International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2010, Vol. 6, Issue 1, pp. 66-75.

The importance of introducing a course on information and communication technologies for development into the information technology curriculum

Walid Al-Ahmad
New York Institute of Technology, Amman Campus, Jordan

ABSTRACT

This paper studies the role and the importance of Information and Communication Technologies for Development (ICT4D) education in Information Technology (IT) programs. The research included the students who attended an ICT4D course at NYiT Amman Campus in the academic years of 2006 to 2009. Data were collected through two questionnaires developed by the researcher responsible for teaching the course. The first questionnaire was administered in the first lecture of the academic semester, and the second questionnaire was administered in the last lecture. The study shows that the students have expressed that an ICT4D course was an important ingredient in the IT curriculum. Of the students, 98.8% expressed that ICT4D had an important role in IT practices and education, 97.1% stated that they were satisfied with the course, 96.7% expressed that the course met the objectives. As a result, it was suggested that the ICT4D course be included in Bachelor of Information Technology curriculum.

Keywords: *ICT4D, IT Curriculum, Academic Program Requirements*

INTRODUCTION

Many of the initiatives addressing the issues of socio-economic development rely on bringing modern technologies, such as cell phones, computers, and Internet access, to populations in need. These initiatives are helping to bridge the digital divide and are often referred to as ICT4D. The digital divide is the gap between those who can effectively use new information and communication tools, such as the Internet, and those who cannot. Information and Communication Technologies (ICTs) are used either directly by the disadvantaged population in some manner, or can be used to assist aid organizations and NGOs to improve socio-economic conditions (such as employment, poverty, education, healthcare, etc.) in developing countries. For aid organizations and NGOs, ICTs provide a useful tool for prioritization of assistance among countries and help them to determine what type of support is most needed in any specific country.

ICT4D is concerned with the whether or not, as well as with how much ICTs can contribute to economic growth and sustainable development (Fillip 2003). ICT is now receiving mounting interest from aid and international agencies and is seen as one of the best development catalysis. Many of these organizations believe that ICT offers an inimitable prospect to establish contact and relations as well as being a source for knowledge exchange and innovation to the poor communities (Göransson and Söderberg 2003). Many studies have shown that the production and utilization of ICTs can play a key role in the context of development and act as a powerful tool for capacity building in human resources and poverty reduction (Jussawalla 2001, Rabayah 2008, Wilson and Heeks 2000).

However, there is a lack of capacity in third world countries in general to build, maintain, and utilize the ICT resources to address socio-economic needs. As an example, none of the more than twenty five universities (both private and public) in Jordan teaches a course on ICT4D in the IT related programs they offer such as Computer Science, Computer Information Systems, and

Management Information Systems. This is in spite of the fact that Jordan is active in implementing ICT4D initiatives (Mofleh and Wanous 2008).

Many studies have shown that IT project failure is very high. A comprehensive study (Sundén and Wicander 2006) has been carried out to identify root causes for IT project failure in developing countries. Another study (Van Reijswoud 2009) argues that ICT projects in developing countries become successful when adapted to local conditions and introduced the concept of appropriate technology to increase the success of such projects. The author believes that introducing a course on ICT4D in IT education will be an important element to improve the success rate of ICT projects and ICT4D initiatives.

Therefore, it is believed that IT undergraduates should be exposed to ICT4D knowledge and skills during their education so that they can play a role in the development process. It is absolutely beneficial for students to be well familiarized with issues related to using ICTs for development purposes. With this purpose in mind, an ICT4D course has been taught as part of the IT curriculum at the New York Institute of Technology (NYiT) - Amman Campus in the School of Engineering and Computing Sciences during 2006-2009 academic years. Students' opinions and reflections related to the course were researched. The research questions of this study were:

- Does the ICT4D course enhance students' awareness of ICT4D importance in IT practices?
- Does the ICT4D course enhance students' awareness of ICT4D importance in IT education?
- What are students' opinions and reflections about the ICT4D course?

The rest of the paper is structured as follows: Section "Study Background" describes the study background and the rationale for choosing the ICT4D course. Section "ICT4D Course" then describes the ICT4D course taught at NYiT Amman. Section "Research Design" addresses the research methodology and data analysis. Section "Key Findings and Discussion" discusses the study findings. Finally, section "Conclusion" concludes the article and glimpses on future work.

STUDY BACKGROUND

According to the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) Computer Society recommendation for IT programs, the Body of Knowledge is arranged in terms of knowledge areas. The knowledge areas are broken down into units. Units are defined in terms of individual topics and learning outcomes, which are divided into core outcomes and advanced outcomes (ACM and IEEE 2008). Although one of the thirteen knowledge areas is titled "Social and Professional Issues", yet the social and professional aspects are considered in the organization context rather than in a wider context, a country for example. One of the units recommended in this knowledge area is "Social Context of Computing". Some of the topics in this unit are related to ICT4D such as: Social impact of IT on society; Gender-related issues; Accessibility issues; Globalization issues; Economic issues in computing; Digital divide. In fact, an ICT4D course will cover all these issues and others.

It is unfortunate that none of the broad goals of an IT program according to the ACM and IEEE recommendations is explicitly related ICT4D. A goal such as making students aware of how ICTs can be used for the sake of socio-economic development and for addressing the United Nations global Millennium Development Goals such as reducing poverty, achieving universal primary education, promoting gender equality and empowerment of women, etc. (Sachs and McArthur 2005) is essential.

In fact, IT programs are most suitable to include a course on ICT4D. This is clear because such programs address societal issues as the following quotation shows (ACM and IEEE 2008):

> *"As an academic discipline, Information Technology focuses on preparing graduates who are concerned with issues related to advocating for users and meeting their needs within an organizational and societal context through the selection, creation, application, integration and administration of computing technologies."*

ACM and IEEE recommendations for an IT curriculum acknowledge the need for local adaptation based on the individual characteristics of institution. However, the adaptation should also be possible within the same global institution that has different campuses world wide such as NYiT.

The School of Engineering and Computing Sciences at NYiT offers a bachelors degree in Information Technology with concentration in computer security. One of the required courses is "Technology and Global Issues". The catalog course description is as follows (NYiT 2009):

> *"In this course the relationships between technology and global concerns are explored. Topics such as sustainable development, standards, ethics, environmental concerns and public policies related to design and development, energy, transportation, air, and water facing both developed and developing nations will be discussed."*

The current course complies with the requirements of the ACM and IEEE. However, the author, who is also the instructor of this course at NYiT Amman Campus, has tailored this course to teach ICT4D. The description and objectives of this ICT4D course are given in the next section.

ICT4D COURSE

This is an advanced course which the students usually take in the third or fourth year of the undergraduate program. This course was first taught in the academic year of 2006–2007. It is a three credit hour compulsory course with two lectures a week. The content of the course is totally based on the online course developed by Dr. Barbara Fillip (2003). Some of the topics discussed in the course are: ICT4D Definition and Terms, Digital Divide, ICTs and Learning, ICTs and Health, ICTs and Agriculture, e-Governance, e-Commerce, Tele-centers, and Knowledge Networking. The students, coming from different Middle East countries (Jordan, Syria, Egypt, Yemen, Iraq, etc.), were asked to take their own countries as a case study in the assignments and projects for the course. The objectives of the ICT4D course are stated as follows:

- To provide students with an understanding of the main issues associated with ICT4D.
- To give students the opportunity to gain some of the technical skills of relevance to the implementation of ICT4D programs (e.g. web-site development, group work, distance-based learning, methods, mobile communications, etc.)
- To introduce them to practical aspects of the delivery of ICT4D programs through the use of external practitioner seminars and workshops.
- To encourage them to think critically about the link between technology and development.
- To provide them with skills and understanding relevant to future careers in the field of ICT4D, both though research and in practice.

This ICT4D course aims thus to create awareness and build capacities among IT students to produce and use information and communication technologies for socio-economic development purposes. As a result, this can lead to strengthening curricula, teaching, and research in ICT4D at the undergraduate level in developing countries in general, and in Jordanian universities in particular.

The course addresses issues related to the UN Millennium Development Goals or MDGs (Sachs and McArthur 2005), namely health, education, and reducing poverty. In fact, all topics are related in one way or another to the MDGs. The idea is to raise awareness and prepare IT students who can develop useful applications in many areas such as health, education, environment, etc. The course structure, material, and teaching methods have not changed much during the study period. The distribution of the students taking this course based on academic years is shown in Figure 1.

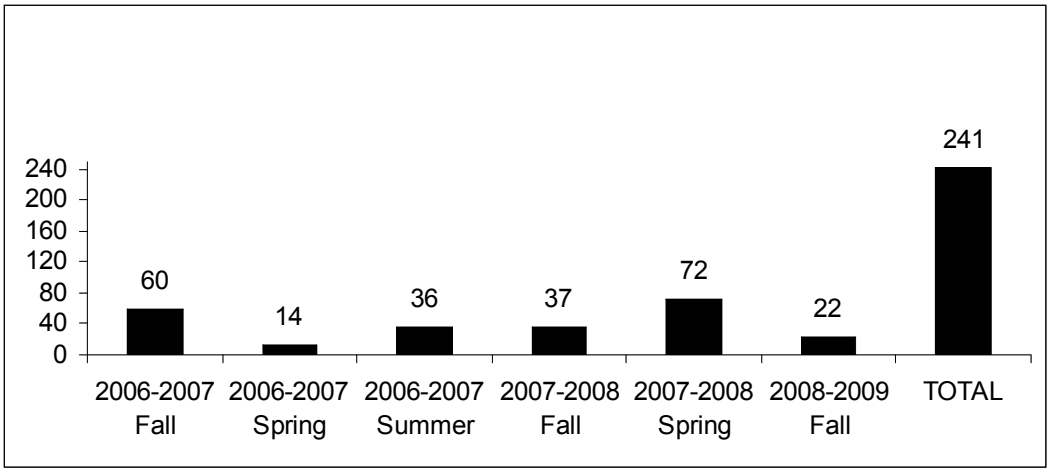

Figure 1: *Distribution of the students in the ICT4D course according to academic years*

RESEARCH DESIGN

The aim of this study was to assess the role and importance of ICT4D in IT education and practice. The research has a wider significance and will be useful for IT curricula developers, IT instructors, and participants in development projects. The research was an on-going study over almost three academic years.

The research used a quantitative descriptive approach so that the researcher remains objectively separated from the subject matter. The target population of the research covered students attending the Technology and Global Issues course at NYiT Amman Campus. This course is a required course for the IT and Computer Science majors in the School of Engineering and Computing Sciences. This course was offered starting academic year 2006/2007. The sample consisted of the whole population (241 students).

Data were collected using two separate questionnaires. The questionnaires were developed by the instructor of the course.

- The first questionnaire was administered in the first lecture of the academic semester. This questionnaire included socio-demographical data such as students' gender and age. It also contained questions on whether the ICT4D was important in IT practice and education.
- The second questionnaire was administered in the final lecture of the academic semester. This questionnaire included questions concerning students' satisfaction and assessments of the course (Has the course fulfilled its goals, has it met students' expectations, was the content adequate, were the methods/techniques used in the presentation adequate? etc.), as well as those contained in the first questionnaire.

The students were informed about the purpose of the study, their likely role in the study, the reason for choosing the topic of ICT4D as a topic for investigation, and the way in which the study was to be conducted. The students were absolutely free to participate and those who agreed to participate in the study did so at the beginning of the course. No incentives were given to the students who agreed to participate in the study and that was clear from the beginning. However, in both phases of data collection, the initial request, reassurance of confidentiality and ability to withdraw from the study were reiterated. The questionnaires were filled by the students anonymously to encourage the students to express their opinions about the course objectively.

Data analysis was performed on the data collected using the two questionnaires. Alternations and improvements in students' opinions and reflections concerning ICT4D and the course were assessed using the obtained data. Nonparametric data were expressed as numbers and percentages. The McNemar test was used during the comparison of the data obtained from the first and second questionnaires. The McNemar test is commonly used with longitudinal studies involving repeated measurements of subjects. The McNemar test was carried out using the SPSS software package. Finally, analysis of students' responses to the open-ended questions was performed to identify common experiences with the course, students' satisfaction and dissatisfaction, and their suggestions for course improvements.

KEY FINDINGS AND DISCUSSION

Almost 70% of the students included in the research sample were males and 30% were females. 68% of the students were in the 19-21 age group and 32% were older than 21 years.

In the first lecture, 80.5% (n=194), and in the last lecture 98.8% (n=238) of the students expressed that ICT4D had an important role in IT practices. When these expressions obtained from the first and last lectures were compared with the McNemar test, the difference between them was found to have a very high significance($x^2=38.521$, $p=0.000$)(Figure 2).

The students were asked their opinions concerning the potential impacts of ICT4D knowledge and experience on IT professions. Table 1 summarises the results obtained. It is obvious from Table 1 that the students' perception of the importance of such course has improved. It is believed that the teaching methods used in this course such as the use of real-world case-studies, seminars and workshops, and implementation projects have contributed to these results. Although the students did not have previous experience with ICT4D, these teaching methods have given them the chance to gain some experience necessary to help them realize the importance and the usefulness of ICTs for development purposes and in addressing the global concerns.

As a result of the active and comprehensive education the students received during this course, other opinions and reflections concerning the importance of ICT4D were as follows:

- ICT4D opens up new entrepreneur projects for IT graduates (10%; n=25). Several students expressed that upon graduation they would consider starting new businesses such as consulting firms to help governments and donor agencies implement ICT4D initiatives successfully.
- ICT4D ensures that societal and ethical aspects of ICTs are understood (15%; n=36),
- ICT4D contributes to the well-being of human kind (48%; n=115),
- It is now the information and globalization age, and therefore it would be very unrealistic to think of IT jobs totally isolated from the socio-economic development aspects (4%; n=10).

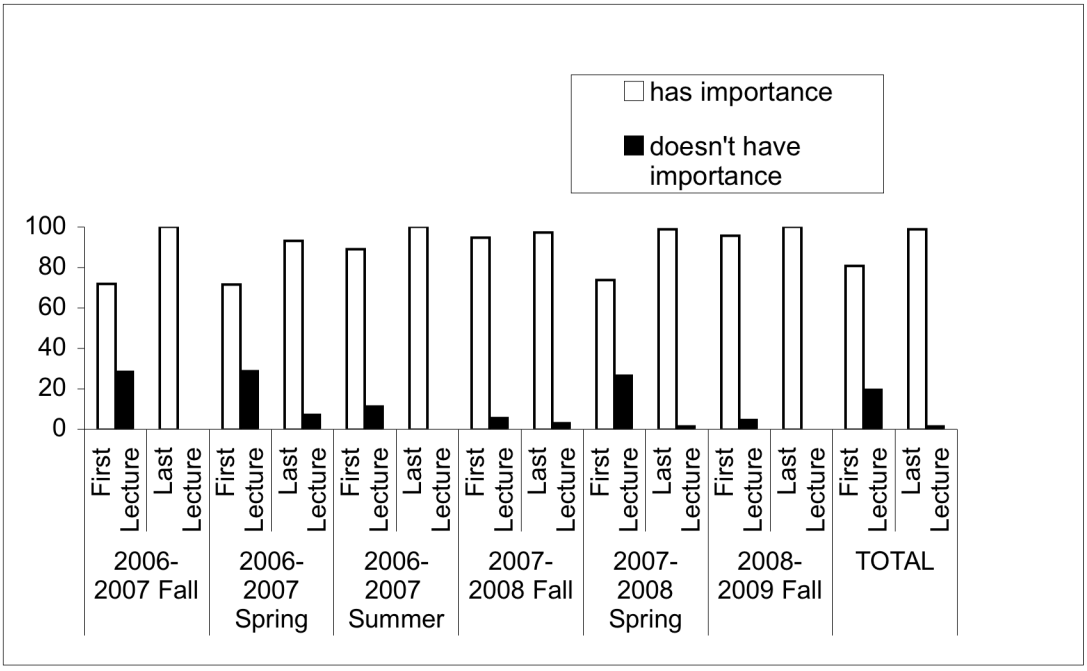

Figure 2: *Level of students considering ICT4D important in IT practices*

Table 1: *Students' opinions concerning the importance of ICT4D course in IT practices*

The role of ICT4D in IT practices		First Lecture		Last Lecture		McNemar p
		n	%	n	%	
Helps in bridging the digital divide and in addressing the MDGs	yes	94	39.0	170	70.5	x2=40.563 p=0.000
	no	147	61.0	71	29.5	
Improves success rates of ICT4D Initiatives	yes	70	29.0	156	64.7	x2=58.266 p=0.000
	no	171	71.0	85	35.3	
Helps in designing applications for socio-economic development in own country	yes	165	68.5	207	85.9	x2=17.284 p=0.000
	no	76	31.5	34	14.1	
Makes IT professionals play new roles	yes	76	31.5	175	72.6	x2=65.333 p=0.000
	no	165	68.5	66	27.4	

Students' attitudes towards the importance of ICT4D in IT education were investigated and the results are shown in Figure 3. The ratio of students pointing out ICT4D as having an important

role in IT education in the first lecture of the semester (73.4%; n=177) has increased to 99.6% (n=240) in the last lecture. This increase was found to be very highly significant statistically (x2=59.138, p=0.000).

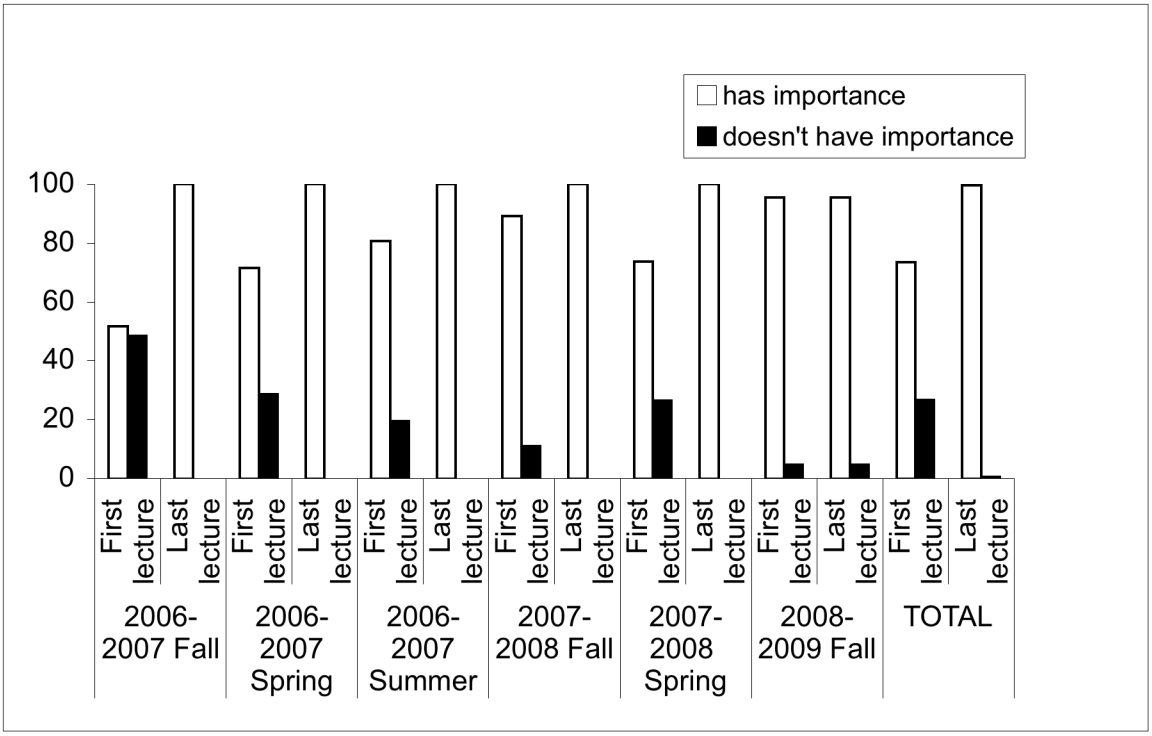

Figure 3: *The level of students considered ICT4D important in IT education*

The students were asked their opinions concerning the importance of ICT4D in IT education in general. Table 2 shows the results obtained. The majority of the students expressed that a course on ICT4D in IT education will make it more appealing to students and links IT to human needs.

With the rapid growth of ICTs, it becomes increasingly important to integrate these technologies into many IT courses. Of concern is the effect of the rapid use of these expanding technologies within ICT4D education curricula on student's ability to acquire and develop critical thinking, interdisciplinary communication, and role socialization skills through use of ICT4D knowledge and experiences. Due to the above mentioned and other similar rationale, ICTs are widely acknowledged to have an important role in socio-economic development education. The students in our study reflected that ICT4D was important for IT education. ICT4D course is believed to have been influential on students' acquiring this opinion.

Table 2: *Students' opinions concerning the importance of ICT4D in IT education*

Importance of ICT4D in IT Education		First Lecture		Last Lecture		McNemar p
		n	**%**	n	%	
Makes IT education more human	yes	115	47.7	179	74.3	x2=35.438 p=0.000
	no	126	52.3	62	25.7	
Improves theory and practice of IT education	yes	115	47.7	165	68.5	x2=20.008 p=0.000
	no	126	52.3	76	31.5	
Makes IT education more appealing	yes	60	24.9	117	48.5	x2=29.308 p=0.000
	no	181	75.1	124	51.5	

The students were asked whether they were satisfied with the ICT4D course in the final lecture of the academic semester. Of them, 97.1% (n=234) stated that they were satisfied with the course (Figure 4). These students explained the reasons of their satisfaction with the course as follows (multiple choices can be selected):

- ICTs should also be used to alleviate human problems and issues such as poverty, unemployment, illiteracy, etc. (60.6%; n=146)
- Some students mentioned that they have realized a new dimension of IT profession and gained a new insight (9.5%; n=23)
- The course was enjoyable and amusing (14.9%; n=36)
- Some students mentioned that they have improved their knowledge and skills of ICTs and their use for socio-economic development purposes (7.5%; n=18)
- The assignments and projects were very useful (1.7%; n=4)

Students who were not satisfied with the ICT4D course (2.9%, n=7) stated the reasons of their dissatisfaction as follows:

- There were too many notes that I had to revise
- The course was too comprehensive
- I haven't had the feeling of being satisfied with the course

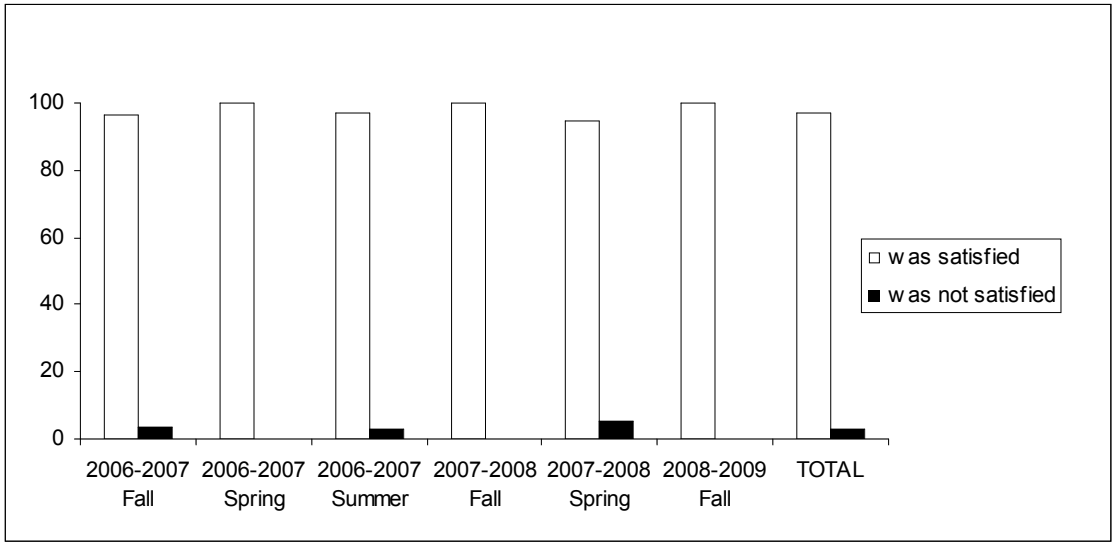

Figure 4: *The level of students' satisfaction from the ICT4D course*

Students were asked to provide an overall assessment of the ICT4D course in the last lecture of the academic semester. Of the students, 96.7% (n=233) stated that the course had met its objectives, 94.6% (n=228) that their expectations from the course had been met, 90.5% (n=218) that they found the content of the course sufficient, and 94.6% (n=228) that the methods/techniques used during the presentations of the course were efficient (see Table 3).

Table 3: *Students' assessment of the ICT4D course*

Student statements		n	%
The course has achieved its objectives	Yes	233	96.7
	No	8	3.3
The course has met students' expectations	Yes	228	94.6
	No	13	5.4
The content was sufficient	Yes	218	90.5
	No	23	9.5
Methods/techniques used in the lecture presentation were efficient	Yes	228	94.6
	No	13	5.4

CONCLUSION

This article discussed the importance and usefulness of an ICT4D course in IT programs. The perceived usefulness of the course was very high, and the students' opinions and reflections regarding the course were noted to be positive. In light of these obtained results, it is believed that a course on ICT4D in IT curricula should be introduced as a required course. It has been recommended to the curriculum committee at NYiT Amman to replace the Technology and Global

Issues course with the ICT4D course. It is hoped that that ACM and IEEE recommendations for the IT curriculum will explicitly list this course as a core course in the future.

REFERENCES

ACM. & IEEE Computer Society. 2008. "Curriculum Guidelines for Undergraduate Degree Programs in Information Technology", accessed February 2009: http://www.acm.org/education/curricula-recommendations

Fillip, B. 2003. "An ICT4D Online Course", accessed February 2009: http://www.knowledgefordevelopment.com,.

Göransson, B. & Söderberg, J. 2003. "Long Waves and Information Technologies – On the Transition towards the Information Society", *Technovation*, Vol 25/3, pp203-211.

Jussawalla, M. & et al. 2001. "Lessons of Investment in Technology Parks and Their Role in Bridging the Digital Divide", *EW Center* – http://www.wdf.org, accessed February 2009.

Mofleh, S. Wanous, M, & Strachan, P. 2008. "Developing Countries and ICT Initiatives: Lessons Learnt from Jordan's Experience", *EJISDC*, Vol 34, no. 5, pp. 1-17.

NYiT 2009. Information Technology Program. Accessed February 2009: http://www.nyit.edu

Rabayah, K. 2008. "A practical ICT for development framework: The ICT Center of Excellence", *IJEDICT*, Vol 4, no. 4.

Sachs, J. & McArthur, J. 2005. "The Millennium Project: a plan for meeting the Millennium Development Goals", *The Lancet*, Vol. 365, Issue 9456, pp. 347-353.

Sundén, S. & Wicander, G. 2006. *Information and Communication Technology Applied for Developing Countries in a Rural Context*, Faculty of Economic Sciences, Communication and Information Systems, Karlstad University Studies.

Van Reijswoud, V. 2009. "Appropriate ICT as a Tool to Increase Effectiveness in ICT4D: Theoretical considerations and illustrating cases", *EJISDC,* Vol 38, no 9.

Wilson, G. & Heeks, R. 2000. *Technology, Poverty and Development*, In Allen, R. & A. Thomas (Eds.) Poverty and Development – Into the 21st Century. Oxford University Press, Oxford.