
Video Conferencing and its Application in Education

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Abstract: In many countries, the demand for jobs in the conventional education system far exceeds the available job offers. Under the right circumstances, open and distance learning systems have proven that they can provide quality education and training to many people at lower unit costs than conventional education systems. In remote or sparsely populated areas, it is not economically feasible to provide the full range of educational opportunities and vocational training through the conventional institutions. Video conferencing as a method of distance education enables learning and training to be delivered in a more efficient and economical way. Due to the rapid development of technology, the idea that a student is trained as a young person for the same life-long job is becoming less viable. Most people are likely to change the profession for at least two or three times throughout their careers. This paper provides some technologies and standards used in video conferencing. In addition, it outlines some basic types of video conferencing and equipment requirements.

Key words: e-learning, information technology, students, standards.

INTRODUCTION

Professional training is undergoing radical change. In the second half of the last century, according to [1], there were three main methods of vocational training: on-the-job training (essentially on-the-job training provided at the workplace); classroom teaching in the public sector or institutions (either as day or evening classes); and organized, internal training (seminars or courses). These three methods are primarily based on personal contact between the teacher and the student, and they are therefore time and place dependent. All three methods are also expensive for employers, especially if there are travel and accommodation costs, or if employees are far from regular work during training. Such methods are also inflexible from the perspective of students.

Concepts of open and distance learning provide the necessary flexibility for adults to continue their education or training even though they work and have families. Some governments and employers have emphasized the importance of lifelong learning and distance education for increased economic productivity. Businesses appreciate especially when employees continue to learn and improve. Individuals see the value of flexibility and access to learning without sacrificing time outside the home. Lastly, the rapid growth of knowledge in areas such as healthcare, technology and management requires from people working in these fields to continue learning in or-

der to keep up with the new findings in the context of their work. E-learning and distance education are ideal methods of lifelong learning. A period of ten years is an eternity in the field of education. For example, in the first edition of the book [1] on technology and the concept of open and distance learning, there are no references to the *World Wide Web*. According to [2], from this time distance, it is difficult to believe that by 1996 there were no educational programs using the *Web*.

As reported in [3], there are three generations of distance learning. The first generation of distance learning was characterized by the predominant use of one technology and the lack of direct interaction between the student and the institution that provides education or awards certificates of successful completion of a particular course. Although educational television and radio were used in the first generation, the main form of first generation distance education was correspondence based on printed learning materials. Distance education of the second generation is characterized by access to multiple types of learning materials (printed material and broadcast), where learning materials are specifically designed for distance learning. Communication with students is mediated by a third party or a tutor, not by the original author of the learning material used in the teaching process. The third generation of distance education is based on two-way communication through media, such

as the Internet or video conferencing, which enables interaction between the teacher and the student using the distance learning system. And maybe more importantly, communication between students, either individually or as groups, is facilitated, but it takes place remotely. Third-generation technologies have led to a more even distribution of communication between students and teachers (as well as between students).

According to [4-5], third-generation systems are sometimes described as knowledge-based systems. Small, relatively autonomous teams manage the design, development, and delivery of a particular course.

According to [5], third-generation distance education is characterized by tailor-made courses, which are rapidly produced and require relatively small initial investment (although operating costs can be significant). Examples of third-generation distance education can often be found in conventional distance-learning universities (dual-mode institutions) and in some smaller training organizations.

According to [6], the main reason for the growth of third-generation distance education is the rapid expansion of the Internet, and especially of the *Web*. The *Web* is a special component of the Internet, which enables the creation of digital materials, then storing and accessing them, and ultimately communication through the Internet. The Internet also includes email, bulletin boards and digital video conferencing, separate or combined with the *Web*. The terms *e-learning* and *online learning* are often used interchangeably, although e-learning can encompass any form of telecommunications and computer-based learning, while online learning involves the use of the Internet and the *Web*. Figure 1 shows an overview of technology-based learning categories.

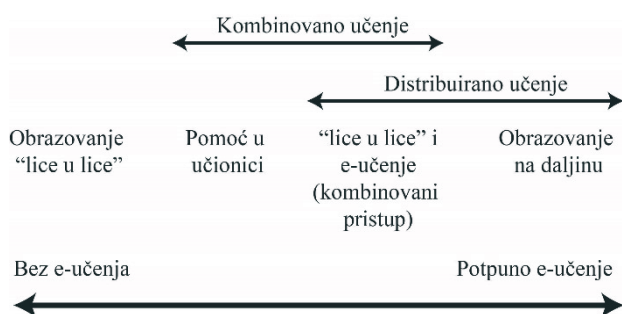


Figure 1. Overview of technology-based learning categories
Source: Bates & Poole, 2003, p. 127

- Kombinovano učenje:** Combined learning
- Distribuirano učenje:** Distributed learning
- Obrazovanje "licem u lice":** "Face-to-face" education
- Pomoć u učionici:** Help in the classroom
- "Lice u lice" i e-učenje (kombinovani pristup):** "Face-to-face" and e-learning (combined approach)
- Obrazovanje na daljinu:** Distance learning
- Bez e-učenja:** Without e-learning
- Potpuno e-učenje:** Full e-learning

According to research [7], despite the benefits, the success of video conferencing depends on various factors, such as teachers, students, but also on their attitudes towards educational technology. In the study [8], it was concluded that over 80% of students responded positively to video conferences. However, 80% of students stated that it would be more comfortable in a classic classroom. In accordance with the findings of studies conducted in educational institutions [7-8], students generally tend to have a positive attitude towards video conferences.

The paper [9] explored the possibility of using free *ooVoo* and *Skype* software in foreign language learning through video conferencing. *OoVoo* and *Skype* are free chat and video communication tools that allow users to send previously recorded video messages, chat with other users synchronously, and participate in video conferences with up to three users at a time.

VIDEO CONFERENCING TECHNOLOGIES AND STANDARDS

The following section provides a brief overview of the standards used for video conferencing. In addition to the standards listed in Table 1 in accordance with [10-11], special standards refer to internet standards related to video conferencing. Particular attention is also paid to standards related to security and encryption, multimedia control, etc.

Table 1. Names of standards for video conferencing technologies

Technology	Name of the standard
Signal transmission	H.310, H.320 (ISDN Networks)
	H.321, H.323 (since 1996)
	H.324 (PSTN)
	H.324m (3G or UMTS)
Video codecs	SIP (VoIP and Video Calls)
	H.261 (introduced in 1988)
	H.261 Annex D
	H.263
Audio codecs	H.264 (MPEG 4 AVC)
	G.711, G.722 and modifications G722.1
	G.722.1 Annex C
	G.723.1, G.725
	G.728, G.729, G.703

- Notes:** PSTN - Public Switched Telephone Network,
- UMTS** - Universal Mobile Telecommunications System,
- SIP** - Session Initiation Protocol,
- VoIP** - Voice over Internet Protocol.
- Source:** Andberg, 2008, pp. 119-126.

Based on the literature review, the paper [10] makes recommendations for basic equipment:

- Camera. Particular attention should be paid to the positioning of the camera (cameras). Another aspect is related to the quality and functionality of the camera (the existence of the zoom option and resizing).

- Sound. Audio quality is immensely important in video conferencing. A delay in sound transmission of only *0.5 seconds* [12] leads to a discrepancy between speech and body movement, which impedes teacher-student interaction. According to [13], a delay of only *0.15 seconds* results in interference with the natural flow of communication.
- Lighting and background. Particular attention should be paid both to the place from which it is aired and the place where the listeners are.

Many video conferencing features are algorithms that have been ratified by the ITU-T (*International Telecommunication Union, Telecommunication Standardization Sector*) standards. This allows seamless connectivity between different products or networks, eliminating thus any interoperability issues.

VIDEO CONFERENCING TYPES

According to the report [14], compressed video conferencing can take place in point-to-point configuration (2 locations) or multiple points (3 locations or more). All video conferencing sites require a proper codec.

All locations participating in a multiple call must be “bridged” by using the built-in multipoint capability or the *Multipoint Control Unit (MCU)*. Many codecs have the built-in ability to “bridge” up to 4 locations, i.e. 3 other locations and their own.

The codec initiates a multipoint call, which may also require additional network bandwidth to make or “host” the call. Using an *MCU* is usually a requirement in conferences with 4 or more points. The *MCU* is a hardware solution that allows you to connect multiple locations to video, audio and the *Web*. During a multipoint conference, all participants can hear each other at any time (Figure 2).

What participants see, depends on how the conference is set up through the *MCU* [14]:

- *Voice Activated*: Participants see the current or the last spoken location.
- *Continuous Presence*: Participants see all locations in different window layouts on the monitor screen. Examples of possible multiple window layouts are given in the following figure.

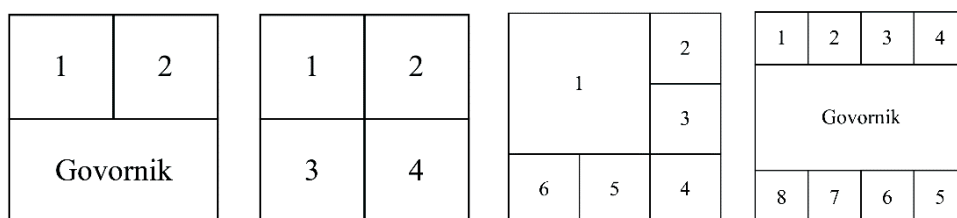


Figure 2. Possible multiple window layouts

CONCLUSION

Video conferencing has become an essential component not only of the business world, but also of the world of education, health, and many other fields. Nowadays, video conferencing is also present in classrooms and it is accepted as a way of teaching. New technologies, such as video conferencing, have given teachers new ways of presenting materials, working with students, and thus they are stimulating the development of strategies that are consistent with new technology. Video conferencing uses synchronous two-way audio and two-way compressed video through the Internet.

Video conferencing students use special cameras, look at monitors and use the microphone of a computer or mobile device at any location. In doing so, students can communicate with each other and with teachers, as if they were in an educational institution. Students receive instructions and information on any topic through video conferencing, and are able to ask questions to participants from all locations involved in the video conference. The use of digital images, videos and video conferencing in the classroom puts teaching beyond textbooks and connects students with the world they live in. Video conferencing, as a form of distance education, illustrates well the relationship between the use of technology and the need for reorganization in order to maximize their benefits. Distance education, when properly organized and structured, also illustrates the ability to reach new target groups and to expand the range of educational offerings through technology.

Video conferencing has flourished with the development of various services on the Internet. Video conferencing, as a way of open and distance learning, provides education and training in a more flexible way than the regular ones. Technology is an essential component of this e-learning technology.

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