FernUniversität in Hagen

Department of Mathematics
and Computer Science

Data Analysis Report

on the Impact of Technology on Learning in Open Universities and Distance Education

Bernd J. Krämer 2007

Research Report 1/2007
ISSN 1865-3944

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Lehrgebiet Datenverarbeitungstechnik

Editor:	Dean of the Department of Mathematics and Computer Science
Type and Print:	FernUniversität in Hagen
Distribution:	Open access at: http://deposit.fernuni-hagen.de

LEONARDO DA VINCI
PROGRAMME

DATA ANALYSIS REPORT

ON THE

IMPACT OF TECHNOLOGY ON LEARNING IN OPEN UNIVERSITIES AND DISTANCE EDUCATION

PROJECT

IMPACT
(THE IMPACT OF NEW TECHNOLOGIES ON DISTANCE LEARNING STUDENTS)

OUTCOME OF
WORKPACKAGE 3

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The IMPACT project (http://www.ericsson.com/impact) is supported by the European Community in the Leonardo da Vinci Programme. Nevertheless the content of this document does not represent the opinion of the European Community, nor is the European Community responsible for any use that might be made of data appearing therein.

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EXECUTIVE SUMMARY

This report summarizes the findings from Workpackage 3 (WP3) study of the impact the use of information technology and new media has had on distance education in higher education and vocational training. Other than for primary and secondary education rarely any valid result on the impact of the use of technology is available for the tertiary education level. This empirical study aimed:

- To identify new facts about European students' experiences and perceptions of the use of technology in higher distance education including personal benefits or failures, increased or deepened knowledge, behavioural changes that were affected by the use of ICT in education or new opportunities to organize the personal learning process

- To determine attitudes towards the use of technology in higher distance education

- To determine students' opinions about the quality and recognition of university degrees awarded by open and distance universities.

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 technology supported distance learning experiences. 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 150 students from FernUniversität in Hagen and five control groups were identified with 30 students each from the five other partners in the consortium. The members of the intervention group were supposed to have experience with distance education at a higher institution, while the members of the control groups should lack such experiences. In all groups experiences with technology-enhanced learning was expected to vary. In the end we were able to recruited 183 completed questionnaires from individuals in the intervention group and 150 from members in the control groups. The collected answers were finally analyzed using various statistical techniques.

The following provides a brief synopsis of findings from this research. For detail and evidence, review the appropriate sections of this document.

1. Impact of ICT on learning in general

In the population at large ICT already plays an important role in people's daily life and most participants take a positive attitude on its' impact. Among the five occupation groups being surveyed, teachers and trainers use the advanced technological equipment in their professional life most frequently. More than 70% of respondents agreed that their ways of working has been changed by the development of technology. More than 80% of the participants found that the impact of ICT on their learning is valuable according to their own study experience. In addition, a significant number of participants (more than 50%) believe that the problems of access to learning for students with disabilities have been resolved thanks to technology with only a small

portion (around 10%) disagreeing. It is important to note, however, that students exhibit a more negative attitude on this issue (around 30% disagree).

2. *Impact of ICT on learning in open and distance universities*

   Most participants agree that ICT facilitates easier access to material for those studying part-time (90%) and its application to support learning and teaching and providing Internet access to student administrative processes has improved distance education (75%). Among the contributions of information and communication technology, multimedia environments are most widely accepted in open and distance universities. 80% of the population agrees that learning is enhanced when text and pictures are integrated in a multimedia environment. On the contrary, while still being the majority, only 50% participants agree that ICT was used to provide individualized learning programmes.

3. *Effectiveness of the use of advanced technology in distance education with respect to increased motivation and active involvement, personal interaction and improved learning*

   A majority of participants agreed that ICT was used to encourage active learning participation and develop high level thinking skills such as synthesis and problem solving. Especially, educational games received general acceptance as an effective way to develop skills like teamwork. Teachers and students particularly support these opinions. An interesting observation here is that teachers and students take a controversial attitude on the contribution of ICT to the issue of intensified personal interaction. Most teachers believe that online communication allows increased amounts of communication between teachers and students while relatively few students support this point of view.

4. *Recognition of open and distance universities*

   While most participants (90%) believe that study at an Open University is especially advantageous to adults who have work and family obligations, the study quality at such institutions has not been well recognized. Among the participants, no agreement has been reached on whether there is a difference in learning outcomes between studying at an Open University or at a traditional face-to-face university. Moreover, while a small majority of participants (50% vs. 25%) supports the claim that university degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities, it is important to notice that the negative opinions mainly came from teachers and students. Also younger people, those under 30, have a more negative attitude rather than users in the age category 30-50. Further research would be required to ascertain if this is down to personal experience as younger people are more inclined to attend conventional universities.

1. OBJECTIVES AND RESEARCH 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 report is the first in a series, each addressing a different context 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 whether and to what extent known difficulties of the distance education model have been toned down or even been removed. We also try to find out whether the strengths of distance and open universities including elaborate learning content and strong, tutorial, organisational and administrative support have been enforced by the use of advance technology.

1.1 Setting the Scene

In distance education the use of technology is essential. It is not a supplement to the traditional forms of distance education: correspondence and telecommunications-based education. The history of distance education reaches back to the 18th century when it took the form of correspondence education first. It was supplemented later by telecommunications-based distance education, which relies on a synchronous form of delivery and interaction. 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 classroom-based higher education, offering large numbers of adults disadvantaged by limited time, distance or physical disability a second chance at higher education.

In Europe and elsewhere, developments in information and communications technology (ICT) throughout the last decade have substantially changed the format of distance education from correspondence-style courses to technologically based courses using the Internet. The use of various forms of electronic media, e.g., for the submission of assignments and their correction, for performing Internet-based seminars, laboratory experiments and collaborative class activities, has increased time and cost effectiveness and improved the exchange of information. Interactive computer-based learning applications, instructional animations, video or audio are believed to enhance the quality of learning materials. New methodological approaches to learning in technology-based educational scenarios have been developed, promising a wider range of teaching functions and a higher quality of learning, more interaction and feedback for distant students.

But also the culture in traditional campus universities has changed tremendously. The initial period of individual e-learning pioneers is gradually being replaced by an organisational integration of technological innovation and e-learning processes in

European universities. In Germany and other European countries these transition processes, which aim at a sustainable embedding of e-learning in universities affecting administrative processes and services, teacher and tutor qualification, content development, curricular structures and quality assurance, are supported by nationally funded case studies and lighthouse projects.

1.2 Objectives 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** – e-learning covers a wide set of applications and processes, such as Web-based learning, computer-based learning, virtual classrooms, virtual learning environments like ILIAS, Moodle or WebCT and digital collaboration. It includes the delivery of content via Internet, intranet or extranet, podcast and videocast, satellite broadcast, interactive TV, and CD-ROM or DVD. But e-learning also provides instructional interactivity, which differentiates learning from mere e-publishing (Allen, 2003).
- **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 hybrid learning arrangements combining on campus presence in lectures, exercise and practice groups or Instructor Led Training (ILT) and online phases using the WWW and ICT.
- **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.

This report addresses the situation of distance students who may have been exposed to the use of technology in varying degrees of intensity ranging from mere correspondence education at one end of the spectrum to a rich inventory of technologies, including learning and course management systems (WCET, 2007; Baumgartner et al., 2002), learning activity management systems (LAMS International, 2007), computer-supported collaborative learning tools (Kumar, 1996), interactive and multi-media learning materials, computer-based simulations and laboratories (Goodman, 2007), micro worlds, smart tutoring programs or automatic self-assessment tools, at the other end.

This report contains the results of the project's first data acquisition and analysis workpackage, WP3, which took place from January to June 2007.

1.3 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 Technology Transfer Center, Hungary, is the technology transfer company of the Department of Information Systems at the Corvinus University of Budapest. Its main focus is both on teaching and research of IT applications in business and in the public sector. Corvinno is continuously working to develop educational programmes in information technology, so as to best fit the university's profile and enable economists to manage information systems in real-life situations. Corvinno's role in the Impact project is to gather data from the Hungarian students about their ICT usage in their everyday learning activities.

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.

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.

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.

Plovdiv University, one of Bulgaria's largest universities situated in Plovdiv, Bulgaria's second largest city. There are eight faculties: Physics, Mathematics and IT, Chemistry, Biology, Economics and Social Sciences, Law, Languages and Literature, and Education. The University takes part in international programmes, such as TEMPUS, COST, NATO, Leonardo, CEEPUS, 5FP, and Marie Curie fellowships and in sub-programmes including the Socrates programme - Comenius, Erasmus, Minerva and Jean Monet. The University has a firm commitment to the use of technology in education and has extensive technology facilities. The University of Plovdiv has considerable expertise of the impact of technology on learning and will contribute expertise and data especially in the fields of distance learning, e-learning and the use of the WWW on-campus.

University Roma Tre, Italy, is a leading university in public distance learning. The LPS (Laboratorio di Pedagogia sperimentale) is a research unit that has been operating within the Department of Education Sciences of University Roma Tre for over ten years. LPS aims to contribute to the development of education culture by devising and implementing experimental research initiatives. The Laboratory publishes the review *Cadmo*. *An International Journal of Educational Research*, cooperates in national and international research projects, conducts higher education activities through the Ph. D. course entitled *Innovation and Evaluation of Education Systems*.

Kommentar [LS1]: Added

1.4 Acknowledgements

The team wishes to acknowledge the support and help given to the publication and distribution of the first questionnaire and the assembly of student responses by administration staff of the partner institutions. We are particularly grateful to Dr. von Prümmer and Ute Rossié from the Rector's Evaluation and Quality Assurance Team who prepared the German online questionnaire and processed the 183 responses collected at FernUniversität and Ute Wandel from FernUniversität's student office who compiled the sample of students questioned. Volker Winkler was extremely helpful in the production of the PDF version of this report.

2 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. We 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. A point of discussion in the project was the definition of the statistical method to be best used. Our experts from Rome proposed to use inductive statistics because 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.

2.1 Research Hypotheses

Our research hypothesis comprises three facets:

- "There is no significant difference in the judgement 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 generally 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 generally 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."

2.2 Methodology: Principles and Approach

The research methodology employed was organized in six 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:
    a. Develop a conceptual model guiding the data analysis and
    b. Devise a questionnaire based on the problems contributed in stage 1).
3) Review, test and approve the questionnaire by all the project team
4) Administer the questionnaire to the six target groups after translating it 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 (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.

2.3 Conceptual Model and Research Topics

The conceptual model underlying the themes to which this and follow-on investigations should provide replies include:

Reaction of learners: Did they enjoy and benefit from the education using ICT?

Learning outcome: Did the students increase in knowledge or intellectual capacity?

Behaviour: Did the students apply technology-enhanced learning and thereby change their behaviour?

Result: Were there quantifiable aspects of organisational performance gain?

Technology: Can we prove or disprove that the increasing use of technology in education is perceived positively?

Attitudes: What are people's attitudes to the impact of technology on learning?

Gender: Does the use of technology enhance the learning process of female students? Do female students benefit from learning traditionally "male" subject areas (engineering) through gender-neutral media like Centra?

Student-centred and task-based learning: Does the use of technology in the learning process create opportunities to prioritise task-based learning?

These facets of the conceptual model guided the design of the items and structure of the questionnaires used in our empirical study.

2.4 Questionnaire Design

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

The questionnaire was designed to consist of three sections:

1) Personal information including social indicators like gender, age, profession, or education as judgements depend on such indicators.
2) Experiences with technology-enhanced learning, and
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 the sake of succinctness and clarity, only closed questions should be used. As we wanted to test primarily perceptions, attitudes and opinions about the impact of technology on distance education, it was decided to use stated views as questionnaire items in Sections 2 and 3 and allow answers uniformly on five-part scale ranging from a high degree of agreement to complete disagreement. The odd number of possible answers has the advantage that respondents who are neither pro nor cons can express their uncertainty about a particular item in the questionnaire.

To avoid and to be able to detect acquiescence, some statements were formulated negatively, e.g., item 10 (see Annex A.1): "Only optimistic people think that the impact of technology on learning is beneficial."

All four questionnaires were reviewed, partly improved and tested 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.

2.4 Characteristics of Intervention and Control Groups

As distance education was the main objective of this investigation, FernUniversität in its role as an open university was selected to form the intervention group among selected members of its student clientele, while the other partners together provided an equal number of respondents in five different control groups.

2.4.1 Intervention Group: 150 Students enrolled in a Distance University

The respondents for the intervention group were 150 students at FernUniversität in Hagen, the only German speaking distance teaching university with approx. 44.000 students. ,

To ensure a sufficiently high number of responses, 1.500 students were selected from FernUniversität's student database (see Fig. 1). Selection criteria were:

1) Students enrolled in at least three different departments to catch cultural differences between disciplines

2) Students from different study phases

3) Different degrees of exposure to learning technology and multimedia learning content in distance education

4) Balanced gender distribution

5) Both part-time and full-time students.

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Tel. 2081

Befragung zu den Auswirkungen des Einsatzes Neuer Medien und der IuK-Technik auf das Fernstudium

07.05.2007

Auswahl:
nicht exmatrikuliert
Vollzeit-, Teilzeitstudierende
endgültig eingeschrieben
Studiengang = s.u. weitg. Gleichverteilung

insg. 5.023 Studierenden davon:

Fachsemester	(Alle)
Staatsangehörigkeit	(Alle)
Hochschulsemester	(Alle)
Hörerstatus	(Alle)

male female

Anzahl von mtknr		geschl		
abschl_l	stg_l	M	W	Gesamtergebnis
Bachelor	Bildungswissenschaft	64	292	356
	Rechtswissenschaft	210	190	400
	Wirtschaftsinformatik	349	88	437
Bachelor Summe		623	570	1193
Master	Elekt-u-Infor-Technik	192	17	209
	Rechtswissenschaft	58	40	98
Master Summe		250	57	307
Gesamtergebnis		873	627	1500

total population

Fachsemester	(Alle)
Staatsangehörigkeit	(Alle)
Hochschulsemester	(Alle)
Hörerstatus	Teilzeitstudent

Anzahl von mtknr		geschl		
abschl_l	stg_l	M	W	Gesamtergebnis
Bachelor	Bildungswissenschaft	46	232	278
	Rechtswissenschaft	177	147	324
	Wirtschaftsinformatik	293	73	366
Bachelor Summe		516	452	968
Master	Elekt-u-Infor-Technik	181	10	191
	Rechtswissenschaft	39	30	69
Master Summe		220	40	260
Gesamtergebnis		736	492	1228

part-time students

Fachsemester	(Alle)
Staatsangehörigkeit	(Alle)
Hochschulsemester	(Alle)
Hörerstatus	Vollzeitstudent

Anzahl von mtknr		geschl		
abschl_l	stg_l	M	W	Gesamtergebnis
Bachelor	Bildungswissenschaft	18	60	78
	Rechtswissenschaft	33	43	76
	Wirtschaftsinformatik	56	15	71
Bachelor Summe		107	118	225
Master	Elekt-u-Infor-Technik	11	7	18
	Rechtswissenschaft	19	10	29
Master Summe		30	17	47
Gesamtergebnis		137	135	272

full-time students

W:\D282\Statistik\20071\Mail\Evaluation\Krämer\Krämer.xls/Pivot

Figure 1: Selection of intervention group at FernUniversität

2.4.1.1 Determining the Samples

We chose 356 bachelor students enrolled in the curriculum Educational Sciences (ES) to meet the first criterion because these students are both exposed to different types of learning technology like Moodle, CSCL tools or synchronous communication and collaboration tools and are concerned with advanced learning technology standards and educational theories. The second group included 400 law students (BL) who have lesser experiences with advanced learning tools but have excellent experiences with novel and interactive multimedia learning materials. 437 students selected were enrolled in Business Informatics (BI), i.e., a cross-disciplinary curriculum that combines technical skills with business know-how. A fourth subgroup included 209 masters students enrolled in the Electrical Engineering (EE) curriculum and 98 law students in a masters program (ML).

The spread over different study phases ranging from second semester bachelor students to master students obviously addresses criterion 2 quite well.

ES and BL students are exposed to learning technology beyond average, while BI and EE students are familiar with technology in general but their experience with learning technology is rather average. The ML students basically rely on correspondence material and standard online communication facilities like e-mail or newsgroups.

Overall the gender distribution in the target population was relatively well balanced with 873 male and 627 female students. Inside the subgroups we notice, however, a striking imbalance with 1 male to 5 female among Educational Science students and 12 to 3 among BI or 10 to 1 among EE students. In total we had selected 1228 part-time students and 272 full-time students.

2.4.1.2 Questionnaire Preparation

Due to the large number of students who were contacted via e-mail by FernUniversität's student secretary, we developed an online version of the questionnaire to automate the collection of responses automatically in a backend database. This had the additional advantage that we were able to control the completeness of each questionnaire as students could only advance to the next page (using button "weiter" in Fig. 2 and 3) if each item on that page was checked.

The original questionnaire was translated into German to increase its readability, avoid possible misinterpretations of items by non-native English students (see Annex A.3.2). A cover page accompanying each e-mail was designed to briefly express the (see also Annex A.3.1):

- Purpose of the questionnaire,
- Responsible organizer (here: Prof. Krämer from FernUniversität),
- Average time needed to answer all items (approx. 10 minutes),
- Deadline,
- Contact person and e-mail address, and
- Information about guaranteed anonymity.

Figure 2: Item 1 partly opened for test purposes

To test the adequacy and completeness of answers to Question 1 ("What is your occupation?"), we opened up this item by adding the option "Other" including a free entry field to allow respondents who were not confident with one of the possible answer to provide specific information about their occupation (see Fig. 3).

2.4.1.3 Announcing a Raffle

To increase the students' interest in the study, we decided to give away five science fiction books authored by a world-famous computer scientist. Students who wanted to enter the raffle had to acknowledge their wish by entering a valid email address in a text input field or reject the offer by checking the button underneath that input field entitled "Ich möchte meine E-Mail-Adresse nicht angeben" (I don't want to provide my email address, see Fig. 3). The note at the top of that page also included the assurance that this information would only be used to enter the raffle and contact the winners.

Figure 3: Webpage announcing the raffle of five books

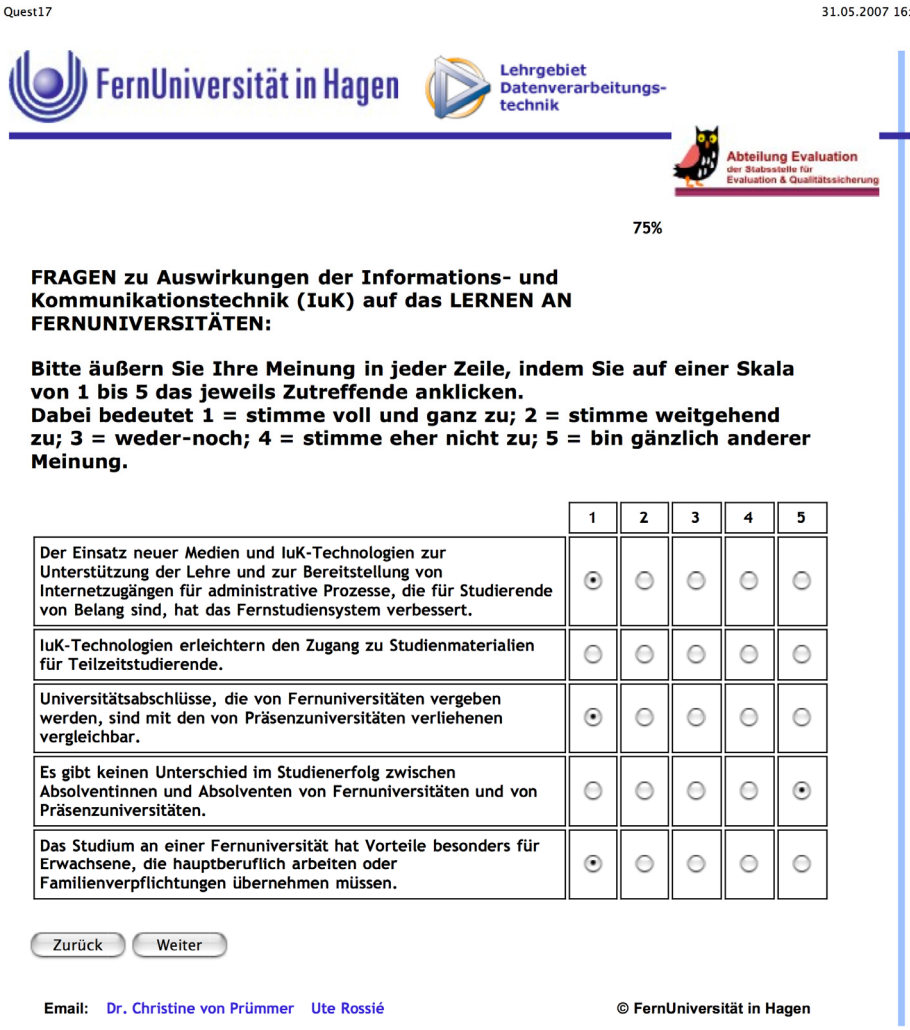
2.4.1.4 Organisation of the Online Questionnaire

The items in Sections 2 and 3 of the questionnaire were organized in two tables so that students could easily survey 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 Open Universities", respectively, cf. Fig. 3). The items in Section 2 addressed aspects like access to learning for students with disabilities, personal contact and online communication, more involved students or improvement in learning outcomes. The aspects investigated for the narrower theme of learning independently at a distance included: access to administrative processes or easier access to material. Here we also investigated personal judgements of the quality and recognition of degrees awarded by open universities.

2.4.1.5 Collecting Responses

183 completed questionnaires were collected in the intervention in a database while the website at https://eva.fernuni-hagen.de/mrIWeb/mrIWeb.dll?I.Project=dvtprojekt was open between May 7 and 29, 2007. The data were extracted in an Excel file and communicated to the Italian partner for further data analysis.

As the interest in the raffle was unexpectedly high with 159 positive responses, we increased the number of books to 9 and the chance to winning to 5.7%. The draw was concluded May 30 and all winners received their price by June 8, 2007.



Quest17 31.05.2007 16:52 Uhr

FernUniversität in Hagen — Lehrgebiet Datenverarbeitungs-technik

Abteilung Evaluation der Stabsstelle für Evaluation & Qualitätssicherung

75%

FRAGEN zu Auswirkungen der Informations- und Kommunikationstechnik (IuK) auf das LERNEN AN FERNUNIVERSITÄTEN:

Bitte äußern Sie Ihre Meinung in jeder Zeile, indem Sie auf einer Skala von 1 bis 5 das jeweils Zutreffende anklicken.
Dabei bedeutet 1 = stimme voll und ganz zu; 2 = stimme weitgehend zu; 3 = weder-noch; 4 = stimme eher nicht zu; 5 = bin gänzlich anderer Meinung.

	1	2	3	4	5
Der Einsatz neuer Medien und IuK-Technologien zur Unterstützung der Lehre und zur Bereitstellung von Internetzugängen für administrative Prozesse, die für Studierende von Belang sind, hat das Fernstudiensystem verbessert.	◉	○	○	○	○
IuK-Technologien erleichtern den Zugang zu Studienmaterialien für Teilzeitstudierende.	○	○	○	○	○
Universitätsabschlüsse, die von Fernuniversitäten vergeben werden, sind mit den von Präsenzuniversitäten verliehenen vergleichbar.	◉	○	○	○	○
Es gibt keinen Unterschied im Studienerfolg zwischen Absolventinnen und Absolventen von Fernuniversitäten und von Präsenzuniversitäten.	○	○	○	○	◉
Das Studium an einer Fernuniversität hat Vorteile besonders für Erwachsene, die hauptberuflich arbeiten oder Familienverpflichtungen übernehmen müssen.	◉	○	○	○	○

Zurück Weiter

Email: Dr. Christine von Prümmer Ute Rossié © FernUniversität in Hagen

Figure 3: Items related to the impact of technology on Open and distance universities

2.4.2 Control Group 1: 30 Students without Experience in Technology-Enhanced Learning from Bulgaria

The English questionnaire was translated first into Bulgarian (see Annex A2) to make life easier for local respondents. Then lecturers at the Agricultural 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 the Italian partner who performed the collected data analysis.

The reason why students at the Agricultural University were chosen rather than students at the project partner's own institution is that Plovdiv University offers study programmes in Natural Sciences, Economics and Social Sciences, Mathematics and Informatics,

Chemistry and others, which makes it difficult to randomly find students with little or no exposure to ICT in a learning context, which was a desired characteristic of this control group. Students from the Agricultural University satisfy this criterion much better and at large.

2.4.3 Control Group 2: 30 Faculty Members from Corvinno, Hungary

As in the German and Bulgarian case, the Hungarian partner translated the questionnaire to Hungarian first, before an on-line version of that questionnaire was produced and made available at:

http://sirius.uni-corvinus.hu/targyertekeles.nsf/login?open&id=GKIK-73HNXH.

Then the study objectives and rationale were disseminated among the faculty SIG (a Special Interest Group consisting of current and alumni students, who are interested in Corvinno's activities). 50 anonymous login codes were prepared for the members of the SIG community and sent via email.

As the website was open, submitted responses were collected automatically and after the 30th filled out questionnaire came in, the collected results were submitted to the Italian partner for data analysis.

2.4.4 Control Group 3: 30 Adult Learners without Experience in Open and Distance Education from Ireland

The persons who filled in the questionnaires under the direction of Distance Education International (DEI) were students at Cork Institute of Technology, Bishopstown in Cork, Ireland. They were all enrolled in adult education courses at Cork Institute of Technology. Many of them were female and many were over 40 years of age.

They were chosen for the control group because they had no experience of study at an Open University or in a distance education system.

The questionnaires were administered to the respondents in a class situation in an evening course and filled out in the presence of the teacher.

30 responses were received and communicated to the Italian partner.

2.4.5 Control Group 4: 30 Vocational Students from Ireland

Approximately 55 questionnaires were distributed to groups within Ericsson Education and to groups in a local third level college. The feedback was rewarding and the target of 30 was met. The groups were chosen to reflect experience with distance education and open universities.

The majority of the respondents came from Ericsson Education. In Ericsson Education the respondents were primarily from the categories of management and training consultants. With regard to the third level college the respondents were lecturers and students.

All data was sent and responded to in electronic format.

2.4.6 Control Group 5: 30 Postgraduate Students in Educational Studies from Italy

The data were gathered among postgraduate students enrolled in Roma Tre University. Over 56 questionnaires were collected; only four respondents were male, following the general pattern in the courses in Education offered by the 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 entry in electronic format.

2.4.7 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 have 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 have a good spread of study disciplines with agricultural science, engineering, social sciences and law. The samples in both group exhibit different levels of exposure to technology, in general, and in education, in particular, while experiences with distance and open universities only exists in the intervention group.

3 REVISION OF THE QUESTIONNAIRE

In the intervention group 67 respondents marked category “Other” of the occupation item (Item 1) and entered a specific job name, which means that they were uncomfortable with the other categories given. With a generous interpretation of the job names listed by the respondents, 45 of these nominations can be mapped to category “Technical”, 5 to category “Student”, and 9 to category “Unemployed”. The other 9, however, did not fit and would require new categories “Self-employed” (8) and “Retired” (1).

The consortium therefore decided to add these two categories to the questionnaires to be used in workpackages 4 to 6.

A special problem occurred with category “Student” because every person in the intervention group is a student of FernUniversität. This made students read the question as “Full-Time students”, which is typically a minority among open and distance university students. The 5 respondents who voted for “Other” but could be considered students in a wider sense are people in a trainee program or apprenticeship.

Another problem was detected with the answer categories in Item 4 (level of education) because the time periods appeared to be awkwardly defined. In the next version of the project’s questionnaires, the category
“One to three years of post-secondary education”
will be replaced by:
“Three years or less of post-secondary education”.

4. DESCRIPTIVE STATISTICS AND COMPARISON OF SAMPLES

The total sample size of the study was 359, which was nearly equally distributed between two groups: the intervention group with 183 and the control group with 176 samples. Different analyses were applied to test our hypothesis. 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.

The results of these analyses are selectively presented in Subsections 4.2-4.4. All corresponding statistical analysis data are presented in detail in Annexes B.1 to B.3. B.1 and B.2 comprise the descriptive statistics, B.3 present the cross-tabulation of both investigation groups. Summary tables for the answers are also included in the annexes as well as Chi-square tests and comparison bar charts, some of which are shown in the main text as well.

The Chi-Square gives us a measure of the statistical significance or probability value and tests the hypothesis that the row and column variables are independent or unrelated to one another. To be able to say that a relationship is statistically significant, the p-value needs to be as small as possible. The value used is less than 0.05 (confidence level of 95%). In the tables, it is therefore necessary to inspect 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.

The t-test presented in Section 4.4 allows us to compare the means of the two sample groups.

4.1 Preparatory Work

Before analysing all items and the last two variables about the personal background of the respondents, we reorganised all items into an ascending positive scale. Thus, a positive feeling about the impact of technology always corresponds to a higher numeric value (i.e., 5 in our case), while a negative opinion corresponds to a lower numeric value (here 1).

Variables as such as "Gender" or "Occupation" are nominal variables because it is possible only to distinguish respondents by a particular feature. Variables such as "Education" or the items in Likert format are ordinal variables because it is possible to sort respondents by the quantity of a certain characteristics they have. Variables such as "Age" are continuous variables because it is possible not only to sort respondents on the basis of a feature but also to individualise a fixed distance between two of them on the scale. The types of variables allowed us to choose the most appropriate kind of analysis.

All the statistical analyses presented in this report were produced with SPSS 13.0.

4.2 Descriptive Statistics of the Intervention Group

The results of the descriptive analysis are discussed in the following subsections according to the three sections of the questionnaire:

4.2.1 Personal Background

The majority of the distance students questioned are in technical positions (47), followed by those in a manager position (47), while the other three categories (teacher or trainer, student and unemployed) range between 15 and 16. Under the correction described in Section 3.1 category "Technical" would nearly double, "manager" and "teacher or trainer" remained stable and the others would only slightly grow.

As Fig. 4 illustrates, the mean age of the intervention group is somewhere slightly above 30.

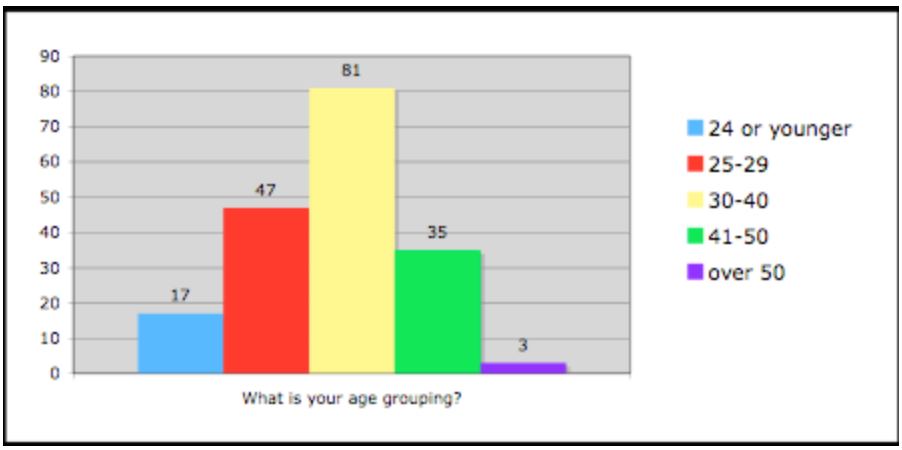


Figure 4: Age distribution of intervention group

More than half of the respondents acquired a high school matriculation, 30 people have mastered one to three years post-secondary education, 53 even more years.

An overwhelming majority of 131 had to change their way of working due to technical innovation and 12 of the respondents in this group had to change their way of working at least once.

4.2.2 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.

Communication technologies support synchronous and asynchronous variants of communication that differs from face-to-face communication due to particular para-lingual characteristics like volume and height of voice or non-verbal means of communication like gestures and facial expressions, which help to reduce misunderstandings (Schröder, Wankelmann; 2002).

More than half of the respondents believe that the problems of access to learning for students with disabilities has been resolved, 12 even strongly agree, only 54 are uncertain,

12 disagree and 3 strongly disagree. 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 (58 versus 87) and the number f respondents who are uncertain is relatively high with 38 people. The contribution of online communication to the increase of communication between teachers and students shows a slightly positive attitude with 84 people agreeing or strongly agreeing but only 48 (strongly) disagreeing. The uncertainty on this item is relatively high with 51 responses. 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 120 (strong) disagreements. This impression is even enforced with 150 positive answers to Item 11, which addresses personal experiences. This positive attitude towards the impact of technology on learning is a bit weaker when asked for encouragement of students to become more involved in the educational process. 94 are still positive, only 25 are negative about this issue but 64 are uncertain. A positive attitude is also visible about the development of higher level thinking skills and more individualized learning programmes but the number of uncertain respondents reaches nearly one third of the sample. 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). The motivating factor of educational games is also perceived positively but 52 respondents are uncertain, which probably derives from the fact that they have no such experience, and 33 are rather negative minded.

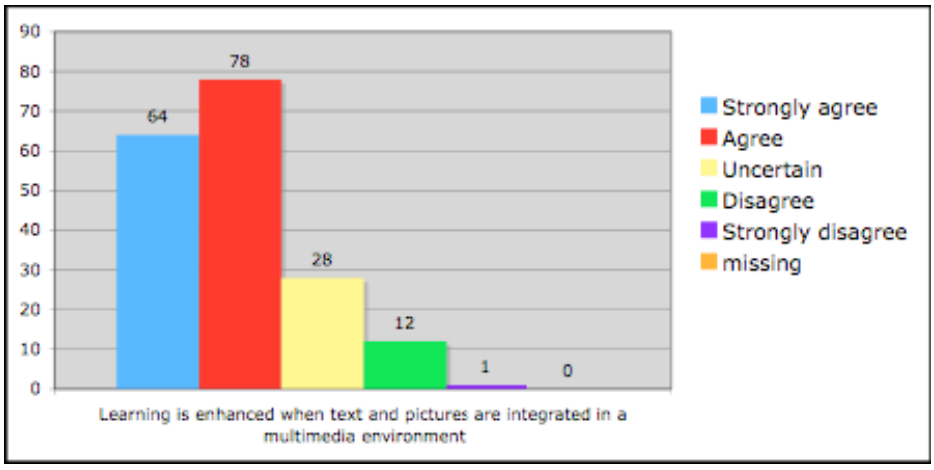


Figure 5: The positive impact of multimedia environments on learning

4.2.3 The Impact of ICT on Learning in Open and Distance Universities

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

- improved student administrative processes,
- easier access to material for part-time study,

- views about the statements that studying at a distance university and a face-to-face university and awards granted by both systems are of the same standard and
- the assessment of a foundational argument for open and distance universities, namely that they are especially advantageous for working professionals and adults with family obligations.

The improvement factors are largely confirmed with a higher value on the strong agreement and only around 7% of the samples being uncertain. Disagreement is neglectable with 3 and 7. That degrees awarded by traditional face-to-face universities and open universities compare is also seen positively with a slightly higher value in uncertain and negative judgements (see Fig. 6). With respect to the learning outcomes of systems, agreements and strong agreements predominate with 85 samples as opposed to 37 disagreements, but the uncertainty factor is quite high with 61 samples. That the study at an open or distance university is especially of advantage to adults who have work and family obligations proves politicians who supported the instalment of these institutions in the 1970s and 1980s to have taken the right decision with a strong agreement by 165 samples and 14 additional agreements.

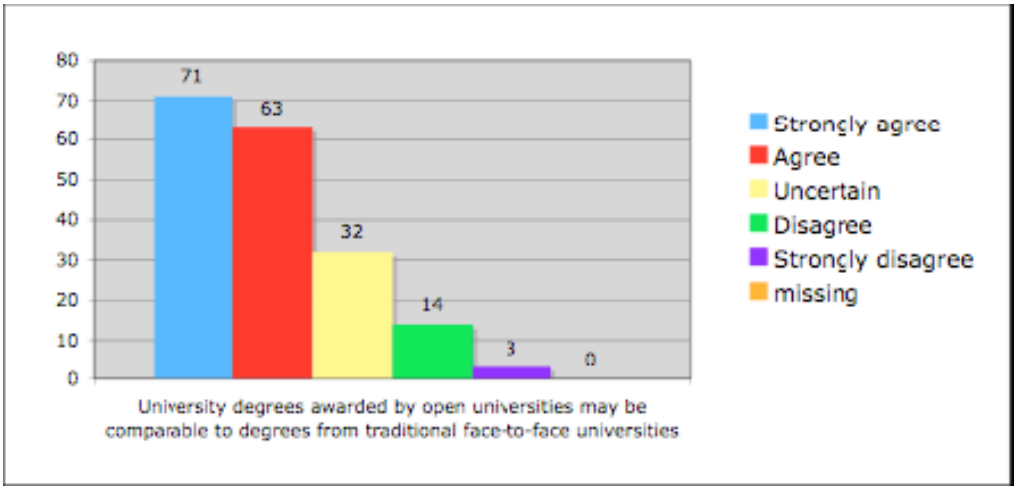


Figure 6: Degrees awarded by face-to-face and open universities are largely considered to be of equal standard

4.3 Descriptive Statistics of the Control Group

We adopt the structure of discussion in the previous section with three subsections.

4.3.1 Personal Background

The samples of the control group are mainly occupied in educational positions as teachers, trainers or students (125). Management positions are occupied by 30 persons, technical staff are 11 and unemployed are 8 people. Two did not provide an answer to this question. Agewise 84 persons are between 24 and 29 years old, 39 are in the thirties, 29 in the forties and 22 over 50. Female participants are dominant with 108 to 66 male in the control group. The level of education shows 79 with high school matriculation, 37 with up to 3 years and 57 with three years and more post-secondary education. The majority of

respondents had to adapt to advanced technological equipment once or more (17 and 100, respectively) but about one third did not experience this.

4.3.2 The Impact of ICT on Learning in General

Opinions about the claim that access to learning in general for students with disabilities is resolved is shared by nearly half of the sample but about one third are uncertain and 28 disagree. Only 34 respondents accept the claim that the intensity of contacts in face-to-face and online education has increased. 19 are uncertain and a large majority of 117 persons objects this position. A somewhat larger group of respondents is convinced that online communication mechanisms have contributed to intensify communication between teachers and learners but still a substantial portion is uncertain or doubts that claim (see Fig. 7).

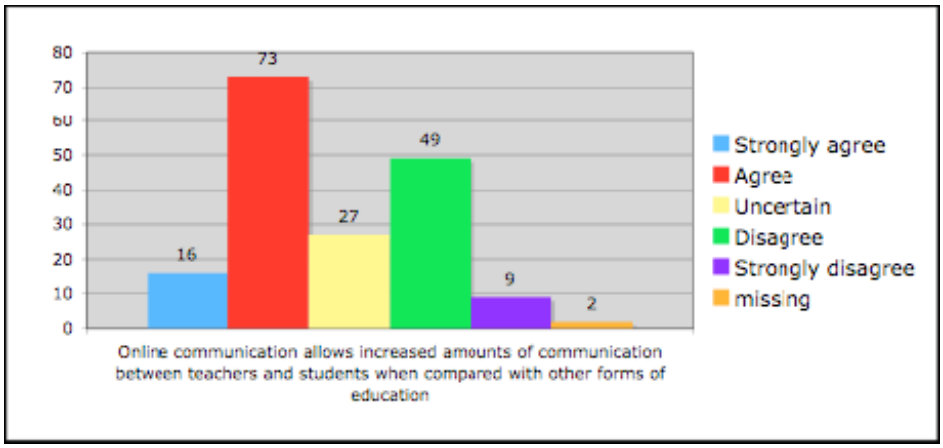


Figure 6: Online communication has intensified interaction between teachers and students

The negatively formulated Item 10 did not mislead the group as more than 100 respondents objected to it, which confirms their mainly positive opinion about the impact of ICT on learning in general. This is enforced by 148 positive answers to the positive formulation of this position under the impression of personal study experiences (Item 11). The claim that ICT in education encourages the active participation of students is viewed positively as well but still 50 respondents are uncertain and 28 disagree. A similar picture is drawn by the answers to claims that ICT has been used to support the development of more demanding cognitive processes that allow students to evaluate a subject matter or create something new by combining elements to a coherent and functioning whole. The support of the claim that ICT has been used to tailor learning programmes to individual needs is even higher and more so is the agreement to the claims that “learning is enhanced when text and pictures are integrated in a multimedia environment” and “educational game motivate learners and promote the development of social skills.

4.3.3 The Impact of ICT on Learning in Open and Distance Universities

In interesting observation related to this group of items is the relatively high number of more than 20 missing answers here, whereas the range is below 5 otherwise.

Overwhelming is the agreement here to the claim that new ICT concepts have improved distance education and related student administrative processes. Attitudes to the claim that technology facilitates access to material for part-time students are even more supportive on this item with 97 strong agreements and 45 agreements against 9 uncertain positions and 3 disagreements. The answers to the statement about the comparability of degrees awarded from traditional face-to-face and from open or distance universities shows a high degree of uncertainty in this group with a slight tendency to disagree (see Fig. 8).

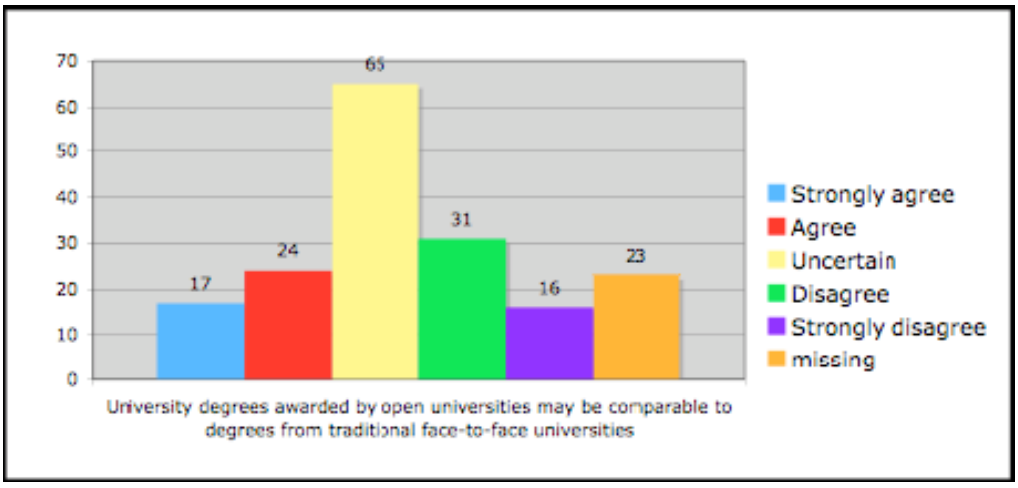


Figure 8: Control group's judgement of the comparability of degrees (see also Fig. 6)

A similar profile depicts the graph of opinions about the learning outcomes between an open and a face-to-face university. Finally we observe an extremely high agreement, even strong agreement, with the claim that "study at an open university is especially of advantage to adults who have work and family obligations.

4.4 Variance between Intervention and Control Group

We applied cross-tabulation to find out whether differences exist between the two different groups of people in our sample. The totality of cross-tables relating to the two study groups is presented in Annex B.3

4.4.1 Personal Background

In the control group we find a similar number of people in a managerial position in both groups but far less technical employees in the control group (see Table 1). The control group has also more teachers and students.

Table 1: Distribution of occupations in both groups

		Main group/Control group		
		Main group	Control group	Total
What is your occupation?	Manager	36	30	66
	Technical	47	11	58
	Teacher or Trainer	16	66	82
	Student	16	59	75
	Unemployed	15	8	23
	Other (e.g. retired)	53	0	53
Total		183	174	357

The age distribution is also different in both groups with a relatively homogeneous distribution among all age categories in the control group, whose mean age is also lower than in the intervention group (see Fig. 9).

With 42 more female than male respondents the gender distribution is a little less balanced in the control as opposed to the intervention group. The differences between the two groups in this variable are visualized in the bar chart in Fig. 7. These differences are visible in the bar chart and tables we generated but also supported by the Chi-Square test presented on pages 3-5 of Annex B.3

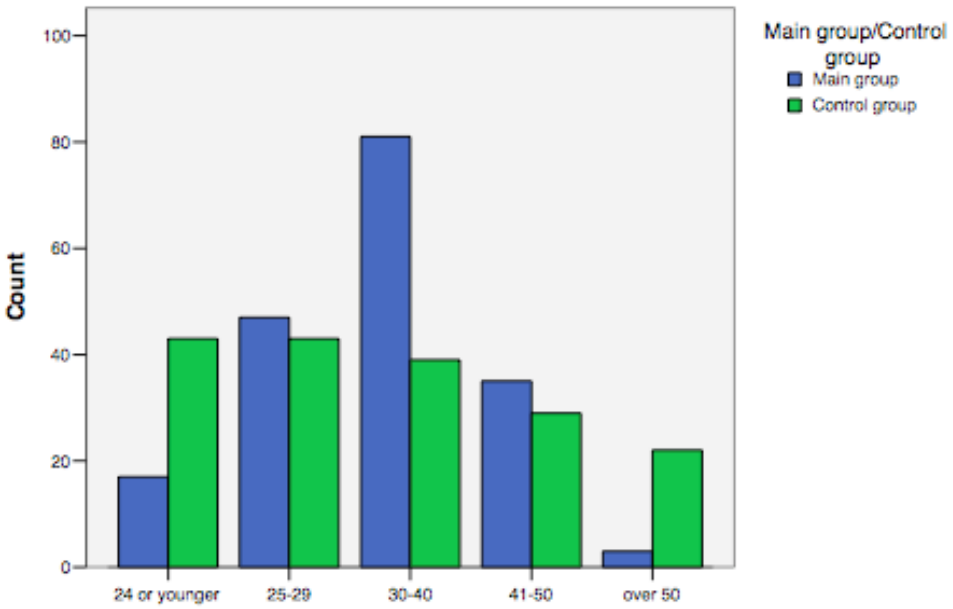


Figure 9: What is your age group?

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 Annex B.3, page 6-8). The intervention group shows, however, 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. Pearson Chi-Square computes a somewhat significant difference for the latter only with a value of 0.29.

4.4.2 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 items more people in the intervention group agree with the actual positive impact statement, in others the control group is a bit more positive (see Annex B.3, pages 9-19). Here and there the Pearson Chi-Square test indicates significant differences.

4.4.3 The Impact of ICT on Learning in Open and Distance Universities

In the third group of items again we find great similarities in both groups concerning the assessment of the stated improvement of distance education due to ICT in learning and administrative process. Facilitated access to material is rated similarly in both groups as well and Pearson's chi-square indicates no significant difference in attitude.

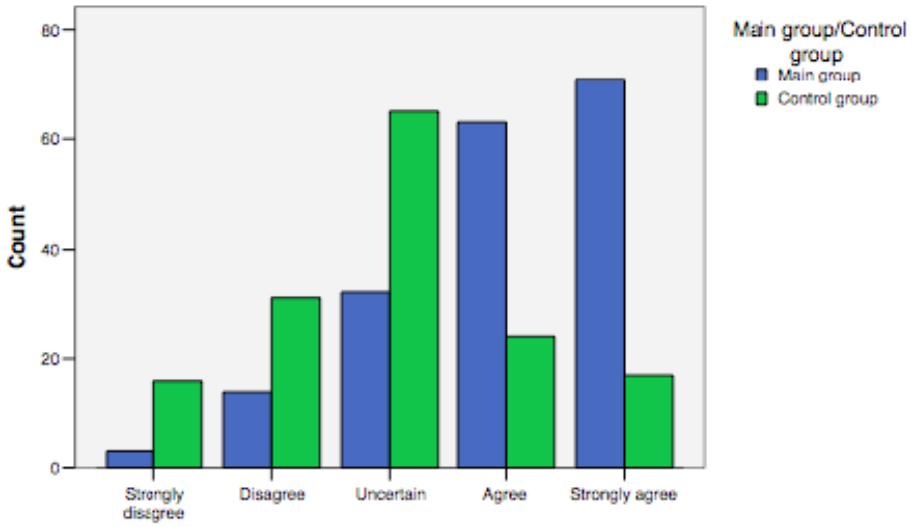


Figure 10: University degrees awarded by open universities are comparable to degrees from traditional face-to-face universities

A striking difference shows up in the respondents' opinion about the comparability of degrees awarded by face-to-face and distance universities: the control group is more critical in this aspect, as can be seen in Fig. 10. Pearson's chi-square test as showed on page 21 of Annex B.3 supports this observation. The level of disagreement is slightly higher than in the intervention group but the level of uncertainty is doubled in this group.

The rating of the quality of learning outcomes in both systems also shows differences in the distribution among the five answer categories, which is also stressed by the chi-square test (Annex B.3, page22). Finally there is also a bit more doubt about the specific advantage of the distance study system 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.

4.4 T-Test

The t-test applied to our two sample groups allows us to compare the means of both groups. Table 2 presents these values. Higher values are given in red. Rows with a green background emphasise variables whose values differ significantly.

Independent sample tests that were computed as well are appended in Annex B.4.

Table 2: Comparing the means of intervention and control group

	Main group				Control group			
Item	*Valid*	*Missing*	*Mean*	*Range*	*Valid*	*Missing*	*Mean*	*Range*
Only optimistic people think that the impact of technology on learning is beneficial	183	0	3,72	4	174	2	3,4	4
From my personal study experience I find that the impact of technology on learning is valuable	183	0	4,12	4	174	2	4,1	4
Information and communications technology has usually been used to encourage us to be active participants in learning	183	0	3,44	4	174	2	3,48	4
Information and communications technology has been used to support the development of higher level thinking skills such as synthesis and problem solving	183	0	3,36	4	175	1	3,42	4
Information and communications technology has been used to support more individualized learning programmes tailored to our own individual needs	183	0	3,37	4	172	4	3,65	4
Learning is enhanced when text and pictures are integrated in a multimedia environment	183	0	4,05	4	174	2	4,18	4
Educational games motivate learners and contribute to developing skills such as teamwork	183	0	3,46	4	173	3	4,06	4
The application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education	183	0	4,42	3	153	23	4,06	4
Technology facilitates easier access to material for those studying part-time	183	0	4,38	4	154	22	4,53	3
University degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities	183	0	4,01	4	153	23	2,97	4
There is no difference in learning outcomes between studying at an Open University or at a traditional face-to-face university	183	0	3,44	4	152	24	2,77	4
Study at an Open University is especially of advantage to adults who have work and family obligations	183	0	4,86	4	154	22	4,44	4
Thanks to technology, the problems of access to learning for students with disabilities have been resolved	183	0	3,52	4	176	0	3,41	4
Contacts between students and teachers can have the same intensity in online education as in face-to-face education	183	0	2,84	4	173	3	2,37	4
Online communication allows increased amounts of communication between teachers and students when compared with other forms of education	183	0	3,29	4	174	2	3,22	4

5 CROSS-TABULATION OF PERSON BACKGROUND AND TECHNOLOGY-RELATED VARIABLES

Cross-table analysis was performed to study the relationship between personal background variables like age, gender, occupation etc. and opinions about the use of technology in higher education, in general, and education at open and distance universities, in particular. Cross tabulations helps us to study the relationships between nominal and ordinal variables.

Variables as such as “Gender” or “Occupation” are nominal variables because it is possible only to distinguish respondents by a particular feature. Variables such as “Education” or the items in Likert format are ordinal variables because it is possible to sort respondents by the quantity of a certain characteristics they have. Variables such as “Age” are continuous variables because it is possible not only to sort respondents on the basis of a feature but also to individualise a fixed distance between two of them on the scale. These types of variables allowed us to choose the most appropriate kind of analysis.

Before analysing all items and the last two variables about the personal background of the respondents were reorganised into an ascending positive scale. Thus, a positive feeling about the impact of technology always corresponds to a higher numeric value (i.e., 5 in our case), while a negative opinion corresponds to a lower numeric value (here: 1).

The results of these analyses are selectively presented in the following subsections. A summary table for the answers in each of the remaining items is also included as well as Chi-square tests and comparison bar charts, some of which are shown in the main text to follow. All statistical analysis data are presented in detail in Annexes B.5 to B.8.

The Chi-Square gives us a measure of the statistical significance or probability value and tests the hypothesis that the row and column variables are independent or unrelated to one another. To be able to say that a relationship is statistically significant, the p-value needs to be as small as possible. The value used is less than 0.05 (confidence level of 95%). In the tables, it is therefore necessary to inspect 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.

5.1 Influence of Age on Peoples Opinions

The extent to which our respondents have used advanced technological equipment in their professional life is indifferent with respect to variable age.

Tables 3 illustrates that people in the age of 30-50 have more frequently changed their way of working because of technological developments than users below the age of 30. The A-Sig. value of the Pearson chi-square test shown in Table 4 indicates significance with 0.01 below significance level.

Table 3: Have you had to change your way of working because of technological developments?

			What is your age		
			41-50	over 50	Total
Have you had to change your way of working because of technological developments?	Yes, more than once	Count	49	19	231
		Expected Count	40,3	16,3	231,0
	Yes. Once	Count	6	3	29
		Expected Count	5,1	2,0	29,0
	No	Count	7	3	95
		Expected Count	16,6	6,7	95,0
Total		Count	62	25	355
		Expected Count	62,0	25,0	355,0

Table 4: Chi-square test to Table 3

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22,591[a]	8	,004
Likelihood Ratio	23,667	8	,003
Linear-by-Linear Association	18,033	1	,000
N of Valid Cases	355		

Item "*Thanks to technology, the problems of access to learning for students with disabilities have been resolved*" shows a big difference for respondents under the age of 24 as opposed to respondents in the age range 25 to 29. The former have a more negative attitude while people in the age range between 25 and 29 have a more positive attitude (see Fig. 11).

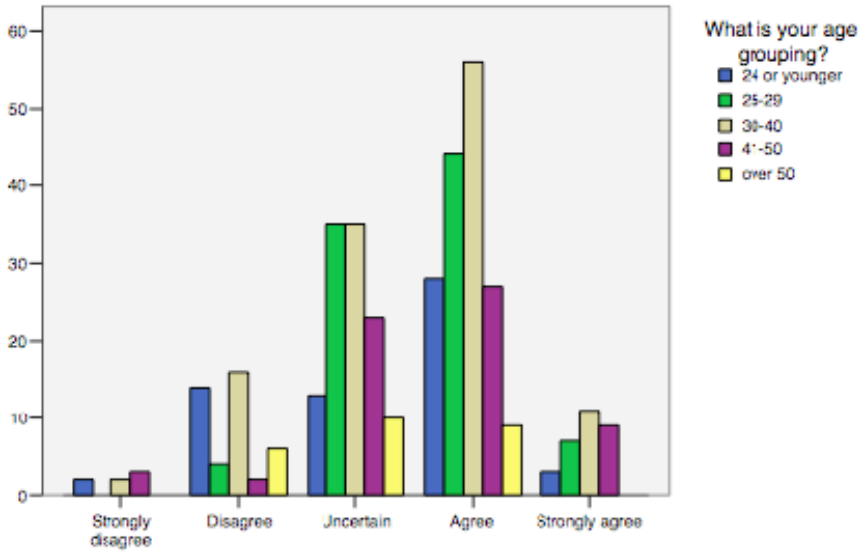


Figure 11: Thanks to technology, the problems of access to learning for students with disabilities have been resolved

Positions to the claims:

- "*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*"

are independent of the age of the respondents (see also Annex B.5, Pages 10-16).

For Item 12 of the questionnaire more users under the age of 24 or younger believe that "*Information and communication technology has usually been used to encourage us to be active participants in learning"* (see Table 5 below and Annex B4, pages 17 and 18).

Table 5: ICT has usually been used to encourage us to be active participants in learning

			What is your age grouping?		
			24 or younger	25-29	30-40
Information and communications technology has usually been used to encourage us to be active participants in learning	Strongly disagree	Count	0	2	3
		Expected Count	,8	1,2	1,7
	Disagree	Count	6	15	13
		Expected Count	8,1	12,0	16,0
	Uncertain	Count	18	27	41
		Expected Count	19,2	28,4	38,0
	Agree	Count	22	41	55
		Expected Count	26,7	39,6	53,0
	Strongly agree	Count	14	4	7
		Expected Count	5,2	7,7	10,3
Total		Count	60	89	119
		Expected Count	60,0	89,0	119,0

More users under the age of 25 believe that:

- *Information and communication technology has been used to support the development of higher level thinking skills such as synthesis and problem solving* and
- *Information and communication technology has been used to support more individualized learning programs tailored to our own individual needs.*

But Pearson's chi-square test shows no significant difference in the second case, only in the first (see also Annex B.5, pp. 20-22).

The assessments of the statements:

- *Learning is enhanced when text and pictures are integrated in a multimedia environment* and
- *Educational games motivate learners and contribute to developing skills such as teamwork*

are indifferent against variable age (Annex B.5, pp. 23-26).

That "*the application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education*" is

true is believed by more respondents in the age between 30 to 40 than other age groups (see Fig. 12 and Annex B.5, p. 28).

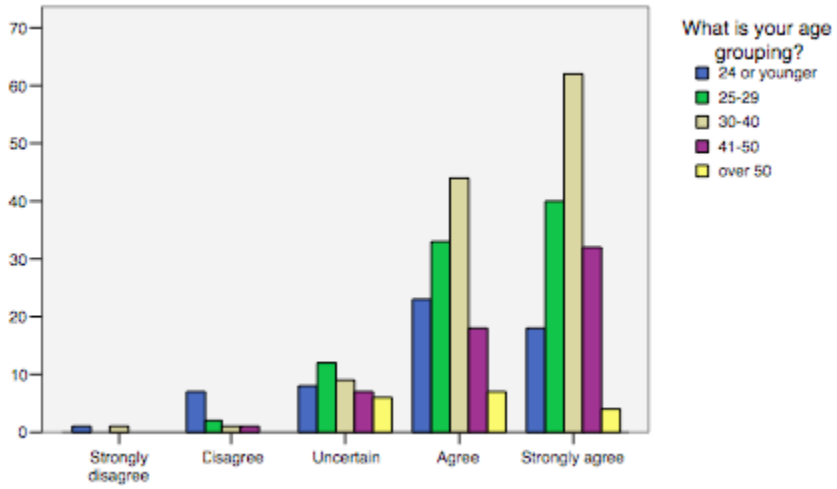


Figure 12: The application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education

Responses to the claim: *Technology facilitated easier access to material for those studying part-time* are independent of variable age.

Users under the age of 30 have a more negative attitude than users at the age 30-50 towards the assertions:

- *University degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities* and
- *There is no difference in learning outcomes between studying at an Open university or at a traditional face-to-face university*

(See also Fig. 13 and Annex B.5, pp. 31-34.)

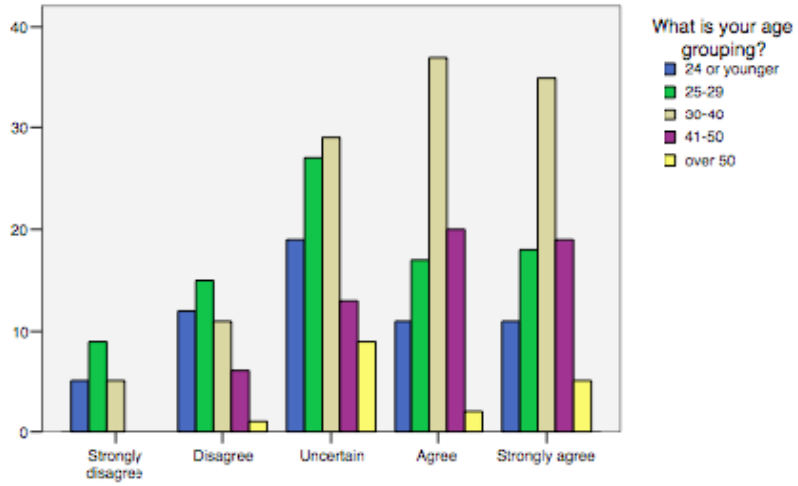


Figure 13: The application of new ICT concepts to support learning and teaching

That the study at an Open University is especially of advantage to adults who have work and family obligations is rated independently of the age group.

4.2 Influence of Gender

The complete results of the cross-tabulation of variable Gender with the technology related items are presented in Annex B.6. In the section we only discuss those items that show a significant dependence of the gender of the respondents.

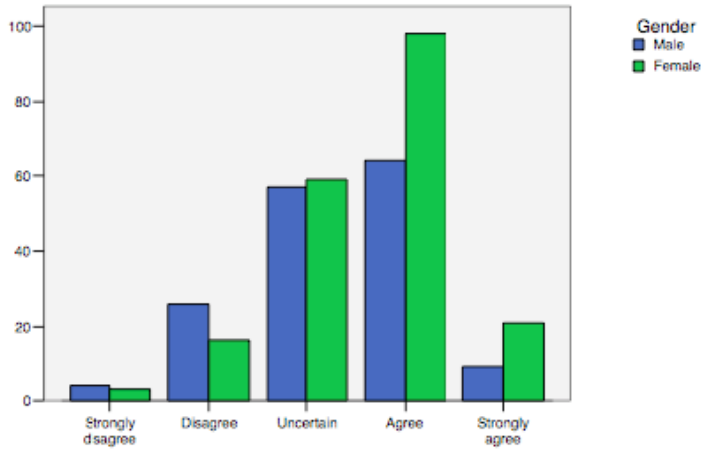


Fig. 14: Thanks to technology, the problems of access to learning for students with disabilities have been resolved

Our study reveals that:

- more male than female respondents *use advanced technological equipment in their professional life* (Item 5);
- more female respondents believe that *the problems of access to learning for students with disabilities have been resolved thanks to technology* (Item 7, see Fig 14);
- 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 *ICT has usually been used to encourage us to be active participants in learning* (Item 12);
- more female respondents are convinced that *educational games motivate learners and contribute to developing skills such as teamwork* (Item 16); and, finally,
- more female respondents strongly agree 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).

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 distance education.

5.3 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 Annex B.7.

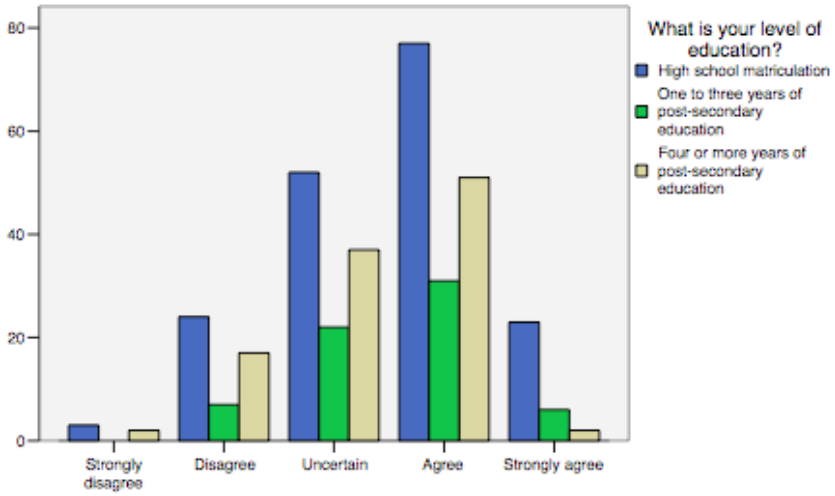


Fig. 15: ICT has usually been used to encourage us to be active participants in learning

Significant dependencies on the level of education we detected include:

- People with four or more years of post-secondary education *use more frequently advanced technological equipment than the others* (Item 5);
- The same group has a more negative attitude about Item 9: *Online communication allows increased amounts of communication between teachers and students when compared with other forms of education*;
- more people with high school matriculation than others strongly believe that *information and communication technology has usually been used to encourage us to be active participants in learning* (Item 12, see also Fig. 15)
- the same group is also more positive than others about the claim that *information and communication technology has been used to support the development of higher level thinking skills such as synthesis and problem solving* (Item 13).

5.4 Influence of Occupation

All results about dependencies of impact judgements on the level of education of the respondents are contained in Annex B.8.

The following dependencies have been detected:

- Managers and technical staff, somewhat less students as well, use more *advanced technological equipment in their professional life* than other groups (Item 5);

- Students have a more negative attitude to believe that *the problems of access to learning for students with disabilities have been resolved thanks to technology* (Item 7);
- Manager and retired persons have a more positive attitude than teachers and students towards Item 8 (*contacts between students and teachers can have the same intensity in online education as in face-to-face education*);
- Managers and teachers are more positive than technical staff and students about the claim (Item 9): *Online communication allows increased amounts of communication between teachers and students when compared with other forms of education* (see also Table 6);
- Students have a more positive attitude than managers concerning the statement (Item 10): *Only optimistic people think that the impact of technology on learning is beneficial*;
- *Information and communication technology has usually been used to encourage us to be active participants in learning* (Item 12) believe teachers and students more than other occupational groups;
- the same groups are also more positive than others about the statement in Item 13: *ICT has been used to support the development of higher level thinking skills such as synthesis and problem solving*;
- Teachers and students also believe more than other occupational groups that *educational games motivate learners and contribute to developing skills such as teamwork* (Item 16);
- Teachers have a more positive attitude than students against the claim (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*;
- Teachers and technicians are more positive than students about Item18: Technology facilitates easier access to material for those studying part-time;
- University degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities (Item 19) 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.

Table 6: Online communication allows increased amounts of communication between teachers and students when compared with other forms of education

			What is	
			Other (e.g. retired)	Total
Online communication allows increased amounts of communication between teachers and students when compared with other forms of education	Strongly disagree	Count	1	17
		Expected Count	2,5	17,0
	Disagree	Count	12	89
		Expected Count	13,3	89,0
	Uncertain	Count	7	77
		Expected Count	11,5	77,0
	Agree	Count	22	131
		Expected Count	19,6	131,0
	Strongly agree	Count	11	41
		Expected Count	6,1	41,0
Total		Count	53	355
		Expected Count	53,0	355,0

6 SPEARMAN'S RHO CALCULATION

To determine the linear relationship between different variables, we also applied Spearman's rank correlation coefficient as a non-parametric measure of correlation. This coefficient allows us to correlate two ordinal variables.
In the analysis, we applied it to all the items. It gives us the direction of the relationship (positive or negative) and its strength. The significant values have a flag in the table presented Annex B.9. The strength of the coefficient is interpreted according to (Muij, 2003, p. 145):

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

The direction of the correlation indicates whether both variables increase their values (positive) or one increases when the other decreases (negative).

It is important to remember that the fact that two variables are related to one another does not necessarily mean that one is the cause of the other. Furthermore, the Spearman's Rho is a rank-order coefficient for ordinal variables. This means that when we use the terms "to increase/decrease" or "more/less" we are not referring to proper measurable "quantities" on a continuous scale, but only to an higher or a lower position in a rank-order.

Therefore, the most relevant results of the analysis are the following:

- The age grouping is negatively correlated (modest intensity) with the *change of the way of working due to technological developments*, i.e., older respondents showed more need for change because of technological innovations (rho = -0,221; Sig. = 0,000).
- The age grouping is negatively correlated (modest intensity) with the agreement to the idea that *ICT has been used to support the development of higher level thinking skills*, i.e., older respondents showed more agreement with this perspective (rho = -0,215; Sig. = 0,000).
- The age grouping is positively correlated (modest intensity) with the agreement to the idea that *university degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities*, i.e. younger respondents showed more agreement with this comparison (rho = -0,212; Sig. = 0,000).
- The age grouping is positively correlated (modest intensity) with the agreement to the idea that *studying at an Open University is especially of advantage to adults who have work and family obligations*, i.e., younger respondents showed more agreement with this assumption (rho = -0,203; Sig. = 0,000).
- The agreement with the item *online communication allows increased amounts of communication between teachers and students when compared with other forms of education* is positively correlated (moderate intensity) with the agreement with the item *Contacts between students and teachers can have the same intensity in online education as in face-to-face education* (rho = 0,454; Sig. = 0,000).
- The agreement with the item *Technology facilitates easier access to material for those studying part-time* is positively correlated (moderate intensity) with the

agreement with the item *The application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education* (rho = 0,443; Sig. = 0,000).

- The agreement with the item *There is no difference in learning outcomes between studying at an Open University or at a traditional face-to-face university* is positively correlated (strong intensity) with the agreement with the item *University degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities* (rho = 0,614; Sig. = 0,000).

The pure data analysis of this test is shown in Annex B.9.

7 FREQUENCIES

We have also calculated the count for each variable considering the answers of all respondents.

Figure 16 just depict the frequencies for Item 5. The complete computation result is presented in Annex B.10 including counts, percentages and further bar charts.

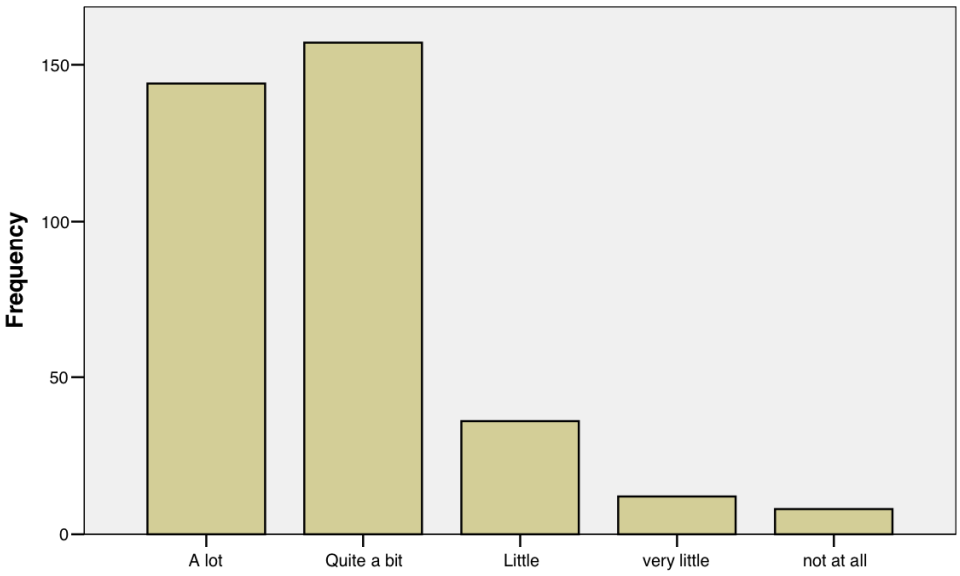


Fig. 16: To what extent have you used advanced technological equipment in your professional life?

Some insights into these data are summarised below:

- most participants (more than 80%) *frequently use advanced technological equipment in their professional life*;
- a large percentage of respondents (more than 70%) have experienced that they *needed to change their way of working because of technological advances*;
- 50% of the sample believes that *the problems of access to learning for students with disabilities have been resolved thanks to technology*, as opposed to only a small portion (around 10%) that disagrees.
- nearly 60% disagree with the claim that *contacts between students and teachers can have the same intensity in the education as in face-to-face education*, but only around 30% agree with it.
- nearly half of the sample agrees that *online communication allows increased amounts of communication between teachers and students when compared with other forms of education,* while around 30% disagree with this statement;

- nearly 60% disagree with the negative statement that *only optimistic people think that the impact of technology on learning is beneficial* and only around 20% agree;

- a large portion of samples (nearly 80%) agrees *based on personal study experiences* that *the impact of technology on learning is valuable for their personal study*.

- more than half of the population agrees that *information and communication technology has usually been used to encourage us to be active participants in learning* with only a small portion (around 15%) disagreeing;

- more than 50% agree 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 with this;

- again more than 50% agree that *ICT has been used to support more individualized learning programs tailored to our own individual needs*, around 20% disagree;

- a majority of respondents (around 80%) *agree that learning is enhanced when text and pictures are integrated in a multimedia environment*;

- around 70% agree *that educational games motivate learners and contribute to developing skills such as teamwork*;

- most users (approx. 75%) agree that *the application of new ICT concepts to support learning and teaching and provide Internet access to student administrative processes, has improved distance education*;

- nearly all respondents (around 90%) agree that *technology facilitated easier access to material for those studying part-time;*

- around 50% agree that *university degrees awarded by open universities may be comparable to degrees from traditional face-to-face universities;* disagreement ranges at 25%;

- no agreement can be determined on the claim: *There is no difference in learning outcomes between studying at an Open university or at a traditional face-to-face university*;

- that *the study at an Open University is especially of advantage to adults who have work and family obligations is shared,* however by an overwhelming percentage of respondents (around 90%).

8 VARIANCE ANALYSIS (ANOVA)

The analysis of variances (ANOVA) allows us to compare the mean score of an ordinal variable (with many scale points) between different groups. The analysis 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, which means 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 (Muijs, 2003, p. 185-200).

The test we used here to find out which comparisons are significantly different is the Scheffe test. A significance level (p-value) is calculated for each test. For example, in the document in Annex B.11, 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, which means that it is highly significant; so it is likely that the associated group (41-50) differ significantly from the age group 25-29.

Another, more significant example could be the one related to 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 and younger is significantly different from all the others groups.

Annexes B.11-B13 presents the results of the ANOVA test applied to variables Age, Education and Occupation, respectively.

9. CONCLUSIONS

This study has confirmed that it is generally 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. We found that there is no significant difference in the judgement of participants 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. A large majority of participants in the study agrees that ICT facilitates easier access to material for those studying part-time (90%) and the application of ICT to support learning and teaching and providing Internet access to student administrative processes has improved distance education (75%). Multimedia environments are considered to provide a high benefit for teaching and learning in open and distance universities. 80% of the population agrees that learning is enhanced when text and pictures are integrated in a multimedia environment. On the contrary, while still being the majority, only 50% participants agree that ICT was used to provide individualized learning programmes.

Our hypotheses that it is generally 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 was not fully confirmed. While most participants (90%) believe that study at an Open University is especially advantageous to adults who have work and family obligations, the study quality at such institutions has not been well recognized. Among the participants, no agreement has been reached on whether there is a difference in learning outcomes between studying at an Open University or at a traditional face-to-face university. Although a small majority of participants supports the claim that university degrees awarded by open universities are comparable to degrees from traditional face-to-face universities, it is important to notice that the negative opinions mainly came from teachers and students. In particular, participants under 30 have a more negative attitude as opposed to participants in the age category 30-50. Further research would be required to ascertain if this is down to personal experience as younger people are more inclined to attend conventional universities. In any case open and distance universities seem to have a marketing problem with respect to the quality of the degrees they award.

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ANNEXES

A.1 Multiple Language Version of the Questionnaire used in WP3

The original English questionnaire "***Impact of technology on learning in Open Universities, distance education systems both academic and corporate***" was translated in the languages of the intervention and control groups.

A.1 English original

Personal background

1. What is your occupation?

- ☐ Manager
- ☐ Technical
- ☐ Teacher or trainer
- ☐ Student
- ☐ Unemployed

2. What is your age grouping?

- ☐ 24 or younger
- ☐ 25-29
- ☐ 30-40
- ☐ 41-50
- ☐ over 50

3. Gender?

- ☐ Male
- ☐ Female

4. What is your level of education?

- ☐ High school matriculation
- ☐ One to three years of post-secondary education
- ☐ Four or more years of post-secondary education

5. To what extent have you used advanced technological equipment in your professional life?

- ☐ A lot
- ☐ Quite a bit
- ☐ Little
- ☐ Very little
- ☐ Not at all

6. Have you had to change your way of working because of technological developments?

- ☐ Yes. More than once
- ☐ Yes. Once
- ☐ No

Questions on the impact of information and communications technologies (ICT) on learning in general

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

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

8. Contacts between students and teachers can have the same intensity in online education as in face-to-face education

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

9. Online communication allows increased amounts of communication between teachers and students when compared with other forms of education

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

10. Only optimistic people think that the impact of technology on learning is beneficial

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

11. From my personal study experience I find that the impact of technology on learning is valuable

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

12. Information and communications technology has usually been used to encourage us to be active participants in learning

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

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

- Strongly agree
- Agree

- Uncertain
- Disagree
- Strongly disagree

14. Information and communications technology has been used to support more individualized learning programmes tailored to our own individual needs

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

15. Learning is enhanced when text and pictures are integrated in a multimedia environment

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

16 Educational games motivate learners and contribute to developing skills such as teamwork

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

Questions on the impact of information and communications technologies (ICT) on learning in Open Universities

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

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

18. Technology facilitates easier access to material for those studying part-time

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

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

- ☐ Strongly agree
- ☐ Agree
- ☐ Uncertain
- ☐ Disagree
- ☐ Strongly disagree

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

- ☐ Strongly agree
- ☐ Agree
- ☐ Uncertain
- ☐ Disagree
- ☐ Strongly disagree

21. Study at an Open University is especially of advantage to adults who have work and family obligations

- ☐ Strongly agree
- ☐ Agree
- ☐ Uncertain
- ☐ Disagree
- ☐ Strongly disagree