

# Educational interaction in distance learning: Analysis of a one-way video and two-way audio system

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## ABSTRACT

The basic definition of distance learning (DL) considers that the teacher and the students are separate in the spatial dimension and that this distance is filled by using technological resources. Recent technological developments, allowing an increasing level of interaction between users, have implicated a deep change in the educational system. Aim of these studies was to analyze the implementation of interaction in a DL system with one-way video and two-way audio channels and to investigate the effect of interaction on psychological variables. Final results suggest that the possibility of interaction in distance learning arouses a greater degree of attention, interest, participation, concentration, satisfaction and perceived efficacy. The distance modality with interaction takes his place at the intermediate level between the traditional face to face lesson and video-recorded lesson or distance learning without interaction. The possibility of interaction during the lesson is a basic factor for the success of a distance course.

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## 1. Introduction

In a situation of rapid technological and socio-economical changes, the educational system has had to face increasing requests in terms of formation and upgrade of know-how and professional skills. Numerous structures, both private and public, are answering this challenge developing distance learning programs.

The basic definition of distance learning (DL) considers that the teacher and the students are separate in the spatial dimension and that this distance is filled by using technological resources (Moore & Kearsley, 1996).

These resources could help working adults to obtain a university diploma, to avoid difficulties linked to physical handicaps, or to implement professional upgrade courses

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without requiring expensive travels. For many years technological tools have not had a remarkable impact on instruction. Recent technological developments, allowing an increasing level of interaction between users, have then implicated a deep change in the educational system.

DL can be implemented in two modalities: synchronous and asynchronous. In the synchronous modality, the teacher and the students interact in real time, for example by means of a two-way video-conference. In the asynchronous modality, the interaction doesn't take place simultaneously. In this case, the teacher can send instructions via video, computer or other technological tools, and the students reply later. For example, instructions can be sent across the WEB and the feedback received via e-mail.

Many users wonder whether DL is as effective as traditional instruction face to face.

The studies comparing different teaching systems indicate that DL could be as or more effective than the traditional system.

In a research conducted at the Stanford University, Gibbons et al. (1977) have compared the scores obtained by subjects of different groups which had attended a course with different teaching modalities: campus, live video, videotape, videotape with tutor. Subjects in the last group reported better scores.

## The Stanford TVI Experiments

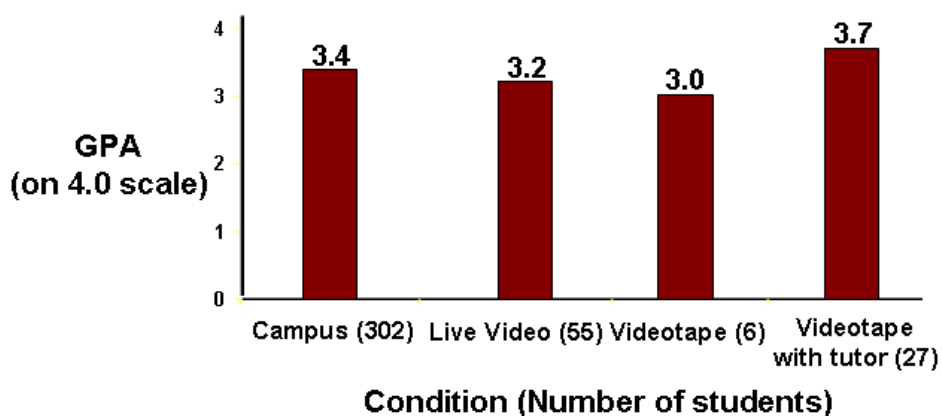


Figure 1. Modified from J. F. Gibbons et al. (1997).

A theoretical framework in which the psychological differences between traditional face to face teaching and DL can be analyzed is given by the Equivalency Theory (Simonson, 1998), which states that if the learning experiences of a traditional course are equivalent to the ones of a distance course, then the two courses will have the same results in terms of learning efficacy.

The learning experiences include all that happens in a classroom, for example lectures, practical activities and social interaction (SI). The mathematical representation of the Equivalency Theory describes the relation between learning experiences and equivalency:

$$\Sigma(\text{TC}) e_i = \Sigma(\text{DL}) e_i$$

where: TC = traditional classroom, DL = distance learning,  $e_i$  = learning experiences,  $e_1$  = social interaction,  $e_m$  = practical activities.

The equation indicates that is the sum of the experiences which determine the equivalency. Thus, even if the detailed components could be not exactly the same, the final result remains equivalent.

The physical separation between teacher and students, and between students, is a potential source of SI decreases during the course. The SI is considered one of the most important factors which contributes to the efficacy of a course, both traditional and at distance (Moore & Kearsley, 1996). Therefore, a lack of equivalency in SI between TC and DL determines a difference in the success of the courses.

The Social Learning theory formulated by Bandura (1986) provides the mechanism by which SI affects the results of a course.

The Equivalency Theory takes into account also the individual differences in reacting to the same learning experiences. In the context of the SI, the individual differences could further alter the results of a course.

## 2. Implementation of distance learning

We briefly review the most widespread systems for implementing distance learning:

### One-way video \ one-way audio

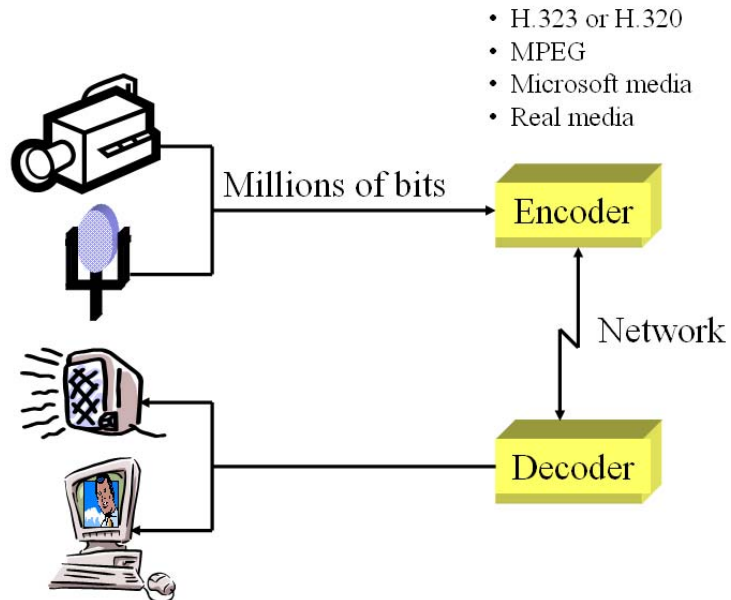


Figure 2. Modified from S. Poltrock (2002).

### Videoconferencing

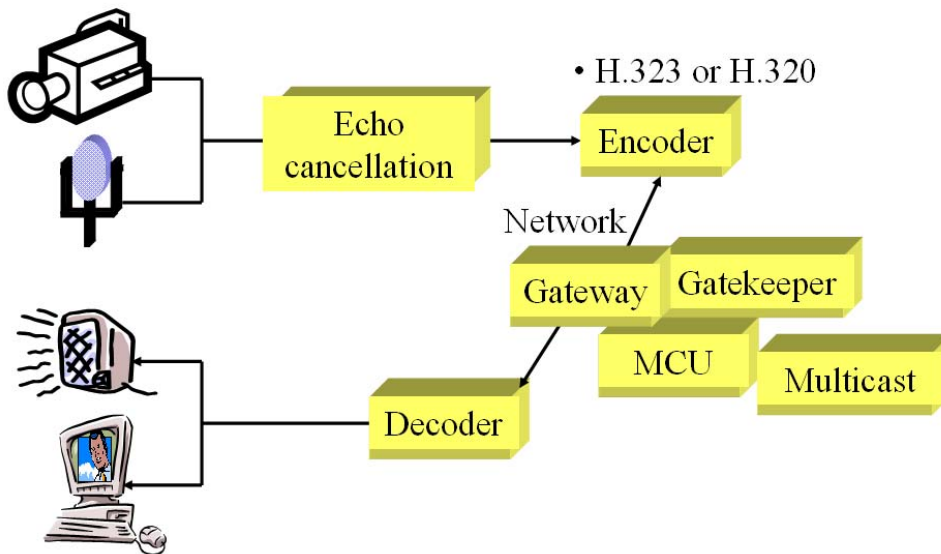


Figure 3. Modified from S. Poltrock (2002).

## Video streaming

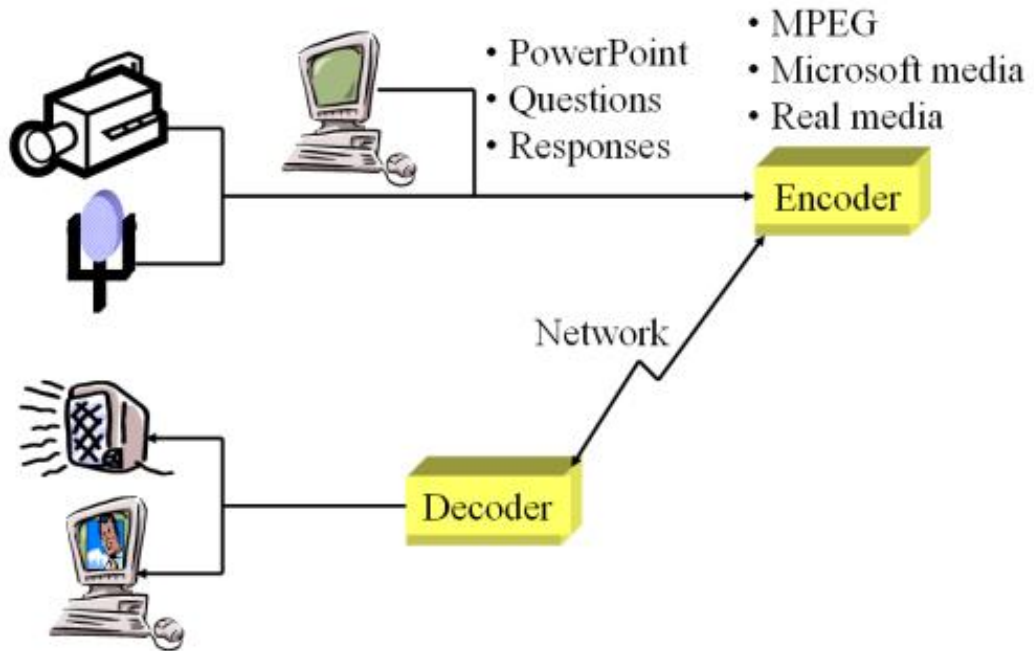


Figure 4. Modified from S. Poltrock (2002).

## Video on demand

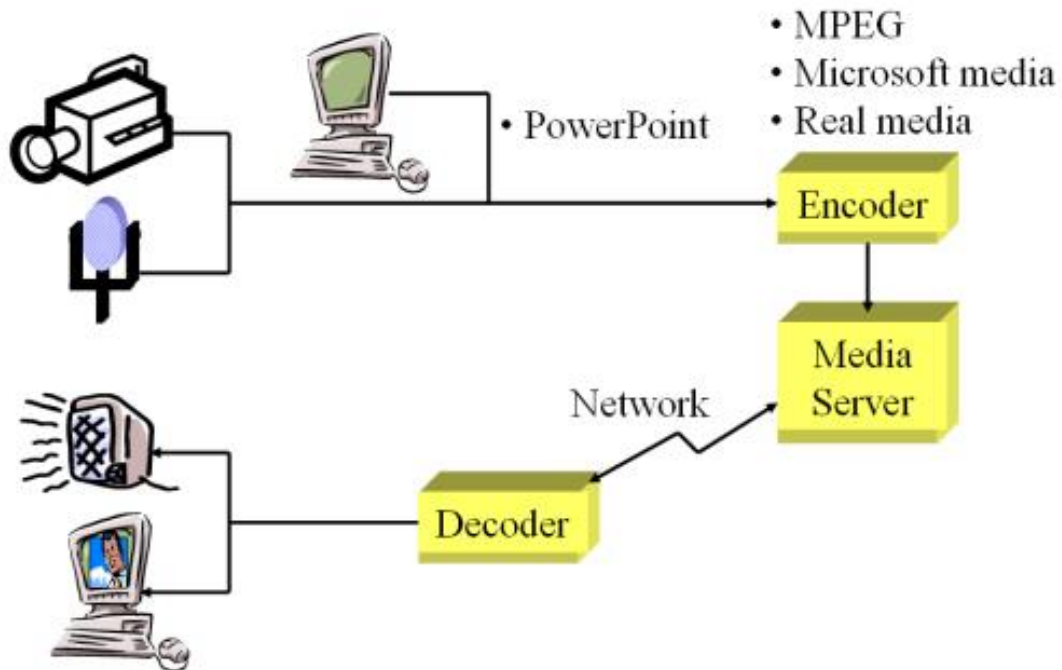


Figure 5. Modified from S. Poltrock (2002).

Considering the direction of the information flow, we can distinguish the following modalities:

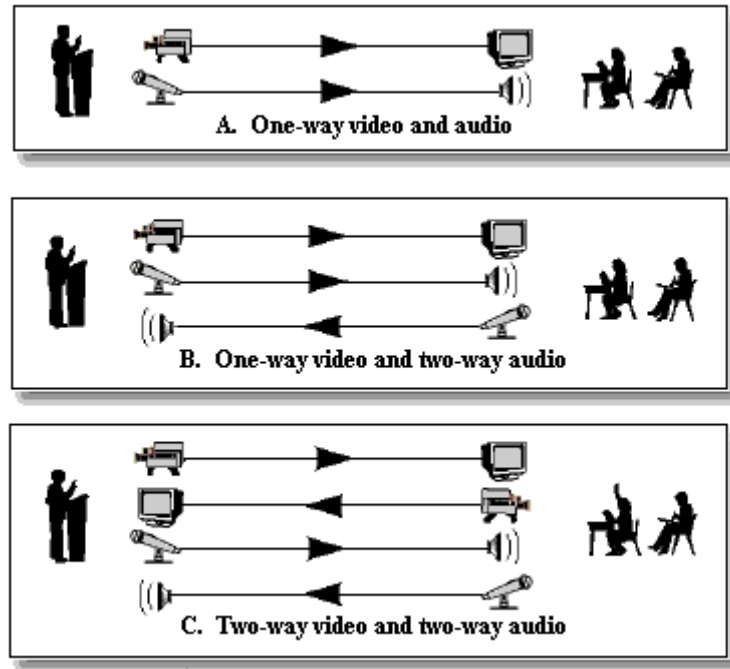


Figure 6. Different modalities of distance learning based on the direction of information flow.

The modality analyzed in our study was a one-way video \ two-way audio system based on satellite transference of the video contents:

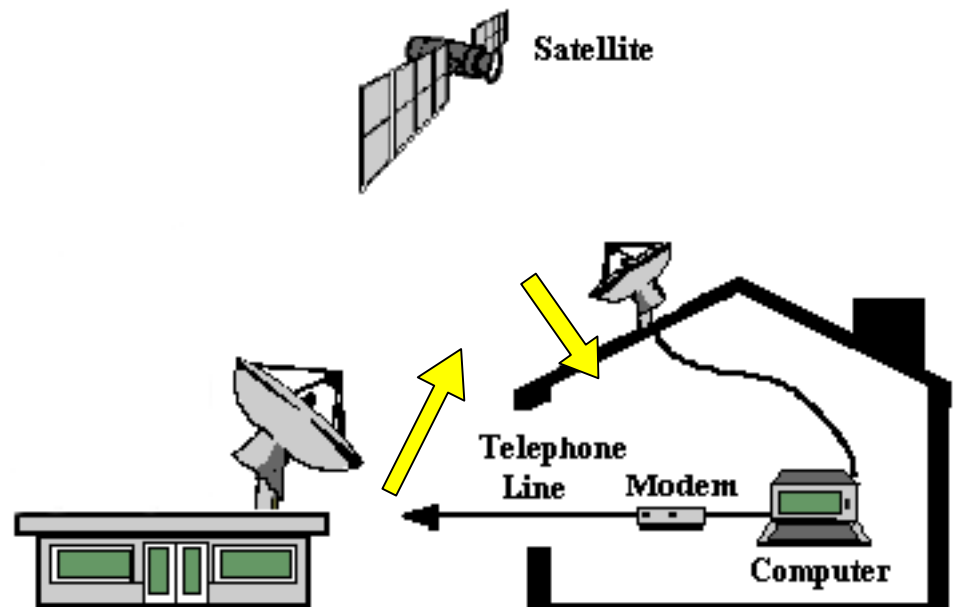


Figure 7. Representation of the system analyzed in this study.

### **3. Benefits of distance learning**

#### **Convenience**

Technological tools implementing distance learning can provide advantages in terms of costs reduction both for the students and for the teachers; in fact, many usable technologies, for example internet, are easily reachable from home. Other tools, such as desktop videoconferencing, can be distributed from a single site, for example a university server, to many remote sites, for example classrooms. The satellite transmissions can be received from equipped positions, video-recorded and then used later.

#### **Efficacy**

Distance learning is not only convenient, but also effective. Several researches have demonstrated that, it can be equally or more effective than traditional instruction: when the method and the technologies are appropriate, when it is provided for the interaction between students and finally when there is continuous feedback between teacher and students (Moore & Thompson, 1990; Verdun & Clark, 1991; CSCL, 2002, available on-line).

#### **Flexibility**

Several distance learning systems allow the students to attend a course when they prefer, for example during the night or in the early afternoon. Moreover, a student may spend thirty minutes consulting a web site, while another may decide to appreciate the contents later on.

#### **Multimediality**

One of the most important advantages of distance learning regards the fact that a wide range of materials can be delivered respecting the individual preferences in the learning modalities. For example, some students prefer materials presented in visual or in acoustic form; others may learn better interacting with a computer program.

#### **Interactivity**

In contrast with the common opinion, distance learning can offer an increment in the interaction with students. In particular, introvert subjects who are too shy to ask questions in classroom, often are more active and participate when they can interact via e-mail or use another individualized tools (Franklin, Yoakam & Warren, 1996). By using interaction, besides, teachers can satisfy the individual needs of single students.

## **Equity**

In many geographic areas, the lack of educational homogeneity is a real problem. The schools in the outskirts often have few teachers and out-of-date teaching tools. Distance learning allows these limits to be overcome and it has been used with great efficacy in countries such as Australia and Canada.

## **4. Effects of interaction in distance learning**

At the Department of General Psychology of the University of Padua a research group (Educational Interaction in Distance Learning Laboratory, EIDLL) has been formed to investigate the effects of different types of interaction in distance learning: teacher-student and student-student.

Aim of the research group was to analyze qualitatively the implementation of interaction in a DL system with one-way video and two-way audio channels and to investigate the effect of interaction on psychological variables as, for example, the degree of satisfaction and perceived efficacy, the level of attention and distraction, etc.

The first studies have shown the remarkable impact due to the introduction and to the improvement of interaction in distance learning (Casarotti et al., 2002). These researches have provided important indications about the attitude and the degree of students participation during a distance lesson. Particularly, the student could interact: 1) virtually raising a hand by pressing a key; 2) addressing all the other students after the teacher's call; 3) answering multi-choice questions by pressing a key. Subjects who could interact with the teacher are more attentive during the lessons than subjects who attended the same lessons with no interaction. An identical situation was observed for the degree of interest, the degree of perceived satisfaction, the degree of participation and the level of concentration. Moreover, interacting subjects considered the lesson more effective than the colleagues who attended it with no interaction. As for distraction, the subjects in the interactive modality showed a lower degree of distraction than the subject in the passive modality.

In short, the results of our studies suggest that the possibility of interaction in distance learning arouses a greater degree of attention, interest, participation, concentration, satisfaction and perceived efficacy (fig. 8).

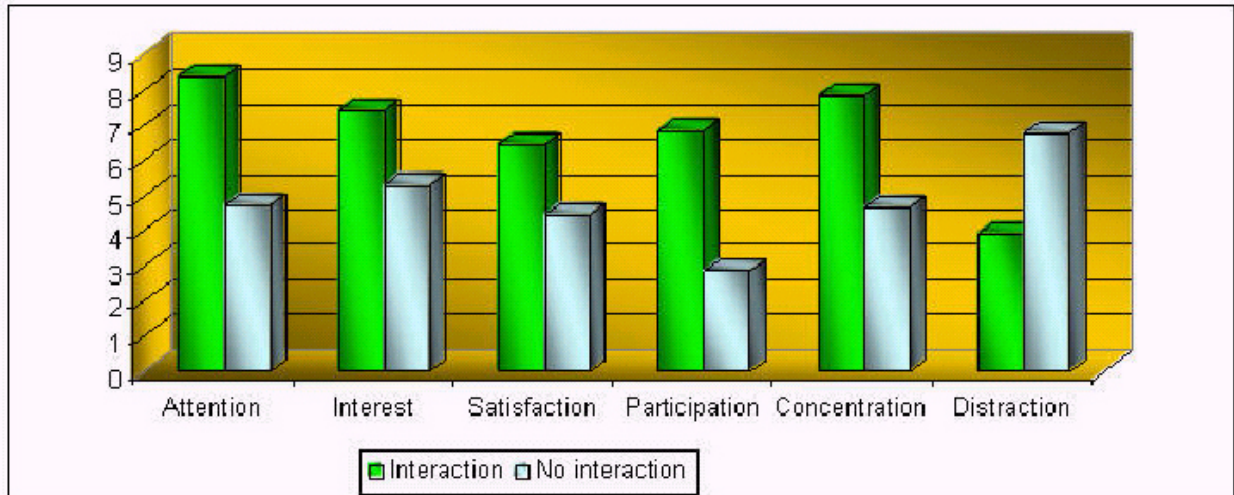


Figure 8. Effect of interaction on psychological variables.

These observations allow us to assume that the efficacy and the assessment of different systems implementing distance learning depends on the possible degree of interaction (fig. 9).

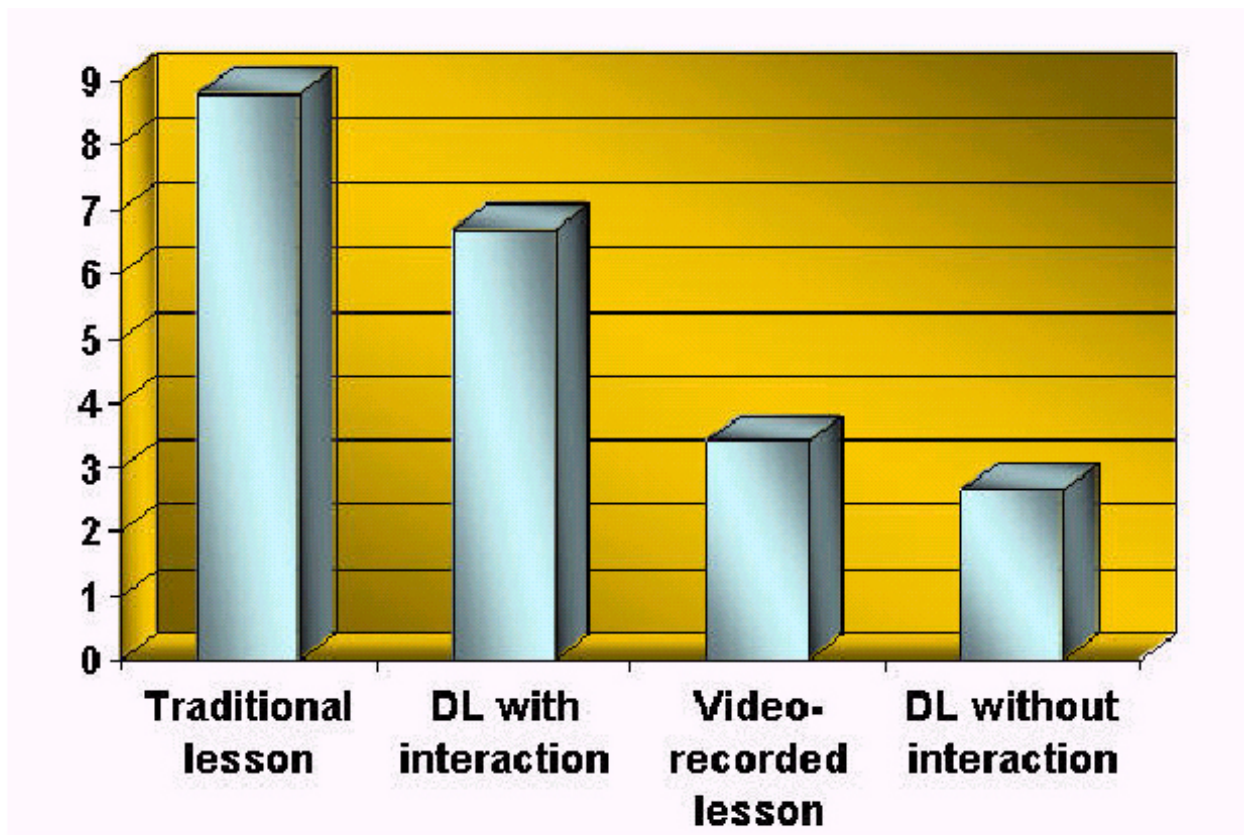


Figure 9. Assessment of different DL systems which differ in the degree of interaction.

It can be remarked that the traditional lesson is considered more positively than the video-recorded lesson or distance learning without interaction (asynchronous modality). At the intermediate level the distance modality with interaction takes his place such as that analyzed in our research. The interaction is crucial; we expect no differences between video-recorded lessons and that conducted at distance without any kind of interaction.

In conclusion, the possibility of interaction during the lesson is a basic factor for the success of a distance course.

The EIDLL intends to assess the quality and the amount of learning in a course at distance by means of new experimental studies manipulating the possibilities of interaction.

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