Interactive Television and e-Learning Convergence: Examining the Potential of t-Learning

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Abstract: The application of emerging digital technologies such as e-mail, the World Wide Web and the Internet in the educational setting has received wide acceptance all over the world. One of the latest technological advancements being considered within the scope of learning is Interactive Digital Television. This paper examines the convergence of Interactive Television and e-learning, towards the establishment of t-learning as a value-adding service of digital television.

Keywords: E-learning, Interactive Television, learning path, t-learning

1. Introduction

The application of emerging digital technologies such as e-mail, the World Wide Web (WWW) and the Internet in the educational setting has received wide acceptance all over the world. Both corporate and academic agendas have recognized the potential advantages of electronic learning, and therefore proceed in the investment towards the implementation of Information Technologies (IT), in order to facilitate learning, even outside their traditional premises (Kramer, 2000).

Digital technologies have opened new directions for experimentation in the field of learning (Collete, 2001). Furthermore, with the turn of the century, a trend of convergence and integration of various technologies brings new opportunities for the globalisation of learning practices. One these technological innovations is the convergence of television and the Internet; namely Interactive TV (iTV) (Dalmas et al, 2001).

ITV is a quite recent development, and therefore unexplored, hindering many risks; however, it has the advantages of the decades of valuable experience in TV, as well as the past and ongoing experience in Internet technologies and applications. The Research Centre of Athens University of Economics and Business (RC-AUEB) has done extensive research in the fields of iTV and e-Learning. By drawing upon the findings of this research, we have proceeded in considering the convergence of iTV and e-learning, or else, 't-learning'.

This paper argues that iTV can facilitate e-learning, and also add value to this practice. In order to explore the concept of t-learning, we have first considered its two dimensions separately, before indulging in their convergence. Therefore, we will first discuss some main issues concerning e-learning, and then we will reflect upon the characteristics of iTV that support the potential of t-learning applications.

2. An Initial Discussion on E-learning

The term 'e-learning' refers to the employment of new technologies for learning purposes. E-learning focuses on the development of flexible mechanisms for the delivery of learning content (Henry 2001). The e-learning market is huge (McCrea, Gay and Bacon 2000; Ruttenberg, Spickler and Lurie 2000; Urdan and Weggen 2000) and covers several applications. However, the majority of e-learning implementations suffer from the absence of measured performance (Lytras and Pouloudi 2001a), (Ford and Jurewicz 2001). In the course of achieving higher performance several relations have been investigated: Knowledge Management Theories (Lytras, Pouloudi and Poulymenakou 2002a), Learning Theories (Shuell 1992) and Information Systems Practices (Lytras, Pouloudi and Poulymenakou 2002b), are determining a complex context of interrelations. E-learning is not a technological phenomenon. It is mainly a social phenomenon, since learning is the key issue and not the technology.

Technology is a facilitator or an enabler that requires a systematic analysis of goals and objectives. Broadband and interactive technologies have expand further the consideration of possible modes of e-learning. An interesting approach to e-learning derived from knowledge management (Mentzas, Apostolou, Young and Abecker 2001) is the consideration that e-learning must be confronted as a process (learning / knowing) and as an artifact / product (learning content / knowledge). From this perspective, any technology that is employed for e-learning purposes has to prove its capacity to support the process of learning in any aspect as well as to promote ways for the development and delivery of learning content.

Several value ingredients of the learning product have been specified in the literature (Lytras, Skagkou and Doukidis 2001g). Needs, Knowledge, Motivation Elements, Problem Solving Capacity, Team Synergy as well as packaging of content in functional units require a systematic approach. E-learning covers a wide range of applications. Several solutions for on-line and off-line learning define a complex context. The evolution of e-learning can be presented in several stages, where the static content delivery is supposed to be the first step in e-learning implementations. The ultimate objective of e-learning applications is the interactive customized and personalized learning scenes where profiling data of learners are used for the mining of learning content. In this direction the embodiment of dynamic features in e-learning applications as well as the establishment of standards for the reusability and codification of content are of critical importance.

The development effort for the preparation of content for e-learning purposes is time and cost consuming a fact that forces reconsiderations of static approaches in e-learning. Learning Management Systems are the typical products in the e-learning industry and several applications dominate in the Market (Lotus Learning Space, WebCT, Blackboard).

The pillars of performance in e-learning are another critical issue. Knowledge management, e-learning pedagogy and application integration formulate a triptych of analysis. In the next years the estimation for the market growth of e-learning is extraordinary (Ruttenberg, Spickler and Lurie 2000; Urdan and Weggen 2000).

The technological pace does not differentiate the key issues of learning. Technology provides the means for the achievement of learning goals but the performance of learning has to be measured in learning terms. The advanced technological futures in e-learning applications can not always be understood from traditional learners. The compromise of functionality and

sophistication in e-learning applications very often is decided according to technological limitations. Limited bandwidth and other technological constraints did not permit in the past the realization of interactive learning scenarios.

In general the above statement describe several open issues for e-learning. To sum up, interactivity, codification, personalization, customization, metadata, motivation, collaboration and technology are the key variables for the enhancement of performance. The selection of technologies that will allow the highest possible performance is a research question. The potential of iTV to enhance e-learning is set at the center of this paper.

3. Digital Television

Digital television describes any TV service that facilitates two-way communication between the viewer and content providers (Espial, 2001). Digital television is defined in two quite different ways that can often be confused. In one sense, it refers to the digital transmission of television signals by TV operators. In other words, the term digital television refers to the signal-type used in broadband multimedia transmissions, as opposed to the analog signal used in traditional television broadcasting. But in this sense, it means several relatively new TV formats – for example high-definition television (HDTV) and interactive television (iTV) – that digitization renders more feasible (Kenyon et al., 2000).

3.1 Interactive Digital Television

The convergence of Digital Television and interactivity leads to **Interactive Digital Television.** iTV combines the appeal and mass audience of traditional TV with the interactive features such as those currently available on the Web (Developer, 1999) and offers new possibilities for the viewer, who can directly access relevant information and other services being just 'one-click' away.

Interactive Digital Television provides a range of new services that combine video and data and give viewers greater control over what they see, in comparison with other traditional services. Moreover, ITV permits consumers to combine the full motion TV with the interactivity and personalization offered by the Internet (Dalmas et al, 2001).

The main characteristics of iTV are the following:

- **Personalization:** in iTV refers to the use of technology and viewer information, in order to tailor interactive content to each individual viewer profile (Lekakos et al, 2001).
- **Digitization:** refers to the technological advancements that allow better quality of sound and picture (Kenyon et al., 2000).
- **Interactivity:** The term 'interactivity' means that control moves away from the networks and is directly placed into the hands of the potential consumer (Watheieu and Zoglio, 2001).

In the near future, a variety of interactive services are going to be included in the range of applications of DTV, which will change drastically the viewer's experience. ITV will enable viewers to read more about the topics presented during the show, to playback, download and store interactive documentation and use video-on-demand applications. These services are going to generate new revenue sources for the main stakeholders of DTV environment (Dalmas et al, 2001). Still, the success of business' strategies will largely depend upon the viewers' demands and preferences to use these interactive services (Lougos et al., 2002).

4. Considering the Potential of t-Learning

ITV is considered as the convergence of two different technologies: Television and Computer technology (and more specifically the Internet). In figure 1, the convergence of three different fields is depicted: PC[1], TV and Learning. In the course of formulating a taxonomy of possible modes of integration, we will initially present some thoughts concerning the use of computers, television and broadband technologies in learning.
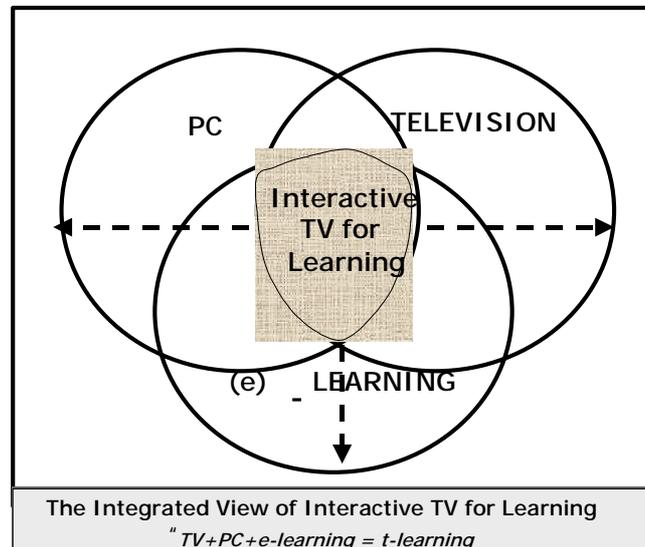

Figure 1: convergence of PC, Television and e-learning

When considering the application of e-learning in an iTV platform, the attributes of iTV mentioned in the previous section could serve as follows:

- First of all, **Personalization** in terms of t-learning suggests that a potential learner-iTV viewer could easily tailor a selection of available t-learning services according to his/her interests. The ability to tailor the service in terms of topics and language, as well as selecting incoming newsletters and updates can help the viewer filter knowledge, and make its acquisition more targeted and effective.
- The **Digitization** that iTV offers is essential to any e-learning- and therefore, t-learning- application. High quality sound and picture are prerequisites to this kind of services. The quality that comes along with iTV is of high standards, and is therefore a very important factor for the successful visualization of knowledge.
- Finally, the **Interactivity** attribute of iTV offers the ability to interact with other actors in the learning system, such as other learners.

In the following section we are going to examine the viability of learning in the environment of iTV, basically by drawing upon previous studies that have examined the provision of interactive services through iTV. Afterwards, we are going to examine how the major capabilities of each medium - Television, PC and ITV – affect the learning process. In this section we will present the added value of ITV in comparison with the other two mediums.

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[1] Implies PC with Internet connection

4.1 Previous Studies Predict the Success of t-Learning

So far, learning and educational services have been applied in the Internet environment. Currently, there is a trend for learning services to be provided in iTV. A number of studies predict the success of learning interactive services through iTV. These studies are presented below:

- According to a research conducted from Telecom Media Networks (Makarem, 2001), interactive TV will not be widely used in the business world. Its primary role is seen as an entertainment device. However, both consumer and business users see Interactive television as a tool for e-learning.

- According to a European Commission Report (1999), it is an interest of many governments to make learning more widely available to their citizens. There is a trend in our era for people to be able to request access to learning procedures any time and any place. Thus, the provision of learning services through iTV has the potential of reaching millions of people at a place and at time that is convenient to them.

- Furthermore, the results of a survey conducted at the Athens University of Economics and Business, indicate that the main factor motivating audiences to use Digital Television in Greece is related with entertainment and escapism reasons. These conclusions should be taken into consideration from service creators that have the responsibility for creating interactive services in the environment of DTV. The main objective of these actors should be the creation of useful interactive services that should be accompanied by entertainment and informative functions. Moreover, each stakeholder of digital television should not forget that it remains an entertainment medium and that they should create interactive services that extend the entertainment function of digital television (Lougos, 2002).

- In another study conducted by the Athens University of Economics and Business, a series of interactive digital TV services were further examined. The results indicate that respondents seem to rate as 'very important' those services that offer important information in real time (i.e. trigger alerts or personalized information) and as 'less important' the services related to interpersonal communication. This suggests that at this particular moment viewers prefer to use DTV as an information-type of medium rather than communication (Lougos et al, 2002). These results enforce the provision of learning services that include informative and educational content.

4.2 The facilitation of Learning by the three Media: PC, TV, iTV

The following table summarizes the most critical elements of three different media (PC, TV and iTV) that determine their potential for facilitating e-Learning practices.

Channels / Mediums			Opportunities for contribution to key learning issues
Personal Computer	**Television**	**Interactive Television**	
▪ Access to Web Pages ▪ Use of CR-ROMs	▪ Enhanced multimedia content ▪ Educational Games	▪ Interactive Content ▪ Personalized and customized content ▪ Motion and visuals	**Content**

		can be combined in a single format	
▪ Difficult to motivate remote users ▪ Cost/Benefit compromise	▪ People are more familiar with TV -> Interactivity can be gained as motivation is evident	▪ Combines the technology of PC and the viewing experience that TV provides	**Motivation**
Potentially high, but unfortunately the solutions are static. Flexibility can be fostered with advanced profiling and customization techniques but usually the e-learning implementation is limited to the customization of a platform.	TV in the traditional case is not flexible. Programs are directed and scenarios are predetermined. Educational programs usually present a scenario that limited interaction is permitted	High flexibility. Audience is more active.	**Flexibility**
Limited based on quizzes Limited, there is no evidence for the achievement of educational goals	Rather inadequate. The absence of interactivity on TV limits the potential of evaluation.	Interactive TV gives answers to the problem of the evaluation of an e-learning application. Under research	**Performance**

Table 1: Characteristics of PC, TV and iTV and their implications for Learning

It should be noted that iTV's added value to learning does not only reside to its technological features, but also to the fact that it is still TV. In other words, the high penetration and acceptance of TV have already established a potential market for iTV's acceptance. Furthermore, considering the fact that iTV will not be more complex to use in comparison to TV, viewers should be familiar with the technology, and therefore quickly become familiar with it.

5. Applying the Learning Path in the Case of iTV

In the case of Interactive TV the phenomenon of learning sets a context that the value of integration can expand the value diffusion for learners.

In figure 2, the process of learning is separated in three stages, namely planning, executing and evaluating (Lytras et al, 2002a). In each of these integrated stages three steps describe the underlying logic of the main goal of each stage. Interactive TV technology can support the whole spectrum of learning. The several integrations depicted in figure 2, formulate a context of possible contribution from iTV.
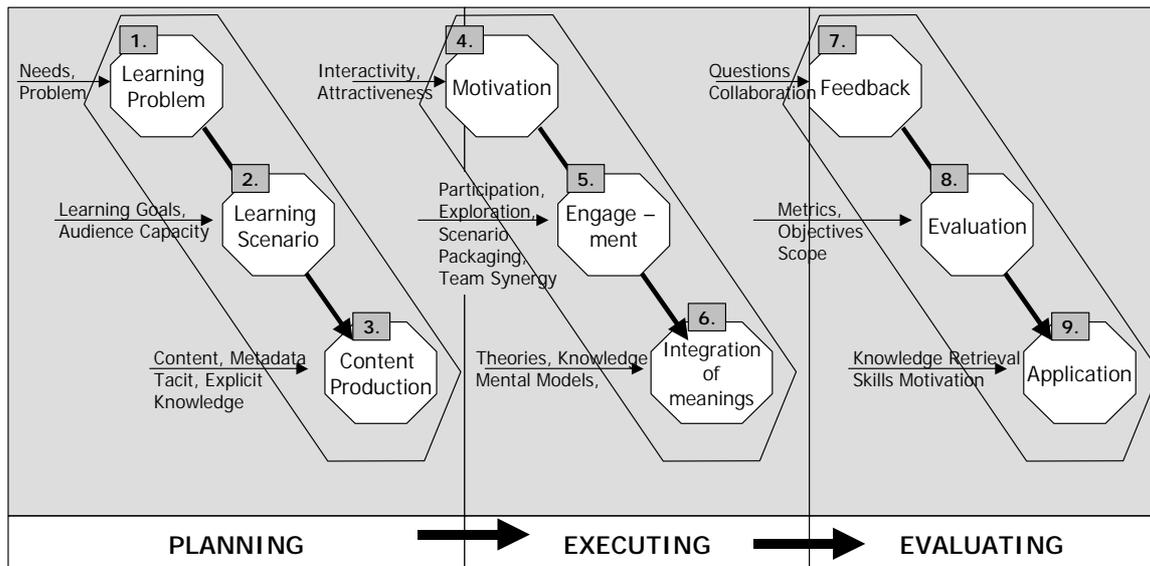
Figure 2: The learning path: A histogram of integrations

- **Planning:** In the phase of planning, a specific problem or a specific topic requires the development of a learning scenario that consequently has to diffuse learning content to learners. The anticipation of needs, and the specification of learning objectives in conjunction to the audience cognitive level drive the detailed specification of the learning problem and the learning scenario that promotes the solution of the stated problem. In any iTV initiative this stage is of critical importance. The development of content is not haphazard since interactivity has to focus on the learning goals. Compared to traditional TV or PC technologies, in interactive TV the packaging and the codification of tacit knowledge is much easier since the movie-like presentation of content is similar to story telling approaches that are used in tacit knowledge capturing and presentation.

- **Execution:** In the execution of learning the effort paid in planning has to be realized as value for learners. Interactive TV is suitable for increased motivation since the multimedia features and the extended interaction choices fit in the habits of learners. The same stands for the engagement of learners. The flow of content in interactive TV permits different manipulations of interactions. The scenario is not static and predefined but the learner is able to change the flow of content diffusion.

- **Evaluation**: The next step following execution is the integration of meanings. Multiple theories and knowledge artifacts can be integrated in order to provide new meanings. In Interactive TV the integration is applicable in a fascinating manner since the show can combine Video, stored information in computer systems, profiling data, personal information, and other elements. In the evaluation stage, iTV has to analyze and to provide modes for supporting feedback to learners, evaluation alternatives (self evaluation, community collaboration, experts advice etc) as well as application scenarios that test the effect of learning scenario to real word situations. Several Interactive Learning shows could be based on the idea of games that require from participants (players) to use the learning outcome of their previous learning

experience. In such games televiewers from home could facilitate push or pull models that create several business opportunities for revenues.

The following table (table 2) presents the t-learning path.

Phase	Sub-phase		
	Learning Problem	Learning Scenario	Content Development
Planning	▪ iTV has subscribers whose profiles can be developed. ▪ Learners can be reached easier through iTV and push and pull models can be implemented.	▪ The variety of media of iTV facilitates the development of scenarios closer to learners needs.	▪ iTV requires more effort in terms of development costs. ▪ TV scenarios have to take in to account how a tele-viewer can learn.
	Motivation	Engagement	Integration of Meanings
Executing	▪ ITV motivates through multimedia and show features. Its eye-catching approach attracts learners.	▪ ITV is not a panacea. The engagement methods require a detailed analysis. The way that learners are engaged in learning scenarios through a remote control or an advanced keyboard is not as simple as it sounds. The higher the engagement the higher the retention and the willingness of learners to pay for iTV learning services.	▪ The media convergence that interactive TV permits increases the opportunities for integration of meaning. ▪ ITV support and e-learning modes that target on groups. A community building is a common model on iTV.
	Feedback	Evaluation	Application
Evaluating	▪ The feedback in iTV can be immediate. The iTV-learning model is interactive and two-way communication is the key advantage. Feedback is facilitated through direct response on learners needs.	▪ Evaluation through iTV refers to capabilities for analyzing the profile of learners and their attitudes after the execution of learning. A number of interactive role playing games can be used in order to test the effect of learning.	▪ Having in mind that iTV can promote several "reality" games, a combination of simulation and application in reality games can expand further the learning effect.

Table 1. the t-learning path

6. Conclusion

In this paper, we have made an initial evaluation of the potential of the convergence of iTV and e-learning. Our examination starts from the important issues that concern e-learning, and then evaluate how iTV technologies can address them, in order to see whether iTV can

facilitate e-learning. Afterwards, we have proceeded in discussing the elements of iTV that can add value to e-learning, thus make t-learning an more effective and convenient process.

What has become apparent from the discussion in this paper is that the field of t-learning sets a new research area, that expands the current e-learning and iTV research agendas. We propose the following future research directions:

- The creation of advanced learning services within the iTV environment. It is necessary to examine how e-learning applications can be established on an iTV platform. This agenda should include both the customization of existing e-learning services on iTV environment, and the creation of new services that iTV can facilitate. An obvious issue is the personalization that iTV offers through the convenient TV interface, which can provide with effective and filtered learning practices.
- The examination of business exploitation of t-learning services. The deployment of t-learning business models and pricing models is necessary.
- The enhancement and possible integration of various technological advancements, in order to promote more advanced t-learning practices, such as the use of cameras from the viewer's side, in order to enhance the interaction of actors in an online t-learning application.

Furthermore, the above research directions pose various social issues, which also create important research questions:

- The social identity of viewers/learners, plays an important role for technology adoption, therefore should be considered in the design of services.
- Issues of ethics have to be considered within the frame of t-learning. As in all e-learning implementations, equity, legality, privacy and justice should be taken into consideration, in terms of both technological and design of the service to be offered (Chozos et al., 2002).

We expect this paper to form the basis for a more extensive study of the issues that affect the medium of iTV to support e-learning.

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