EDUCATIONAL MEDIA EVOLUTION: FROM PRINTED DOCUMENTS VIA ELECTRONIC EDITIONS TO CLOUD SERVICES

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Abstract

Educational processes employed in the schools, colleges, and universities today are facing a severe challenge. Printed educational documents that have been constantly transformed in electronics form for the last two decades now are going to be substituted by integrated solutions. New integrated cloud solutions not only change educational process in terms of curriculum but also involve modified educational facilities and architectural solutions in general. The paper discusses in detail the history of educational media, the evolution they undergo and the prospects. Examples of educational media used when teaching Electronics and Computer Engineering (ECE) students in Belarusian State University of Informatics and Radioelectronics are demonstrated.

Key words: *educational process, educational media, electronics editions, cloud services.*

Introduction. Educational activities mean, in quite general sense, the transfer of knowledge from the teachers to the students, or, in terms of engineering, data communication between them. Obviously, data communication and related areas have been developing drastically over recent years. A number of everyday duties underwent great change, beginning with private issues as telephone calls, purchasing clothes, foods, paying bills, arranging seats in theaters or reserving train/bus/air tickets and ending with job related aspects such as issuing business orders, making/accepting reports, scheduling job tasks, managing documents, etc. Certainly, the process of education cannot be left aside. Moreover, it is the process of education that is the most important domain of the society influenced by rapid changes in information technologies changes.

From Printed Documents to Electronic Editions. Educational process, as specified by appropriate curriculums, include various types of learning activities. For instance, the learning activities of Electronics and Computer Engineering (ECE) students taught in Belarusian State University of Infor-

matics and Radiolectronics (BSUIR), typically include a) lectures; b) workshops: c) laboratory experiments, d) individual assignments (individual semester tasks/projects) [1]. Traditionally, each type of the activities is supported with appropriate literature published and printed in the university. Obviously, a lot of tutorials of various kinds, such as textbooks, courses of lectures, laboratory experiments manuals, instructions on individual semester tasks/projects etc., need to be published and updated on regular basis. Actually, every year each of the faculties introduces new laboratory equipment, laboratory models, test benches and other equipment used in studies of ECE students. That means, the students need appropriate teaching materials related to electrical and electronic devices in use, equipment and boards. In fact, each of numerous laboratories in the university needs its own training materials describing equipment used, experiments to be performed, related techniques and methods as well as reports to be submitted. Also, various teaching materials have to be modified depending on appropriate curriculums amended.

The results are as follows:

– large premises, such as library rooms, book depositories are reserved for paper editions;

– lecture auditoriums are designated for professors to deliver lectures in order to transfer information to the students. At the lectures, however, most of time is spent not for gaining any knowledge of the subject taught, but to write down the information delivered by a professor.

The most important conclusion is that the students need to visit the university facilities in person in order to get any information.

The situation began to change in the 80s of the last century when PCs got introduced into the educational process. Some of the editions mentioned above were transformed in the electronic form. However, most of them represented just the copies of their paper originals and available only in computers installed in the university premises.

In attempts to increase the efficiency of the educational process, the universities were organizing special classrooms equipped with desktops so that to enable students to use appropriate software suitable or specially developed to support educational process. Also, library rooms got equipped with desktop computers or terminal to ensure access to some book available in electronic form. However, in spite of these improvements, university premises remained to be the sole place where the student were able to get necessary information and knowledge.

The situation further improved in the early 21st century when laptops came into wide use. Two things are the most important: first, any document

in electronic form could now be easily copied, transferred and/or stored and, second, students became able to access data available from universities/colleges without need to visit them. It makes sense to analyze the changes that above mentioned learning activities underwent.

Lectures. Entire course of lectures now became available in computer files. Not only texts and pictures, but colors, shapes, various diagrams, animations, audio files, movies are at disposal of the lecturer and the students. All educational materials can be copied in advance and so the main goal of the lecturer: to provide the students with information lost a great deal of its meaning. Now on, the task of the lecturer became to explain the matters i.e. to assist the students in gaining knowledge not just providing them with the contents of the subject.

Workshops. In similar way, all materials the student need for workshops can be copied in advance. The result is the student do need any more to visit the library rooms as all materials are ready in their laptops and can be used at home or any other places.

Laboratory Experiments. Laboratory experiments represent the most important component in educational process of ECE students. Previously laboratory experiments were performed using electrical/electronics workbenches with appropriate equipment and instruments. Recently a number of electronics simulators became available, including, for instance, PSpice, Electronics Workbench, MicroSim, Proteus, etc. These simulators make it possible to perform the laboratory experiments using the students' laptops without visiting the laboratories with physically existing equipment and devices. Although, the question of electrical circuits/electronic device simulation for educational purposes without having hands-on training with physically existing components remains disputable, a great deal of academic subjects, such as Electrical Circuit Theory, Analog Devices, Digital Devices, Automatic Control Systems, etc. are using now simulators in the courses of laboratory experiments.

Thus, the students became more mobile and can practice their skills with electronic components and circuitry without visiting the university laboratories.

Individual Assignments (Individual Semester Tasks/Projects). These kinds of learning activities are supported similarly with above mentioned ones.

ICT, On-the-Go Approach. In modern society various information is available for consumers via multiple channels: media, radio, TV, web sites of both mass media and independent commercial companies, smartphones via mobile phone operators, tablets, etc. Unlike twenty years ago, the users consume information mostly on-the-go, i. e. when performing their everyday duties, in the transportations, when having rest, etc. Modern communications applications make it possible to communicate persons with each other without meeting physically yet benefiting from opportunities offered by information and communication technologies (ICT).

It is known from experience that actually every student in the Belarusian State University of Informatics and Radioelectronics (BSUIR), Minsk, possesses a smartphone and sometimes also a tablet and, very frequently, them both. The students willingly install various communications applications such as WhatsApp, Viber, etc. That means the students can easily transfer, receive, and consume information from various sources. Therefore, the students possess both hardware and software necessary for effective use of ICT [2].

In modern teaching techniques the role of seminars and workshops is ever increasing. However, they can be organized in more effective way using the benefits of ICT. Messengers such as above WhatsApp, Viber allow to organized chats for an entire student group, a number of groups (for lecturers) or for a certain team of students interested in specific problem or having common interests (e.g. similar subjects of their reports).

One more tool for productive teaching is the use of social networks such as extremely popular Facebook, Twitter, YouTube, etc. These networks allow to present a lot of materials, including texts, images, videos to organized groups of students. Unlike common lectures delivered with premises of a university the materials placed in social networks can be modified or amended and, what is even more important, listened to, looked at, and consumed in any place and at any moment.

For such types of studies as individual assignments, semester and course projects/works, ICT can be used first, for reporting results (using e-mail); second, for consultations and supervision of student activities (using chats).

The use of ICT and, or in other words, distant related education techniques, offers a number of obvious benefits and, on the other hand, is unavoidable because of the modern life style. Educational process can be organized so that the students study “on-the-go” [3], that is, at home, while travelling, or staying in places other than the site of a college/university. That means, colleges/universities are losing their importance as a centers that the professors and students must visit in order to accomplish effective exchange of knowledge.

However, the use of ICT is accompanied with a number of challenges. The most essential problems to solve are:

– the need to tailor new curricula based on the use of ICT;

– the necessity to overcome the resistance of some professors reluctant enough to accept ICT techniques.

Cloud Services and Integrated Solutions. Society digitalization involves educational process as well. Recent decade a lot of computational and engineering tools became available on-line. Instead of using laptops with preliminary installed applications like MathCAD (when it comes to mathematics) or circuit Electronics Workbench, PSpice or Multisim (when it comes to circuit simulation) the students even more frequently use cloud services. Obvious benefits typical for on-line approach described for publishing related items in [3] are, no doubt the same winning for educational process as well. Laptops that have been regarded as an essential instrument used by any university students for ten recent years, now are being increasing substituted by tablets and mobiles. A great number of students use mobiles to perform calculations typical for engineering practice: to perform operations with complex numbers, for instance, or even to solve sets of linear equations using on-line services.

A lot of engineering applications previously available for desktops and laptops are now have on-line versions and can be used free for educational purposes. Actually, cloud services make it possible now to organize a full-scale laboratory where the students will be able to perform laboratory experiment/work-out individual task/solve design problem and further to prepare report containing appropriate texts, explanations, simulation results, etc., and finally submit the reports to a professor for approving.

Also, some words shall be said on cryptography and electronic signatures. Electronic signatures are now implemented in a great number of countries. In Belarus, for instance, any citizen can now (and even is asked to do so) to get his/her electronic signature to use in his/her communications with state authorities and for other purposes. The use of electronic signature solves the problem of students' identification.

Summing up, it should be noted that available technologies make it possible to build on-line laboratories and classrooms to realize on-the-go educational process. On the other hand, the creation of educational process that includes cloud service based solutions needs, first, to involve experts other than university professors; and second, needs investments, probably, quite substantial compared to commonly used "in class" learning activities supported with old-fashioned printed editions.

Conclusions

● The role of lectures within modern educational process undergo great changes: providing the students with information loses a great deal of its meaning. Now on, the task of the lecturers became to explain the matters i.e. to assist the students in gaining knowledge not just providing them with the contents of the subject.

● In modern teaching techniques the role of seminars and workshops is ever increasing. These learning activities can be organized in more effective way using the benefits of ICT.

● Available technologies make it possible to build on-line laboratories and classrooms to realize "on-the-go" educational process.

● The shift to new integrated cloud service based educational process makes a number of university facilities like library rooms, book depositories, or lecture auditoriums needless.

● College/university campuses are losing their importance as places that the professors and students must visit in order to accomplish effective exchange of knowledge.

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