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INTRODUCTION

This book *The impact of new technologies on distance learning students* addresses a crucial dimension of educational provision: the expenditure on educational technology of the 27 Ministries of Education in the European Union and of Ministries of Education and Higher Education throughout the world, for their schools, colleges and universities.

If it cannot be proved that there is an impact of technology on learning and if it cannon be proved that this impact is beneficial then this expenditure is without justification. As recently as 2005 the World Bank claimed 'The positive impact of ICT use in education had not been proven. In general, and despite thousands of impact studies, the impact of ICT use on student achievement remains difficult to measure and open to much reasonable debate.'

The book takes a different approach to other studies in the field in that it concentrates on the impact of technology on learning in adult education, lifelong learning and distance education. In this context it has a special focus on distance education. Much previous work in the field has focused on the impact of technology on learning by children in schools.

The book has a matrix structure. One branch of the matrix is provided by studies of the five forms of distance education technologies used in the study: distance education systems electronic distance education (usually referred to as e-learning), synchronous e-learning the se of the World Wide Web on-campus and mobile learning. The other branch of the matrix is supplied by two studies of the impact of technology on learning by men and women and by younger and older learners.

This book was published with the assistance of the European Commission through its Leonardo da Vinci programme. The statistical appendices on which this book is based are found on the project website at:

http://www.ericsson.com/thecompany/company_facts/businesses/programs/the-impact-of-new-technologies-on-distance-learning-students

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THE IMPACT OF TECHNOLOGY ON EDUCATION — THEORETICAL AND METHODOLOGICAL ASPECTS

Benedetto Vertecchi

Background

It is clear that communication technology affects learning, as it is clear that such an influence directly or indirectly affects any other aspect of people's lives and of social activities.

In few decades, the conditions of living have significantly changed, notably in industrialised countries. As a baby is given birth, an organised space is open in the memory of the automatic archive of the register of personal data in the locality where the event took place. At first, that memory space only gives little information (when and where the birth occurred and data on the civil status), but it will be constantly enriched with new information as life goes on. At the same time (when the services to the population are not integrated), something similar happens in the health services archives and in the archives providing information on children facilities (e.g. the organisation of nursery schools and, a few years later, of kindergartens and primary schools).

Up to this point, it is simply a matter of gathering and organising information supporting the organisation of social services. In these activities, the use of information technologies and its advantages are immediately perceived by all. Other uses of technology are less evident and single individuals are more or less aware of it depending on their culture and experiences (some can simply imagine that something happens, others may exactly know how it happens). As soon as he is born, the above-mentioned baby undergoes various check-ups, most of them supported by automatic equipment. Several productive sectors are interested in acquiring information on newly-born children, such as industries producing children food, medicines, clothes or toys.

Since his first months of life, the baby is surrounded by a variety of stimuli differently produced or transmitted through technological equipment. He is reached by sounds and images produced by audio and video digital equipment, but he is also surrounded by a control apparatus, which is made possible by technological development: smoke detectors, environmental thermostats, gas leak detectors. If he wakes up in the night, a microphone will reveal his cry to his parents. Ad hoc programmes will consent to establish growth conditions, such as the increase of body weight and height. Those same programmes can establish if the relation between the variations regarding body mass and nourishing is correct or if changes are to be introduced.

Such a pervading presence of technology since the very first days of life can be not specifically noted for several reasons. The first one is that technology provides for solutions once differently obtained: instead of recording the birth of a child in a digital memory, a paper form was filled in. Later on, intermediate technologies were introduced, such as punched cards or tapes. The register of personal data (which brings back the image of a sheet or a card containing data on the person it is referred to) is always a register of personal data (at least for its functions), however it is no longer a paper form, but a set of memory locations.

All the strata of the population are immerged in a technology-dominated context. Children play technological games before going to kindergarten. Boys and girls have created a real communication subculture with the introduction of a new syntax and a new style for e-mail communication or for sending short messages through mobile phones. They seem to be in the van of communication because they organise group interactions in various fields, from humanitarian interventions for the victims of natural disasters to mutual help in assembling a motorbike. Adults start to understand not simply the limits (on the contrary, they have the impression to be at the beginning of an indefinite development whose further direction is unknown), but also the potentially risky implications of the pervading presence of technology: nobody can be sure of the real respect of privacy because one can be localised just by having a mobile phone in his pocket, be it on or off, or by using a credit card.

Technology is no longer or not just a way of developing that facilitates complex operations and contributes to the improvement of life conditions, it becomes a moral and political issue involving individual and collective life dimensions. We have tried to sketch out a complex scenario. But we are not supposed to dwell upon it now. The abundant references to experiences common to both children, adults and old people are necessary to understand if and how it is possible to define something that can be identified as the *impact* of technology on education. This was, indeed, the intent of the research whose results we are about to discuss. Well, the answer is a positive one. An *impact* of technology on education can be identified by following a much more complex path than one would imagine at first. It is not sufficient to compare two situations, the one characterised by the absence of technology in organising and proposing an educational message, the other qualified by this very presence, because this would lead to ignore that technology is hardly separable from other conditions of daily life. But one should wonder if and how much people's attitudes and cognitive styles are being modified by a progressively widening exposure to technological stimuli; and which effects (not necessarily positive) can be linked to technology-centred experiences.

This last issue needs a deeper remark. As in the case of any other proposal presenting itself as a complex construction based on a progress made by scientific research, technology is wrapped in a *positive* halo. Regarding behaviour, the adoption of styles resorting to unusual resources gives rise to phenomena of *modernisation*. But modernisation is not always and not necessarily the sign of a positive evolution. The association between

uniformly positive implications and phenomena of modernisation is equivalent to accepting an interpretational synecdoche making the meaning of words narrower and limited to a single part of it, the one containing those implications considered as positive in the general sensitiveness. Hence, research has the task to reconstruct a correct conceptual space in which meanings are considered in their whole extension. And this is a difficult task because it clashes with the social uses of language aiming at narrowing the range of meanings (e.g. in advertisements or in political language).

The research design

The complexity of research clearly emerges when the reasons that made it difficult to practise a traditional data-collecting model as the one represented in figure 1 are critically considered.

Figure 1. A traditional model for collecting data on the changes occurring in a given context due to an intermediate variation.

Such a model implies that those changes that are introduced in the intermediate steps (variations) correspond to aspects, which are totally absent from the initial situation. In other terms, if the research concerns the impact of communication technology on learning, it should be possible to define an initial situation in which a group of people has no experience with technologies, is not influenced by socially-shared opinions and has no expectations on the possible advantages. Since this research aims at defining aspects of learning, in the initial situation the statistical *population* of students is supposed to have no experience with communication technologies and no opinions on the usefulness that the use of such technologies presumably has in facilitating learning.

No convincing arguments are needed to demonstrate that it is not acceptable that a population of students has nothing to do with communication technology (at least in the countries participating in the research, and undoubtedly anywhere else).

Even if in the initial situation extraneousness to technology cannot be obtained, a *population* could be hypothetically imagined that has no experience with communication technologies used for acquiring information, that is for a sort of learning. In other words, the individuals included in the population under study could be supposed as being experienced in the use of communication technology, but inexperienced in the use of a specific technological resource or in the field in which such a resource is applied. This is a convincing hypothesis only if the individuals included in the *population* whose characteristics are being analysed are very similar to each other. For example, the research design could aim at verifying if the use of a resource or of a given procedure determines higher levels of learning than those obtained

with other resources or procedures. From the point of view of methodology, this means that both experimental and control samples are extremely reduced. The research hypotheses must be restricted in order to avoid the risk of confusing the roles that variables have from time to time. Time itself must be strictly necessary to develop a precise experience not affected by uncontrolled or unexpected variables.

Obviously, the methodological cautions are not to be applied to a research activity aiming at detecting the impact of communication technologies on education. In particular, it is necessary to consider:

- that it is unlikely to find a population of students that have no experience with technologies that;
- it is equally unlikely to find individuals involved in educational activities that have not yet developed a mature attitude towards communication technology;
- the attitude towards communication technology is highly influenced by a socially accepted common sense;
- such a common sense gathers and spreads the elements of an ideology of modernisation in which values precede the analysis of phenomena.

The research design becomes even more complicated if the above mentioned cautions are observed. But the quality of the knowledge that can be obtained is not comparable with the inappropriate inductions based on findings taken from investigations in which common sense interpretations prevail in formulating the hypotheses, defining the procedures, selecting the tools, evaluating the results.

The *Impact* project has opened new spaces for theoretical reflection and for the criticism of a research methodology concentrating on those aspects of communication technology in which the dynamic parts of the cognitive and affective profile of the individuals involved become relevant. As a first approximation, the linear pattern sketched in figure 1 is likely to be changed as it appears in figure 2.

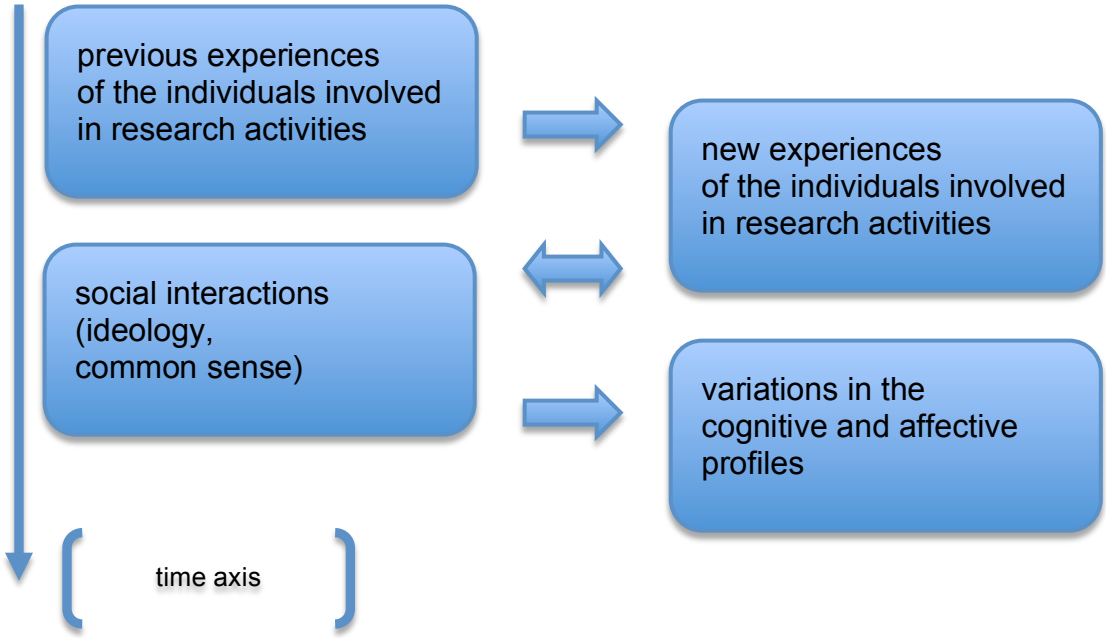

Figure 2. A model for identifying attitudes concerning the educational impact of communication technology.

When moving from the traditional model to the one represented in figure 2, changes intervene in the interpretations of the variations taking place in the intermediate steps where given phenomena occur. Considering the experiences made by the individuals involved in the research and the influence that social interactions have on those experiences, it is no longer possible to formulate a linear interpretation because the studied phenomena express a variety of mutually interacting factors. Consequently, establishing a cause-and-effect relationship between technology-centred experiences or procedures and the changes that can be observed in the population profiles would be an excessive simplification. Instead, we should wonder about the incidence of social interactions on the attitudes towards communication technologies, notably in the widespread attribution of values. Language has been adjusted to express a common sense in which the acceptation of new proposals is independent of the manifestation of original thinking.

The quality of the variables

Raffaele Lambruschini was one of the main interpreters of the educational needs of the XIX century, the age of the Italian Risorgimento. There is at least one aspect of his thought that is worth remembering here. Lambruschini worried about the effects that the interactions with parents, relatives and servants could have on the education of children and young people. Hence, he used to look after children from the age of three and to take care of their education until they were eighteen. In that long span, contacts between parents and children were allowed three days a year only. Our interest is not in how Lamborghini scheduled educational activities; it lies in his understanding that *causes* (in the sense of the educational methods effectively and explicitly practised) and *effects* (the results of education) could be connected only if no additional *cause* (or additional *variable*) was

introduced in the intermediate phases thus affecting the original design. In other words, if children's conditions in acceding to education could be considered as *independent* variables (with *pre-assigned* values) and the educational choices represented additional *independent* variables concerning the *process*, a relation between dependent and independent variables could only be established if no other independent variable (as the interactions with people not included in Lambruschini's educational design) intervened in modifying the experience conditions (figure 3).

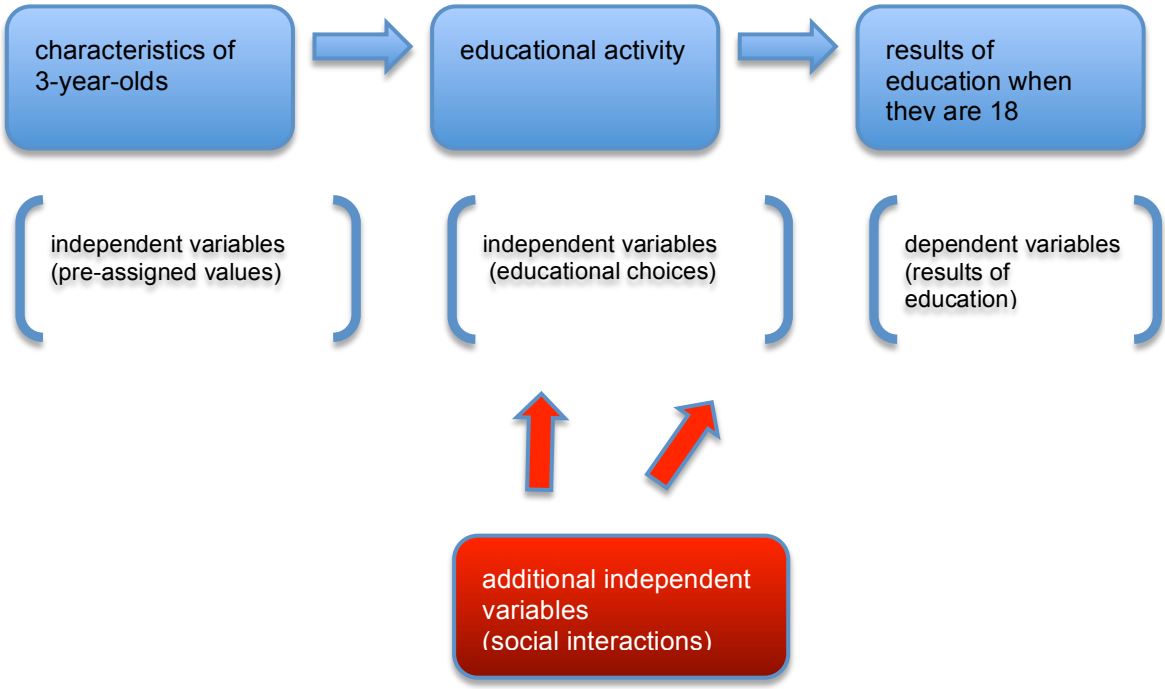

Figure 3. Additional variables interfering with the *explicit* educational activity (in Lambruschini's hypothetical situation).

If it is true that situations presenting extreme characteristics are the ones in which specific aspects are more visible, Lambruschini's attempt to protect children and young people's education from external influences proves that he was aware of the number of variables affecting education, only a part of which is explicitly predictable and determines the expected outcomes, while all the others often alter the intervention on education and the resulting effects.

Lambruschini's experience is worth remembering for the analogies with the *Impact* research. A study of the characteristics of a students population with no experiences of communication technology and with a neutral attitude towards it recalls Lambruschini's need to protect children and adolescents from variables that could have affected his educational design. If such a population existed (but this is an unreal hypothesis), the study of the impact of information technology would be extremely simplified: two *samples* (C1 and C2) would be selected from the population of students with no experiences and with a neutral attitude. C1 and C2 would have the same characteristics. Therefore, if these characteristics correspond to V1, V2…Vn, we will have

V1(C1) = V1(C2), V2(C1) = V2(C2), Vn(C1) = V1n(C2). The experience with communication technology would represent the process independent variable distinguishing the experience of C1 (*experimental* sample) from the experience of C2 (*control* group). If the dependent variables (i.e. the variables whose values are calculated at the end of the activities) are named D, we will have the three following hypotheses:

Hp1 D(C1) > D(C2)
Hp2 D(C1) = D(C2)
Hp3 D(C1) < D(C2)

If Hp1 is confirmed, then the dependent variables detected in the sample using information technology (C1) have more positive values than those of the control group (C2). If Hp2 is confirmed, the resulting conclusion is that experience has produced no effects. Finally, the confirmation of Hp3 would mean that the use of technologies has produced negative effects.

However, this schematic interpretational pattern is not applicable to complex phenomena as the educational ones, in which most effects depend on the kind, intensity and quality of the interactions among the people involved in specific experiences. In other words, when studying the impact of communication technology on educational phenomena, it is necessary to consider cognitive variables (which levels of learning can be associated with technological solutions?), affective variables (how does technology affect motivation to learning? Which attitudes can be directly associated with the use of technology? And which attitudes reflect generally accepted opinions that are independent of proofs or demonstrations?) and relational variables (how do social attitudes affect individual attitude?)

The impact of technology and the ages of life

Separating cognitive, affective and relational variables is not an easy task. Undoubtedly, the use of technological resources is rapidly expanding, but this takes place in contexts where the expectation is often highly ahead of the time when possible technological solutions are directly experienced. Different attitudes are also correlated with different ages (and this is not a synchronous phenomenon because attitudes vary with local contexts and their social, cultural and economic characteristics). Such differences can depend on the inurement that people of different age have to technologies and related behaviours. Younger people have experienced technologies since their first years of life (toys, videogames). They have learnt how to use technological resources together with or even before they were able to establish a link between technological solutions and subsequent conceptualisations (e.g. making arithmetical operations without realising what is being done). More and more, digital memories are substituting biological memories and machines operations are replacing the individual ability to do the same operations. In other words, young people's adaptation to technology is a mainly unconscious "debit-and-credit" result: operating and acceding to sources is increasingly rapid, but in parallel autonomy is partially lost (a tolerable part, hopefully).

The case of less younger people is different. Apart from those who are involved in the development of technology for professional reasons, scarcely critical attitudes, sometimes close to magic, are still common. Though a study as the *Impact* one primarily aims at detecting young people's cognitive and affective issues referred to technology, the attitudes of less younger people have inevitable consequences on the others.

The first, main objective of the study on the impact of technology on the population is the identification of attitudes, which are likely to be connected with its use. But ours would be an incomplete study if limited to attitudes. It is necessary (and highly recommended) to investigate those aspects of the cognitive and affective profiles individuals are less aware of, but whose relevance emerges when they are considered in the whole population. Two important fields have already been remembered: the relation between the use of digital memories and the evolution of the biological memory on the one hand; the variations already occurred or actually occurring in the ability to make demanding mental operations (starting from the arithmetical ones).

Formal and informal experiences

Personal devices for automatic information processing began to circulate quite recently: the first desktops appeared on the market about thirty years ago. In these three decades, contradictory trends were registered:

- in the initial phase, modernisation associated with the use of automatic equipment involved culturally, socially and economically elevated strata of the population;
- afterwards, the phenomenon was generalised so that today – in the industrialised countries – there is at least one computer in each household and the great majority of children and adolescents own one. In other words, as computers have become more and more widespread, the necessary cultural levels to make use of it have lowered. On the other hand, owning a computer is no longer an income indicator and even prices have dropped;
- the social division characterising the diffusion of the first computers partially happened in the Nineties as well, when the first web technologies appeared. But even for web technologies, the trend was similar to the previously identified one.

Today, an online connection is a recurrent element in the developmental environment of children and young people and, even more, of university students and participants in vocational training. The shift from a *specific* element connoting a context to an *environmental* element (as a fridge or a television) must be accurately considered from both points of view: cognitive and affective. In fact, this shift presumably corresponds to cognitive experiences with technologies in which *informal* learning prevails on *formal* learning. On the other hand, communication technology itself makes the amount of possible messages largely grow. A *selection* can be made among

these messages (if this follows explicit criteria, learning has a more formal character); otherwise, one can simply undergo an exposure whose outcomes are not easy to define.

The difficulty in establishing the impact of communication technology increases as informal learning prevails on formal learning. In a sense, this supremacy is to be considered for its anthropological implications rather than for what specifically concerns technology. In formal learning, communication is mainly based on subject-oriented knowledge, while in informal learning, the notion of *culture* changes: it is no longer referred to a knowledge identifying and interpreting events and explaining phenomena; it refers to a set of information giving a practical knowledge, but not conducting the exploration of causes.

A complementary serendipity

The huge amount of data collected with the *Impact* project will be discussed further in this report. On the whole, such data meet the original project demands. Through the design and creation of an innovative set of tools mainly centred on the use of the Likert scale, attitudes towards technology were reconstructed and the existence of a widespread common sense on communication technology was admitted. Attitudes represent an affective and behavioural development of this common sense (figure 4). Nonetheless, the research was gradually enriched with new possible reflections and lines of enquiry: while the reconstruction of the attitudes corresponded to the project hypothesis, the attempt at conceptual reconstruction and methodological design joined with the impact analysis is a sort of *complementary serendipity*. In fact, if on the one hand the project demands have been met, on the other new dimensions have emerged (and this is the *complementary serendipity*).

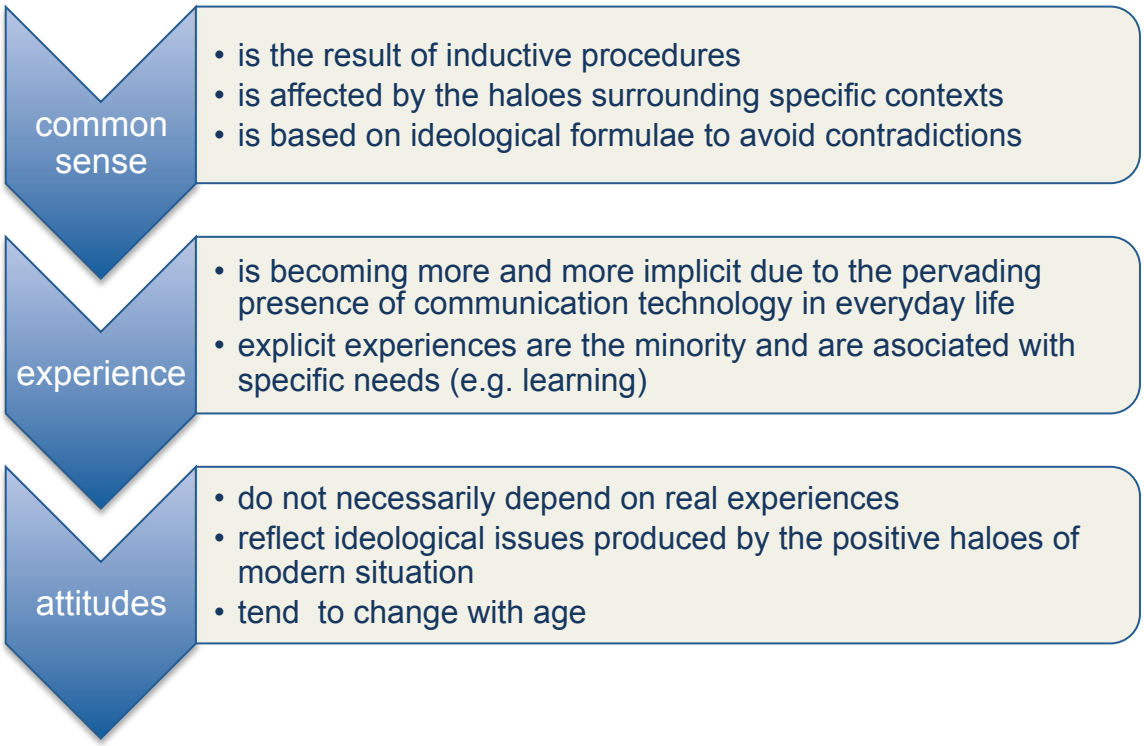

Figure 4. Aspects of the research on attitudes

Overcoming the linear interpretation lying at the basis of critical interpretations as the one represented in figure 4, is a result of the *complementary serendipity*. The development of new hypotheses needs a shift from a linear interpretational pattern to a circular one in which the interactions unceasingly modifying experiences and attitudes are considered within a common sense less subordinate to ideology.

Regarding methodology, this means that those variables that in a linear interpretation are independent or dependent, in the circular pattern take on one role or the other in relation to space and time. A notion of technology which is fundamentally abstract because it is neither placed in a line of development, nor referred to specific social conditions, is replaced by a new and conscious one that can revise, enrich and continuously reorganise its interpretational repertory.

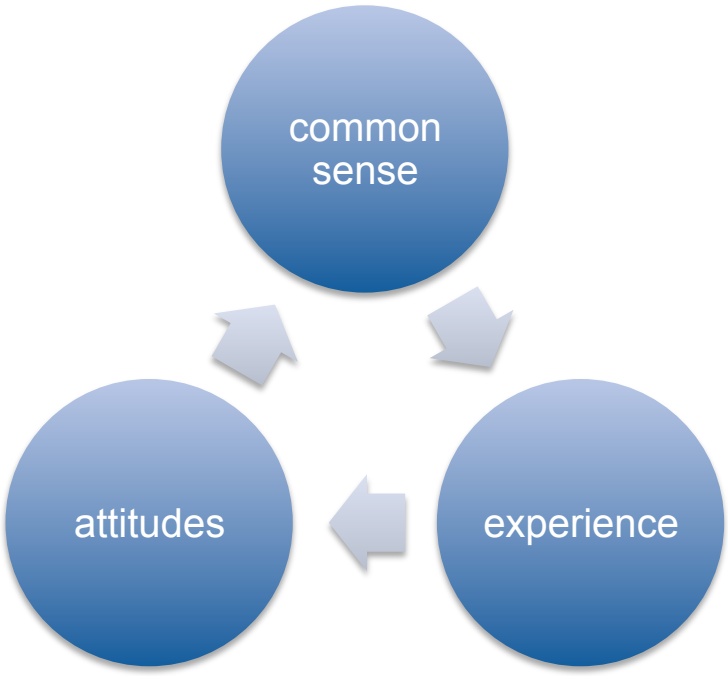

Figure 5. Circular interpretational pattern

The move from the linear to the circular pattern is mainly important when technology is applied to education. The quality of educational processes has a positive connotation when they imply a profound conceptualisation supporting critical attitudes towards reality. However, a criticism involving the contents of learning without considering how educational mediation took place would be an odd one. But this is a problem to be tackled in a new project.

RESEARCH METHODOLOGY AND APPROACH

Francesco Agrusti, Bernd J. Krämer and Nevena Mileva

Introduction

As we get deeper in the information age, traditional ways of learning and knowledge acquisition are challenged with rapidly changing technologies. The growing entanglement of work and education imposes pressure on individuals and universities. Adult learners are increasingly seeking for pervasive study opportunities.

Universities are pushed to provide custom self-instructional course materials and flexible tutorial support relying on the Internet and advanced ICT to give learners maximum control over both the place and time of learning. Thus the traditional distinction between off-campus education in distance and open universities and on-campus study becomes blurred. However, the impact of these changes on adult education is not well understood and systematic knowledge that helps educators to exploit technology to the advantage of their students is rare.

In this chapter, we first give an overview of the IMPACT project's approach to elicit such knowledge. Then we present a first set of findings about higher education students' opinion on the impact of the use of ICT in open and distance universities. These results are derived from a quantitative analysis of data acquired through an international survey that involved students with and without distance learning experiences.

Distance Education: Then and Now

Studying and learning anytime and anywhere is an idea that reaches back to the 19th century, when Anna Eliot Ticknor founded the Society to Encourage Studies at Home to provide study opportunities for US women on the basis of correspondence instruction (Ticknor, 1891). Much later, distance education approaches evolved with the advent of radio and tv broadcasting and possibilities to record audio and video. But only after the early success of the British Open University a wave of foundations of distance teaching universities in Europe and the United States during the 1960s and 1970s provided real alternatives to traditional on-campus higher education. Their special mission is higher education off-campus serving particularly students who have part-time or full-time jobs, family obligations or other reasons that prevent them from studying on campus.

In Europe and elsewhere, developments in information and communications technology (ICT) throughout the last decade have substantially changed

distance education environments (Krämer, 1997). The traditional correspondence- or tv-based style of distance teaching was enriched with (interactive) educational media (Krämer & Wegner, 1998), Web-based courses, Internet-enabled synchronous and asynchronous communication and collaboration (Qu & Nejdl, 2001), computer-based tutoring systems (Rosi et al., 2000), Internet-based assignment and assessment systems, learning management systems, and other ICT-based services. Learning on the move with mobile devices stretches the concept of anywhere-anytime learning even further by use of the wireless Internet and other wireless communication facilities and supports the seamless continuation of interaction when the learner is away from the desktop PC (Bull et al, 2004; MLEARN BOOK, 2008). Virtual reality environments can supplement traditional laboratories with remote or simulated experimentation sessions (Duro et al., 2008) or provide a visual and interactive test bed for distant engineering students (Kötter et al., 1999). More recently, social software and participative tools that evolved in the context of Web 2.0 have been successfully used in technology-enhanced learning (Ulrich et al., 2008).

Distance Education in the Context of New Media and Information and communication Technologies

But how has the use of these technologies in different forms of distance education been perceived by the students? What effects did the use of ICT in distance education have on the students' learning process? Distance universities use these technologies to support blended learning scenarios through the inclusion of more synchronous and cooperative learning experiences, while more and more campus universities exploit e- and m-learning opportunities for off-campus learning. Thus the differentiation between (open) distance universities and campus universities becomes blurred. But does this evolution affect the attitude of a wider public towards distance and self-paced learning? Is a degree from an open or distance university considered mainstream now? Does the quality of distance education compare with that of traditional campus education? At the beginning of the project we did not know how people think about these questions because empirically founded answers to these and similar questions were not available in the area of adult education. Very recently (Ellis, 2008) presented the results of a PhD dissertation that investigated the "Satisfaction of Graduate Students with their Distance Learning Experience" empirically. The focus of this study is different from ours because it addressed students' satisfaction with respect to management, organisation and pedagogical issues of distance education at the graduate level.

In the following sections of this chapter we are going to present the methodological approach of the impact project and major findings related to our empirical research of people's opinion on the impact of technology on learning, in general, and on learning in open and distance teaching universities, in particular.

Objectives and Reseach Context

This research project aims to compensate the current lack of research information on the impact of technology on adult education, in particular, in the context of distance learning and lifelong learning. This book addresses different contexts of the use advanced technology in learning and teaching at universities and vocational institutions. It focuses particularly on the growing field of distance education. According to Desmond Keegan (1990), distinguishing characteristics of distance education include the:

- Separation of the teacher from the learner(s)
- Use of technical media supporting communication and collaboration among students and their teachers;
- Influence of an educational organization.

In this study we investigate empirically:

- Students' views about the value of ICT and its actual and potential role in distance education;
- A list of opportunities that might be enhanced by ICT on learning in distance education.

The overall approach of the project is depicted in Fig. 1. The project plan was designed after a detailed literature study (Keegan et al., 2007) that revealed the need for systematic knowledge helping educators to exploit technology to the advantage of their students. The proposed research methodology was a series of randomized controlled trials using questionnaires and statistical analyses as research instruments.

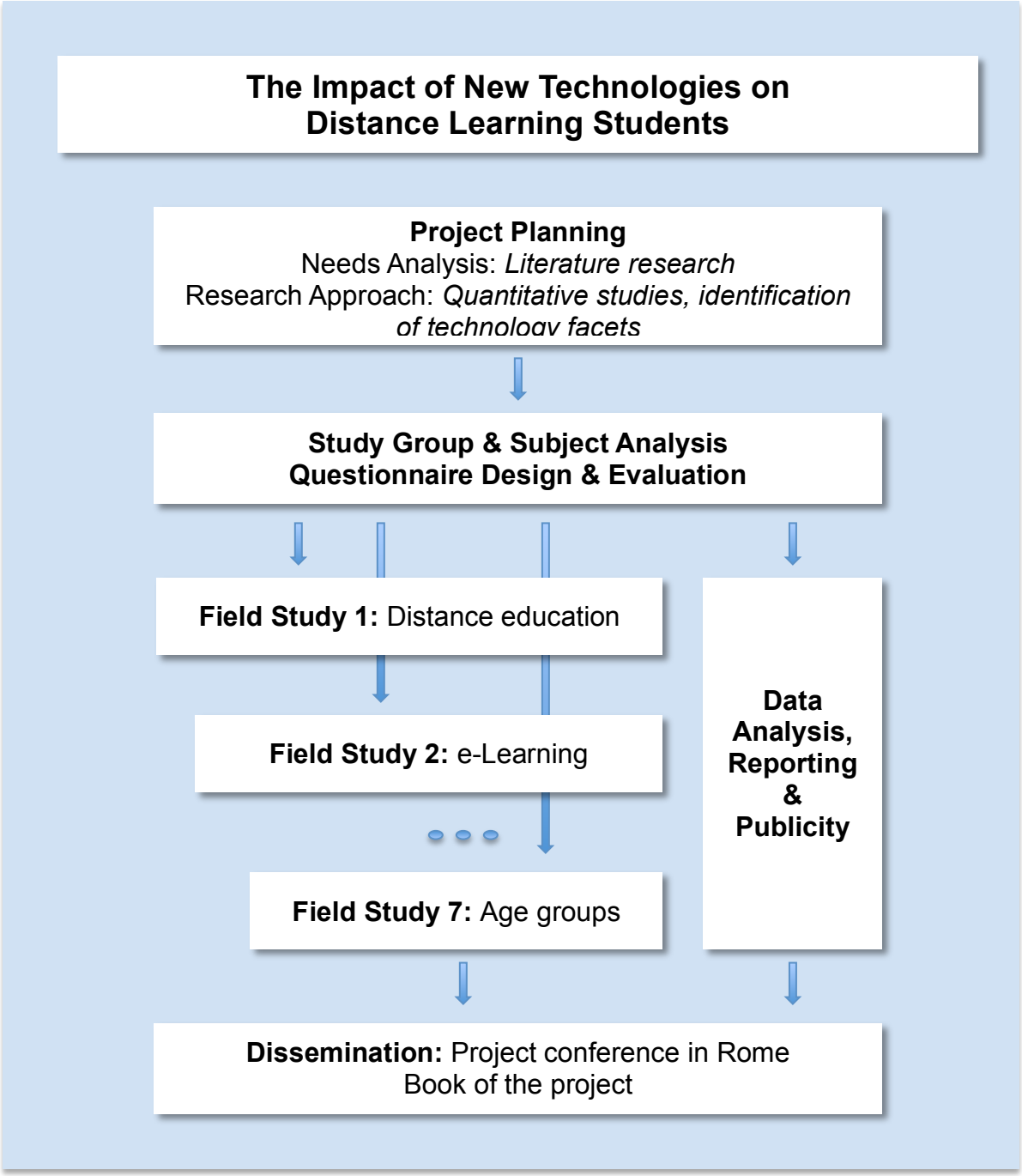

Figure 1. Project planning

Aims of the Project

Distance education is a rich and complex sector today comprising five major fields of education and training provision that are detailed here for the first time:

Distance education –providing education and training at a distance by Open Universities, distance education institutions and a growing number of distance education departments of conventional institutions

E-learning – providing education and training via the WWW for students who study mainly independently using learning or course management systems or virtual learning environments like ILIAS, Moodle or WebCT, respectively.

Synchronous e-learning systems – providing education and training on the WWW to students who study mainly in groups using LMSs with elaborate synchronous communication features like Centra or Horizon Wimba.

Blended learning – using the WWW and ICT for the provision of education and training on university and college campuses as a supplement to lectures and Instructor Led Training (ILT) given on campus or, alternatively, as a substitute for lectures when the courseware is provided on the WWW in the institution in place of lectures.

Mobile learning – providing education and training on PDAs (including palmtops and handhelds), smartphones and mobile phones.

Along these axes of education and training provision, the project pursues a series of workpackages whose ultimate goal is to present a set of findings that help instructors understand the implications of various technologies for their students, and to provide research-based principles for how instructors can best use technology in their teaching. As mobile learning has been extensively investigated before by a previous project led by nearly the same consortium, the first four facets of distance education are the focus of this work.

Project Consortium

The project consortium represents a good mixture of cultures including western, central, eastern and southern Europe. It represents an interesting combination of target groups including campus education of young adults, distance education with a large number of working professionals at a mean age of 29, and vocational training focused on business and technical experts. Correspondingly the type and intensity of technology in the learning process varies to great degree.

Corvinno, Hungary, is an independent, innovation and consultancy company based in Budapest. Corvinno Technology Transfer Center is leading prestigious research projects in the field of ICT. It is disseminating its results through conferences and publications. The Information Technology Foundation of the Hungarian Academy of Sciences assists with the Scientific Co-ordination of the project ensuring that the methods used are consistent and that the methodological principles are respected. It has developed experience in e-learning, synchronous e-learning virtual classrooms (using Centra Symposium), WWW on campus and mobile learning development and contributes expertise and data in these fields.

Distance Education International, Ireland, has made extensive contributions to the literature of distance education and e-learning, has participated in a wide

range of European projects and has edited the world's only series of academic volumes on distance education. Distance Education International provides the scientific research co-ordinator, whose main role is to ensure that the methods used for observing and collecting qualitative and quantitative data are accurate and that the methodological principles (particularly those that ensure that the results are comparable and valuable) are respected. The publications of Distance Education International in distance learning became required reading for scholars throughout the world and were constantly cited in books and journal articles and became set texts for postgraduate university degree programmes in distance education on all continents. It also provides data and expertise especially in the fields of distance education, e-learning, synchronous e-learning virtual classrooms and mobile learning.

Ericsson Education Ireland is part of Ericsson, the telecommunication infrastructure provider. As part of Ericsson Global Services, Ericsson Education is one of the leading providers of training solutions to the telecoms industry. It has led a number of EU research projects, most notably in the field of mobile learning. Ericsson provides expertise and project data on corporate learning and technology. They have developed expertise, especially in e-learning, synchronous e-learning virtual classrooms and mobile learning.

FernUniversität in Hagen, Germany, is the only public distance teaching university in Germany serving also other German speaking countries in Europe. FernUniversität provides its 43,000 students with a range of university degrees. The project team from FernUniversität has pursued and led a range of R&D projects on learning technology both at the European and national level and is involved in higher distance education of computer science and engineering students for 15 years. FernUniversität provides expertise and data, in particular, on distance education, e-learning and mobile learning.

Plovdiv University, Bulgaria, is a leading cultural and scientific institution in Bulgaria, the largest institution of higher education in Southern Bulgaria, and the second largest Bulgarian university, after St. Kliment Ohridski University of Sofia. The University of Plovdiv has considerable expertise of the impact of technology on learning and contributes expertise and data especially in the fields of distance learning, e-learning and the use of the WWW on-campus.

University of Rome III, Italy, The Universita degli Studi Roma III is a major Italian university. It is Italy's leading provider of university courses in distance learning. It provides data and expertise especially in the fields of distance learning and e-learning and the use of the WWW on-campus. The Dipartmento di Scienze dell'Educazione of the Universita degli Studi Roma Tre was the first Italian university to launch distance education courses in Italy.

Research Methodology and Approach

The research methodology proposed by the project to test the impact of the introduction of new technology on adult learners was randomized controlled

trials. The methodology used will be based on randomised controlled trials that are well designed and implemented plus the quantity of the evidence needed. Randomised controlled trials are studies that randomly assign individuals to an intervention group or to a control group, in order to measure the effects of the intervention.

The process of randomly assigning a number of individuals to either an intervention group or a control group ensures, to a high degree of confidence that here are no systemic differences between the groups in any characteristics except one – namely, the intervention group participates in the intervention and the control group does not.

Therefore the resulting differences of outcomes between the intervention and the control group can confidently be attributed to the intervention and not to other factors. In this instance, in the project we proposed: the 150 students in the intervention group and the 150 students in the control group to be supplied equally by all the partners.

Methodology: Principles and Approach

The research methodology employed was organized in stages:

1) Collect problems to be investigated from partner institutions

2) *Form a sub-committee of experts in data analysis in social sciences whose task was to*:

- Develop a conceptual model guiding the data analysis and
- Devise a questionnaire based on the problems contributed in stage 1).
- Review, test and approve the questionnaire by all the project team
- Administer the questionnaire to the six target groups after translating it into the local language – if necessary.
- Assemble the responses acquired by each institution and perform suitable data analyses.
- Evaluate the analysis results and present them in a comprehensive report

A range of statistical analyses were applied to the collected data including descriptive statistics covering the whole population of respondents, t-tests comparing the intervention and control groups, non-parametric correlations, cross-tables or variance analysis.

Conceptual Model

The task of the project is to give the concerned audience an answer to the question: what's the ICT added value to the distance education. In fact, we should measure the impact of ICT on a specific Learning Environment in 6 different forms (organizations)

Our hypothesis are:

- A great deal of technology is used in the education of adults
- There is a widespread hope/dream/belief that this has a positive impact on distance learning environments

This may be represented by outcomes. Through the use of ICT:

- students develop an appropriate level of capability,
- become more engaged with their own learning, and
- achieve learning outcomes across the curriculum at a higher level.
-

ICT is used to support pedagogical practices that provide learning environments that are more Learner-centred, Knowledge-centred, Assessment-centred, and Work-oriented.

We should use indicators for these outcomes (indicators that show us if we'll reject the hypothesis or accept, if the ICT has added value to the distance education in its 6 forms):

- Build knowledge and connect to the work place
- Promote active learning and authentic assessment
- Engage students by motivation
- Provide tools to improve student performance
- Support high-level thinking
- Increase learner autonomy
- Increase collaboration and cooperation
- Provide learner-centered approach
- Overcome physical disabilities

Conceptual Model again

We use the four levels of Kirkpatrick's evaluation model – a well-known and often used model in education or training evaluation practice. According to this model, we can identify four themes to which the investigation should provide replies:

Reaction of learners – did they like and enjoy the education using ICT; did they consider the education relevant; was it a good use of their time; level of participation; level of effort required to make the most of the learning; perceived practicability and potential for applying the learning.

Learning is the measurement of the increase in knowledge or intellectual capability – did the students learn or experience what intended to be thought or experience.

Behaviour is how the students applied the learning and changed their behavior – did the students put their learning into effect when go to the work place; were the relevant skills and knowledge used; is the learners aware of their change.

Result evaluation is the effect on the learning organization – quantifiable aspects of organizational performance like students' drop-out, failures, quality ratings, achievement of standards and accreditations, growth.

Research Topics

The themes connected to the four levels model:

- WWW as an obstacle to learning (Learning)
- The technology added an important component to the course (Behaviour)
- Studying in computer-enhanced courses is better (Reaction)
- The incorporation of technology in courses damages learning (Learning)
- University degree and certification (Results)
- Technological solutions are capable of overcoming the isolation in which a considerable amount of the learning activities in distance education take place (Behavior).

A distance education student can only recognize errors of interpretation committed during the course of study after a serious delay (Reaction/Learning)

Our research questions connected to the themes and indicators are:

- How does exposure to and use of ICTs in the learning process affect present and future employment?
- What is the impact of learning methodology used in learners' achievement and motivation?
- What is the impact of ICTs in education/training on access, use of, attitudes toward, and learning outcomes?
- How can ICTs be used to present, comment on and discuss learners' performance, and what are the implications of such impact?
- Are some subjects better suited for ICT integration than others?

Questionnaire Design

> "Statistical designs always involve compromises between the desirable and the possible." (L. Kish, 1987)

Building on a comprehensive literature analysis (Keegan et al., 2007) and professional expertise of project team members, a conceptual model and framework questionnaire were first developed in a sub-committee of experts in data analysis in social sciences. The questionnaire was then reviewed and tested by the project team. For each of the distance learning modes listed above and the variables gender and age, an own questionnaire was derived from the framework questionnaire. Prior to performing the surveys in different European countries represented by the consortium, the questionnaires were translated into the local language to avoid language problems among the respondents. The series of surveys, data analyses and reporting activities

were organized in 7 work packages, each led by a different consortium member.

Each questionnaire consisted of three sections. Sections 1 and 2 were the same for all seven questionnaires, while Section 3 was focused on the special field of investigation, e.g., e-learning or gender. All questions were closed using a typical five-level Likert item. Section 1 elicited personal information including occupation, age, gender, level of education, degree of exposure to advanced technological equipment, and perceived changes of work habits affected by technological advancements (see Table 1).

Table 1: Items 1 – 6: Questions to the personal background

Item 01: What is your occupation?
Item 02: What is your age grouping?
Item 03: Gender?
Item 04: What is your level of education?
Item 05: To what extent have you used advanced technological equipment in your professional life?
Item 06: Have you had to change your way of working because of technological developments?

Section 2 investigated experiences with technology-enhanced learning and personal judgments of its use (see Table 2).

Table 2: Questions in Section 2 on the impact of ICT on learning in general

Item 07: Thanks to technology, the problems of access to learning for students with disabilities have been resolved.
Item 08: Contacts between students and teachers can have the same intensity in online education as in face-to-face education.
Item 09: Online communication allows increased amounts of communication between teachers and students when compared with other forms of education.
Item 10: Only optimistic people think that the impact of technology on learning is beneficial.
Item 11: From my personal study experience I find that the impact of technology on learning is valuable.
Item 12: ICT has usually been used to encourage us to be active participants in learning.

Item 13: ICT has been used to support the development of higher level thinking skills such as synthesis and problem solving.
Item 14: ICT has been used to support more individualized learning programmes tailored to our own individual needs.
Item 15: Learning is enhanced when text and pictures are integrated in a multimedia environment.
Item 16: Educational games motivate learners and contribute to developing skills such as Teamwork.

The details of the different work packages will be treated in detail in the following chapters. In a conference paper (Schulte & Krämer, 2008), the results of the first three surveys are presented and significant differences in the responses to the identical Sections 2 are discussed.

Intervention and Control Groups

In all surveys the project adopted a widely used rule of thumb that requires a sample size of 300 people with 150 in the intervention group and 150 in the control group in each survey. The members of the intervention group were supposed to have experience with the current topic of the questionnaire, e.g., with distance education at a higher institution, while the members of the control groups were selected such that they lack such experiences. Experiences with technology-enhanced learning were expected to vary in these groups. Each consortium member was involved in each survey. The data were collected in a standardized Excel format at each site and sent to Francesco Agrusti at Roma Tre who integrated all data and analyzed them professionally with the help of SPSS. Each work package leader was then in charge of interpreting the results and presenting them in a comprehensive report. The reports and an annotated bibliography are available on the project website.

The main characteristics of intervention and control groups have an effect on data analysis:

Questions from 1 to 6 constitute the general personal background section (gender, age, education, occupation, use of technology, change for technology). The variable Main group / Control group has been added. Nevertheless, it is important to highlight that groups of respondent were not randomly sampled, and they do not correspond to any definite population. In this sense, it would be better to define the process of selecting respondents as a *judgmental* sampling and the second group as the *comparison* group.

Variables as Gender or Occupation are nominal variables, because it is possible only to distinguish respondents by a particular feature. Variables as Education or the items in Likert format are ordinal variables, because it is

possible to sort respondents by the quantity of a certain characteristic that they have. Variables as Age are continuous variables, because it is possible not only to sort respondents on the basis of a feature but also to individuate a fixed distance between two of them on the scale. Due to the type of variable, it is possible to choose the kind of analysis more appropriate.

Before analysing data, we recode all the items and the last two variables of Personal background into a ascendant positive scale. This means that a positive feeling towards technology corresponds always to an higher numeric value (i.e. 5), while a negative opinion corresponds to a lower numeric value (i.e. 1).

Analysis of Data Collected

The total sample size of the study was average 300, which was nearly equally distributed between two groups: the intervention group with 150 and the control group with 150 samples. Different analyses were applied to test:

- Experience of distance learning methods
- Perceptions of the use of ICT in distance learning
- Opportunities offered by use of ICT in distance learning.

A descriptive analysis of the intervention and control group and cross-tabulation was performed to understand the characteristics of both groups and to find homogeneity and differences between them. Cross tabulations helps us to look at the relationships between nominal and ordinal variables.

Frequencies analysis contains the count for each variable of the different answers. It also contains percentages and Bar Charts. It considers all the respondents.

Crosstabs analysis contains, for each of the six Personal Background variables, a summary table of the answers in each of the remaining items. Cross tabulations help to look at the relationships between nominal and ordinal variables. The file includes also Chi square and comparison Bar Charts. The Chi Square gives us the measure of the statistical significance or probability value and it tests the hypothesis that the row and column variables are independent or unrelated one to another. In order to say that the relationship is statistically significant, the p-value has to be as small as possible. The value used is less than 0.05 (confidence level of 95%). It is necessary to look at the “Pearson Chi square“ row in the “Asymp. Sig.” column. If the p-value is less than 0.05, this means that there is a low probability that the differences we have found are due to chance.

T-test analysis allows us to compare the means of two groups. Considering the Main and the Control Group, we found the means of all values and indicate whether these differed. Applying the T-test, we found whether these differences where significant or not.

This coefficient allows us to correlate two ordinal variable. In the analysis, we applied it to all the items. It gives us the direction of the relationship (positive or negative) and the its strength. The significant values have a flag in the table presented. To interpret the strength it is possible to refer to the following indications (Mullis, D. (20049 Doing Quantitative Research in Education with SPSS. London: Sage, p. 145):

- +/- 1 weak
- +/- 3 modest
- +/- 5 moderate
- +/- 8 strong
- over 0. +/- 3 very strong

It is important to remember that the fact that two variables are related one to another does not mean directly that one is the cause of the other.

The analysis of variance (ANOVA) allows us to compare the mean score of a ordinal (with many scale points) variable between different groups. It works by comparing the spread (variance) of the group means with the spread of values within the groups.

In ANOVA we can use one or more Independent variables, but they all have to be nominal or ordinal. If the Independent variables have more than five groups, ANOVA quickly starts to loose its power to discriminate between them. ANOVA uses a test (the F-test) to determine whether there are significant differences between the means of the groups. A cut off point of <0,05 used as a rule of thumb to determine whether or not our relationship is significant. The F-test is a global test, this means is that if we find a significant difference (p-value <0,05) all we know Is that overall there is a significant difference somewhere in the comparisons between the groups.

The test we used here is to find which comparisons are significantly different is the Scheffe test. A significance level (p-value) is calculated for each test. For example, in the document called “One-way Anova Age” we have a significant p-value from the F-test for the question “Contacts between students and teachers can have the same intensity in online education as in face-to-face education” (value 0,015 < 0,05). This means that we have a significant difference somewhere between the groups.

As we can see in the Post Hoc Tests, in the row of the same question at the column labelled ‘Sig.’, we have a p-value of 0,036 what means that it is highly significant, so it is likely that the associated group (41-50) differ significantly from the 25-29 group.

An other example, more significative, could be the one at the question “Information and communications technology has been used to support the development of higher level thinking skills such as synthesis and problem solving”: here the group 24-younger is significantly different form all the others groups.

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THE IMPACT OF TECHNOLOGY ON STUDENTS AT OPEN AND DISTANCE UNIVERSITIES

Bernd J. Krämer and Daniel Schulte

Introduction

As we get deeper in the information age, traditional ways of learning and knowledge acquisition are challenged with rapidly changing technologies. The growing entanglement of work and education imposes pressure on individuals and universities. Adult learners are increasingly seeking for pervasive study opportunities. Universities are pushed to provide custom self-instructional course materials and flexible tutorial support relying on the Internet and advanced ICT to give learners maximum control over both the place and time of learning. Thus the traditional distinction between off-campus education in distance and open universities and on-campus study becomes blurred. However, the impact of these changes on adult education is not well understood and systematic knowledge that helps educators to exploit technology to the advantage of their students is rare. In this chapter, we first give an overview of the IMPACT project's approach to elicit such knowledge. Then we present a first set of findings about higher education students' opinion on the impact of the use of ICT in open and distance universities. These results are derived from a quantitative analysis of data acquired through an international survey that involved students with and without distance learning experiences.

Evolution of Distance Education

Studying and learning anytime and anywhere is an idea that reaches back to the 19th century, when Anna Eliot Ticknor founded the Society to Encourage Studies at Home to provide study opportunities for US women on the basis of correspondence instruction (Ticknor, 1891). Much later, distance education approaches evolved with the advent of radio and TV broadcasting and possibilities to record audio and video. But only after the early success of the British Open University a wave of foundations of distance teaching universities in Europe and the United States during the 1960s and 1970s provided real alternatives to traditional on-campus higher education. Their special mission is higher education off-campus serving particularly students who have part-time or full-time jobs, family obligations or other reasons that prevent them from studying on campus.

In Europe and elsewhere, developments in information and communications technology (ICT) throughout the last decade have substantially changed distance education environments (Krämer, 1997). The traditional correspondence- or TV-based style of distance teaching was enriched with (interactive) educational media (Krämer & Wegner, 1998), Web-based

courses, Internet-enabled synchronous and asynchronous communication and collaboration (Qu & Nejdl, 2001), computer-based tutoring systems (Rosi et al., 2000), Internet-based assignment and assessment systems, learning management systems, and other ICT-based services. Learning on the move with mobile devices stretches the concept of anywhere-anytime learning even further by use of the wireless Internet and other wireless communication facilities and supports the seamless continuation of interaction when the learner is away from the desktop PC (Bull et al, 2004; Keegan, 2007). Virtual reality environments can supplement traditional laboratories with remote or simulated experimentation sessions (Duro et al., 2008) or provide a visual and interactive test bed for distant engineering students (Kötter et al., 1999). More recently, social software and participative tools that evolved in the context of Web 2.0 have been successfully used in technology-enhanced learning (Ulrich et al., 2008).

Professional Development, Continuing Education, and Self-Organised Learning

Independent of all these technological advances, open and distance universities have always played an important role for continuing adult education and the professional development needs of executives and professionals who want to update or expand their professional skills or make a career change. A large proportion of distance students does not aim at a formal degree but just seeks to improve their performance or acquire specific competences in a narrow field. To support this clientele, open and distance universities often liaise with employers in specific sectors and professional bodies to design and offer courses that match sector needs. FernUniversität's Faculty of Economics, for instance, offers add-on study programs for legal experts and engineers to raise the students' competencies in MBA topics. This faculty also cooperates with the financial sector and provides custom-designed continuing education courses on finance management and financial services. The Faculty for Mathematics and Computer Science liaised with IT industry to offer courses in control engineering with specific focus on programmable logic controllers.

Open and distance teaching universities particularly address "adults who have flexible and pro-active attitude towards learning and developing themselves (Stubé & Theunissen, 2008). The learner's expected role is that of a self-directed and self-motivated manager of personal learning (Collins, 2004).

Distance and Campus Education are Converging

Measured against a didactic expectation, the potential of the technological developments sketched in Section 1.2 cannot be overseen. The didactic expectation reads as follows (Arnold, 2008): What can these technologies offer to us in the sense of chances for the subject development with respect to competence development. (Arnold, 2008) recognizes two comparative advantages:

1. Comfort and
2. Individualization of learning.

The comfort and user-friendliness of digital media, for instance, allows lecturers to upload (excerpts of) the content of their lecture on a server and thus relieve students from the burden to take notes during the lecture or even allow them to skip class attendance (the latter is a characteristics of distance education).
The potential of an individualisation of acquisition paths takes into account that individuals learn in different ways and at different pace. The ideal is a properly designed learning environment that meets self-organized learners who take an active role and personal responsibility in the development of their skills and competencies.

But how have the students perceived the use of these technologies in different forms of distance education? What effects did the use of ICT in distance education have on the students' learning process? Distance universities use these technologies to support blended learning scenarios through the inclusion of more synchronous and cooperative learning experiences, while more and more campus universities exploit e- and m-learning opportunities for off-campus learning. Thus the differentiation between (open) distance universities and campus universities becomes blurred. But does this evolution affect the attitude of a wider public towards distance and self-paced learning? Is a degree from an open or distance university considered mainstream now? Does the quality of distance education compare with that of traditional campus education? At the beginning of the project we did not know how people think about these questions because empirically founded answers to these and similar questions were not available in the area of adult education.

Very recently (Ellis, 2008) presented the results of a PhD dissertation that investigated the "Satisfaction of Graduate Students with their Distance Learning Experience" empirically. The focus of this study is different from ours because it addressed students' satisfaction with respect to management, organisation and pedagogical issues of distance education at the graduate level.
In the following sections of this chapter we are going to present the methodological approach of the impact project and major findings related to our empirical research of people's opinion on the impact of technology on learning, in general, and on learning in open and distance teaching universities, in particular.

Context, Hypotheses, and Approach

This section summarizes, comments, and illustrates the content of a comprehensive report (Krämer, 2007) whose appendices include detailed results of the SPSS data analysis and different language versions of the first survey conducted in the Impact project. In this survey we collected data about personal backgrounds and experiences, we investigated preferences by querying more than 150 persons with experiences in distance education

forming the intervention group and more than 150 persons who had no such experience and who were assigned to the control group.

Study Design

The students involved in intervention group of the first study all had distance learning experiences. They were all enrolled at FernUniversität in Hagen. To cover cultural differences among different academic disciplines, students enrolled in four different departments were selected from FernUniversität's student database: law, educational sciences, business administration, and electrical engineering. Different levels of study experiences were addressed by selecting students both form undergraduate and graduate programs and from different semesters. We also tried to find an equal distribution among female and male students. The majority of students addressed studied part-time; only about 17% were full-time students. The questionnaire was administered to 1600 students at FernUniversität online for one month. 183 persons (a bit more than 11.4%) responded between May 7 and 29, 2007. All statistical analysis presented in this paper were produced with SPSS 13.0.

The control group was composed of 176 students who were relatively equally distributed across Plovdiv University (Bulgaria), Corvinno (Hungary), Roma Tre, the Cork Institute of Technology and Ericsson Education (both Ireland). The members of the control group had no experience in distance learning. The control group included Bulgarian and Italian campus students (in engineering and social sciences, respectively), faculty members at Corvinno, vocational students from Ericsson, and adult learners at Cork.

- The following assumptions guided the study performed in this work package:
- There is no significant difference in the judgment of people with or without experience in learning at an open or distance university that the use of technology in distance education can overcome several disadvantages of this study model including impeded interaction between tutors and students, indirect communication, or reduced opportunities for social interaction.
- It is widely accepted that the use of technology in higher distance education is beneficial for the student population at large and for special needs students in particular.
- It is widely accepted that the education provided by open university compares with that of campus universities and the degrees awarded by open universities are equally well recognized as those awarded by traditional campus universities.
- The objectives of this first empirical study of the Impact project was to determine whether the above hypotheses and the two central hypotheses of the project defined in Chapter 2, namely that technology has an effect on learning at distance and open universities and that this effect is beneficial, are actually observable.

Specific Questions in Part 3 of the IMPACT Questionnaire

The questions in Part 3 of the project's first questionnaire, which focused on the impact of technology on learning at open and distance universities, are listed in Table 1.

Table 1: Questions 17-21 related to the impact of ICT on learning in open and distance universities.

Item 17: The application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education.
Item 18: Technology facilitates easier access to material for those studying part-time.
Item 19: University degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities.
Item 20: There is no difference in learning outcomes between studying at an open university or at a traditional face-to-face university.
Item 21: Study at an open university is especially of advantage to adults who have work and family obligations.

Possible Limitations

Possible limitations of the study may include response bias, a low response rate, the fact that only one distance teaching university was involved, lack of experience of the respondents in the intervention group on the topic of investigation, and possible misinterpretation of certain questions and critical terms like technology-enhanced learning, synchronous e-learning. To reduce response bias, meaning that the respondents may not accurately represent the student population at large, students from all faculties at FernUniversität and all study programmes were selected and a nearly equal distribution between men and women was sought.

The response rate we observed for FernUniversität's students corresponds to the rates we usually have. FernUniversität was the only distance teaching university involved in the Impact project. With the given project resources and time were scarce, there was no realistic possibility to involve other distance teaching universities within Europe in this study. But the collective analysis data are accessible for further research and completion by external groups after the project is concluded. As all participants of the intervention group were students from FernUniversität, we can rule out the danger of lack of experience with distance education in general. This fact and the strong assumption that no personal experience about distance learning existed in the control group, encouraged us to raise more general questions about the recognition of degrees from distance universities and the effect of distance learning (Questions 19 and 20 in Table1). Whether sufficient experience with ICT in learning was available, was addressed in a few questions in Part 1 of the questionnaire (see Chapter 2 of this book).

To reduce a wrong understanding of the questions and introduction into the actual research topic, all questionnaires and introductory comments were

translated in the national languages of participating groups. For the specific topic of this investigation “learning at open and distance universities” no specific technology was addressed. The respondents could simply rely on their personal understanding of technology in (distance learning, which is not harmful as we did not conclude statements about a particular technology from the analysis results of Part 3 of the questionnaire (see Table 1).

Analysis and Evaluation of the Respondents’ Personal Background

Following the structure of the questionnaire, we summarize the findings derived from the answers to the items part by part. The findings to Parts 2 und 3, with the latter being focused on “learning in open and distance universities”, exploit a range of standard analysis techniques including descriptive statistics, cross tabulation, T-test and others.

Descriptive Statistics

Descriptive statistics capture the basic characteristics of the data collected. They provide simple summaries about the sample and the measures. The total sample size of the study was 359, which was nearly equally distributed between two groups: the intervention group with 183 responses from students of FernUniversität and the control group with 176 responses from students of the other five partners in Bulgaria, Hungary, Ireland, and Italy. The number of female respondents was a bit higher than male with 197 versus 162.

The total population of respondents exhibited the following characteristics: 66 people (18.4%) held a managerial position, 58 were technical employees (16.2%), 82 or 22.8% worked as teachers or trainers, 75 or 20.9% were full-time students, 23 were unemployed (6.4%), and 53 persons or 14.8% marked the item “other (e.g., retired)”. The mean age of the total population was slightly above 30. More than half of the respondents acquired a high school matriculation, 67 people have mastered one to three years of post-secondary education, and 110 indicated four and more years.

The answers to Item 5 “To what extent have you used advanced technological equipment in your professional life?” are depicted in Fig. 1. More than 84% of the respondents frequently use technological equipment in their professional life, 13.4% use technology rarely, and only 2.2 % have no access at all.

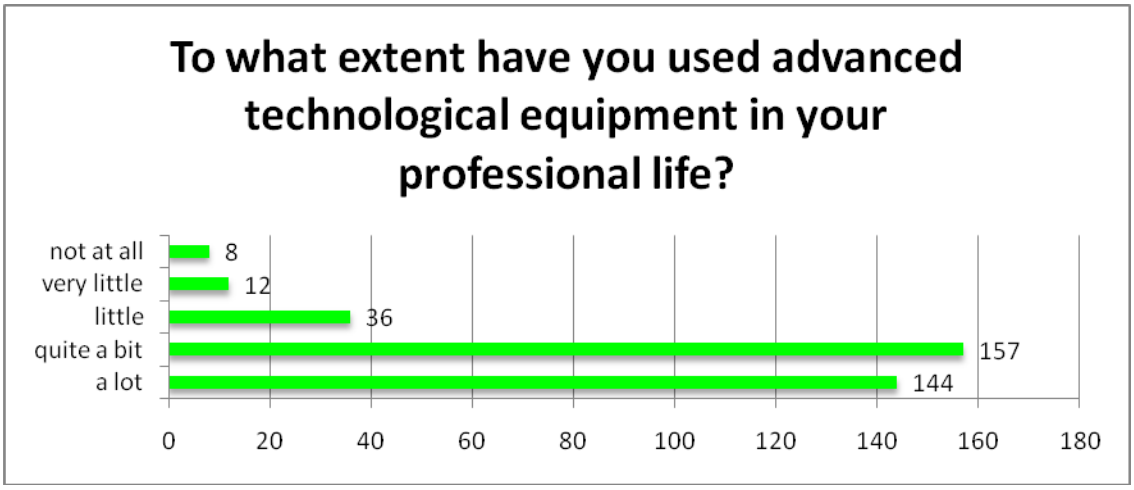


Figure 1: Frequencies of answers to Item 5 in Section 1 of the questionnaire

Interpretation of the Data

When comparing the figures about the respondents' personal background for the intervention and the control group, some interesting differences show up (see also Fig. 2): We find a similar fraction of people in a managerial position in both groups but far less technical employees in the control group. The control group includes more teachers and students, instead. The statistical significance is supported by a Pearson Chi-square value of 0.000, which lies far beyond the usual cut-off point of 0.05. Most likely, distance students have chosen the occupation "student" only if they were full-time students, while part-time students indicated their current profession. Indeed, more than 70% of FernUniversität's students are part-time students working full-time. The relatively large number of respondents in the intervention group who chose "other (e.g., retired)" as their occupation may be due to the fact that people were unsure whether their profession like solder, housewife, nurse, free lancer, social worker, policeman, or self-employed would fit into one of the other categories.

The age distribution is also different in both groups with a relatively homogeneous distribution among all age categories in the control group as opposed to a distribution with a centre at the age group of 30 - 40 years in the intervention group. In addition, the mean age in the control group is lower than in the intervention group.

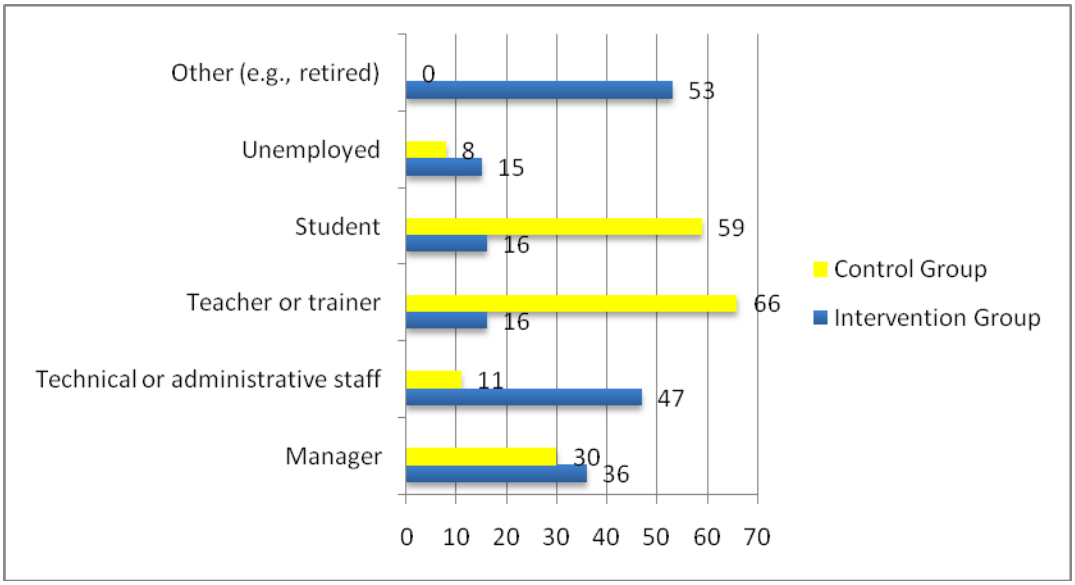


Figure 2: Distribution of occupations in intervention and control group

With 42 more female than male respondents the gender distribution is a little less balanced in the control that in the intervention group. A significant difference was detected with respect to the Item 6, which investigated the need to adapt to advanced technological equipment. On this item, the intervention group was affected more often. This may be explained by the fact that the intervention group includes relatively many technical employees and that the mean age in that group is somewhat higher. The determination of significant differences referring to the age of the respondents supports this assumption. The reason for this is that people in the age of 30 – 50 are likely to have changed their way of working because of technological developments (Item 6) more frequently than users below the age of 30. Furthermore we can observe that more male than female respondents use advanced technological equipment in their professional life, which was asked in Item 5, and – referring to the occupation managers and technical staff – less students use more advanced technological equipment in their professional life than other groups.

From these observations we can summarise that an overwhelming majority of respondents have been exposed to technological advances and had to change their style of working correspondingly. Hence, we can conclude that experience in the use of ICT does exist sufficiently to provide a solid basis for answering the questions in Parts 2 and 3 of the questionnaire competently.

Results on the Impact of Technology on Learning in General

Concerning the questions on the "impact of technology on learning in general" (Part 2 of the questionnaire, see Chapter 2), we can summarize the results as follows:

- 50% of the respondents believe that the "problems of access to learning for students with disabilities have been resolved thanks to technology" (Item 7), as opposed to only a small number of respondents (around 10%) who disagree.

- Nearly 60% disagree with the claim that “contacts between students and teachers can have the same intensity in online education as in face-to-face education” (Item 8) but only around 30% agree with it.
- Nearly half of the respondents agrees that “online communication allows increased amounts of communication between teachers and students when compared with other forms of education” (Item 9), while around 30% disagree with this statement.
- Nearly 60% disagree with the negative statement in Item 10: “only optimistic people think that the impact of technology on learning is beneficial”. Only around 20% agree with it.
- A large portion of respondents (nearly 80%) agrees that “the impact of technology on learning is valuable for their personal study” (Item 11).
- More than half of them agree that “ICT has usually been used to encourage students to be active participants in learning” (Item 12). Only a small fraction disagrees.
- More than 50% agree with the claim in Item 13 that “ICT has been used to support the development of higher level thinking skills such as synthesis and problem solving”, while only around 20% disagree.
- Again more than 50% agree that “ICT has been used to support more individualized learning programs tailored to their own individual needs” (Item 14), only around 20% disagree.
- A majority of respondents (around 80%) agree that “learning is enhanced when text and pictures are integrated in a multimedia environment” (Item 15).
- Around 70% agree that “educational games motivate learners and contribute to developing skills such as teamwork” (Item 16).

Cross Tabulating Intervention and Control Group

To discover the differences in opinions about the impact of technology on learning in general that experiences in open universities and distance education can induce, the answers of the two groups need to be compared.
Cross tabulations allowed us to reveal the relationships between nominal variables, such as intervention and control group or gender, and ordinal variables reflected by the items in Parts 2 and 3 of the questionnaire. (Nominal variables have different labels but no order, while ordinal variables are associated with values than can be ranked.)

A range of significant differences in judgement between members of the intervention and the control group were observed when cross tabulating the items of Part 2 with variable “group membership”. These differences are listed below:

- The statement in Item 7 that “problems of access to learning for students with disabilities have been resolved” is viewed rather positively in the intervention group, while agreement and uncertainty have a higher share in the control group and their values are nearly balanced. The higher degree of agreement in the intervention group could lie in the fact that distance students perceive the use of ICT more

than others as a means to bridge the physical distance between learners, lecturers and tutors.

- The attitude of respondents to the Item 8, which states that “contacts between students and teachers can have the same intensity in online education as in face-to-face education”, is rather negative in both groups with a significantly more positive trend in the intervention group. Again different experiences of distance students with respect to limited contact options in the past may have caused this difference.
- Concerning answers to Item 9, which states that “online communication allows increased amounts of communication between teachers and students when compared with other forms of education”, the degree of uncertainty is significantly lower in the control group than in the intervention group. The opinions are, however, relatively equally distributed between agreement and rejection. Here it is likely that participants in the control group are easier in finding an opinion because they – other than many distance students – have experienced other forms of education.
- The negatively formulated Item 10 about the “benefits of technology for learning” is negated in both groups by a majority of respondents (i.e., the benefits are recognized). But a significantly higher negation can be observed in the intervention group.
- The opinions to Item 14 that “ICT has been used to support individualized learning programs” and Item 16 that “educational games motivate learners” are seen slightly more positive in the control group. It could well be that ICT applications are viewed as additional offers and a supplement to other educational methods in the control group, while the intervention group considers them rather as a replacement for traditional forms of distance education.

Figure 3 below, which is adapted from (Schulte & Krämer, 2008) visualises these differences in attitude between intervention and control group.

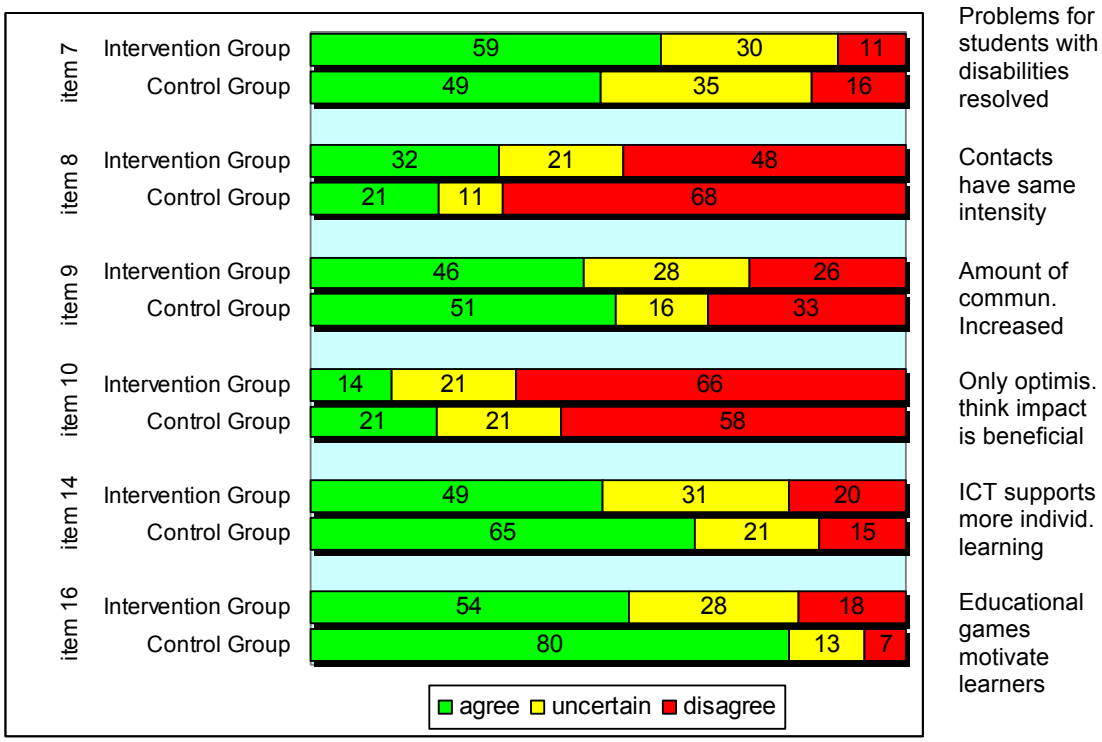


Figure 3: Significant differences between intervention and control group (values in percentage of valid responses)

Through cross tabulation, we also found a significant influence of variable gender on the judgment of Item 7: “Thanks to technology, problems of access to learning for students with disabilities have been resolved”. Female respondents exhibit a more positive attitude than male respondents and the number of respondents who are uncertain is less on the female side. Figure 4 illustrates this result in terms of a diagram.

Figure 4: The influence of gender on the judgment of Item 7: Thanks to technology, problems of access to learning for students with disabilities have been resolved.

The observation of more positive responses by women on the impact of technology on learning in general also applies to the answers to Items 9, 12, and 16 (see Table 2 in Chapter 2). This suggests that women exhibit a more optimistic attitude against technology in learning than men. The gender specific aspect of the impact of technology on learning for men and women was further investigated in a separated study presented in this volume.

Cross-tabulated with variable age, further statistically significant differences can be recognized for Item 7: “Thanks to technology, the problems of access to learning for students with disabilities have been resolved. Respondents in the age group 24 and under show a more negative attitude than those in the age range 25 to 29. Conversely, more people under 25 believe that:

- ICT has usually been used to encourage them to be active participants in learning (Item 12 in Table 2 of Chapter 2) and
- ICT has been used to support the development of higher level thinking skills such as synthesis and problem solving (Item 13).

Spearman’s Rho

Spearman’s Rho calculation serves to detect linear relationships between variables. Using this method, we found that the answers to the questions of Part 2 of the questionnaire (7 – 16 on the impact of technology on learning in general) are – as far as significant – positively correlated. For items 11 – 16 even a positively moderate correlation was detected significant for each combination of the six items. Whoever had a positive attitude towards at least one claim about the “impact of technology on learning”, exhibited a positive tendency towards the other items, too. Because of their intensity, the following correlations are of particular interest:

- An agreement with the claim that “contacts between students and teachers can have the same intensity in online education as in face-to-face education” (item 8) is moderately positively correlated to an agreement with the claim that “online communication allows increased amounts of communication between teachers and students when compared with other forms of education” (item 9).
- Respondents who agree based on their personal experience with the statement that “the impact of technology on learning is valuable” (item 11) also tend to support the thesis that “learning is enhanced when text and pictures are integrated in a multimedia environment” (item 15).
- Responses to the claims “ICT has usually been used to encourage students to be active participants in learning” (item 12) and “ICT has been used to support the development of higher level thinking skills such as synthesis and problem solving” (item 13) are moderately positively correlated.
- Answers to item 15 (*learning is enhanced when text and pictures are integrated in a multimedia environment)* are moderately positively correlated to answers to item 16 (educational games motivate learners and contribute to developing skills such as teamwork).

Results on the Impact of Technology on Learning at Open and Distance Teaching Universities

The focal point of this survey was to collect opinions about the impact of technology on distance education, the role of distance education for society and the recognition of degrees awarded by open and distance universities, and the comparative learning outcome.

Analysis in Brief

In brief, the analysis of the data collected on Part 3 of the questionnaire used in the study (see Table 1) produced the following results:

- Approx. 75% of the respondents agree, “the application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education” (Item 17 in Table 1; see also Fig. 5).
- Around 90% of the respondents agree, “technology facilitated easier access to material for those studying part-time” (Item 18).
- Around 50% agree “university degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities” (Item 19); disagreement ranges at 25%.
- No agreement can be determined for Item 20 (there is no difference in learning outcomes between studying at an open university or at a traditional face-to-face university).
- An overwhelming percentage of the respondents (~90%) share the opinion that “the study at an open university is especially of advantage to adults who have work and family obligations” (Item 21).

The intervention group largely confirms the improvement factors claimed in Items 17 and 18 with a higher value on the strong agreement and only around 7% of the respondents being uncertain. Disagreement is negligible with 10%. That degrees awarded by traditional face-to-face universities and open universities compare (Item 19) is also seen positively with a slightly higher value in uncertain and negative judgments. With respect to the comparability of the learning outcomes of both systems (item 20), agreements predominate with 85 respondents as opposed to 37 disagreements but the uncertainty factor is quite high with 61 respondents.

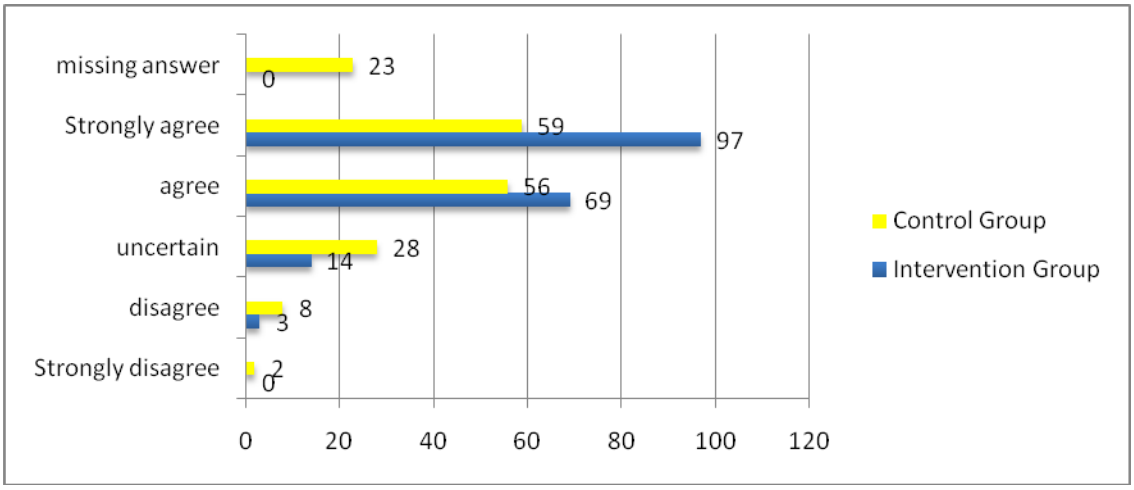


Figure 5: Opinions about Item 17: The application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education.

That “the study at an open or distance university is especially of advantage to adults who have work and family obligations” (Item 21) proves politicians true who encouraged and supported the installment of open and distance teaching universities in the 1970s and 1980s. 165 respondents strongly agree and 14 more agree.

An interesting observation related to the control group is the relatively high number of more than 20 missing answers in this section of the questionnaire, whereas this rate is below 5 otherwise.

Different Judgements in the Investigation and Control Group

In Part 3 of the questionnaire, which addresses experiences and opinions on learning at open and distance universities, differences in valuation between respondents in the intervention and control group are of particular interest because the former have experiences with the distance learning model, while the latter lack such experiences. Through cross tabulation and filtering of statistically significant differences by means of Pearson’s chi-square we obtained the results discussed below.
A striking difference shows up in the respondents’ opinion about the comparability of degrees awarded by face-to-face and distance universities (Item 19): The control group is much less certain about this aspect than the intervention group. More than 42% of this group are uncertain, while agreement and disagreement are nearly balanced. The intervention group shows a significantly higher agreement. The level of disagreement and uncertainty in the control group is nearly twice as high as in the intervention group (see also Fig. 6).

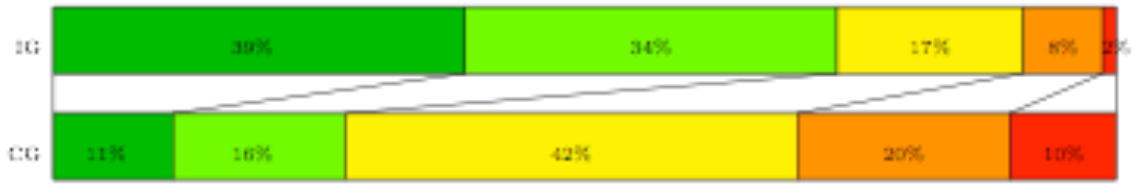


Figure 6: Differences in responses to Item 19 between intervention group (IG) and control group (CG): University degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities.

Results with respect to the quality of learning outcomes in both systems (Item 20) differ analogously. Both groups show differences in the distribution among the five answer categories (see Fig. 7). We also observe a higher percentage of doubt about the specific advantage of the distance study system in the control group than in the intervention group. This can likely be explained by the lack of experience of control group members.

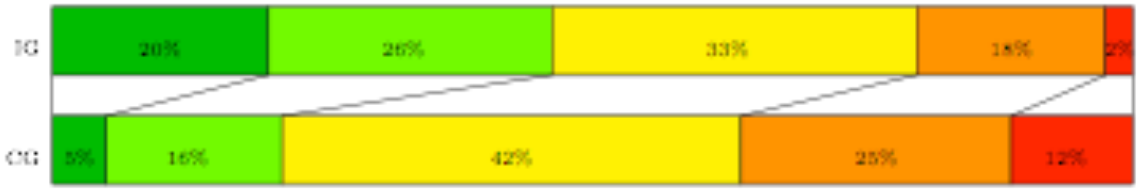


Figure 7: Different attitudes towards Item 20 “There is no difference in learning outcomes between studying at an open university or at a traditional face-to-face university.” between intervention and control group: University degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities.

The agreement to the claim: Study at an open university is especially of advan-tage to adults who have work and family obligations (Item 21) is overwhelmingly high in both groups. In the intervention group the agreement is even significantly higher than in the control group.

Different Judgements with respect to Selected Variables

When cross tabulating the responses to Items 17 - 21 with variables representing the respondents’ personal backgrounds, the following significant differences were found:

- Age: That “the application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education” (Item 17) is supported by more respondents between 30 and 40 years old than in other age groups. Users under the age of 30 have a more negative attitude than users at the age 30 – 50 towards the two claims “university degrees awarded by open universities may be comparable to degrees from

traditional face-to-face universities" (Item 19) and "there is no difference in learning outcomes between studying at an open university or at a traditional face-to-face university" (Item 20).

- Gender: More female respondents strongly agree, "the application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education" (Item 17, see Fig. 8).

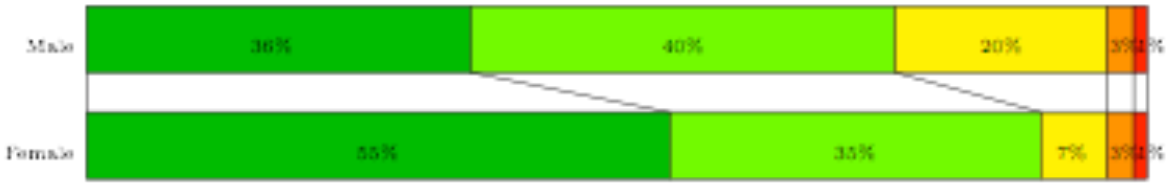


Figure 8: The application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education.

- Occupation: Teachers have a more positive attitude than students towards the claim that "the application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education" (Item 17). Teachers and technicians are more positive than students about the statement that "technology facilitates easier access to material for those studying part-time" (Item 18). Item 19 (university degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities) is viewed more negatively by teachers and students than by retired people. Finally students are a bit more pessimistic that "the study at an open university is especially of advantage to adults who have work and family obligations" (item 21).

Spearman's Rho Calculation

Spearman's coefficient allows us to correlate two ordinal variables. In the analysis, we applied it to all the items. It indicates the direction of the relationship (positive or negative) and its strength. We found several significant correlations between the answers to the items of Part 3 of the survey. Table 2 surveys all significant correlations.

Table 2: Spearman's Rho Correlation for the items on the impact on learning at open and distance universities

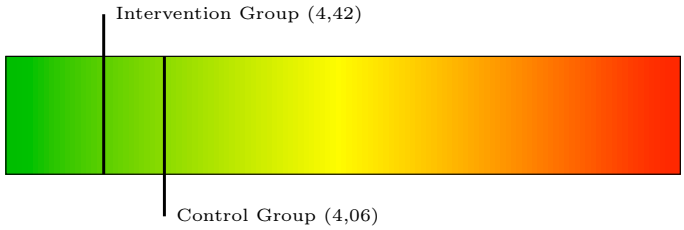
	(17)	(18)	(19)	(20)	(21)
(17) Application of new ICT concepts has improved distance education.					
(18) Technology facilitates easier access to material for those studying part-time.	0,443				
(19) University degrees may be comparable.	0,223				
(20) No difference in learning outcomes.	0,149		0,614		
(21) Advantage to adults who have work and family obligations.	0,358	0,336	0,328	0,264	

Responses to the claim that “university degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities” (Item 19) and the claim that “there is no difference in learning outcomes between studying at an Open University or at a traditional face-to-face university” (Item 20) are strongly correlated, i.e., a positive attitude towards the comparability of degrees coincides with the opinion that the study success of students at a distance and campus university is comparable.

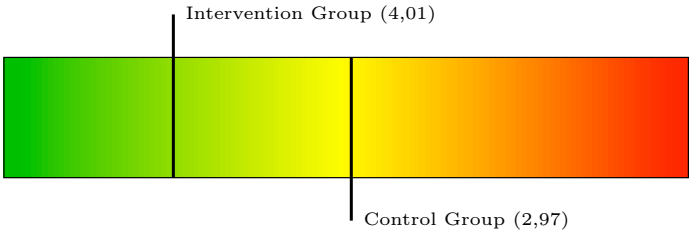
The agreement with the idea that “technology facilitates easier access to material for those studying part-time” (Item 18) is moderately positively correlated to an agreement with the claim that “the application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education” (Item 17)
.
The responses to items 17, 18 and 19 are moderately positively correlated to the agreement with the statement that the “study at an open university is especially of advantage to adults who have work and family obligations” (Item 21).

T-Test

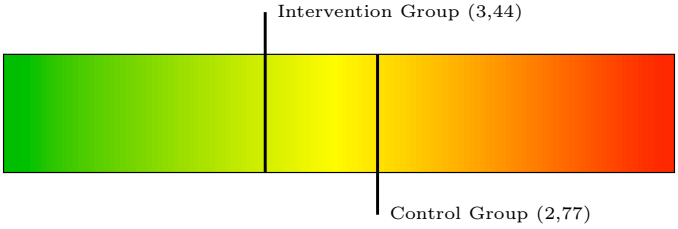
The T-test allows us to compare the means of the answers of two groups and determine whether they differ significantly. Especially we compared the means of the investigation and control group. In four of the five items of Part 3 of this survey we found significant differences.



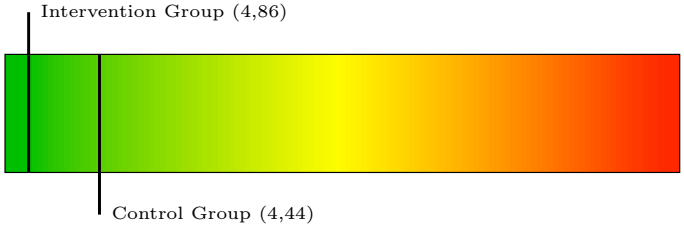
Item 17: The application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education.



Item 19: University degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities.



Item 20: There is no difference in learning outcomes between studying at an open university or at a traditional face-to-face university.



Item 21: Study at an open university is especially of advantage to adults who have work and family obligations.

Conclusions and Outlook

Our research hypotheses that technology does, in fact, have an impact on learning and that this impact is beneficial is approved by our analysis results. Especially the high disagreement to the claim that only optimistic people think that the impact of technology on learning is beneficial and the even higher degree of agreement to own good experiences shows, that most respondents of our questionnaires strongly support our research theses. In addition, the acceptance of claims like thanks to technology, the problems of access to learning for students with disabilities have been resolved as well as the positive attitudes towards special impacts of ICT (item 12 – 16) prove our hypotheses.
We also have identified interesting differences between opinions depending on age, gender, education, occupation, and personal experiences. For example, female students tend to be more positive on the impact of technology on learning than male.

We have seen for the impact of technology on learning in open universities that most participants agree that ICT facilitates easier access to material for those studying part-time and its application to support learning and teaching and providing Internet access to student administrative processes has improved distance education. The agreement that a study at an open university is especially advantageous to adults, who have work and family obligations, is overwhelming. Our hypothesis that the comparability of education provided by open universities and face-to-face universities is comparable has, however, not been verified. Especially in the control group a great deal of uncertainty exists about the comparability of degrees awarded open universities and traditional face-to-face universities.

This result contrasts to the result presented in a press note about a recent Forsa study (Europäische Fernhochschule Hamburg, 2008). This study suggests that nearly half of heads of personnel departments (49%) make no difference between applicants with a degree from a distance teaching or a campus university. 24% even prefer graduates from a distance teaching university, while 23% prefer graduates from a traditional campus university, and only 4% are uncertain or have no opinion on this question (see Fig 9).

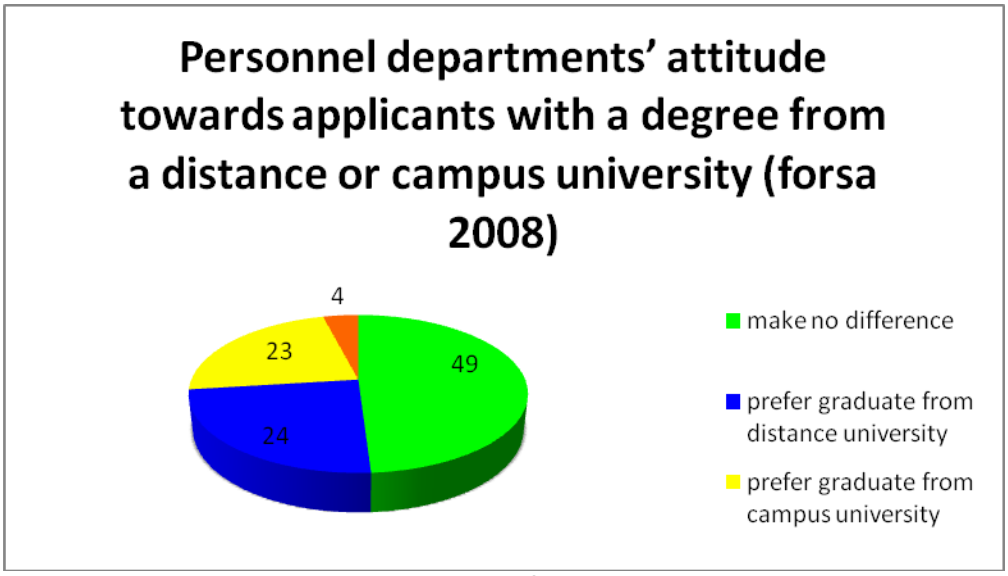


Figure 9: Forsa study on the opinion of persons responsible in personnel departments

This is a positive sign in the light of our hypotheses on the acceptance of degrees awarded by open and distance universities and the assumed quality of distance learning. But our results also show that there is still room for improvement.

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THE IMPACT OF TECHNOLOGY IN E-LEARNING

Nevena Mileva

INTRODUCTION

This chapter summarizes the findings from the study of the *Impact of technology on learning in "traditional" elearning.* E-learning is the provision of education and training via the WWW for students who study mainly as individuals using LMSs (or VLEs) like WebCT and Blackboard. This empirical study aimed:

- To identify new facts about European students' experiences and perceptions of the use of technology in higher education including personal benefits or failures, increased or deepened knowledge, behavioural changes that were affected by the use of ICT, or new opportunities to organize the personal learning process
- To determine attitudes towards the use of ICT and e-learning versus the use of traditional educational methods
- Opportunities offered by use of ICT in e-learning.

Based on a collection of questions provided by the partners, a sub-committee designed a questionnaire that was grouped in three sections: 1) personal information, 2) experiences with technology-enhanced learning, and 3) questions related to the use of ICT in e-learning. The rationale behind this structure was to reuse the questions in Sections 1 and 2 in the analysis of other facets of technology-enhanced learning and teaching and just adapt the questions on Section 3 to the particular subject under investigation.

An intervention group was formed with 156 students from all six partners, control group was formed with 167 students again from all six partners in the consortium. The members of the intervention group were supposed to have experience with e-learning at a higher institution, while the members of the control groups should lack such experiences. In two groups experiences with technology-enhanced learning was expected to vary.

THE PROFILE OF THE RESPONDENTS

Personal Background

The majority of the respondents are students (182), followed by respondents in a teacher/trainer position (44) and in a technical (43), while the other three categories (manager, retired and unemployed) are 28, 1 and 4. The students'

subjects of study are very important, if we take into consideration that students are more than 50% (56,3%) of all of our responders. We have no informationabout their domains of study. But we have to point out, that some educational/training programs and organizations are much more oriented towards science and technology than others, what could be a factor for a significant difference.

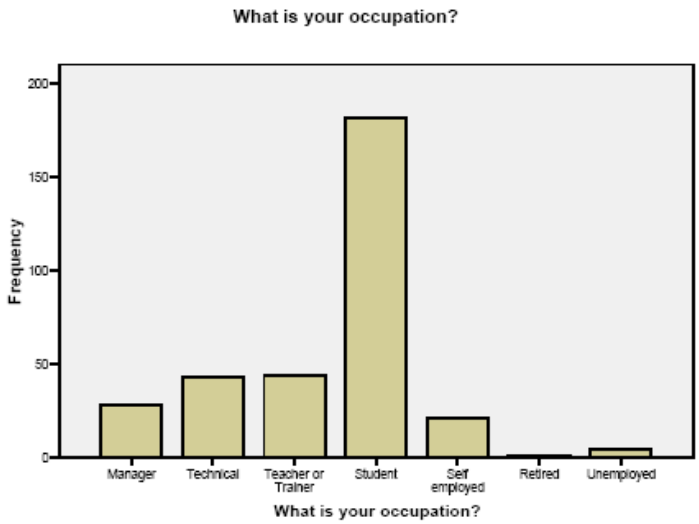

Figure 1. Occupation

Age

As the following figure illustrates, most of the responders are in the 24 or younger age group.

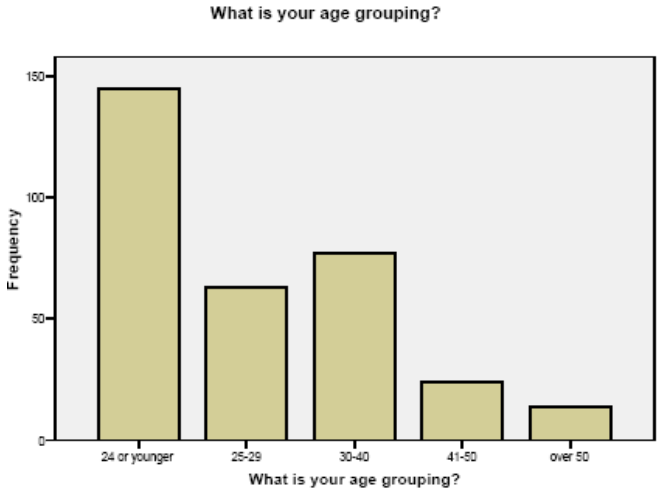

Figure 2: Age distribution

Educational background

More than half of the respondents acquired (159) a high school matriculation, 55 people have mastered one to three years post-secondary education, 97 even more years.

Gender

Just over half of the respondents were female (52,9%), indicating that there is a good balance of gender in the sample.

Experience with advanced technology

Collecting information about the competence of respondents in use of advanced technology is problematic if they cannot be directly observed. One approach is to ask people to rate themselves in terms of their own skills and to achieve maximum standardisation by giving the respondents an example of a use of each software/equipment to guide them to the level of skill one wishes to know about (for example, word-processor, presentation software, e-mail, PDA).

The questions concerning ability to use and apply technology were answered on a five-point scale, ranging from 1 (‘not at all) to 5 (‘a lot’). In general, our sample reported good skills with the advanced technological equipment (Figure 3).

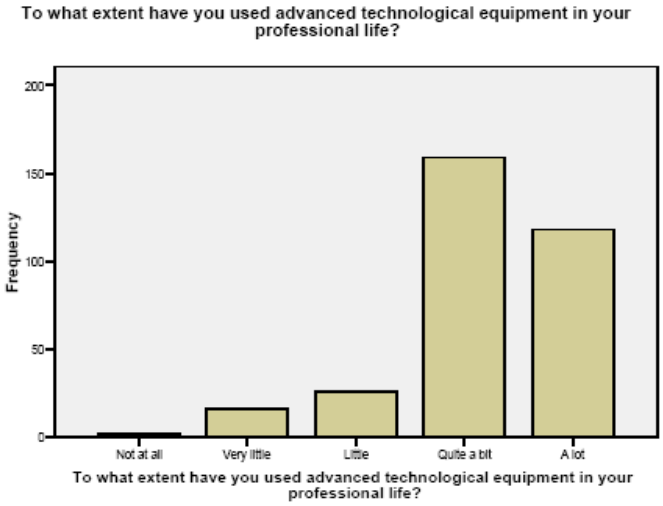

Figure 3: ICT use

The results from ICT usage question were verified from the results of the question “Have you had to change your way of working because of technological developments?” – 68,4% have changed their way of working because of technological development, 55,4% of them – more than once.

The profile of our responders shows that we obtained a good representation of age (88,2% to 40 years, actively working people), gender (half male, half female) and personal background (if we have in mind, that we investigate the role of ICT for educational purposes and students could be actively working people), of the population engaged in e-learning activities.

The Impact of ICT on Learning in General

The items in the section of the questionnaire that asked for the impact of ICT on learning in general addressed both general impressions and more specific attributes like the intensity of contacts and communication between teachers and students, benefits for disabled students, encouragement for active participation or more individualized learning programmes.

Perception of the use of ICT versus the use of traditional methods in learning in general

The first five questions from this section were targeted at gaining information about the views of our responders about the value of ICT and its actual and potential role in learning as general. Five questions, measured on a five part scale, could be grouped into two groups:

- The first group could be named 'positive perception of the different advantages ICT can bring to learning and education' (questions 7,8,9);
- The second group could be named "positive attitude towards learning with traditional methods and negative attitude towards learning with ICT' (questions 10,11).

More than half of the respondents (52,7%) believe that the problems of access to learning for students with disabilities have been resolved, 47 even strongly agree, most people from the other half (106) are uncertain, 33 disagree and 12 strongly disagree. These 106 responses 'I do know not' lead to the indication that, due to the lack of experience with ICT, responders expressed themselves rather cautiously about its role, without stating a higher preferences for traditional education methods, which are well known for all of the responders.

A different picture is drawn when the intensity of contacts between students and teachers in a face-to-face situation and in online education are equated: more people disagree or even strongly disagree with this argument than people agree or strongly agree (180 versus 75) and the number who are uncertain is relatively high with 66 people.

The contribution of online communication to the increase of communication between teachers and students shows a slightly positive attitude with 160 people agreeing or strongly agreeing but only 16 (strongly) disagreeing. The uncertainty on this item is relatively high with 91 responses (Figure 4)

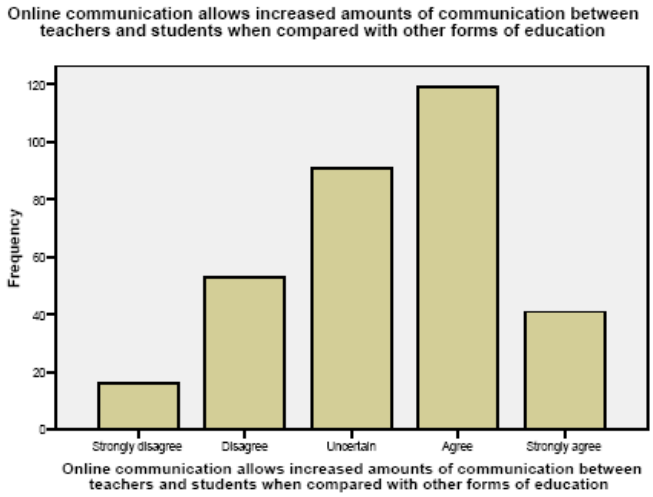

Figure 4. The contribution of online communication to the increase of communication between teachers and students

The negatively formulated Item 10 “Only optimistic people think that the impact of technology on learning is beneficial” supports the positive perception of the impact of technology on learning with 185 disagreements.

This impression is even enforced with 266 (82,4%!!!) positive answers to Item 11, which addresses personal experiences.

Opportunities offered by use of ICT versus by use of traditional methods in learning in general

This part of the questionnaire contained 5 questions, offering a list of opportunities that might be enhanced by ICT. The respondents were asked to indicate how important in their opinion each item was on a scale from 1 (no importance at all) to 5 (very important), with an option of ‘I do not know’. The questions could be grouped into three groups:

1. The first group could be labelled ‘Promoting access to individualized, active and complex learning’
2. ‘Facilitating the learning process and learning outcomes’ .
3. ‘Facilitating contact and information exchange’

The positive attitude towards the impact of technology on learning is strong when asked for encouragement of students to become more involved in the educational process. 181 are positive, only 43 are negative about this issue, but 94 are uncertain.

A positive attitude is also visible about the development of higher level thinking skills and more individualized learning programmes (173 and 202 are agree) but the number of uncertain respondents reaches nearly one third of the sample (34,7% and 24,8%).

A relatively strong agreement can be found on the impression that learning is enhanced when multimedia components are integrated in the learning content (see Fig. 5).

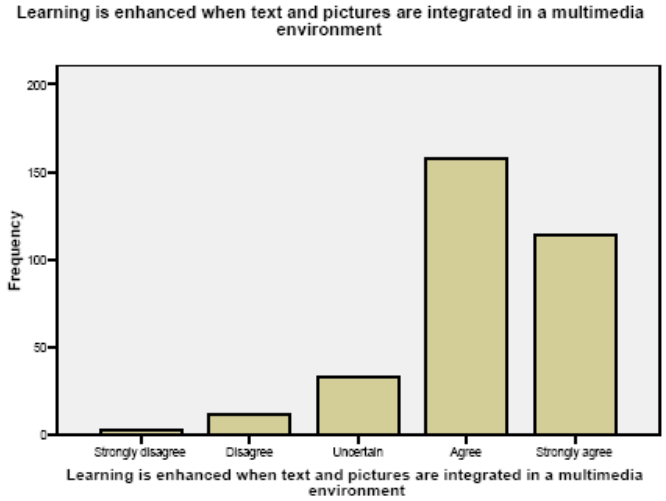

Figure 5. The role of the multimedia

The motivating factor of educational games is perceived very positively – 239, 56 uncertainly respondents derive from the fact that they have no such experience, and only 25 (7,8%) are rather negative minded.

THE IMPACT OF ICT ON LEARNING IN E-LEARNING

The third section of the questionnaire especially looked at perceptions and opinions about the impact of ICT on learning in e-learning. This group of 5 items addressed issues like:

- enhanced the effectiveness of learning,
- easier interaction with the tutor,
- views about the statements that the use of WWW is an obstacle to learning and that the online study is difficult to be organized
- enhanced the communication with the learning content.

Perception of the use of ICT versus the use of traditional methods in e-learning

Some questions from this section were targeted at gaining information about the views of our responders about the value of ICT and its actual and potential role in e-learning. Three questions, measured on a five part scale, could be grouped into two groups:

- The first group could be named ‘positive perception of the different advantages ICT can bring to e-learning’ (question 17);
- The second group could be named “positive attitude towards learning with traditional methods and negative attitude towards learning with ICT’ (questions 18,21).

The enhanced the effectiveness of learning are largely confirmed with a higher value of the agreement – 67,4% and only around 4,9% of the samples being disagree. We have a high value uncertain people – 100.

We have very strong agreement that WWW is not an obstacle to learning (253 people, 78,3%), and at the same time, our responders are rather uncertain than sure that ICT and advanced technology and equipment bring difficulties in the learning organization (112 versus 131).

Opportunities offered by use of ICT versus by use of traditional methods in e-learning

This part of the questionnaire contained 2 questions, offering two opportunities that might be enhanced by ICT in e-learning. The respondents were asked to indicate how important in their opinion each item was on a scale from 1 (no importance at all) to 5 (very important), with an option of 'I do not know'. The questions could be summarized in:

1. 'Facilitating the interaction with the tutors'.
2. 'Facilitating the communication with the learning content'.

63,5% of our responders think that the new technology gives a possibility more frequently to communicate with the tutor.

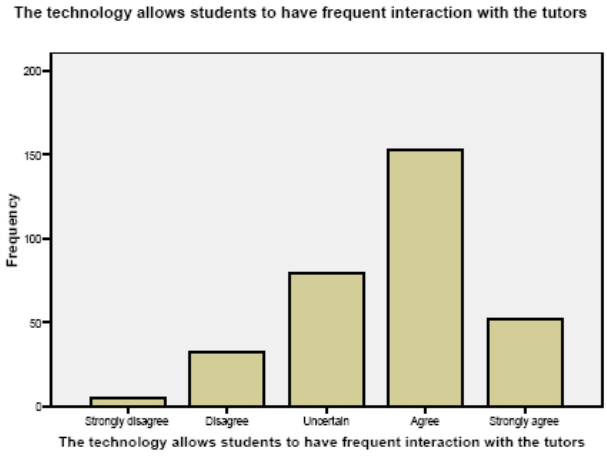

Figure 6. Interaction with the tutor

We have the same result for the impact of ICT on the communication of the learning content – 62,5% are agree.

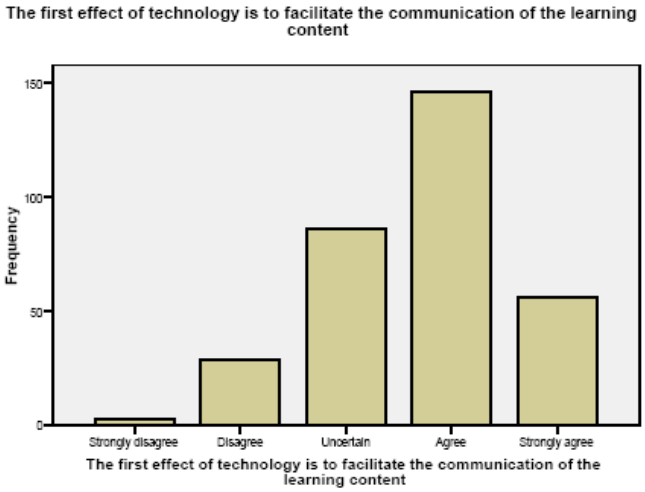

Figure 7. Communication with the content

VARIANCE BETWEEN INTERVENTION AND CONTROL GROUP

Personal Background

In both groups we find a similar number of people in all occupational categories (see Table). It's confused to put category "student" in occupation – it should be better to difference students' study subjects like technical, science, humanities, managerial etc.

The age distribution is also similar in both groups with an inhomogeneous distribution among all age categories inside of both groups (see Fig. 8).

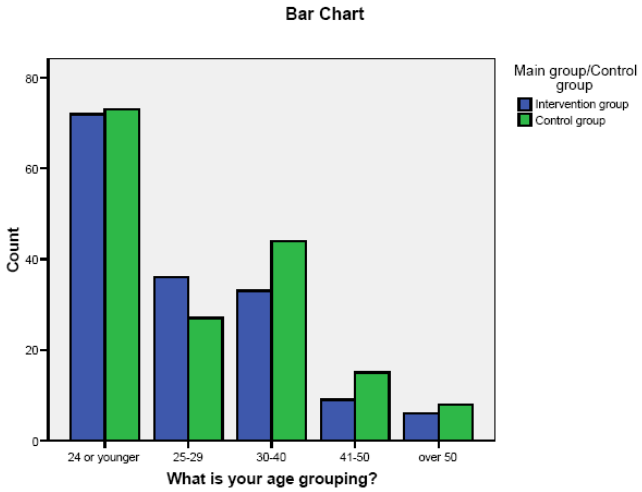

Figure 8. Age – intervention/control groups

With 27 more female than male respondents the gender distribution is a little less balanced in the control as opposed to the intervention group (12). The lack of differences between the two groups in this variable is visualized in the

bar chart in Fig. 9. These differences are visible in the bar chart and tables we generated but also supported by the Chi-Square test (p>0,05).

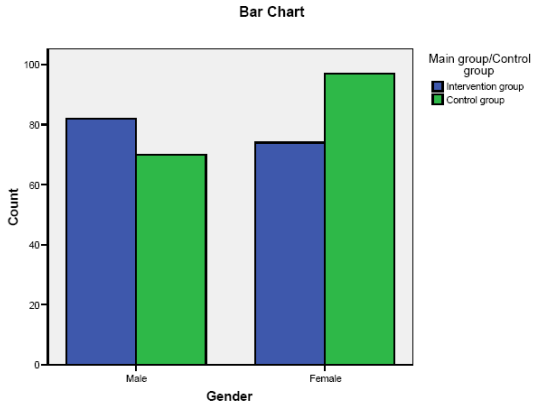

Figure 9. Gender – intervention/control groups

The graphs illustrating the level of education, experiences in the use of advanced technology and the need to adapt to new technology, have a quite congruent shape with slightly different numbers (see Annexes). There is again a little bit confusing situation – the control group shows slightly higher numbers of people who had exposure to advanced technological equipment in their professional life and who had to adapt to changes due to technology innovation more than once. But Pearson Chi-Square shows that there is a high probability that this difference is due to chance (0,867 and 0,164).

The Impact of ICT on Learning in General

Similarly, the bar charts representing

- the assertion that the problems of access to learning for students with disabilities has been resolved,
- the respondents' agreement with the claim that the intensity of contacts in face-to-face and online learning compare,
- the belief or experience that online communication mechanisms have increased the amount of communication between teachers and students,
- the negative statement about the benefits of technology for learning,
- the value of technology for learning reflected from personal study experiences,
- the agreement or disagreement with the claim that ICT has been used to involve students,
- the claimed support of technology in education for the development of higher level thinking skills,
- the opinion that ICT has been used to support more individualised learning programmes,
- the attitude that learning is enhanced with multimedia environments and the claim that educational games motivate learners

have similar profiles in both groups. In some positive items more people from the control group agree and strongly agree than from the intervention group, or the numbers are equal. The Pearson Chi-Square test indicates that there is a high probability that this difference is due to chance.

The Impact of ICT on Learning in E-learning

In the answers of the first question from the third group, we find similarities in both groups. There is a big difference in the numbers of people that are uncertain if the integration of blended learning approaches in campus teaching has enhanced the effectiveness of learning: 38 versus 68 for the control group. And the Pearson Chi-Square test indicates that this difference is not due of chance (0,025).

In the second question we have a little bit more disagreements in the control group than in the intervention group, but the Pearson Chi-Square test indicates that this difference is due of chance (0,833).

Next two questions have similar answers in the both groups. It is interesting to look at the bar chats to see that 10 more people are strongly agree that the technology allows students to have frequent interaction with the tutors and that the first effect of technology is to facilitate the communication of the learning content, and these people are from the control group (Fig. 10,11).

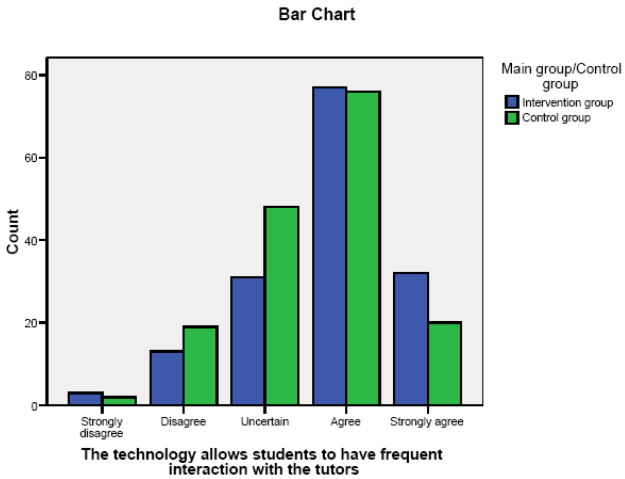

Figure 10. The technology allows students to have frequent interaction with the tutors

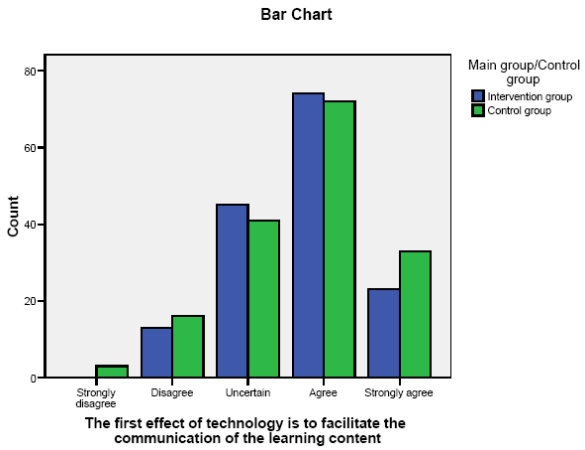

Figure 11. The first effect of technology is to facilitate the communication of the learning content

There is a bit more doubt if the online courses bring difficulties in learning organization in the control group than in the intervention group. This can probably be explained by the lack of experience of the samples in the control group.

Cross-Tabulation of Person Background and Technology-related Variables

Influence of Age on People's Opinions

The item "*Thanks to technology, the problems of access to learning for students with disabilities have been resolved*" shows a difference for respondents under the age of 24 as opposed to respondents in the age range 25 to 40. The last group has a more negative attitude while people in the age range under 24 have a more positive attitude (see Fig. 12).

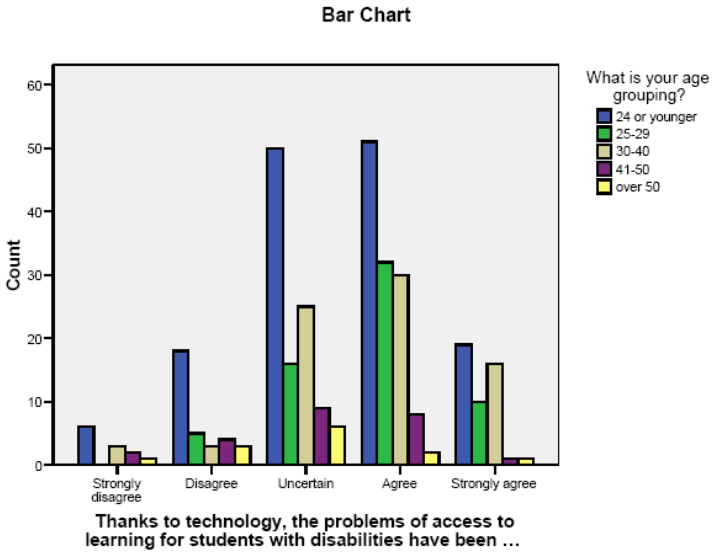

Figure 12: Thanks to technology, the problems of access to learning for students with disabilities have been resolved

Respondents' positions to the claims that:

- "*Contacts between students and teachers can have the same intensity in the education as in face-to-face education*",
- "*Online communication allows increased amounts of communication between teachers and students when compared with other forms of education*",
- "*Only optimistic people think that the impact of technology on learning is beneficial*" and
- "*From my personal study experience I find that the impact of technology on learning is valuable*"
- "*Information and communication technology has usually been used to encourage us to be active participants in learning"*
- "*Information and communication technology has been used to support the development of higher level thinking skills such as synthesis and problem solving'*
- *"Information and communication technology has been used to support more individualized learning programs tailored to our own individual needs."*
- *" Learning is enhanced when text and pictures are integrated in a multimedia environment"*
- *"Educational games motivate learners and contribute to developing skills such as teamwork"*

are independent of the age of the respondents.

That "*The integration of blended learning approaches in campus teaching has enhanced the effectiveness of learning*" is true is believed by more respondents in the age under 24 than other age groups: 67% are agree and strongly agree from the group under 24, 65% are agree and strongly agree from the group 25-29 and 53% from the group 30-40. But Pearson's chi-square test shows no significant difference.

Users in the group of 25-29 have a more positive attitude (84% versus 74%, 75%) than users at the age 24 and 30-40 towards the assertions: "*The use of the WWW is an obstacle to learning*"

Users in the group to 29 age have a more positive attitude (72% versus 52%) than users over 30 years old towards the assertions: "*The technology allows students to have frequent interaction with the tutors*" and the Pearson's chi-square test shows that this difference is significant.

Responses to the claims:
"*The first effect of technology is to facilitate the communication of the learning content"*
"Those who study online have difficulty in organising their learning"
are independent of the variable age.

Influence of Gender

The complete results of the cross-tabulation of the variable Gender with the technology related items is presented in Annexes. In the section we only

discuss those items that show a significant dependence of the gender of the respondents.

Our study reveals that:

- more female respondents believe that *the problems of access to learning for students with disabilities have been resolved thanks to technology (Item 7)*;
- more male respondents believe that *contacts between students and teachers can have the same intensity in online education as in face-to-face education (Item 8)*;
- more female respondents believe that *online communication allows increased amounts of communication between teachers and students when compared with other forms of education* (Item 9);
- more female respondents believe that *Information and communications technology has been used to support the development of higher level thinking skills such as problem solving and synthesis* (Item 13);
- more female respondents are disagree that *those who study online have difficulty in organising their learning* (Item 21).

In summary, it seems that females have a more positive attitude toward the impact of ICT on learning in both traditional face-to-face and e-learning.

Influence of Level of Education

Again, the influence of the level of education on the respondents' attitudes will be discussed only when a significant. The complete set of analysis results is detailed in Annexes.

Significant dependencies on the level of education we detected include:

- More people with high school matriculation than others believe that: *Thanks to technology, the problems of access to learning for students with disabilities have been resolved* (Item 7);

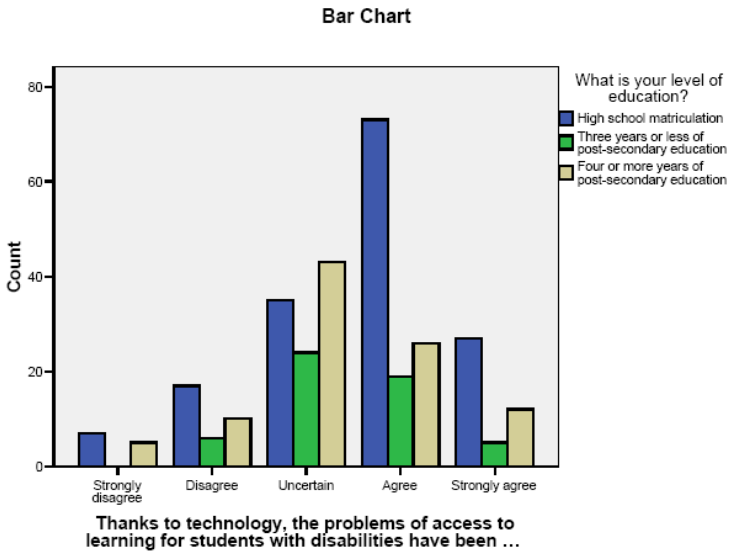

Figure 13. Thanks to technology, the problems of access to learning for students with disabilities have been resolved

- more people with high school matriculation than others have negative opinion towards: *Contacts between students and teachers can have the same intensity in online education as in face-to-face education* (Item 8);

- the same group is also more positive than others about the claim that o*nline communication allows increased amounts of communication between teachers and students when compared with other forms of education* (Item 9)

- more people with high school matriculation than others have positive opinion towards: *From my personal study experience I find that the impact of technology on learning is valuable* (Item 11)

- the same group is more positive than others about the claim that *information and communications technology has been used to support the development of higher level thinking skills such as problem solving and synthesis* (Item 13)
- more people with high school matriculation than others believe that: *The technology allows students to have frequent interaction with the tutors* (Item 19) and *The first effect of technology is to facilitate the communication of the learning content* (Item 20).

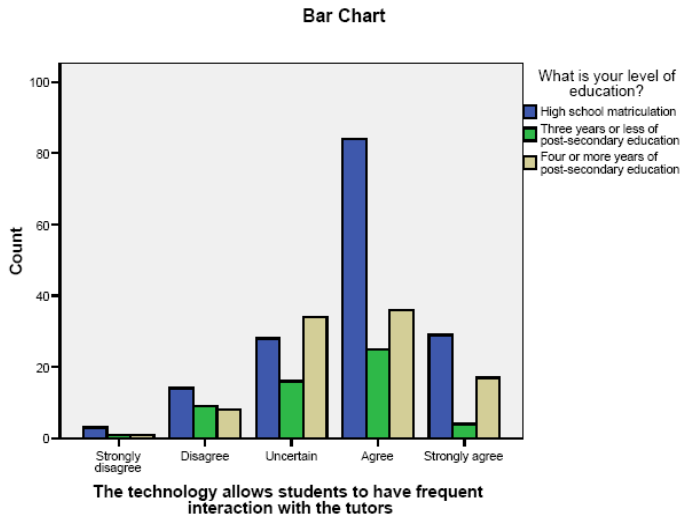

Figure 14. The technology allows students to have frequent interaction with the tutors

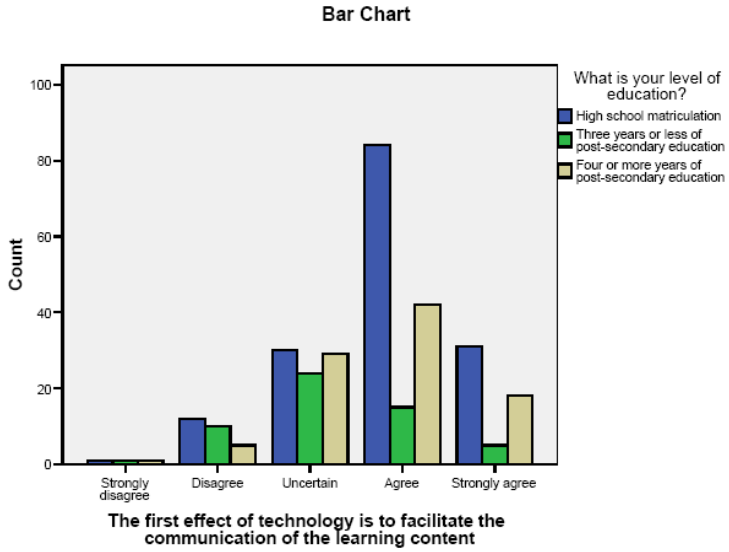

Figure 15. The first effect of technology is to facilitate the communication of the learning content

Influence of Occupation

All results about dependencies of impact judgements on the level of education of the respondents are contained in Annexes.

The following dependencies have been detected:

- Students and Teachers and trainers are more positive than other groups about the claim (Item 9): *Online communication allows increased amounts of communication between teachers and students when compared with other forms of education*

- Students have a more positive attitude than managers concerning the statement (Item 13): *Information and communications technology has*

been used to support the development of higher level thinking skills such as problem solving and synthesis

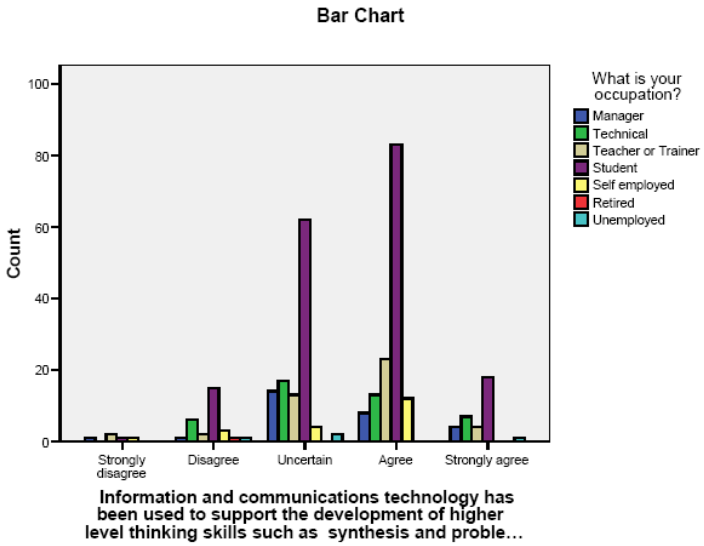

Figure 16. Information and communications technology has been used to support the development of higher level thinking skills such as problem solving and synthesis

CONCLUSIONS

The results presented show that responders in our sample held a fairly positive view of the different advantages that ICT can bring to learning and education. However, this positive view of ICT was accompanied by a rather positive attitude towards learning with traditional education methods and one which questioned the value of ICT in education. A closer inspection of the answers on the individual questions reveals that the responders were especially interested in the use of ICT for purposes of information exchange, such as 'to communicate with the tutor' and 'to share information and ideas with people from the team'.

If ICT is to be used in an educational context, our responders specifically expressed doubts about the quality of the human interaction when there is no face-to-face contact.

Analysis of the results show that the responders attached importance to all the opportunities that ICT offered, though the 'facilitating contact and information exchange' received most support.

The responders think it important to use ICT in order to 'develop employability skills such as teamwork, problem solving, self-learning capability, presentation skills, etc.'. They attribute the same importance to use of ICT in order to 'develop a more collaborative approach to learning'. In general, attaching importance to these categories of opportunities was positively related to a 'positive perception of the different advantages ICT can bring to learning and education' and negatively related to 'positive attitude towards learning with traditional methods and negative attitude towards learning with ICT'. This implies that the responders with a more positive attitude towards the use of

ICT in education attached more importance to the different opportunities ICT can offer in these two issues. In contrast, the responders with a more negative perception of ICT, and who adhered more to traditional methods, agreed less with these two categories of opportunities offered here.

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SYNCHRONOUS E-LEARNING SYSTEMS

Desmond Keegan

INTRODUCTION

This chapter is in two parts:

- Background to the study – the need for the study, its focus on adult education, lifelong learning, distance education, research methodology and approach

- Impact of technology on learning in synchronous e-learning systems – a study of the impact of technology on adult learning

BACKGROUND TO THE STUDY

The rationale for the research study on *The impact of new technologies on distance learning students* is found in the enormous amounts of money paid annually by government Departments of Education and of Higher Education throughout the world for the purchase of educational technology for schools, colleges and universities.

It is known that each of the Departments of Education in the 27 European Union states spends millions of euros annually on the provision of educational technology for schools, colleges and universities.

Allied to this massive expenditure on educational technology for schools, colleges and universities is the fact that the research on the impact of technology on learning is unacceptably fragile.

In 1999 Schachter in his *The impact of education technology on student achievement: what the most current research has to say* states that 'research on the impact of technology on learning is in its infancy'.

The scene is much the same today. In March 2005 the World Bank stated that 'the positive impact of ICT use in education has not been proven. In general, and despite thousands of impact studies, the impact of ICT use on student achievement remains difficult to measure and open to much reasonable debate'.

The World Bank (2005) study *Impact of ICTs on learning and achievement* states bluntly 'A review of the research yields few conclusive statements, pro or contra, about the use of ICTs in education. For every study that cites significant positive impact, another study finds little or no such positive impact'.

Technology is not a frill but an important part of any modern training strategy. Teachers and trainers all over Europe need guidelines on its use and proof of its impact on learners. Because educational technology is expensive policymakers at institutional and national levels are asking 'Does this level of spending on technology make a difference to student learning?'

In addition what research there is, is in the field of research of the impact of technology on American schoolchildren. Most of the research is on what the Americans call K-12 (that is Kindergarten to high school graduation).

This study is different. It focuses firmly on the impact of technology on adult education, distance education and lifelong learning.

The field of distance education is of particular importance. In distance learning technology is a necessity and not an option. What distance education did was to break with more than 2000 years of the educational transaction being focused on face-to-face interpersonal communication in the learning group and replace it with an apersonal form of communication mediated by technology. It is, therefore, a form of education in which technology is essential.

In all of this development the role of technology is central. The great difference between conventional education and distance education is that in conventional education the technology is a supplement to the teacher and in distance education the technology is a replacement for the teacher.

Distance education today

This is the background to distance education today. Today distance education is a rich and complex form of education and training provision with five major sub-systems:

- Distance Education: the provision of education from Open Universities and distance education courses from conventional universities and other institutions both public and private

- E-learning: electronic distance education is the provision of education and training on the internet and the World Wide Web

- Synchronous elearning systems: group-based e-learning using different browser software from e-learning

- The WWW on-campus: the growing tendency to provide courseware on the WWW on computers distributed around university campuses. This may be either as a complement to the lecture or a replacement for the lecture when the lectures are cancelled. When the lectures are cancelled and replaced with courseware only on the WWW it is a form of distance education.

- Mobile learning: the provision of education and training on PDAs, smart-phones and mobile phones.

Thus this research focuses on a form of education in which the use of technology is obligatory.

Research methodology and approach

Because of the fragile research findings in the area of the impact of technology on learning, epitomized by the recent (2005) World Bank pronouncement 'the positive impact of ICT use in education has not been proven' great care was taken in the choice of methodology for *the The impact of new technologies on distance learning students* study.

Every effort was made to choose the best methodology available.

This was identified as the United States Department of Education's (2003) *Identifying and implementing educational practices supported by rigorous evidence.*

The United States Department of Education presents its methodology in four parts thus:

I. A description of the randomized controlled trial, and why it is a critical factor in establishing "strong" evidence of an intervention's effectiveness;

II. How to evaluate whether an intervention is backed by "strong" evidence of effectiveness

III. How to evaluate whether an intervention is backed by "possible" evidence of effectiveness; and

IV. Important factors to consider when implementing an evidence-based intervention in your schools or classrooms.

Well-designed and implemented randomized controlled trials are considered the "gold standard" for evaluating an intervention's effectiveness, in fields such as medicine, welfare and employment policy, and psychology.
This section discusses what a randomized controlled trial is, and outlines evidence indicating that such trials should play a similar role in education.

Definition: Randomized controlled trials are studies that randomly assign individuals to an intervention group or to a control group, in order to measure the effects of the intervention.

The unique advantage of random assignment: It enables you to evaluate whether the intervention itself, as opposed to other factors, causes the observed outcomes. Specifically, the process of randomly assigning a large number of individuals to either an intervention group or a control group ensures, to a high degree of confidence, that there are no systematic differences between the groups in any characteristics (observed and

unobserved) except one – namely, the intervention group participates in the intervention, and the control group does not.

Therefore – assuming the trial is properly carried out the resulting difference in outcomes between the intervention and control groups can confidently be attributed to the intervention and not to other factors. There is persuasive evidence that the randomized controlled trial, when properly designed and implemented, is superior to other study designs in measuring an intervention's true effect.

This section discusses how to evaluate whether an intervention is backed by "strong" evidence that it will improve educational outcomes in your schools or classrooms. Specifically, it discusses both the quality and quantity of studies needed to establish such evidence.

Quality of evidence needed to establish "strong" evidence of effectiveness: randomized controlled trials are a critical factor in establishing "strong" evidence of an intervention's effectiveness. Of course, such trials must also be well-designed and implemented in order to constitute strong evidence. Below is an outline of key items to look for when reviewing a randomized controlled trial of an educational intervention, to see whether the trial was well-designed and implemented. It is meant as a discussion of general principles, rather than as an exhaustive list of the features of such trials.

Key items to look for in the study's description of the intervention and the random assignment process are:

the study should clearly describe

(i) the intervention, including who administered it, who received it, and what it cost;
(ii) how the intervention differed from what the control group received; and
(iii) the logic of how the intervention is supposed to affect outcomes.

In order to obtain such a finding of statistically significant effects, a study usually needs to have a relatively large sample size.

A rough rule of thumb is that a sample size of at least 300 students (150 in the intervention group and 150 in the control group) is needed to obtain a finding of statistical significance for an intervention that is modestly effective. In general, larger sample sizes are better than smaller sample sizes, because they provide greater confidence that any difference is due to the intervention and not to other reasons.

IMPACT OF TECHNOLOGY ON LEARNING IN SYNCHRONOUS E-LEARNING SYSTEMS

A Synchronous e-learning or Virtual Classroom application may be deployed over the Internet or Intranet. It allows geographically dispersed students to

remotely attend courses given by a live instructor who may be based at any location on the globe.

Students attending Virtual Classroom courses are typically presented with PowerPoint slides that are verbally presented in real-time, by the instructor. Interactivity is a key element of this training method and, in addition to asking questions, there are numerous opportunities for interaction through the use of chatrooms, breakout sessions / small tutorial groups, application and document sharing and web surfing.

Synchronous e-learning systems are a highly technological form of learning and, as such, are an excellent from of education and training for study of the impact of
technology on learning.

The problem with using synchronous e-learning systems is that they are little known and little used in Europe, though widely used in the United States, especially for corporate training.

As readers of this study may not be familiar with synchronous e-learning systems, and may not be aware that group-based e-learning is widely used in America, side by side with the individual based forms of e-learning with which they are familiar, a presentation of synchronous e-learning systems is provided here.

This features one of the major American systems, Wimba, formerly known as Horizon Wimba.

Clearly the provision of 150 students for the intervention group of this study in Europe would appear to pose a problem as this form of training provision is little known and little used there. In the event the research group contained two of the leading users of synchronous e-learning systems in Europe: Ericsson Education Ireland is a major user for corporate training and Corvinno, was able to use students from the Corvinus University of Budapest, probably Europe's largest user of these systems for academic university education.

Needless to say the researchers who provided the respondents for the control group had no difficulties in randomly selecting from their large student bodies respondents who had no experience with synchronous e-learning systems.

Terminology

Considerable confusion exists in the terminology used to describe these group-based elearning systems. Three terminologies are used to refer to these systems by the various providers: 'synchronous e-learning systems' or 'live e-learning' or 'virtual classrooms'.

The term 'virtual classrooms' has strengths in that it emphasises that a grouping of students is set up for the learning experience in a class as in ILT (instructor led training) but not as in 'traditional' elearning where students study mainly individually. It also uses the word 'virtual' to show that the class

does not meet face-to-face but are brought together electronically or virtually and can be in any part of the world. The weakness of the term is that people use the term ‘virtual classroom’ for a wide variety of educational structures not limited to the synchronous elearning systems under discussion.

The term ‘live elearning’ has strengths in that it emphasises that it is a form of elearning that is live. The use of the term ‘live’ shows that the class comes together at a certain time and for a certain duration and that they hear the trainer’s voice ‘live’ and can communicate ‘live’ with the other students in the class. The weakness of the term is its vagueness and the lack of clarity as to what ‘live elearning’ refers.

The term ‘synchronous elearning systems’ has strengths in that it emphasises that one is dealing with a form of elearning and that this is a synchronous form of elearning. The term ‘synchronous’ differentiates this form of elearning from more traditional forms which are clearly asynchronous and gives the idea that one is dealing with a live event going on synchronously at a number of locations. The weakness of the term is its use of the cumbersome word ‘sychronous’, a term that is little used outside education circles.

Synchronous means happening, existing, or arising at precisely the same time or recurring or operating at exactly the same periods or having the same period and phase. In digital communication it refers to a transmission technique that requires a common clock signal (a timing reference) between the communicating devices in order to coordinate their transmissions. It means occurring at the same time or at the same rate or with a regular or predictable time relationship or sequence.

Asynchronous means not happening, existing, or arising at precisely the same time. In computing it refers to not synchronised by a shared signal such as clock or semaphore, proceeding independently. It is a process in a multitasking system whose execution can proceed independently, in the background. Other processes may be started before the asynchronous process has finished.

The Wimba system

On June 16, 2004, Horizonlive and Wimba, two well-known providers of live e-learning, formally combined to form a new company, Horizon Wimba. As part of the transition to the new company some of the existing products have been re-branded in order to maintain current market awareness of both the product lines and to better position new products in the future.

Horizon Wimba is today known as Wimba. The company presents itself thus: ‘Wimba is a leading provider of collaborative learning software applications and services to the education industry. Collaborative software applications for the online and blended education market enable institutions to bridge technology and pedagogy by supplementing course management systems with many of the proven disciplines of in-person learning environments. Wimba's intuitive solutions enable educators and students to quickly and easily teach and learn live online, engage in live chat and instant message

exchanges, benefit from oral content being added to text-based course content, and more. Instructors can also use Wimba solutions to easily convert Microsoft Word documents into online course content and to create and administer tests, quizzes, and exams. A focus on education and collaboration with educators fuels product development'.

Wimba develops web-based collaboration software for online distance education, language learning and live interactive communications. These collaborative learning applications enable instructors and students to fully embrace the new wave of pedagogical opportunities afforded by campus-wide networks and the internet; regardless of geographic location, bandwidth or operating system. The virtual rooms enable instructors to conduct live, online classes, meetings, office hours and study groups, and the vocal collaboration technologies, add oral content directly into course content, webpages and assessments.

Wimba believes that approximately 1,100 universities and colleges worldwide are using a live elearning system, of which a little more than 25% use the Wimba Live Classroom for live online classes, office hours, study groups, meetings, and professional development training.

They claim that in terms of using voice tools for language learning, there are only about 200 colleges worldwide that use them, and they all use Wimba voice tools, as there is no other software company that makes voice tools for language learning. This is quite noteworthy. After all, with the presence of course management systems (such as Blackboard and WebCT) there are literally thousands of language courses that have some online component, yet the majority of them do not have any speaking or listening components to them - which seems counterintuitive for learning languages.

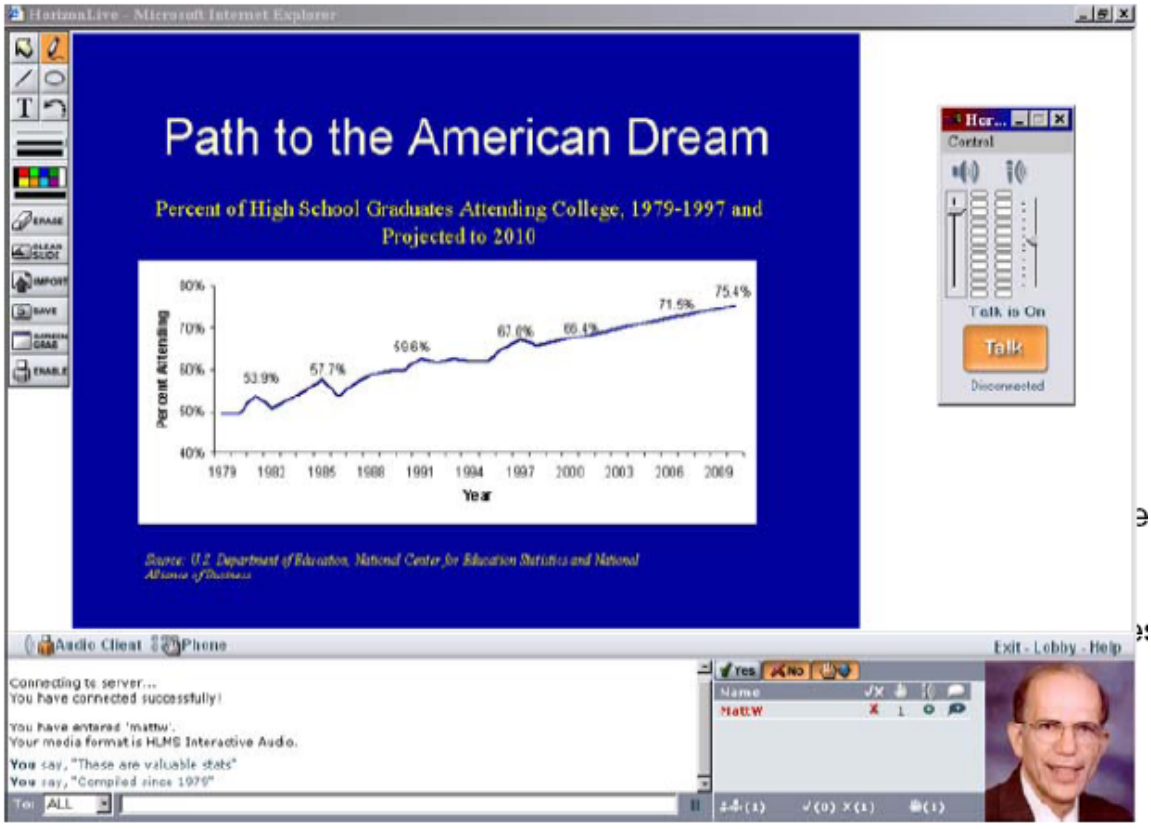

Fig 1. Synchronous e-learning system

Above is a presentation of the Horizon Wimba Live Classroom during a course on the 'Path to the American Dream'. In the centre screen one finds the PowerPoint slide that the teacher is describing and showing to the class. In the top left-hand corner are the tools for use during the presentation. In the top right-hand corner is the volume control for use during the course and when a student is given the microphone to address the class. In the bottom left-hand corner is the email facility using which a student can send messages to the teacher or the whole class. In the bottom right-hand corner is the administration centre. This provides facility for agreement (Yes), facility for disagreement (No), facility for asking a question (raised hand), list of participants on the course and picture of the course presenter.

RESULTS OF THE STUDY

Questionnaires were distributed to the Intervention Group, comprising respondents from Ericsson Education Ireland and the Corvinus University of Budapest, all of whom had experience of studying in synchronous e-learning systems, and to the Control Group made up of respondents of the University of Plovdiv in Bulgaria, the University of Rome III in Italy, the German Open University, the FernUniversität in Hagen and the Cork Institute of Technology in Ireland, none of whom had any experience of synchronous e-learning systems.

The statistical stipulations of the United States Department of Education's (2003) *Identifying and implementing educational practices supported by*

rigorous evidence were carefully observed. An additional dimension to the validity of the findings was that they were collected from varying parts of Europe: Bulgaria, Ireland, Italy, Germany and Hungary.

Of particular interest and importance was the question: *From my personal study experience I find that the impact of technology on learning is valuable.* This is an important question. It is formulated with great clarity. It focuses directly on the two major hypotheses of the study: 'Technology has an impact on learning' and 'This impact of technology on learning is beneficial'.

That the impact of technology on learning is beneficial and valuable is strongly supported by this study.

No one in the Control Group Strongly disagrees. The total for Strongly disagree and Disagree is only 2.7%. 87% Agree or Strongly agree. This is a ringing endorsement that the impact of technology on learning is beneficial and valuable.

When the Intervention and the Control Groups are compared it is found that somewhat more of the Intervention Group vote Strongly agree and slightly more of the Control Group vote Agree.

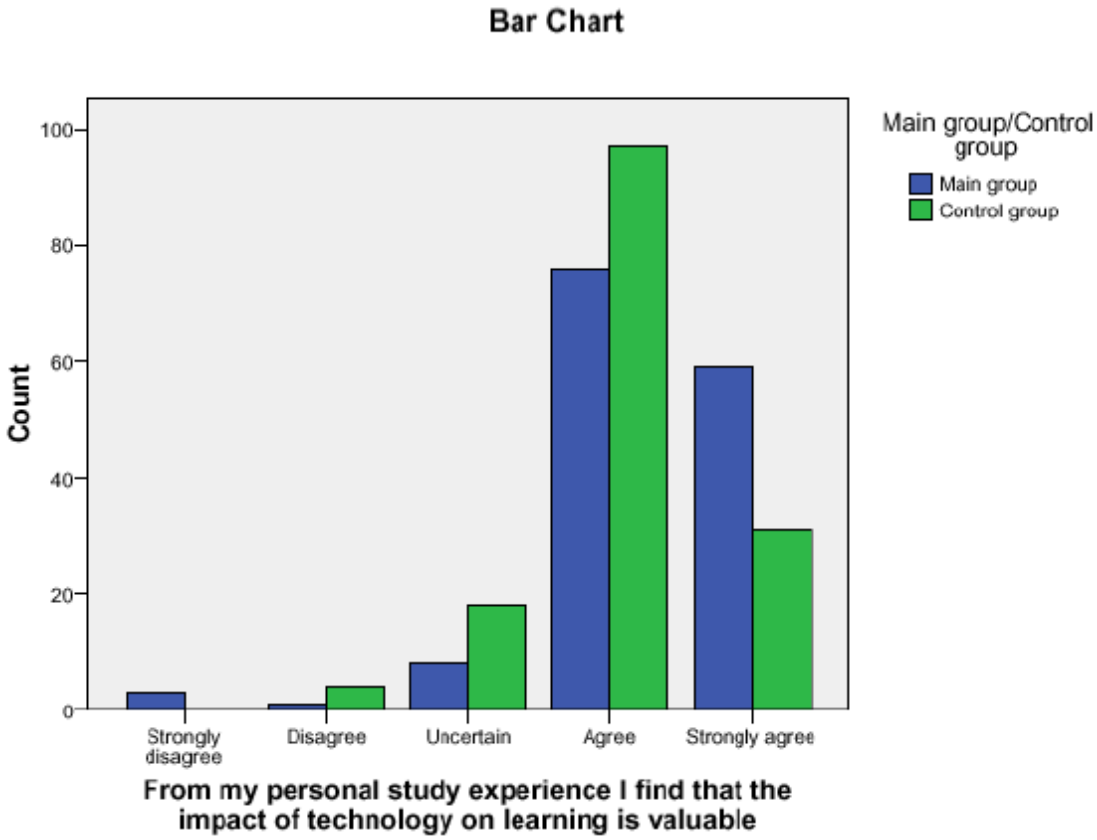

Figure 2. Personal study experience statistics

When the cross-tabulation of this question with age is done it is found that this important conclusion is valid for all age groupings in the study:

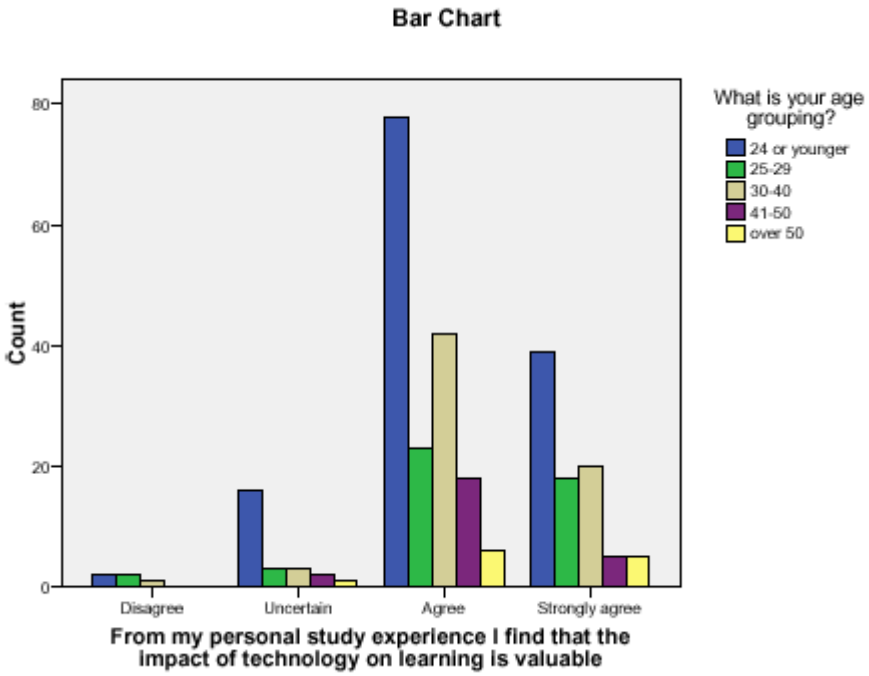

Figure 3. Personal study statisitcs x Age

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IMPACT OF TECHNOLOGY IN USE OF THE WWW ON CAMPUS

Francesco Agrusti

Introduction

The ultimate goal of the IMPACT project is to provide a set of findings that can help instructors in understanding the implications of different technologies for their students, and to provide research-based principles on how instructors can better use technology in their teaching practises.

The unit headed by Prof. Benedetto Vertecchi from University of Rome “Roma Tre” provided data analysis and treatment of the whole project and was in charge of Work Package 6 report.

Work Package 6 results of IMPACT Project was focused on:

- Evaluating the impact of technology in traditional higher education courses with on-campus World Wide Web and in advanced technology equipped laboratories.
- The use of the Internet for supporting or substituting student’s study analysing.

For what concerns the first point we paid attention specifically on technology equipped community places that students could find in the universities.

Figure 1 - Piazza Telematica in Roma Tre University.

A *telecentre* http://www.telecentre.org is "a public place where people can access computer, the Internet and other technological advanced equipment"[1] in order to learn, communicate and support a social and community development of their knowledge and skills. The definition of telecentre is usually committed to increase the social and economic impact of grassroots communities. In this chapter we refer mostly to campuses and universities related telecentres. In particular, it was asked to our respondents about the impact on learning from the World Wide Web on-campus sites.

In order to make clear what was intended for WWW on-campus site to the students participating the study, we presented the foremost community technology center in Roma Tre University, called 'Piazza Telematica', that is the largest single concentration of public-access computers on campus. This facilities include computer classrooms and public-user labs; specialized multimedia facilities; file, printers, and Web servers; and an extensive software library.

It offers 198 multimedia high-tech workstations arranged in two large air-conditioned rooms with 124 and 74 PCs respectively.

The facility also has a CED room for the servers and network equipment as well as two workstations for staff. The whole area is connected to a Local Area Network (LAN), which enables users to access both the internal and external network.

The following activities are allowed through the Piazza Telematica workstations:

- Browsing the Internet.
- Using Microsoft Office suite.
- Print out documents through shared printers.
- Take the ECDL course.

One of the activities that is possible to realize in the Piazza Telematica is the online ECDL course to achieve the European Computer Driving License test. The course lasts about six months and it is fully available online. By their personal code, students can access the online course both from the Piazza Telematica workstations and from any other personal computer connected to Internet.

In order to ensure flexible, secure learning environments for students, teachers and trainers face complex challenges and conflicting budget demands every day - from tech support to training, from security to wiring, from staff costs to network infrastructure, and from upgrades to multiple platform support.

There is no doubt that in the last years, the progress of technology equipment facilitates so much technology directors to achieve their needs related to successfully satisfy teachers and students requests.

Nowadays, on-campus networks provide students, faculty, and staff with access to Internet services, e-mail, and the World Wide Web from classrooms, residence hall rooms, offices, and public areas.

As long stated in ICT security papers (http://www.pki-page.org) the users have to feel comfortable with the security of their data over these public areas networks. A large number of campuses are moving beyond traditional security practices and turning to Public Key Infrastructure as trusted tool for securing electronic transactions. We asked to our respondents how much the access to the internet and intranet is stable and secure enough to inspire confidence: more than the 70% agreed or strongly agreed that there are moderate technological advanced equipments to trust in campus public areas.

As result from the outcomes of our study, it is important to observe that respondents take a positive attitude on the contribution of ICT to the existing ILT (Instruction Led Training) and that use of technology added a crucial component to the course nevertheless they almost completely disagreed (more than 50% disagreed or strongly disagreed and more than 30% is uncertain) about the fact that there is not educational difference between laboratory experiences and online experiences.

A similar outcome was obtained from the question related to online discussion and their level of effective communication: this and other issues will be discussed further in this chapter.

Research methodology and approach

This project focuses onto the European and extra-European culturally and technologically developed area which may be considered paradigmatic of other situations elsewhere in other countries: project partners are very prominent institutions in the field of distance education in Europe, and they provide the study with a miscellaneous of population. Therefore we obtain different layers/groups for business density, occupation, sex, and age.

The research methodology blended quantitative techniques (questionnaire with general learning questions plus specific questions and questions on educational background of respondents) and in-depth statistical analyses.

Two main goals have been set: a) the general one: test the impact of the introduction of new technology on adult learners; b) and the specific one test the impact of the technology on WWW on-campus students.

The target population (aged from 24 or younger to over 50) included occupation specific segments: teachers or trainer; manager; students; technical; self-employed; retired; unemployed.

The quantitative sample, composed of 300 individuals, was stratified per quota representing intervention group and control group, with a numeric consistency of 150 and 150 cases respectively.

The research methodology proposed by the project to test the impact of the introduction of new technology on adult learners was randomized controlled trials.
A survey sampling was chosen to conduct the present study. Survey sampling is both a science and an art. To achieve good results the experience of the survey consultant is critical: it will allow the wedding of common sense to methodological precision.

The purpose of sampling is the accomplishment of efficiency, representation, and minimal disruption. It was decided to use a sample survey in order to achieve savings in time and expense, and at the same time, to maintain statistical representation during the project.

The sampling can be contrasted with census in which information is obtained by about every member of a given population. It is important to realize that using a sample from a population to infer something about the entire population involves the risk results from dealing with partial information. If risk is too high to be acceptable in seeking the solution to a problem or the answer to a question, then a complete survey or census, rather than a sample survey, must be conducted.

But this second alternative was definitely not applicable to our case.Determining the representativeness of the sample is the surveyor‘s greatest problem when sampling. By definition, "sample" means a representative part of an entire group.

To avoid the bias in our surveys we have to identify the main sources of it in the questionnaire:

- A non-representative sample.
- Leading questions.
- Question misinterpretation.
- Untruthful answers.

Study results can be ruined to possible non-representative sample bias in two ways. The first is to actually choose a non-representative sample. The second way is to have a large number of non-returns.

To address leading questions issue we reconsider all the questions to balance the leading ones (i.e. changing into negative statements).
To avoid misinterpretation, we also revised items wording in case of a high percentage of uncertain answers. Therefore data show us a reduced number of non-returns.

Regarding the sampling issue, we chose a representative sample of e-learning individuals involved in. As stated before, the total sample size of the

study was 300, which was equally distributed between two groups: the intervention group with 150 and the control group with 150 samples.

This kind of sampling was made to accomplish the United States Department of Education's (2003) *Identifying and implementing educational practices supported by rigorous evidence* (http://www.ed.gov/rschstat/research/pubs/rigorousevid/index.html).

Specifically, every effort was made to comply one of the fundamental stipulation (number 8a): 'A rough rule of thumb is that a sample size of at least 300 students (150 in the intervention group and 150 in the control group) is needed to obtain a finding of statistical significance for an intervention that is effective'.

All corresponding statistical analysis data are presented in detail in the official report, which includes also the overall descriptive and inferential statistics. Summary tables for the answers are also included in the report as well as Chi-square tests and comparison bar charts, some of which are shown in this chapter as well.

Organization of the research methodology

The research methodology employed was organized in six stages:

1) Collecting topics and related issues to be investigated from partner institutions.
2) Constituting a sub-committee of experts in data analysis in social sciences whose tasks were to:
   a. Developing a conceptual model guiding the data analysis and
   b. Devising a questionnaire based on the problems contributed in stage 1).
3) Reviewing, test and approve the questionnaire by all project teams.
4) Administering the questionnaire to the six target groups after translating into the local language – if necessary.
5) Assembling the responses acquired by each institution and perform suitable data analyses.
6) Evaluating the analysis results and present them in a comprehensive report (this document).

A range of statistical analyses were applied to the collected data including descriptive statistics covering the whole population of respondents, t-tests comparing the intervention and control groups, non-parametric correlations, cross-tables or variance analysis.

The project has to validate two research hypotheses[2] as objective:

- Technology does, in fact, have an impact on learning.

- Technology does, in fact, have a beneficial impact on learning.

These research hypotheses are detailed by other in depth ones:

- A great deal of technology is used in the education of adults
- There is a widespread hope/dream/belief that this has a good impact on learning in distance learning environments

In particular, for the WP6, we have to deal with research hypotheses relate to e-learning on WWW on-campus (http://www.ericsson.com/impact).

- "There is a growing tendency at colleges and universities around the world for computers for student use to be distributed widely around the university of college, not just in computer labs but in corridors, alcoves and student areas."
- "There is as growing tendency for lecturers and professors to place their courseware on these computers. In many ways this replaces the distribution on paper of lecture notes that used to be commonplace in universities."
- "There is a growing tendency for lecturers and professors to cancel their lectures and use the courseware on the WWW as the only form of instruction in their course. Where this occurs, this should be regarded as a form of distance education because the technology becomes a substitute for the teacher which is one of the characteristics of distance education."
- "Where this does not occur it should not be regarded as a form of distance education because the technology is only a supplement to the teacher, as any other form of audio-visual assistance is."

The research hypotheses will be validated through outcomes provided by indicators. We will use as indicators some statistical hypotheses.
Statistical hypothesis is a statement about population. In case of parametric tests it is a statement about population parameter. To confirm the truth of this statement at 100% we would need to research whole population. However investigate about the whole population was ineffective and impossible to perform within the duration of our project.

Process of the verification of the hypothesis based on samples is called hypothesis testing. The objective of testing is to decide whether observed difference in sample is only due to chance or if it is statistically significant.

To assess the impact effectiveness we used the four-level model developed by Donald Kirkpatrick (1994). "According to this model, evaluation should always begin with level one, and then, as time and budget allows, should move sequentially through levels two, three, and four. Information from each prior level serves as a base for the next level's evaluation. Thus, each further level represents a more precise measure of the effectiveness of the training program, but at the same time requires a more rigorous and time-consuming analysis."

These four levels of the evaluation model provided the research topics on which we designed the items and structure of the questionnaires used in our experimental research.

The questionnaire was designed to consist of three sections:

1) Personal information including social indicators like gender, age, occupation, or education as judgements depend on such indicators
2) Experiences with technology-enhanced learning
3) Questions related to technology-supported distance learning experiences.

The rationale behind this structure was to reuse the questions in Sections 1 and 2 in the analysis of the other three facets of technology-enhanced learning and teaching (e-learning, synchronous e-learning and blended learning) as well. Only the questions in Section 3 were adapted to address the corresponding investigation topic.

For Section 2 and 3, we used *intensity questions* to measure the strength of a respondent's feeling or attitude on a particular topic.

All the questionnaires were reviewed, partly tested and improved for completeness, exclusiveness and uniqueness by the whole project team during a project meeting held in March 2007 in Plovdiv. The questionnaires were then approved by the whole project staff.

Characteristics of Intervention and Control Groups

The intervention group was composed of 75 respondents each, from Roma Tre University and from the University of Plovdiv (the two partners with face-to-face university courses students).

The control group was composed of roughly 37 respondents from each of the following institutions: Ericsson, Distance Education International, FernUniversität, and Corvinno.

The members of the intervention group were selected on the basis of their experience with e-learning on World Wide Web on-campus, while the members of the control groups lacked of such experience. In the two groups the experience with technology-enhanced learning was expected to vary.

As the presence of elearning on campus was the main objective of this investigation, Roma Tre University and University of Plovdiv were selected as providers of face-to-face university courses to constitute the intervention group among selected members of their student, while the other partners together provided an equal number of respondents in four different control groups.

Intervention Group: 150 Students enrolled in face-to-face university courses

The first half of respondents for the intervention group were 75 students enrolled in Faculty of Education of Roma Tre University, the fifth most populated Italian speaking face-to-face faculties in education with approx. 6.000 students (http://statistica.miur.it/scripts/31gennaio/prima.asp).

The questionnaires were administered before classes, giving to the respondents all the time needed to answer. Then Data were entered in electronic format.

In detail, the data were gathered among postgraduate students enrolled in Roma Tre University courses:

- "Pedagogia Sperimentale" held by Prof. Benedetto Vertecchi.
- "Master di I Livello in Valutazione degli Apprendimenti" directed by Prof. Benedetto Vertecchi.
- "Master di II Livello in Valutazione dei Sistemi di Istruzione" directed by Prof. Benedetto Vertecchi.
- "Master di I Livello in Didattica Generale e Museale" directed by Prof. Nardi.
- "Master di II Livello in Mediazione Culturale dei Musei: Aspetti didattici sperimentali e valutativi" directed by Prof. Nardi.

Selection criteria for respondents were:

1) They must had exposure to any kind of e-learning system through www on-campus.

2) They may differ for degree of exposure to learning technology.

3) They may be both part-time and full-time students.

Similar guidelines were used from University of Plodvid to constitute the second half of respondents of intervention group.

Overall the gender distribution in the target population was relatively well balanced with roughly the same number of male and female students.

Questionnaire Preparation

Due to the large number of students who were contacted, two different versions of the same questionnaire were developed: an electronic version in order to automate the collection of responses automatically sending them via

email; the second in a more classical paper format to reach students during seminars and exams. The text of the questionnaire was the same for both versions. For this second version respondents were provided with electronic data entry. Finally it was achieved a unique backend database.

The original questionnaire was translated into Italian to increase its readability, to avoid possible misinterpretations of item by non-native English students (see annexes). An informative message accompanying each e-mail was designed to briefly inform respondents on (see also annexes):

- Purpose of the project,
- Responsible organizer (here: Prof. Benedetto Vertecchi),
- Contact person and e-mail address, and
- Guaranteed anonymity.

Organisation of the Electronic Questionnaire

The electronic questionnaire was developed using Visual Basic Scripting for Microsoft Office Word. We used a document file to create a dynamic form and to reduce the size of the questionnaire to one page only in order to not overwhelm the respondents with a too intrusive design.

The distinct sections of the questionnaire were organized in different tables, so that respondents could easily recognize all aspects relevant to the actual theme of the questionnaire (i.e., “the impact of ICT on learning in general” and “the impact of ICT on learning in WWW on-campus”, respectively).

The items in Section 1 were constituted by questions about the personal background of respondents: sex, age, occupation and level of education. In order to better detail the students’ background, two more questions were added to investigate the role of technology in their professional and everyday life.

The items in Section 2 addressed aspects like access to learning for students with disabilities, personal contact and online communication, improvement in learning outcomes.

The items in Section 3 addressed aspects related to the specific subject of this specific work package: the impact of technology on e-learning in word wide web on-campus.

The electronic questionnaire used in the study by the University of Rome III is shown below:

ROMA TRE UNIVERSITÀ DEGLI STUDI	IMPACT OF TECHNOLOGY ON LEARNING IN THE USE OF THE WWWW ON-CAMPUS	**IDQue**

Informazioni personali

1. Qual è il tuo lavoro?	Seleziona una voce	2. Età.	Seleziona una voce
3 . Sesso.	Seleziona una voce	4. Qual è il tuo livello di istruzione?	Seleziona una voce
5. In che misura utilizzi attrezzature tecnologicamente avanzate nella tua attività professionale?			Seleziona una voce
6. Hai mai dovuto cambiare il tuo modo di lavorare o studiare a causa degli sviluppi tecnologici?			Seleziona una voce

Domande sull'impatto dell'Information and Communications Technology (ICT) sull'apprendimento in generale

Esprimi il tuo accordo o disaccordo con le affermazioni che seguono.

7. Grazie alla tecnologia sono stati risolti i problemi di accesso all'apprendimento delle persone con difficoltà percettive o motorie.	Seleziona una voce
8. I rapporti fra docenti e studenti possono avere la medesima intensità nell'educazione faccia a faccia e in quella in rete.	Seleziona una voce
9. La comunicazione in rete consente di aumentare, rispetto ad altre soluzioni, l'intensità dei flussi di informazione fra docenti e allievi.	Seleziona una voce
10. L'opinione che l'impatto della tecnologia sull'insegnamento sia vantaggioso è corretta.	Seleziona una voce
11. Nella mia personale esperienza di studio ho riscontrato che l'impatto della tecnologia sull'insegnamento è apprezzabile.	Seleziona una voce
12. L'ICT viene utilizzata abitualmente per incoraggiarci a partecipare attivamente nei processi dell'istruzione.	Seleziona una voce
13. L'ICT viene utilizzata per sostenere lo sviluppo di abilità cognitive complesse di alto livello come la capacità di sintesi e la risoluzione di problemi.	Seleziona una voce
14. L'ICT viene utilizzata per sostenere programmi di individualizzazione dell'istruzione in funzione dei bisogni individuali degli studenti.	Seleziona una voce
15. L'apprendimento è incentivato quando il testo e le immagini sono integrate in un ambiente multimediale.	Seleziona una voce
16. I giochi educativi motivano gli allievi e contribuiscono a sviluppare abilità relazionali, come ad esempio lavorare in gruppo.	Seleziona una voce

Domande sulle conseguenze che ha l'utilizzazione di internet nelle università tradizionali con funzione di integrazione o sostituzione dell'offerta didattica.

17. L'accesso alla rete internet e intranet è abbastanza stabile e sicuro per ispirare fiducia.	Seleziona una voce
18. L'istruzione attraverso internet è un'utile integrazione all'addestramento esistente in cui gli studenti sono guidati nell'aula informatica da un istruttore.	Seleziona una voce
19. L'uso della tecnologia aggiunge un aspetto importante al corso.	Seleziona una voce
20. Non c'è differenza a livello didattico tra le esperienze di laboratorio e le esperienze svolte on-line.	Seleziona una voce
21. Le discussioni on-line non raggiungono lo stesso livello di efficienza nella comunicazione di quelle in presenza.	Seleziona una voce

La preghiamo di inviare come allegato questa scheda al seguente indirizzo di posta elettronica:

francesco.agrusti@uniroma3.it

Grazie per la collaborazione!

Organization of the paper questionnaire

The classical paper format questionnaire was condensed in only one front and back printed sheet: the Section 1 was packed in the first half of the front, the Sections 2 and 3 where designed in a wider manner to keep the question easily readable and, at the same time, keeping the Likert scale clearly expressed under each of them.

Collecting responses

The questionnaires needed for the research aims were collected mainly by the electronic version. The received questionnaires were mostly with any missing values and, as expected, with no conflicting values.

Control Group: 150 students enrolled by other project partner

The control group is composed of about 37 respondents each from Ericsson, DEI, FeU and Corvinno.

Before the submission, the questionnaire was translated in the appropriate language of each partner. Each partner chose the appropriate manner to submit the questionnaires to their students.

After the collection of questionnaires, the data was entered in a specific-made Excel sheet that was finally transmitted to Roma Tre University research group who performed the statistical data analysis.

Summary about the Composition of Groups

From the description of the selection of samples in the intervention and control group we can conclude that we achieved a good mix of different nationalities, age groups, professional backgrounds and career or study stages, and different modalities of education including traditional face-to-face teaching of young adults on campus, education of working adults in evening classes and in distance and open universities and vocational training for professionals. We had a good spread of study disciplines with agricultural science, engineering, social sciences and law. The samples in both groups exhibited different levels of exposure to technology, in general, and in education.

DESCRIPTIVE ANALYSIS OF SAMPLES

As stated before, members of the intervention group were selected on the basis of their experience with e-learning on World Wide Web on-campus, while the members of the control group lacked of such experiences. Further in this paragraph we will compare results from both groups.

Comparison of Personal Background

For what concerns the occupation there are a few more students in the main group than in the control group. This is exactly what was expected because

the main group was constituted by samples derived from the two face-to-face universities. Although the age is not directly related to the occupation, it substantially confirms the profile of our typical respondent as a student of 29 or younger.
For what concerns the gender, the two groups do not significantly differ. Both the two groups had used advanced technological equipment in their professional life a lot or quite a bit. For the sake of accuracy, in the control group 94 people answered ‘a lot’ and 34 ‘quite a bit’, on the contrary in the main group only 34 respondents answered ‘a lot’ and 78 prefers the option ‘quite a bit’.

Profile of typical respondent

Considering the personal background questions (unfortunately the two groups slightly differ for what concerns the level of education. This configuration was achieved to the best of project possibilities. Although this is not a factor that could invalidate our inferential statistics, we have to underline it for future considerations) the profile of typical respondent of the control group matches to the one of the main group for the following aspects:

- The age is in mean under 29 years, although in the control group it is slightly higher.
- The respondent had used frequently advanced technological in his professional life and more than once had to change his way of working because of technological developments.
- The profile of our respondents shows that we obtained a valid representation of population we intend to investigate for: age is up to 40 years in the 81,6% of cases, gender is equally distributed between male and female, and the ICT used for professional purposes is always present for the population engaged in e-learning activities.

THE IMPACT OF ICT ON LEARNING IN GENERAL

Both groups share feelings about the statement that says ‘Thanks to technology, the problems of access to learning for students with disabilities have been resolved’: the same number of people agreed to the statement.

In both groups about 20% of respondents is uncertain regarding the statement “Online communication allows increased amounts of communication between teachers and students when compared with other forms of education”. Anyway there is a substantial difference between the two groups: in the main group 71,4% of respondents agreed or strongly agreed against to only the 43,5% in the control group; at the same time only the 12% disagreed or strongly disagreed with the statement in the main group against 36,2% in the control group (about three times higher).
A significant difference was found in the responses of main group and control group to the item “Online communication allows increased amounts of communication between teachers and students when compared with other forms of education” (chi square = 31,635, df = 4, p = 0.000).

Main group respondents:

- are **less likely** to *disagree* with the statement than expected (16 actual as opposed to 28,5 expected if there where no relationship between the variables).
- are **more likely** to *agree* with the statement than expected (89 actual as opposed to 69,5 expected).

Control group respondents:

- are **more likely** to *disagree* with the statement than expected (41 actual as opposed to 28,5 expected).
- are **less likely** to *agree* with the statement than expected (50 actual as opposed to 69,5 expected).

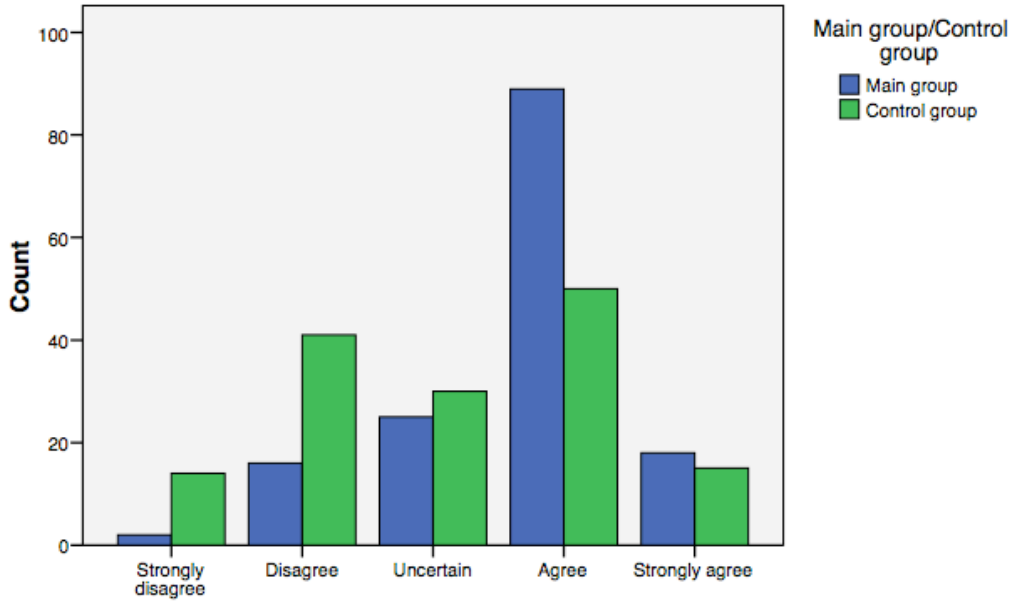

Figure 2 - Online communication allows increased amounts of communication between teachers and students when compared with other forms of education * Main group/Control group

The same pattern occurs also in the question 'Contacts between students and teachers can have the same intensity in online education as in face-to-face education': there are respectively for the main and the control group: 26,8% / 24,8% of respondents uncertain, 40,2% / 53,2% (strongly) disagree, 33% / 22% (strongly) agree.

This negative attitude of control group towards the previous statements is confirmed by the results of the statement 'The opinion that the impact of technology on learning is beneficial is correct': only 22% of respondents of main group (strongly) disagreed against the 41,5% of control group; at the same time the 55,6 % of main group (strongly) agreed against the 44% of control group.

A particular case is observable in the question 'Form my personal study experience I find that the impact of technology on learning is valuable': the same number of people (131) agreed or strongly agreed for both group, and 16 people from main group was uncertain against the 19 people from control group, and only 2 respondents from main group disagreed. There were not any respondents from both groups that strongly disagree with the statement.

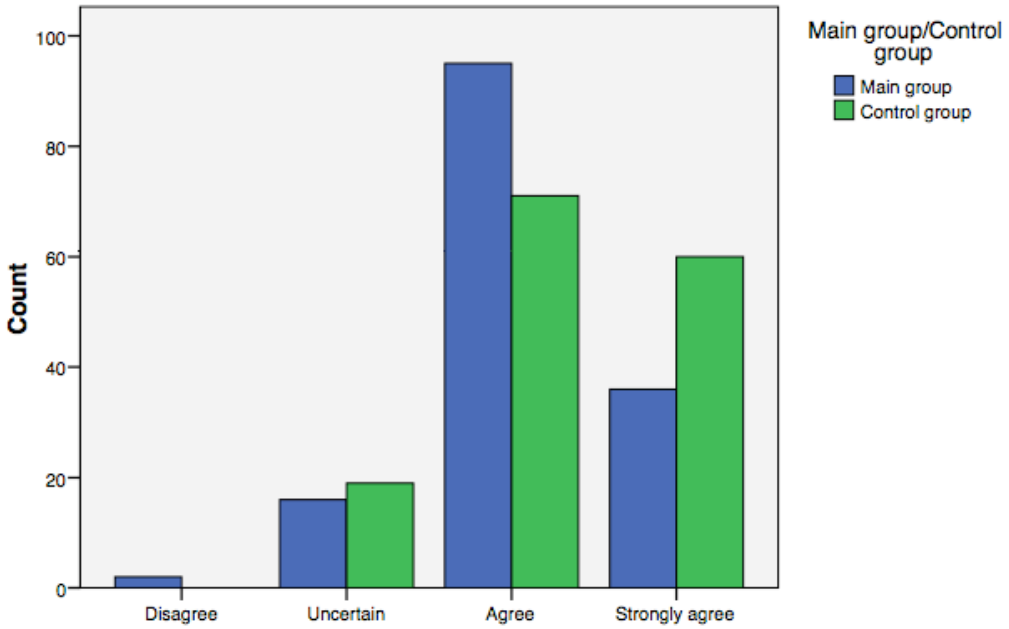

Figure 3 - From my personal study experience I find that the impact of technology on learning is valuable * Main group/Control group

THE IMPACT OF ICT ON LEARNING IN WWW ON-CAMPUS

In Section 3, it was asked more detailed feelings towards the impact of technology on learning in World Wide Web on-campus.

For what concerns the last five questions of the questionnaire, we obtain three questions that allows us to highlight a different behaviour between main and control group.
The only two questions that do not show particular differences between distributions of respondents are the following:

- 'Access to the internet/intranet is stable/secure enough to inspire confidence'.

- 'There is no educational difference between laboratory experiences and online experiences'.

The first one has a specific distribution of respondents because there was not any respondent that strongly disagreed with the statement.

The first of three questions that presents a considerably difference (in numbers of respondents) is 'to what extent do you agree with the following statement: e-learning on-campus is a useful supplement to existing ILT (Instructor led training) (face-to-face provision)': although more than 30% of respondents of the main group was uncertain about the statement only 67% agreed or strongly agreed against the more than 90% of control group.

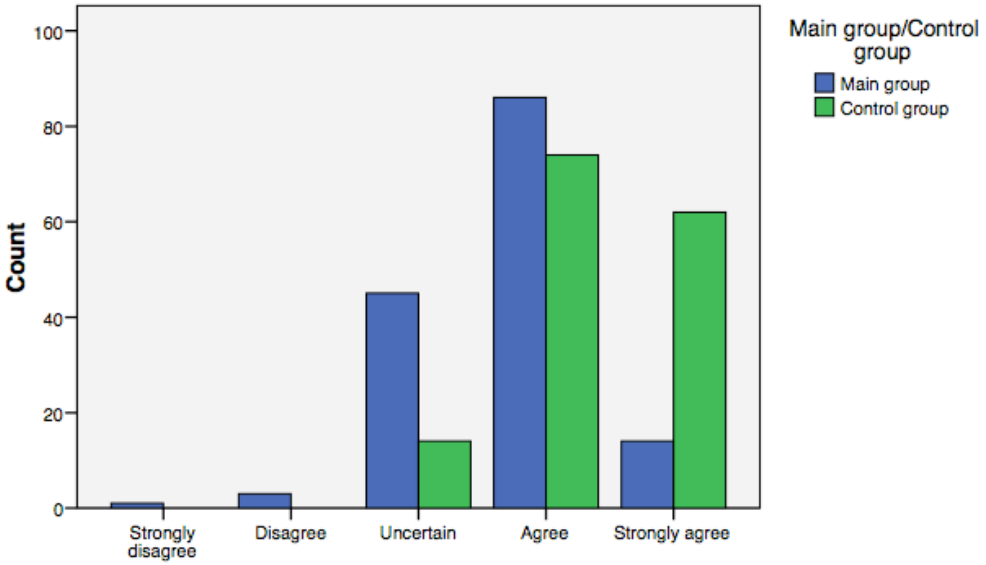

Figure 4 - To what extent do you agree with the following statement: E-learning on- campus is a useful supplement to existing ILT (Instructor led training) (face-to- face provision) * Main group/Control group

This attitude is confirmed by the statement 'The use of technology added an important component to the course': not considering the disagree values, the uncertain values count 51 people for main group against 29 for control group and almost the 60% of respondents of main group agreed or strongly agreed against almost the 80% of control group.

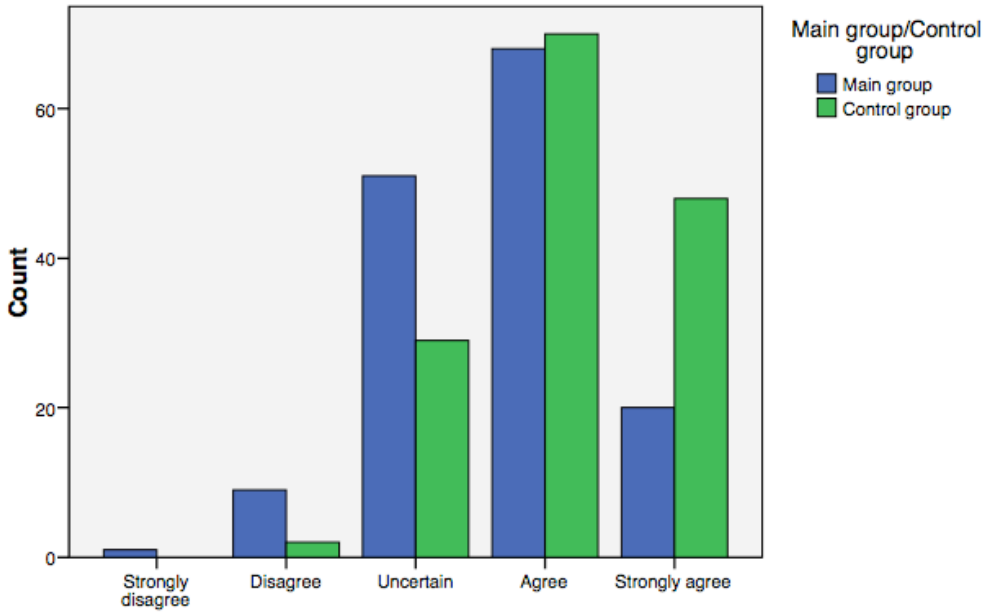

Figure 5 - The use of technology added an important component to the course * Main group/Control group

The third subject confirms the previous opinion, is 'Online discussion do not reach the same level of effective communication as do face-to-face communications': considering the different number of uncertain respondents (33,5% for main group against 20,1% of control group), we observe that only 42% of respondents of main group agreed or strongly agreed against the 62,3% of control group; this attitude is also verified by the 24% of respondents disagreed or strongly disagreed of main group against the 17,4% of control group.

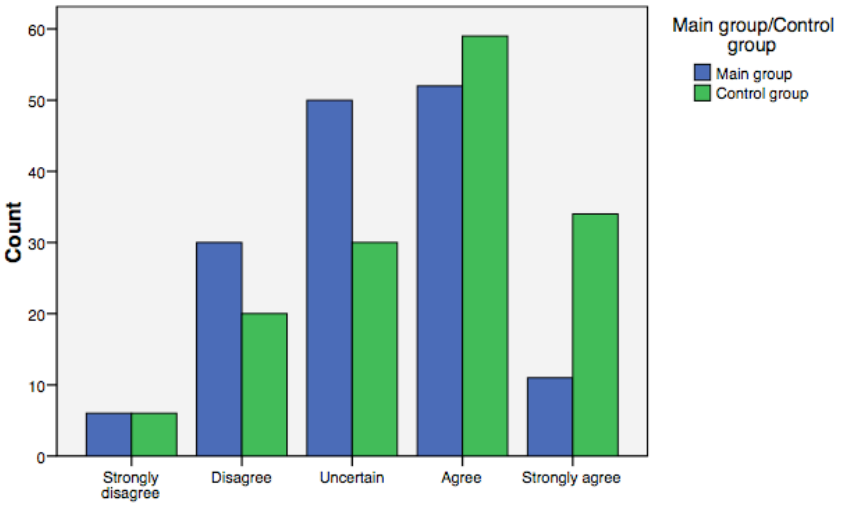

Figure 6 - Online discussions do not reach the same level of effective communication as do face-to-face communications * Main group/Control group

A significant difference was found in the responses of main group and control group to the item "Online discussions do not reach the same level of effective

communication as do face-to-face communications" (chi square = 19,197, df = 4, p = 0.001).

Main group respondents:

- are **more likely** to *be uncertain* than expected (50 actual as opposed to 40 expected).
- are **less likely** to *strongly agree* with the statement than expected (11 actual as opposed to 22,5 expected).

Control group respondents:

- are **less likely** to *be uncertain* than expected (30 actual as opposed to 40 expected).
- are **more likely** to *strongly agree* with the statement than expected (34 actual as opposed to 22,5 expected).

This apparently bizarre trend could be explained because respondents with experience of on-campus laboratory probably know the limits of advanced technologies and so do not blindly accept this kind of e-learning but consider it for its factual benefits in the actual educational environment.

Conclusions

The present research has confirmed that it is a shared feeling that the use of technology in higher distance education is beneficial for the student population at large and for specific students' needs.

However, to better understand illustrated findings we must bear in mind the difference between considering the respondents as one large sample or as two different groups.

On the former it is possible to highlight the following findings:

1. The profile of our respondents shows that we obtained a valid representation of population we intend to investigate for: age is up to 40 years in the 81,6% of cases, gender is equally distributed between male and female, and the ICT used for professional purposes is always present for the population engaged in e-learning activities.
2. Respondents always held a fairly positive attitude towards the wide benefits that ICT can bring to learning and education. However, this positive view of ICT is slightly absent comparing directly pure technology aided learning with traditional education methods.
3. A closer inspection of the answers to Session 2 questions reveals that the respondents are mainly interested in the use of ICT for purposes of information exchange, such as 'to communicate with the tutor', for support more individualized learning programmes and the development of higher level thinking skills.
4. Above all, the respondents feel that, from their personal experience, the impact of technology is very important used in an educational context.

On the latter, we have to consider the two distinct groups: the intervention group and the main group. For what concerns the Section 2 questions, the slightly difference between this two group is widely explained by respondents sampling.
In the case of this work package, as in the previous ones, the sample was intentionally selected within those categories relative to the universities and, more generally relative to teaching. All this kind of respondents were in contact with technology and with the impact of technology on e-learning.

Therefore we have to investigate the majority of differences in the Section 3, where we actively selected the two groups to differ one from the other. For this kind of questions we report here some noticeable findings:

1. Analysis of the cross tabulations shows that the respondents from control group are more persuaded (more strongly agree and less uncertain than expected) with the fact that online discussions do not reach the same level of effective communication as do face-to-face communications, vice versa respondents from main group are more uncertain and less likely to strongly agree than expected.
2. From the comparison of means it is observable a more positive attitude of the control group towards the utility of e-learning on-campus as supplement to existing face-to-face education.
3. In the comparison of means there is a more firm belief between control group respondents that the use of technology adds an important component to the course.
4. And, as stated before, the control group is more persuaded to believe that online discussions do not reach the same level of effective communication as do face-to-face communication.

Therefore, it is observable that there is a significant difference in the judgement of respondents with or without experience in learning at World Wide Web on campus. Although at first sight it seems that control group receives the technology with more enthusiasm than main group, then they criticize the quality of online communication in front of traditional face-to-face communications.
So even if respondents with more experiences in e-learning on World Wide Web on campus seem to accept more coldly the technology innovation, our interpretative hypothesis is that they actually accepts the technology with its limits and imperfections, recognizing its several benefits.

REFERENCES

Winfrey, E. (1999) Kirkpatrick's Four Levels of Evaluation. In Hoffman, B. (ed) *Encyclopedia of Educational Technology.* http://coe.sdsu.edu/-eet/articlesk4levels/start.htm. Retrieved 22 October 2008.

ATTITUDES TOWARDS MOBILE LEARNING

Gabor Kismihok

Research context

On 1 February 2008 Carl-Henrich Sandberg, the CEO of Ericsson announced: “There are now 3.3 billion mobile subscriptions in the world – and every month an additional 50 million people in the world start using their first mobile phone. Broadband is the next step with both mobile and fixed broadband growing rapidly. This figure of 3.3 billion mobile subscriptions far outstrips all previous forecasts.”

Competition between eLearning solutions is increasing at an alarming rate, while changes of the surrounding environment and the demands of both students and the labour market are frequent and substantial. As the announcement of Sandberg indicates the importance of mobile technology in mainstream education is inevitable. Vendors must meet these requirements in order to successfully compete both on national and international level. Moreover these factors put pressure on higher education institutions to turn towards the development and application of such innovative and modern technologies that enable students to easily access, understand and apply complex curricula and other teaching materials.

In this chapter we investigate empirically how mobile learning managed to break in the world of distance education. Is it still in its infancy or managed to make a step forward towards being an everyday routine? What do students and teacher think about mobile Learning? Before answering these questions let’s have a brief overview about the field itself.

Mobile Learning

Being mobile while studying is not a new idea. It has been incorporated into teaching activities and official curricula a long time ago in the form of field trips and on-spot trainings. The appearance of mobile technology in education in the mid 1990s has extended the scope of teaching and leaded us into a new world of education. Mobility in learning, supported by the latest information and communication technologies (ICT), has become an essential need of both the new generations of students and educational institutions (Naismith, Corlett, 2006.). In order to suit all the requirements it is not enough to simply ‘mobilize’ the ordinary learning environments (Walker, 2006; Keegan, 2005), but conflicts of informal learning and Face-to-Face (F2F) education also have to be eliminated (Sharples, 2006). Integration of mobile devices into education also fosters the inclusion of innovative educational practices. (Milard, 2006; Hoppe, 2006). In traditional educational institution, just like in the Corvinus University of Budapest, Hungary (Part of the survey has been conducted in this institution), learning technology should be an integral part of knowledge transfer between students and lecturers, but it cannot be the only platform of

teaching. However it is essential to keep up with students' demand – which forces institutions to involve technology more and more in their everyday teaching activities, enabling students to be flexible in their learning – and construct F2F based learning platforms, which provide elasticity in course content development and delivery.

Research Methodology and Approach

For detailed information about the applied research methodology please consult Chapter 2. This discussion only concentrates on the mobile learning research related issues and differences.

One of the main issue here is the range of Intervention and Control Groups The intervention group, which was selected on the basis of their experience with mobile learning and composed of 75 respondents each from the Department of Information Systems at the Corvinus University of Budapest and from Ericsson (These organisations have incorporated mobile learning into their teaching portfolio). The control group was composed of about 37 respondents each, from Roma Tre, Plovdiv University, DEI, FeU.

In both groups experiences with technology-enhanced learning was expected to vary.

Intervention Groups

At the Corvinus University the students and tutors, who were involved in mobile learning related courses were asked to fill out an electronic questionnaire. The questionnaires were administered online, between the dates of 1st of March and 31st of April.

The original questionnaire was translated into Hungarian in order to increase comprehension and avoid possible misinterpretations of item by non-native English students (see annexes A). An informative message has been sent via e-mail, which was designed to briefly inform respondents on (see also annexes):

- Purpose of the project,
- Responsible organizer (here: Gábor Kismihók),
- Guaranteed anonymity,
- Link to the questionnaire.

Within Ericsson Education questionnaires were distributed to groups, which were engaged with mobile learning during their corporate trainings. The feedback was rewarding and the target of 75 was met. The majority of the respondents came from Ericsson Education. In Ericsson Education the respondents were primarily from the categories of management and training consultants. All data was sent and responded to in electronic format.

Control Groups

The control group is composed of about 37 respondents each from Roma Tre, DEI, FeU and PU. Before the submission, the questionnaire was translated in the appropriate language of each partner. Each partner chose the appropriate manner to submit the questionnaires to their respondents.

In Bulgaria the lecturers at the University of Plovdiv handed out printed copies of the Bulgarian version of the questionnaire to randomly selected students of that university during their class. After the students had completed their questionnaires, they were collected and the data was compiled in an Excel sheet that was finally transmitted to perform the data analysis.

The persons who filled in the questionnaires under the direction of Distance Education International (DEI) were students at Dublin Institute of Arts and Digital Technology, IADT, Ireland. They were all enrolled in adult education courses at there. Many of them were female and many were over 40 years of age. The questionnaires were administered to the respondents in a class situation in an evening course and filled out in the presence of the teacher.

In Italy the data was gathered among postgraduate students enrolled in Roma Tre University. The groups were chosen in order to represent this particular tier of students. The questionnaires were administered before classes, giving to the respondents all the time needed for answering. Data were then converted into electronic format.

The attitude towards mobile learning was investigated with the following Items:

Item 17: I would propose mobile learning as a method of study to others.
Item 18: A mobile phone allows one to communicate more easily with tutors and other students.
Item 19: Mobile devices increase access to education and training.
Item 20: The fact that a mobile phone is a generally available device is important for education.
Item 21: Whoever possesses a mobile phone has all he or she needs for undertaking academic or professional study.

Research Hypotheses

As stated in previous chapters, the project in general has to validate two research hypotheses as objective:

- Technology does, in fact, have an impact on learning
- Technology does, in fact, have a beneficial impact on learning.

Regarding to mobile learning the following domain specific assumptions can be made:

> "There is no significant difference in the judgement of people with or without experience in mobile learning that the use of mobile technology can enhance the general quality of learning."
>
> "It is generally accepted that the use of mobile learning in education is beneficial for improving the communication between students and educators."
>
> "Incorporating Mobile learning into educational activities adds additional value for the learning programmes provided by higher educational institutions."

Data Analysis

The full data analysis can be found on the following website:

http://www.ericsson.com/impact

Descriptive Statistics

The focus group

In the focus group respondents had already some experience in mobile learning. Almost two third of the population was male (99). Regarding the age, most of the responders were under 30 (56%) and one third of the whole sample was 24 years old or younger. 48,7 percent had four or more years of post secondary education, three years or less of post secondary education had only 21,3 % and exactly 30 percent acquired a high school matriculation. The typical respondent was still a student (38,7%) when the data was recorded. The second biggest group belongs to the technical people (24%). The share of managers, teachers and retired is 17,3%, 12% and 8% respectively. The vast majority of these people use advance technology in their professional life, 91 people out of 150 said that they use technology a lot and 47 people are engaged with technology quite a bit. 72,7 percent of the respondents changed their way of working because of technological developments at least once, and the vast majority 60,7% had to do that more than once during their life. This is not a surprise. As this group is engaged with mobile learning, which is a very recent method of learning requires strong technological support, there is a reason to assume that the respondents are familiar with technology.

One of the aims of this project was to have a clearer picture about the impact of ICT in learning in general. Besides the focus field (mobile learning) the respondents had to answer questions about the relationship between learning and using technology in education in general. The first question related to the

use of technology for disabled people got a positive outcome, out of the 147 responses 67 agreed and 8 strongly agreed that technology improved the access to learning, however 55 people were uncertain about this issue.

Regarding to the intensity of online teacher-student communication a remarkable amount of people said (59,1%) that contacts between actors in face-to-face education is still more intensive compared to on-line online education. On the other hand 42,6% stated that online communication allows increased amounts of communication between teachers and students compared with other forms of education (30,7% uncertain). Mobile learners in general don't share the opinion that the impact of technology on learning is beneficial - 43,2% disagree and 14,2% strongly disagree. In contrary 82,7 percent said that according to their experience the impact of technology is valuable.

As it seems for the focus group technology is valuable but its benefits are limited. According to 52% of respondents, technology is a good motivator, it encourages us to be active participants in learning. They also said (77 people out of 145) that technology supports the development of higher level thinking skills. There was a common agreement (61,3%) on the statement that ICT has been used to support more individualized learning programmes tailored to our own individual needs and also on the importance of multimedia environment in learning enhancement (83,4% agreed). Just like multimedia, educational games are also considered positive, 93 people out of 150 said that games motivate learners and contribute to developing skills such as teamwork.

When it comes to mobile learning, mobile learners recommend mobile learning as a method of study to others. 74 out of 142 respondents do so, but 44 people remained uncertain. The same amount was uncertain when judging whether a mobile phone allows one to communicate more easily with tutors and other students or not (61 agreed out of 149).

Mobile devices also increase the access to education and training said 56,6 percent. There was a significant amount of disagreement appeared with the statement that a mobile phone is generally available is important for education. 38,9 percent disagree with this statement and 29,5 percent uncertain (see Figure 3). What is certain that according to 83,9 percent mobile learners in this survey thinks that possessing a mobile phone is not sufficient for undertaking an academic or a professional study. According to the main group, technology is a key issue when it comes to learning. It is important to use technology, it is also important to incorporate and support self paced learning. There is also an agreement on the importance of mobile learning and mobile technology regarding to education, but there is still a significant amount of uncertainty about the impact and the appropriate usage of this technology.

Control Group

The control group looks homogenous. The vast majority of the respondents is from the group of students (66,4%) followed by teachers (21,3%), which is

also represented when it comes to age grouping. Despite the technology related topic, which usually attracts males better, here more female (60,1%) responses had to be recorded than male answers.

There was no surprise on the educational breakdown as well, as the population of the respondents was relatively young and still student, most of the people reported high school matriculation (88 out of 150), 43 of the population had three years or less post secondary education and only in 19 had four or more years of post secondary education recorded. As it seems using advanced technology is an everyday routine in this group. Half of them use technology quite a bit and 31,3 percent a lot, however one third of them never changed their way of working due to technological developments.

The control group in general agrees with the statement that “thanks to technology the problems of access to learning for students with disabilities have been resolved”. Besides 47 uncertain answers 84 were in favour out of 150 responses. Regarding the intensity of the online student – teacher communication 47,3 percent denied that it’s as intensive as face to face education. 57,7 percent of them say that online communication increases the amount the teacher – student interactions.

The majority of this group also agrees that the impact of technology on learning is beneficial (64,7%) and valuable (86%). This group has a very clear, positive attitude towards ICT in learning. They argue that technology is involving people more in learning (67,8%), supports the development of higher level thinking skills (61,1%) and helps individual learning (66%). 81,7 percent agree that text and images enhance learning in multimedia environment and 75% trust educational games as a contributor to teamwork skill development.

Not having experience and proper knowledge about mobile learning made the respondents uncertain. 55 people were uncertain whether to propose mobile learning as a method of study or not. On Figure 6 it’s visible that also 55 respondents from this population would do so and 40 would not. Control group participants have a positive attitude towards not only the general ICT supported learning, but also towards mobile learning. There is a significant belief that mobile technology allows one to communicate easier with tutors and students (62,7%), mobile devices increase access to training (44,7%) and their availability is important for the educational scene (50,7%). Despite all this positive thoughts, most of the members of the control group still can’t imagine that a single mobile device would be enough for undertaking an academic or a professional study.

Differences between Focus and Control Groups

About the Impact of ICT on learning the analysis was only significant in connection with limited amount of items. An interesting and also significant result of the comparison was, that people who were engaged in mobile learning before were more negative regarding the intensity of communication in online education compared to traditional face-to-face education. However

most of the respondents in both groups disagreed with the statement, there was a remarkable amount of positive answer in the control group (44 out of 150 agreed) and also relatively high very negative feedback from the focus group (27 out of 149 answers totally disagreed).

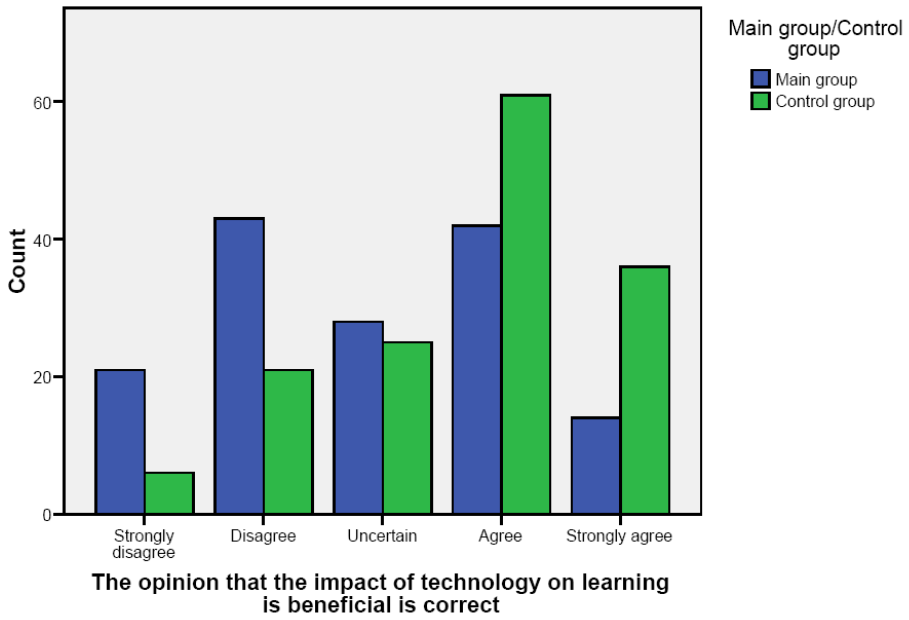

Figure 1. Impact of technology on learning is beneficial

The abovementioned positivism of the focus group was also visible by the judgement whether the impact of technology on learning is beneficial or not (See Figure 1.). Just like in the previous case here the control group was more positive than the focus group, with relatively low uncertainty in both groups. On one hand altogether 64 respondents disagreed in a certain level in the focus group compared to 27 in the control group. On the other hand 56 agreed in the focus group (97 in the control group).

Mobile learning

An interesting but not significant change in the opinion of the focus group appears by the items connected to mobile learning itself. Here with a 0,072 significance level (with a 0,05 cut off value!) the focus group was more positive than the control group. 74 out of 142 of those, who already used a mobile learning related service said that mobile learning is something what he or she could recommend to someone else (control group: 55/150). However the amount of uncertain answers was high in both groups: 44 in the focus and 55 in the control group.

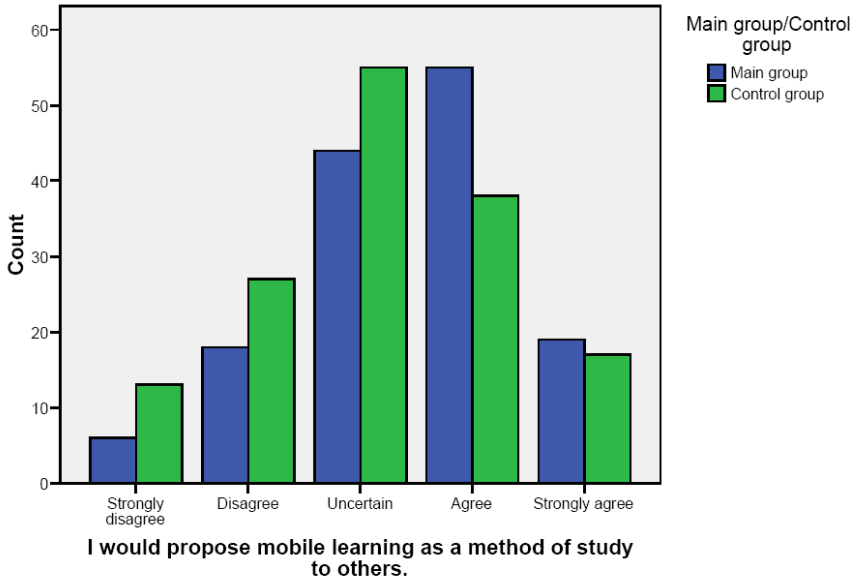

Figure 2. Proposing mobile learning

One possible reason of being positive about mobile learning is that the majority of the focus group also thinks that mobile devices in general increase access to education and training. 85 out of 150 gave positive answer to this item. There is a certain connection between this item and the previous one, as the Spearman – rho correlation coefficient shows a more than moderate connection with a value of 0,606.

This unexpected positivism didn't show up by the mobile communication related item. Here the critical tendency of the focus group is quite strongly represented again. The same amount of people (44) disagreed and was uncertain regarding the communicational benefits of a mobile phone in education. This is a surprising result, as the main function of a mobile phone is the communication itself!

However from the questionnaire the researchers couldn't find out, what kind of mobile services did the respondents of the focus group use, as the there are several mobile services where not the communication, but the mobility of the learner is in the centre of attention.

The control group was also more positive regarding how important is the general availability of mobile phones in education. The respondents in the focus group were more negative (56/149) or uncertain (44/149), the respondents of control group were either positive (76/150) or negative (45/150) about the topic. What both groups could agree on is the item about whether a mobile phone is enough to undertake an academic or professional educational program. Both groups denied this idea (125/149 in the focus group and 110/150 in the control group), but just like before the focus group stressed its negative attitude with the high number of strongly disagree answers (89).

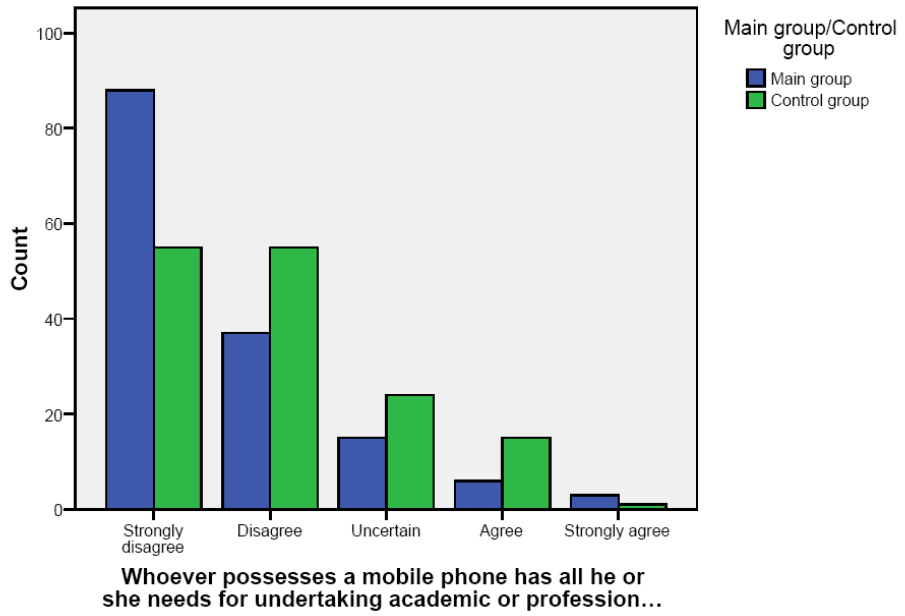

Figure 3. Undertaking a professional study only with a mobile phone

Spearman's RHO

In general we could find significant differences between items, but they were mostly weak or slightly moderate. It is difficult to draw conclusions from this analysis, but in the following the most important outcomes and remarkable correlation regarding to the mobile learning related items are detailed.

This group has moderate and significant correlation between the items except the last question: "Whoever possesses a mobile phone has all he or she needs for undertaking academic or professional study", only showing minimal correlation towards all other items.

Despite this last item, the general level of correlation compared to the previous group is much stronger here. The values are positive and in general they are between 0,4 - 0,5, but there is also a value above 0,6. As an example, the item "I would propose mobile learning as a method of study to others." has the following correlation values within the group:

- A mobile phone allows one to communicate more easily with tutors and other students. (0,404)
- Mobile devices increase access to education and training. (0,606)
- The fact that a mobile phone is a generally available device is important for education. (0,427)
- Whoever possesses a mobile phone has all he or she needs for undertaking academic or professional study. (0,132).

CONCLUSIONS

This research on this new field of mobile learning is one of the first ones, which tries to measure what students and real users of mobile learning applications think about this technology compared to students who weren't engaged with this way of teaching before. The database created by this project contains 300 questionnaires from two groups (focus and control group) which is also freely available from the project website www.ericsson.com/impact for all researchers to do further research.

The results of this analysis are two folded. On one hand some useful and significant data has been gathered and analysed, which describes the main attitude differences between traditional and mobile learners. As it is visible from the descriptive analysis there is a remarkable scepticism towards technology in the focus group and also great positive expectations from the control group.

On the other hand most of the analysis which has been carried out didn't provide significant results. Among these results there are quite a few items which support our hypotheses and also some which deny them, however based on our observations it is not possible to say significantly that our main research ideas are justified or not.

However regarding the first hypothesis - *"There is no significant difference in the judgement of people with or without experience in mobile learning that the use of mobile technology can enhance the general quality of learning."* – there is significant data in this research, which shows that this might not be true! The abovementioned scepticism shows that people who are engaged in technology based learning are a bit more careful about articulating their expectations, especially positive expectations towards technology based learning and in this case mobile learning. But it must be also declared, that the outcomes of this analysis are still not sufficient to justify this research question.

When it comes to our next research statement, - *"It is generally accepted that the use of mobile learning in education is beneficial for improving the communication between students and educators."* – it is also quite hard to say anything which justifies or denies this statement. It was generally accepted that communication has great importance in education and using mobile devices might have a positive impact on educational communication between students and educators. However one of the significant results of this research was that students, who tried mobile learning, were more pessimistic regarding this question than those who didn't. However mobile learning as a category is quite broad, and there is no evidence that respondents in the focus group were using communication related applications. This was one of the weaknesses of the questionnaire, which should be handled in future research.

Regarding the *"Incorporating Mobile learning into educational activities adds additional value for the learning programmes provided by higher educational*

institutions." there was no significant evidence gathered from this research pro or contra to this statement. There is no doubt, that mobile educational services treated positively in both groups and there is a positive support from both groups towards technology in education. But there is no evidence coming out from this research, which gives a clear justification.

There is still quite a long way to go. This was one of the first steps on this new field of mobilised education but hopefully not the last. It is essential to carry out other quantitative research, which targeted more carefully, maybe leaving this traditional focus and control group method and focusing more on the attitudes of the mobile learners.

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IMPACT OF TECHNOLOGY ON LEARNING FOR MEN AND WOMEN

Joseph Thompson

Research Methodology

This project focuses on Europe, as a culturally and technologically developed area, which may be considered paradigmatic of other situations elsewhere in other countries. As it was described above, institutions from five different EU member states (Bulgaria, Germany, Hungary, Ireland and Italy) collected and analysed the data.

The research methodology was a combination of blended quantitative techniques (questionnaire with general learning questions plus specific questions and questions on educational background of respondents) and qualitative analysis (in-depth statistical analyses).

Two main objectives have been set:

the general one: test the impact of the introduction of new technology on adult learners;

the focused one: test the impact of the technology on learning for men and women.

According to the initial plans the quantitative sample composed of 300 cases, was stratified per quota representing intervention group and control group, with a numeric consistency of 150 and 150 cases respectively.

The research methodology proposed by the project to test the impact technology on mobile learning was randomized controlled trials with survey sampling using inductive statistics. The purpose of sampling is the accomplishment of efficiency, representation, and minimal disruption. Using inductive statistics was necessary as only weak agreements exist on the meaning of variables. One of the goals of the project should therefore be to define a number of variables that can be shared in the scientific community in Europe.

It is also necessary to point out which were the possible sources of biases in the proposed questionnaires. This list includes:

- A nonrepresentative sample;
- Leading questions;
- Question misinterpretation;
- Untruthful answers.

During the various work packages of the project the below mentioned procedure had to be followed by the consortium:

1) Collect topics and related issues to be investigated from partner institutions

2) Constitute a sub-committee of experts in social science data analysis. This task force was responsible for:
a. Developing a conceptual model guiding the data analysis and
b. Editing a questionnaire based on the problems contributed in stage 1.

3) Review, test and approve the questionnaire by all project teams

4) Administer the questionnaire to the six target groups after translating into the local language – if necessary.

5) Assemble the responses acquired by each institution and perform suitable data analyses.

6) Evaluate the analysis results and present them in a comprehensive report

A range of statistical analyses were applied to the collected data including descriptive statistics covering the whole population of respondents, t-tests comparing the intervention and control groups, non-parametric correlations, cross tabulation and variance analysis.

Data Analysis

In this section of the report we will discuss the results from the data gathering on the impact of learning between men and women.

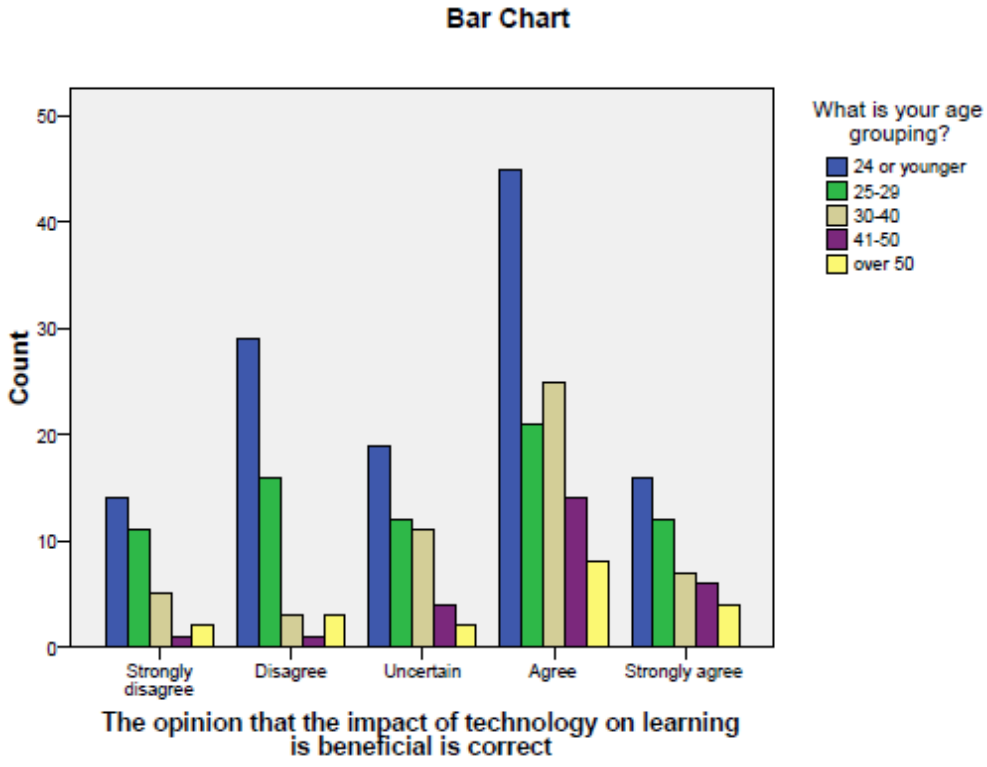

Figure 1. The opinion that the impact of technology on learning is beneficial is correct

From the above diagram we can see first and foremost that that age group of people aged between 24 and under believe very strongly that the impact of technology on learning is beneficial is correct. This is the case for both men and women.

Thanks to technology, the problems of access to learning for students with disabilities have been resolved * Have you had to change your way of working because of technological developments?

Crosstab

			Have you had to change your way of working because of technological	
			No	Yes. Once
Thanks to technology, the problems of access to learning for students with disabilities have been resolved	Strongly disagree	Count	1	1
		Expected Count	1,4	,7
	Disagree	Count	9	3
		Expected Count	10,6	5,1
	Uncertain	Count	30	15
		Expected Count	29,1	14,0
	Agree	Count	33	19
		Expected Count	32,5	15,7
	Strongly agree	Count	10	2
		Expected Count	9,4	4,5
Total		Count	83	40
		Expected Count	83,0	40,0

Another very interesting point from the data collection was that men and women think very differently when it comes to the effect on technology on learning for people with disabilities.

Conclusions and Findings

My research led me to believe that the following conclusions for the data sets are what both men and women believe the impact of learning to be. But before we can do that, we must look at the research that was carried out in this field in the first place.

"We know that successful technology-rich schools generate impressive results for students, including improved achievement; higher test scores; improved student attitude, enthusiasm, and engagement; richer classroom content; and improved student retention and job placement rates. Of the hundreds of studies that show positive benefits from the use of technology, two are worth noting for their comprehensiveness".

The above statement mentions two studies about learning through technology. They were research studies carried out by

1. U.S. Department of Education
2. ACOT (Apple Computers of tomorrow)

Much of today's research carried out on distance learning is based in the ideas of the American department of education. Where the U.S. Department of Education started work in this field, many others use this as the basis for their research. The reason for this is because of the model that was used and proved a foundation for research groups wanting to take this area into more detail.

The second research carried out was the Apple Corporation. The project was known as ACOT (Apple Computers of tomorrow). Although it was research carried out by an company, a lots of time and money was invested over a number of years.

My research was carried out having investigated both research studies carried out. My conclusions and findings were as follows:

- Women who seem to agree with technology being more beneficial to learning are either in a technical or management role
- Men who agree appear to be in either a technical or teacher orientated role
- Women who agree with technology being a catalyst for learning appear younger than men in this regard from our findings. The average age is younger.
- We can see that men have more years of post-secondary education as opposed to women on the survey
- We come across contrasts when we look at the statistics from the survey. Men agree that they have used advanced technological equipment in your professional life more so than women.
- When the men and women were asked about if they had to change their way of working because of technological developments, both groups answered almost identically
- From the statistics generated, we can see that women think technology needs to plays a greater role in learning for people with disabilities
- Women seem to be less convinced that the problems of access to learning for students with disabilities have been resolved.
- It also is apparent from the results, that both men and women disagree with online teaching having the same intensity as face-to-face teaching
- Contrast again appears with regards to increased amount of communication through technology. Men agree that online communication will allow for greater amount's of communication. Where as women are not as receptive to this idea.

- From the results, we can see that both groups agreed almost identically that educational games motivate learners and contribute to developing skills such as teamwork
- Both men and women agreed that online education *does not* have same intensity in online education as in face-to-face education.
- But both groups are of the same thinking that technology can enable the learning process.
- Men and women both agreed that only optimistic people think that the impact of technology on learning is beneficial
- Both men and women had very similar thing with regards to the impact of technology on learning is valuable on a personal level.
- From the statistics, we find that women think Information and communications technology has been used to support the development of higher level thinking skills such as synthesis and problem solving more so than men.
- We also find that men and women believe learning is enhanced when text and pictures are integrated in a multimedia environment
- The number of women using technology in everyday life is increasing whereas men are less receptive to this idea.
- Some answer's offered very little difference as both men and women both think of technology as an enabler for learning.
- Men believe that online and other technologies provide women with enhanced opportunities for study than women do.

My conclusions were drawn from the data set that was available to me. This was collected for many different age group of both men and women. The data sets had information collected from men and women from all over Europe.

I believe that my findings are backed and represented in the samples taken from the data collections.

YOUNGER AND OLDER LEARNERS AND TECHNOLOGY

Desmond Keegan

LITERATURE ON THE IMPACT OF TECHNOLOGY ON LEARNING BY YOUNGER LEARNERS

There is a considerable literature on the impact of technology on learning by younger learners. Much of this literature is American, and focuses on the impact of computers on learning in K-12 (primary schools and high schools).

Pride of place in this literature is still held by the American researcher, Tapscott's 1998 book *Growing up digital: the rise of the net generation.*

At the start of the book Tapscott proclaims the arrival of the "Net Generation," a force of 80 million youngsters ranging from toddlers to the tender age of 20 who are well-versed in the Digital Revolution of computer software, video games, e-mail, and the Internet. This group constitutes 30 percent of the population.

Through the book's chapters, Tapscott presents a well-defined profile of NGeners with the hope that readers may come to understand them and accept the cornerstone of their culture by "embracing the new media." The author believes that those refusing to accept the digital media are destined for a collision course. To avoid the ill fate, Tapscott summarizes his philosophy in the last statement of his book: "Listen to your children."

The book was written on the Internet with the collaboration of hundreds of adults and N-Geners, the latter representing cross sections of societies across six continents. These young people communicated their ideas and experiences to one another, to the monitoring adults on Tapscott's team, and to the author, himself, through online *Growing Up Digital* forums, discussion groups, and activities.

Many N-Gens, who have never used an instruction manual possess an authority of digital knowledge unknown by past generations. These are digitally savvy youngsters who assimilate the new media "like the air". Tapscott reminds the reader that in addition to the children acquiring valuable skills through their use of the new media, they are also having fun. When Tapscott asked N-Geners why they used the Internet, their overwhelming response was the same: "It's fun!"

A similar approach is taken by Prensky (2001) in his study *The Digital Natives.* Prensky claims that 'A really big discontinuity has taken place. One might even call it a 'singularity' – an event which changes things so

fundamentally that there is absolutely no going back. This so-called 'singularity' is the arrival and rapid dissemination of digital technology in the last decades of the 20th century'.

Central to the positions of both Tapscott and Prensky are criticisms of the education system and claims that it cannot cope with the new generation of students. Tapscott states: 'There is growing appreciation that the old approach is ill-suited to the intellectual, social, motivational and emotional needs of the new generation'. To this Prensky adds: 'Our students have changed radically. Today's students are no longer the people our educational system was designed to teach'.

Prensky believes that his digital natives are native speakers of a digital world, that they command the digital language of computers, video games and the internet and that other citizens speak an out-dated language, that of the pre-digital age. He claims that today's students think and process information fundamentally differently from their predecessors and 'it is very likely that our students' brains have physically changed – and are different from ours – as a result of how they grew up'.

Owen (2004) criticizes Prensky's use of Big-Bang rhetoric and emotive language: 'The slogan does not stand up to inspection … This does not deny the idea that there is a profound change in the ways that we as humans mediate
ourselves in the world. There is a lot of serious thinking going on about
this that does not rely on sloganising. Ultimately hanging on to slogans like
'digital native' can lead to bad decision making'.

A much more serious challenge to Tapscott's Net Generation and Prensky's Digital Natives has been mounted by the well-known German researcher Schulmeister' s (2008) *Gibt es eine 'Net Generation?'* (Is there a Net Generation?).

In a 128-page study Schulmeister calls into question the whole basis of Tapscott and Prensky's position. He queries the whole world of Net Geners (and Net Genners), Digital Natives, Millenials, Multitaskers, the instant message generation, the gamer generation, generation @, Generation Y and the Net Generation.

Schulmeister surveys a wide range of literature including German sources like Opachowski's (1999) *Generation @,* de Witt's (2000) *Medienbuldung für die Netz-Generation,* Howe and Strauss's (2000) *Millenials Rising,* Paloff and Pratt's (2003) *Virtual Student,* Oblinger and Oblinger's (2005) *Educating the Net Generation,* Seufert's (2007) *Ne(x)t Generation Learning* and Günther's (2007) *Digital Natives – Digital Immigrants.*

Schulmeister takes a generally sceptical attitude to these studies and concludes: The picture beginning to emerge from research on young people's relationships
with technology is much more complex than the digital native characterisation

suggests. While technology is embedded in their lives, young people's use and skills are not uniform. There is no evidence of widespread and universal disaffection, or of a distinctly different learning style, the like of which has never been seen before. We may live in a highly technologised world, but it is conceivable that it has become so through evolution, rather than revolution. Young people may do things differently, but there are no grounds to consider them alien to us. Education may be under challenge to change, but it is not clear that it is being rejected.

He further comments: Are these new student skill and preference sets different enough to demand changes in teaching methods to successfully engage with these students? Do the skill sets of incoming students demand (possibly only transitional) 'remedial‹'teaching, for example, in using libraries and finding primary sources? Is the changing student profile going to need different ways of teaching that, e.g., minimise traditional patterns of attendance and increase flexibility in where and when learning takes place?

We note that this is not necessarily a function of age, as there are plenty of mature students (and even old students) who make considerable use of Web 2.0 technologies, and many young students who do not use the technologies.

LITERATURE ON THE IMPACT OF TECHNOLOGY ON LEARNING BY OLDER LEARNERS

The literature on the impact of technology on learning by older learners is less extensive than the literature on the impact of technology on learning in schools and colleges. Nevertheless, a sample of relevant studies is presented below.

As has been frequently stated there is little published research on the impact of technology on learning in adult learning, distance education and lifelong learning.

From the United Kingdom the National Institute of Adult Continuing Education (NIACE) carries out its mandate of promoting adult learning by publishing a briefing document *Mobile ICT Resources for Older Learners*. It states:
Older people (those over the age of fifty) are playing an increasingly vital role in the social and economic life of the nation. They bring a wealth of ideas and experiences that can be explored and exploited with computer technology. Older
people should not be marginalized, and it is important that they are given a chance to learn the skills necessary to manage their lives with the technology available.

An American study by Nash (2004) from the University of Oklahoma focuses on study habits and requirements of the older learners group (age 55 and up):
Contrary to conventional wisdom and expectations, the "early adopters" of the University of Oklahoma's online Bachelor of Liberal Arts degree were not tech-savvy teenagers. Instead, in the late 1990s, one year into our new online program, we found that the average age was 53, although we had many

students in their 70s. The majority of the older learners were women, who returned to higher education for many reasons. We did not have much insight into those reasons at first, but, after observing the same perennial flowering year after year, we began to understand the nature of the passion for knowledge and self-actualization that so characterized older learners.

In addition to being intrinsically motivated by the subject matter itself, older learners (over 55 years of age) expressed a profound respect for a college degree, as well as for the institution itself. In many cases, they had encouraged and even paid for the college education of their children, even when it meant financial sacrifice and a dream postponed in their own lives. As a result, older learners tend to bring a unique passion to their studies. Older learners (age 55 and up) give many reasons for choosing online delivery. Most revolve around issues of convenience, flexibility, program focus, and the quality of instruction.

An Australian study by Barnett and Adkins (2004) from the Queensland University of Technology has the title ‘Engaging with the future: older learners see the potential of computers for their lifestyle interests’. They write:

People over 65 years are a small but growing demographic of information technology users. Peer teaching and the ongoing support provided by computer groups for older people address their learning needs in the context of specific age-related issues. This study has shown that the capacity of older people to imagine the future is implicated in the tenacity they show towards learning computer skills.

Policy guiding the adoption of new information technologies in Australia intimates that all citizens should become computer literate so that they can fully participate in the “information society” (Commonwealth of Australia, 2001/2002). Not surprisingly, social exclusion of older people has been a topic of many investigations and commentaries in relation to the practical outworking of access to technology in this context.

Another Australian study by Hazzelwood (2001) from the University of Tasmania has the title ‘The third age learner accessing new technology’. She writes:

The project is about mandatory lifelong learning for adults living longer lives in a
time of rapid change brought about by new technological advances. The literature and research in this field is also expanding rapidly as a global ageing population is confronted with new information, complex systems, and a range of new technologies which all require new learning. The increasing number of third age older adults and 'baby boomers' accessing information and communication technology by choice or necessity has implications for policy makers as well as both on- and off-line course developers and practitioners.

A less optimistic attitude to the impact of computer use on older adults is presented by Dickinson and Gregor (2006) from the University of Dundee in Scotland in *the International Journal of Human-Computer Studies* with the

provocative title ‘Computer use has no demonstrated impact on the well-being of older adults’.

The research states that technology is frequently presented as a panacea for the support needs of the ageing population, based in part upon the commonly cited assertion that computer and internet use has an empirically verified positive effect on the well-being of older people. In this paper we review the studies that this assertion is based on and conclude that they do not support it. While the original studies rarely make unsupportable claims, the secondary literature which cites them is frequently very misleading; limitations include, failure to distinguish between the effects of training/support and computer use; misattributing causality; inappropriately generalising results from a different population.

Pate, Du and Havard (2004) consider the issue of instructional design for older learners in an article ‘Instructional design – considering the cognitive learning needs of older learners’.

Within the past few years discussion has grown regarding the cognitive learning needs of older adults.

But why should instructional designers even consider the cognitive learning needs of older adults. Aren’t these older adults past the point of learning or having the need to learn? Aren’t they just going to retire, relax, travel, do hobbies, visit the grandkids, and live off their retirement income?

Statements were recorded that said learning was “not necessary”, “don’t need to know”, or “not worth the effort”. Older adults also had less confidence in their learning abilities particularly as they relate to technology. Cost barriers were also present in preventing older adults from acquiring computers and other technology for their personal use.

RESULTS AND CONCLUSIONS

The research study into the impact of technology on learning by younger and by older learners followed the methodological guidelines of the United States of America Department of Education’s (2003) *Identifying and implementing educational practices supported by rigorous evidence.* In this instance each of the participants, Ericsson Eduction Ireland, Corvinus University of Budapest, the German Open University, the University of Rome III, the Dun Laoghaire Institute of Art, Design and Technology and the University of Plovdiv, Bulgaria provided 25 younger respondents for the Intervention Group and 25 older respondents each for the Control Group, the fulfilling the stipulations of the US Department of Education methodology.

A summary of the results and conclusions is presented here:

1. The two major hypotheses of the study, namely that ‘technology has an impact on learning’ and that ‘the impact of technology on learning is beneficial’

are both well supported by this research on the impact of technology on learning by younger learners and by older learners.

The best evidence for this conclusion is from the responses to Question 11 'From my personal study experience I find that the impact of technology on learning is valuable.' 80% of respondents agree an only 5% are in disagreement with this proposal. This is a major endorsement of the impact of technology on learning and of the beneficial nature of this impact.

This support comes equally from the younger and the older respondents. 85% of the younger respondents, 127 out of 150, either agree or strongly agree. 112 out of 150, or 75% of the older respondents have the same opinion.

2. The work of the most important researcher in the field, the American scholar Tapscott, is well supported by the analysis to which it was subjected by this investigation. Tapscott's study, *Growing up digital: the rise of the net generation,* remains the leading study in the field.

Tapscott's research would support Question 17 'Older learners have more difficulties in using technology in the learning process than younger learners'. The respondents to this investigation clearly support Tapscott's position with 60% in agreement and only 18% disagreeing.

Further support is provided by the respondents to Question 19 'Older persons are hesitant about online study'. As in Tapscott's work 62% agree that older persons are hesitant about e-learning while only 13% disagree. Significant numbers of both younger and older respondents share Tapscott's position.

3. Further support is given to the hypotheses of the study by the responses to Question 10 'The opinion that the impact of technology on learning is beneficial is correct.' Over 50%are in agreement and only 28% disagree. Both groupings of respondents support the position that the impact of technology on learning is beneficial, with the older respondents being more favourable.

4. The investigation addressed the difficult question of whether problems of access to learning for students with disabilities had been resolved by technology.

The question is blunt and challenging. It does not ask whether the problems of access to education for students with disabilities have been improved. The question says resolved. The issue of whether it can be said that the problems for students with disabilities have been fully resolved may have influenced the answers of some respondents.

The problems of access to education for students with disabilities is an age old problem going back hundreds of years. If it could be shown that technology had resolved these problems it would be a great achievement for technology and prove clearly that the impact of technology on learning is not only a fact but is highly beneficial to society.

The bluntness of the question may have triggered some of the 3% strongly disagree answers who feel that technology has been beneficial to learning, that technology has improved the problems of access for students with disabilities, but who hesitate to agree that all the problems with disability have been resolved. Only in a Utopian world will all the problems for disability be finally solved. Some of the 14% who disagree may also be motivated by such considerations. So too may be some of the 30% who are uncertain.

In these circumstances the statistic that 84% either agree or are uncertain, and 54% either agree or strongly agree, is a good result and supports the claim that technology has had an impact on learning and that this impact has been beneficial in the field of access to education for those with disabilities.

That more than half of the respondents to this analysis agree that technology has fully resolved the problems of access to education for students with disabilities is a great success story for the role of technology in education.

5. The study did not accept, however, that contacts between students and teachers can have the same intensity when mediated by technology and when they take place in face-to-face education.

In their replies both the younger group and the older group are very similar in their attitudes with 40% in disagreement divided almost equally between the groupings.

This is an important finding as it underlines the continued important of face-to-face education in a technology era and requires consideration by those, especially in corporate e-learning, who often wish to eliminate the human factor in e-learning. Universities which are 100% online, like Kaplan University in the United States and universities which equiparate all forms of teaching whether in classrooms, laboratory or online, as in the University of Leicester in the United Kingdom are other cases in point.

6. In a reply slightly contradictory to the previous conclusion, the investigation supports the claim that the use of technology in educational communication 'allows increased amounts of communication between teacher and students' better than other forms of education.

A large group (27%) are uncertain but 52% agree and only 20% disagree, thus giving solid support to the use of technology in educational communication and in contacts between teachers and students.

7. The study investigated the role of technology in making active participation in learning possible (Question 12).

The results are that 57% of respondents agreed and only 16% disagreed that 'Information and communications technology has usually been used to encourage us to be active participants in learning'.

These results show that the theme of active participation in learning is strongly supported by the younger learners who have both more respondents in the agree category and fewer in disagreement. The older respondents are also supporters of the idea of active participation in learning but less clearly than the younger grouping.

8. The work of Marton in Sweden and of Entwhistle in the United Kingdom had emphasised the importance in education of learning higher level thinking skills, synthesis and problem solving.

The study investigated the challenge presented to technology by this research into higher level skills. The question is: is technology only of value for learning lower level mechanical skills or can it have a beneficial impact on higher level thinking skills as well?

The contribution of technology to supporting the learning of higher level skills like synthesis and problem solving is quite well supported by the statistics with 57% choosing either agree or strongly agree and only 12% in disagreement. The figure for uncertain is high at 30% and may indicate that respondents were not sure of the learning of higher level skills.

9. One of the great contributions of distance education was to contribute to the individualisation of education. Distance education broke with the two thousand year old pattern of education within the learning group and placed the learner largely on his or her own. The study asked had information and communication technologies (ICTs) been used to support more individualized learning possibilities.

This, if it could be proved, would be an important contribution of technology to learning, as individualization of learning is difficult in face-to-face schools colleges and universities.

56% of respondents are found to be in agreement with the statement and 16% disagree. Thus the role of distance education, e-learning and mobile learning in supporting the individualization of the learning experience and the central role of technology in achieving this, is supported by the study. The 43% who disagree or are uncertain may feel that although technology has the possibilities of supporting individualized programmes, these programmes have not, in fact, been achieved.

10. Educational games have been one of the great contributions of technology to education and training. The great development of educational games and simulations today has been due to technology.
Again the responses are favourable to the impact of technology on learning in this area. 12% disagree or strongly disagree whereas 60% either agree or strongly agree.

In this case the younger respondents are much more enthusiastic than the older voters with 111 out of 150 younger respondents (74%) in the agree or strongly agree category. The older respondents are less favourable and

outnumber the younger respondents in the disagree and strongly disagree categories. There are a very large number of uncertain respondents in the older group (57 out of 150 or 38%) and fewer in the agree and strongly agree categories.

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