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# Education of Clinical Disciplines in Pre and Post-Graduate Study Oriented on Increasing of Newest Infectious Diseases Knowledge

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## Abstract

Modern information and communication technologies have reached immense growth over past decades. This also caused an improvement in the teaching abilities and forced many teachers to reevaluate their traditional forms of education. The primary aim of our starting work is to increase an educational level in the area of infectology. To realize such activity we stated two technological requirements. The first was the ability to distribute live education events to the almost unlimited number of users. The second one presented no technical requirements for users in the sense of the need to have any special and/or commercial equipment. Therefore, we prepare special and scientific sessions that will be periodically organized as live streamed education activities.

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*Keywords:* on-line education; live video streaming; multimedia; infectology; antiinfection treatment

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## 1. Introduction

Face-to-face forms of education, especially lectures organized in large classes have been considered for a long time as fundamental approach of teaching despite of well-known pedagogical limitations, e.g. large class sizes, repeating lectures, increasing workload. It is because the lectures were thought to be the most cost effective method to introduce new themes and their facts (Bennett, 2008; Foertsch, 2002). However, the usage of modern information and communication technologies (ICT) in higher education has changed

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this traditional approach of the teachers to the explanation of their scientific topics. Thus, new multimedia educational tools may assist students to understand many complex and difficult concepts related to the science learning (McKinney, 2009; Sloan, 2006; Bednarcikova, 2008). Some authors also argue that students of today's net generation use digital materials rather than those offered through traditional, usually printed way.

The students expect to have a wide range of learning e-sources with convenient and flexible access and they seldom have the problems to use them in their study. Social media services such as YouTube or Flickr have also significantly influenced the attitude of recent generation to the multimedia. Furthermore, social networks facilitate effective collaboration and communication (Lim, 2012; Schneiderman, 2011; Vybiral, 2011). In this sense, the traditional lectures should be considered as a way of providing a guide to and/or an overview of key concepts and the students should use them in private self-study.

Evaluation of experiences based on using a video-based learning environment revealed that the students consider broadcasted or steamed instruction video as effective for carrying out self-evaluations. The teachers also considered streaming video as useful education tool for all the reflection processes of their students. On the other hand, they also indicated some shortcomings (Leijen, 2009; Reisslein, 2005). Other studies that examined the final grade and satisfaction level differences among students taking specific courses using three different methods: face-to-face in class, satellite broadcasting, and live video-streaming indicated no statistically significant differences. Such results provide evidence to support distance education (DE) and to use it as a viable, convenient and flexible alternative delivery mode capable of extending learning opportunities (Abdous, 2010).

The ability to adopt different effective teaching methods in education makes teaching processes more demonstrative and more attractive as well. Furthermore, it is also a feature of grand teachers. Methods designed for both teaching and learning usually include explaining, demonstrating, collaborating, modeling, questioning and additional processes. Based on ICT, these methods may be easily realized not only in the presence forms, but even more frequently in distance forms of education with comparable or even better results.

Trends in this expansive area have already influenced all degrees of education including higher education and education of clinical and health care disciplines. Nowadays, the anatomical structures are presented to the students in three dimensional (3D) space, students may examine virtual patients, they are involved into virtual surgery and other clinical interventions, telemedicine tools are used to monitor and/or to evaluate health status of remote patients, real and/or live surgery interventions equipped with audio comments of professionals are distributed directly into the classrooms etc (Williams, 2011; Barger, 1999; Cerny, 2011; Macurova, 2010). These technological aspects result in better absorption and understanding of particular topics by students and also in better implementation of new research results into the teaching plans and curriculums. In contrast to the standard DE form, intended only to the students and members of particular faculty and/or study group, we decided to offer access to the newest knowledge from the area of infectology to the pre and post-graduate students at medical faculties, as well as to the clinical professionals and specialists and to the wide range of interested population. Lectures of professionals will be distributed to the audience all around the world using telemedicine tools and internet services. Therefore, the domain of our actual work is DE and dissemination of recent information about infectious diseases, their treatment and prevention.

## **2. Distance education**

Current trends in education indicate an expansion of DE, and the most of higher education institutions offer certain type of such activities. This is caused by technology innovations but also by budgetary constraints. Because of limited financial sources, the universities often reexamine their curriculums and

explore alternatives to find cost-effective ways of delivering education. Here, DE can be considered as default alternative. Regarding used grade of technology, it may be organized as different concepts including distance learning, distributed learning, online learning, e-learning, virtual education, web-based learning, computer-based training, and blended or hybrid learning (Abdous, 2009).

From historical point of view, DE is not a new concept. On the other hand, it is usually referred to the delivery of video (Jesshope, 2001; Simonson, 2003). However, DE based on video transfer can be set as one of the main technological profiles:

- videoconference – interactive two-way video and audio. This is probably the best “simulation” of the real class and the face-to-face form of education. The teaching events are in real-time, communication runs synchronously, but depending on the quality of internet connection, usually the high-speed networks are required.
- instructional television fixed service (ITFS) – broadcasted (satellite, cable and/or terrestrial) as one-way video and two-way audio. It was widely employed at many colleges and universities since the 80’s (Fong, 2001), where the distance students were able to make a phone call to the teacher to ask questions and interact with him/her.
- streaming – one-way video and audio. Using streaming technology the live-lecture video (with audio) is broadcasted using network infrastructure and the students may watch it anywhere they are. Archived materials together with web-streaming functionalities can be used to deliver delayed education content to the distance learners through the universities’ web sites. The students are usually allowed to interact with the teacher via e-mail and/or web-based discussion boards (asynchronous communication).

Due to the above mentioned facts as well as to the skills and our previous activities, we have been motivated to prepare an innovative approach to the education of clinical and health care disciplines. The targeted groups include pre and post graduate students, clinicians and employers in the health care system, physicians in attestation preparation and wide range of interested people too. Individual lecture sessions are planned to be organized as combination of both the actual knowledge and the recent research results. The live educational meetings, based on streaming technologies will be accessible for any interested person all around the world using internet and only free noncommercial products. All recorded and archived education materials will be shared using our portal of Multimedia support in the education of clinical and health care disciplines with no restrictions that ensures accessibility not only for users from medical faculties. Selected topics will be processed also in the form of printed materials with the aim to reach maximal social impact.

### **3. Video streaming technologies**

Video streaming technology combines videoconferencing and the internet so that the live or recorded events can be distributed via the web (Robin, 2001). Using this technology to video lectures means that students can view the streams on their own computers wherever it suits them rather than having to take part in a face-to-face lecture (Garrison, 2001). The use of video streaming as a sole teaching strategy essentially remains a non-interactive medium and may therefore have certain disadvantages that are comparable to traditional lectures. Nevertheless, it represents innovative teaching and learning resources with perspectives to be used also in mobile devices.

Thanks to the availability of high-bandwidth network infrastructure the live video streaming enables teachers to deliver high-quality video and audio presentations while enabling students to view, interact, and connect with their teachers and/or classmates. This opposes that video streaming removes interaction and human contact between students and teachers. The real truth is that the advances in methods of data compression and extension of computer networks have significantly increased the ability to interconnect

teachers and their students across the world. Teachers and lecturers may perform teaching remotely using live video streaming over the internet even more easily than ever before. All participants, like teachers, students, parents can be involved in collaboration with each other and simplify both the learning and communication processes.

In general, it is possible to specify two main types of video streaming on the internet. These types include true streaming and downloading.

### *3.1. True streaming*

True streaming – also called as streaming media or streaming servers, where no waiting to watch event is involved as the media (specialized servers) are able to broadcast live events. An additional advantage of true streaming is that the education content can be broadcasted at different bit rates. Users can start watching live events almost immediately after they start playing it. Time delay, due to the server processing and type of network connection, according to our experiences, moves about 15 seconds. In the case of archived records, the file is also played almost as soon as it is downloaded. Basically, the content is sent to the users as stream so they watch it as it arrives to the computer.

### *3.2. Downloading*

Downloading – or so called http streaming. It is a method where the video file (containing video, audio, animations, texts etc.) is usually offered to the users as embedded hyperlink on the web page. Users download entire content/file on their computers as first and then it can be opened and viewed. Depending on size of file it takes some time to be downloaded completely, so the users have to wait for whole file. Although it cannot be used for live events, the advantage is that the user can quickly skip already viewed or for him/her uninteresting parts of lectures, presentations and/or other teaching courses. Combination of streaming and downloading methods creates something like progressive downloading, where the downloaded file can be played as its individual parts are received. In contrast to true streaming this may result in non-continuous playing.

## **4. True streaming in our program**

To stream live events using true streaming methods it is necessary to have streaming server, that prepares, encodes and transmits video to the users. There are several file formats that can be used and some of them are offered by RealNetworks (RealMedia), Apple (QuickTime), Adobe (Adobe Flash) or Microsoft (Windows Media).

Considering our previous experiences and our technical equipment we decided to use RealNetworks Helix technology to stream live education events. We prefer to use it as it meets all of our technical requirements. Except of many other advantages it is also because of ability to handle traffic loads and ability to detect users' connection speeds and to supply appropriate files automatically. Thanks to its stability we use it as an effective tool of DE and also as a tool to offer the newest research results to the wide group of remote users.

Helix, similarly to other server solutions, uses three main components to handle live events. These are encoder, streaming server and decoder.

- Encoder – a source of video signal. It is responsible for digital compression of all captured video and audio data that are sent to the streaming server.
- Streaming server – forwards video data to the remote users. Produces different file formats and streams them on different bit rates.

- Decoder – player, responsible for decoding of received video files and for playing them in the computer of remote user.

Principle scheme of the video streamed communication and interconnection of above mentioned parts of true streaming is shown on figure 1.

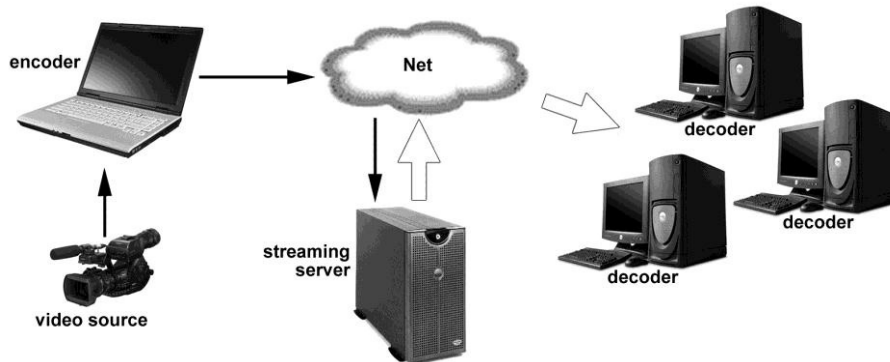


Fig. 1. Live video streaming principle.

The advantages of Helix technology include platform independence (Linux, Windows, and Solaris) and support of various codes. The encoder at the transmitting side is represented by RealProducer processing and encoding input video and audio signals. The necessary equipment consists of video camera, microphone, speakers and computer with connection to the internet. Helix server receives data from encoder and distributes streamed content to the remote users. Free RealPlayer is used as decoder at the side of student watching live education event. In this way, the students as consumers of education content do not need to have any special ICT products or equipment to watch live events.

## 5. Scientific topics

The primary goal of our activities is focused on creation of systematic approach in organisation of live meetings. This should cover not only a few individual lectures with completely different topics and streamed randomly as unorganized sections. Therefore, we specified one area of medicine to offer students the most actual information about it as a pilot conceptual solution delivered in periodically repeated terms. The selected specific topics will cover branch of infectology as it concerns not only clinicians but also a large group of patients and healthy people as well.

The bacterial resistance against antibiotics, convenient anti-infectious treatment and nosocomial infections are only a few of themes that every one of us should be informed about. These are the one of the major problems of European Commission (EC) in the area of public health. It is also the priority of national government as the consumption of antibiotics is one of the greatest in European Union. European Surveillance Antibiotic Consumption (ESAC) rated Slovak republic on the sixth place in consumption of antibiotics. Furthermore, there are hospitalized 80 million patients per year in EU and 5 percents of them get nosocomial infection. Approximately 40 thousand of such patients die of it. This is the reason why EC emphasises the need to increase awareness of population using education activities with the aim to improve situation and to solve these problems.

In that sense, we try to address live lectures to the wider group of undergraduate students, PhD students, physicians in continuous education and to the public as well. They will be able to watch

presentations for example about the most frequent infections, their transmission mechanisms, rational usage of anti-infective drugs or about the resistance of microorganisms against anti-infective medicine and many other that are covered by main topics as are summarized in the table 1. Using realization of above mentioned activities we also plane to minimize antimicrobial resistance to improve management of patients with nosocomial infections.

Table 1. List of prepared sessions and their main topics. Targeted groups are S – students of medicine, C – clinicians, H – health care employees, P – general public.

Session	Main topic title	Pt	Target group
I	Physiological bacterial settlement, most frequent bacterial infection	4	S, C, P
II	Rare bacterial infections	4	S, C, P
III	Mechanisms of infections transmission in community and in hospital	5	S, C
IV	Antibacterial pharmaceuticals used in community	4	S, C
V	Antibacterial pharmaceuticals used in hospital	4	S, C
VI	Antimycotics, antivirotics and antiparasitics	4	S, C
VII	Respiratory infections	4	S, C
VIII	Urinary tract infection, neuroinfections, gastrointestinal infections and skin infections	4	S, C
IX	How and when to use antibiotics	4	S, C, P
X	Sepsis	4	S, C
XI	Nosocomial infections and resistance on antiinfective pharmaceuticals in hospital	4	S, C
XII	Preventions against nosocomial infections	5	S, C
XIII	Antivirotic treatment of the most frequent infections	5	S, C
XIV	Recommendations in treatment of micotic infections	4	S, C
XV	Selected topics and panel discussion		S, C

Individual live video streams will be broadcasted as free to join events, so not only the students of our faculty will be able to watch it. Anyhow, we have arranged that the active teams of participants will be composed of physicians and professionals with skills in education of clinical disciplines. Information about regularly organized sessions are announced at the faculty webpage as well as at the webpages of other education institutions, scientific societies, and health chambers and on webpages of Ministry of Health and Ministry of education. The streams will be archived and shared together with additional education material.

## 6. Conclusion

Learning science is a complicated system affected by too many input and output factors that should be beard in mind while searching for optimal and the most effective results. We suppose the combination of traditional teaching methods with new technological innovations satisfies teachers as well as students and may offer optimal learning experience for clinical medicine subjects. We decided to use streaming media technologies as it is a cost effective solution for multiple users to access audio and video content on the web in near real-time. It also allows to present education content to the global audience without the need for expensive broadcast equipment or facilities.

Using of streaming and software videoconferencing tools that we use at the faculty and also their advantages motivated us to utilise them in more intensive ways. Therefore, we realize live streaming of

education events to improve quality of education and to offer an access to the newest scientific, clinical and specialized research knowledge. Activities are based on methodologies enabling to share lectures, seminars and conferences anywhere and without the need of having specialized equipment at the side of participants. In contrast to our previously streamed courses, the individual infectology oriented sessions will be archived now. An asynchronous collaboration will be offered to the user through the ability to annotate archived events. The substantial educational materials will be published also in printed versions to satisfy user not familiar with multimedia technologies.

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