learning. It discusses that technology alone cannot deliver successful learning outcomes. In rolling out technology-enabled learning solutions a range of other factors must be taken into consideration. A model for technology-based learning values and pilot study of a group of technology-enabled digital learning initiatives in institutions are presented to highlight the importance of people and process related factors alongside technology. The outcome of this preliminary study is presented; it indicates no significant strategic gains were derived from the use of web-technologies.

Keywords

digital learning, technology in learning, strategic value of digital learning

1. Introduction

For over a decade rapid ICT advancements have contributed towards staggering growth in the deployment of education sector technology solutions; such technology deployments have promised to revolutionise access to global learning opportunities. Internet and Web-based technologies have both had a profound effect on the ways in which education and training institutions now operate. It is now possible within ICT-enabled nations for educators and trainers to think of new ways in which to use the Internet to provide knowledge management (KM) and training opportunities. Some technology-assisted learning solutions however seem to have concentrated solely on technological aspects of learning solutions without proper consideration of people and processes, often resulting in unsatisfactory outcomes (Asgarkhani, 2011b, Asgarkhani, 2013).

Literature reviews published throughout the last decade suggest that Internet and Web-based technologies have both had a major impact on the ways in which educational and training organisations operate (Asgarkhani and Clear, 2011). Various studies (e.g. Baynton 2001, Rosenberg 2001, Higgins 2002, Burns et al 2001, and Dobbs 2000) suggest that in the early 2000s we witnessed rapid advancements in ICT - which led to the emergence of a globally and electronically connected world. A

paradigm shift was witnessed in the ways with which the transfer and management of knowledge was handled. A review of e-learning cases (e.g., various cases in online learning in the Training Magazine, Asgarkhani 2003, Kiser 2001, Montanden 2002 and Rossett 2002, Pan, Lau and Lai 2010) in the early 2000s suggests that most tertiary educational institutions and professional training organisations within ICT-enabled and globally networked countries had acknowledged to some extent the strategic importance of using technology-based education and learning through Web-based applications.

Advances in IT that emphasise e-learning technology without looking at broader educational and strategic issues are however insufficient to deliver state-of-the-art e-learning solutions. Some programs delivered electronically appear to have been developed and implemented in a somewhat reactive and isolated manner; more specifically, without much thought being given to strategic implications, global developments, cultural issues, the so-called digital divide and the complexity of today's KM systems. A review of cases (Asgarkhani and Clear, 2011) shows that solutions which did not consider strategic values did not deliver the expected value.

In order to demonstrate the importance of broader educational and strategic issues in technology-assisted education, a model was developed to assess perceived value to be delivered by technology. The model was then used in a pilot study to assess those values. Recently, the trial was extended to otherinstitutions; this paper reflects on the updated outcome.

2. The Evolution of Technology-Assisted Learning

The last 10 years or so have seen a paradigm shift in knowledge and learning transfer mechanisms; composed from the authors' personal experience, a brief anthology of technology in learning and education includes:

- Film, in turn moving to TV technologies and video tapes
- Mainframe computer-based "teaching machines"
- Early microcomputers as a basis for Computer Based Training (CBT)
- Touch screens and interactive videodisks based on "InfoWindows" hardware technology
- Power PCs, CDs and DVDs
- Global networking advancements and web-based solutions
- Mobile technologies and development of 3G and 4G networks to make mobile learning viable.

Currently, educational solutions are increasingly (Tuncay et al, 2011) concerned with:

- Providing flexible access (anytime/anywhere)
- A focus on outcomes (for instance resulting in jobs)
- Shifting from physical facilities (buildings and classrooms) to networked facilities (virtual classrooms and learning environments) with greater emphasis on online over paper-based delivery

The electronic learning industry is diverse. Numerous universities have developed profit orientated e-universities offering courses and degree programs. The e-learning industry also includes companies that support the establishment of learning infrastructures and networks for higher education institutions (as well as corporations) including course management and delivery tools such as Blackboard, WebCT and Moodle. What's more, the learning and educating industry seems to have moved on from technology-based learning alone in representing e-learning; new concepts such as m-learning and b-learning have also emerged.

There was considerable debate in the early 2000s (e.g., Dobbs 2000, Industry Report 1999, Kaeter 2000, and Kiser 2001) over the effectiveness of e-learning. Many people (e.g., Rosenberg 2001, Kushnir 2009) considered technology-based learning disappointing at best, arguing that its impact has been relatively minimal. Others (Kiser 2001, Dobbs 2000, and Kruse 2002a) argued that the benefits of e-learning outweighed its drawbacks. The perceived importance of digital learning had motivated

some governments to develop national guidelines and strategies for introducing e-learning solutions (e.g., New Zealand e-Learning Advisory Group 2002).Overall, e-learning appeared to be taking root in organizations of all sizes - even though there were often different views concerning the ways in which e-learning can benefit individuals or organizations.

Studies of learners' attitudes towards e-learning within tertiary educational institutions (e.g., Burns et al 2001, Asgarkhani 2003) indicated that there was an increasing demand for web-assisted courses. It appeared that the demand for quality web-assisted courses with multifaceted person-to-person interaction would increase rapidly. There were also barriers to consider. Access to information and communication technologies (ICTs) is critical for economic and social development. Developing effective digital learning and solutions depends on the state of the ICT industry and electronic readiness (e-readiness) of countries, organizations and societies. This was discussed in the early 2000s by numerous researchers (e.g., Information Society Index 2001, OECD Workshop 2000, META Group 2000 and Asgarkhani 2002b, Kurilovas et al 2011). Overall, it was claimed that differences in diffusion and use of ICTs and electronic networks could widen the digital divide between countries, social division within countries related to income, education, age, family type, and location. Finally, within businesses division may result related to sector, region and size.

In November 2001, when the benefits of distance learning via the Internet was being heavily promoted, the global communications company Marconi (Marconi, 2001) called on government and private stakeholders in South Africa to accelerate the introduction of e-learning centres in remote, rural and disadvantaged areas - suggesting that economic and educational benefits could have an immediate, measurable impact on poverty in South Africa. Higgins (Higgins, 2002) viewed e-learning as a tool that can play a significant role in bridging the digital divide in the APEC region. However, the digital divide can also be considered as a barrier to successful rollout of e-learning solutions. Some of the causes of the digital divide that can even today limit successful implementation of technology-based or digital solutions can include:

- Lack of telecommunications and network infrastructure and required financial resources to enable their development
- Limited PC and Internet access
- Lack of ICT literacy and cultural resistance
- High access costs to global networks and the Internet
- High cost of business investment
- Strategic business impediments; the need for reorganisation, skills, security and privacy considerations

2. A Strategic Model for Assessing Benefits of e-Learning Initiatives

Following the literature review, case studies and interviews (Asgarkhani and Clear 2011), the perceived benefits (literature review including Asgarkhani 2003, Rosenberg 2001, Kruse 2002b, Kruse 2002c, Sitze 2001 and Burns et al 2001) led to developing a strategy model for assessing e-learning and knowledge sharing solutions. This two-dimensional model developed to assess the value of e-learning considers three key strategic parameters: efficiency, effectiveness and growth. For each parameter, three functional aspects were considered: time, distance and creativity.

Efficiency

- Time: Accelerating business processes & activities concerned with training and educating managers.
- Distance: Reducing geographical & distance inhibitors; allowing managers in various regions to participate in learning practices.
- Creativity: Enhancing existing business processes and activities from the educators' perspective.

Effectiveness

- Time: Improving information flow & business intelligence throughout the supply and value chain components; this facilitates timely and effective learning delivery & more profitable learning & educating processes for educators.
- Distance: Enabling integrated control of the supply and the value chain processes. Perceived as a business-driven value, it can enhance educational value through being educated in management courses considerably
- Creativity: Enabling new and/or modified processes to allow innovative and more exciting methods of learning.

Growth

- Time: Obtaining early market entry/presence for educators who are seeking internationalization.
- Distance: Introducing new management learning products to new markets
- Creativity: Developing new products and services that are related to educating and learning for managers.

This model was tested in a small number of institutions (6) and preliminary outcomes were discussed in (Asgarkhani and Clear 2011) before being extended to 19 institutions. The model used a rating scheme as follows:

- Strong Strategic Gains - 5
- Moderate Gains - 3
- Small Gains - 1
- No Gain - 0

The outcome of ratings is displayed below:

Table 1.

Efficiency	
Time	2.39
Distance	3.71
Creativity	2.23
Effectiveness	
Time	2.32
Distance	3.43
Creativity	1.71
Growth	
Time	1.61
Distance	2.78
Creativity	2.20

The score is the average weighted score for strategic gain in each area, as rated by all panels. Taking 2.5 to be the average gain in each category, the gain in most categories is below average. However, it has to be emphasised that this is a pilot study only; the outcomes cannot be generalised, although it was surprising to see that value gain in most areas seems minimal. Minimising "Distance" barriers seems to have scored the biggest gains. *Efficiency* related to *distance* scores the highest gain. However, the gain in *growth* related to *distance* seems more modest. Note however that the average gain in all categories except for *creativity* in *effectiveness* and *time* in *growth* is above 2 (low to moderate gains). Thus some gain was reported in most strategic categories. Overall, the outcome of the pilot study regarding strategic gains is not conclusive; a broader and deeper study may result in more conclusive outcomes.

3. Why are Strategic Gains Not Significant?

The above results are provisional; this preliminary assessment suggests, however that gains from the introduction of technology to learning has not matched expectations and perceived benefits. Pending further study of strategic gains, there remains a need to probe for fuller explanations as to why technology projects in learning have not produced the expected gains. Technology-based projects in learning

are similar to many other IT projects. A review of a small number of cases and previous studies in broad consideration of success factors in IT projects (Asgarkhani 2011a) suggest that successful rollout of technology solutions needs consideration of a number of factors:

- The solution relates closely to the problems it is trying to address.
- The solution is of an acceptable quality - though a broad term, "quality" in this situation refers to a combination of factors including, at least, usability, fitness for use, reliability & timeliness.
- There is a governance process in place that determines processes and conditions of use and change.
- The solution is affordable and is accessible by the targeted community of users.

In principle, development and introduction of technology-assisted learning needs to be based upon structured and strategic frameworks that address issues beyond technology and tools. Some of the issues that may improve outcomes regarding strategic gains made available by technology-assisted learning include:

- Appreciating the challenge of introducing and supporting the adopted technology
- Clarifying expected stakeholder roles
- Determining suitable frameworks for broader planning of its appropriate use
- Understanding approaches to design and delivery of relevant practices - e.g., course development, resourcing and maintenance methodologies.
- Considering change management and stability issues in technology-assisted education

4. Conclusions

In the early 2000s many educators and educational technologists believed the sector would offer significant value gains in education by employing web technologies. At the same time, the potential benefits of e-learning could only materialise when the solutions were introduced as part of a well-planned and supported education/training environment. It was pointed out that technology alone could not drive e-learning development. In other words, access to the right technology for delivering learning solutions was and still is essential but insufficient. Effective online learning and knowledge sharing inevitably relies on development strategies that optimise technology application. Based on the analysis of the literature review and case study reviews, a model for perceived benefits and strategic value of e-learning was developed. This model was used in Phase II of the project to firstly assess the effectiveness of the model and secondly to establish a first impression of the reality with regards to strategic value of e-learning.

The pilot study indicated that the model developed for evaluating e-learning solutions showed promise. Furthermore, it demonstrated that only in limited areas had the gain been significant; most categories reported moderate gains and despite heavy investment in technology the gains were not significant. Further study is needed to determine more accurately the factors requiring consideration, however, following this preliminary review it appears the chances of expected gains from the application of technology in education can be improved by considering the issues tabulated above.

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