sanako

Hardware-enhanced language labs compared to Software-only solutions

White Paper

November 2004

1 Executive Summary

During the past years there has been a lot of discussion surrounding hardware- and software-based solutions for language learning, both of which, admittedly, have their own benefits and drawbacks. This white paper will focus on providing practical information about the differences between two particular types of systems that we refer to as hardware-enhanced and software-only solutions.

In this document, we use the term hardware-enhanced to refer to language lab systems that use standard classroom computers and local area networks, but also include some purpose-specific hardware. This special hardware enables the use of certain special features, and provides a performance level that certain language lab functions require. The term software-only system is reserved for solutions that run on standard computer classrooms without any additional language lab hardware.

The main difference between hardware-enhanced and software-only systems is that a hardware-enhanced language lab usually includes more possibilities of use and far better audio and video quality than software-only solutions. The main advantage of a software-only solution is that no extra cables are needed in addition to the LAN cables of the computer classroom.

Table of Contents

About the Authors

SANAKO Corporation

SANAKO specializes in language learning, virtual meetings and web-based real time conferencing software and licensing, serving academic and business clients globally.

www.sanako.com

2 Introduction

Sanako's product portfolio has a full range of products, from hardware systems to hardware-enhanced systems and to software-only systems. We can therefore offer numerous options for customers who are unsure of the type of solution that would best suit their needs. Sanako Lab 100 and 200 are hardware-based language labs, Sanako Lab 300 is a hardware-enhanced language lab, whereas Lab 250 and Lounge 100 are software-only language learning solutions. As Sanako's extensive product range covers all these different types of solutions, we are able to write this comparison based on our actual experiences with them.

3 Definitions

Hardware-enhanced and software-only language labs have many similar features and functions. However, to get a better idea of what the two terms actually mean, we will explain them in more detail in the following:

3.1 Hardware-enhanced Language Lab

The term hardware-enhanced language lab refers to systems, where an additional hardware component is used for the most complex and quality-critical functions, such as transferring and mixing audio in program transfer and the various pair and group communication modes.. In other words, the system requires a central unit (audio-hub), which performs group discussions, pair discussions and other audio routing functions. This means that student audio and video is routed through a dedicated cable and, in some cases, PC screen transfer may also utilize a hardware-based CSS system (Computer Supervisory System) that has its own cable for screen image broadcasting. Headsets are usually connected to a unit called a headset adapter, which is, in turn, connected to both the PC and the central unit.

3.2 Software-only Language Lab

A software-based language lab uses a normal PC classroom and requires no additional hardware. Audio and video is routed through a standard LAN cable and headsets are directly connected to the PC sound card.

4 The Development of Language Labs

From their inception in the early 1960's, Language labs have catered to a very specialized user market. The functionality created in those early days remains the "standard" for products produced today. However, technology has changed a great deal since the early 60's and the changes in product design have reflected this.

Before the advent of digital technology, language lab systems relied on various applications of analog technology and the change from reel to reel machines to cassette mechanisms was a big step in the late 60's. The 1970's saw the emergence of micro controllers and these devices were also used by our company in language labs produced during this time. These labs can be considered to be the first examples of the "hybrid lab" that combines digital technology with a hardware-based solution. They used the latest digital control technology at the teacher console, and the best possible mechanisms for recording, and playing audio tapes.

During the early 80's, we continued to develop state-of-the-art language labs, while simultaneously exploring the role of computers in language labs. Early experiments in 1982 showed that we could interface our tape mechanisms to a computer, and provide synchronized sound to computer images.

The early 90's witnessed the beginning of widespread computer use. Although slow at first, the computer explosion was fuelled by the emergence of the internet. At the same time, great changes took place in teacher console technology. The teacher console was developed to include a Graphical User Interface (GUI), which communicates with the electronic systems that are required for communication between the teacher and student headsets. These components allow students to talk with each other, with their group, or with the whole class.

By the mid 90's, computer technology had developed to the point where it was possible for our engineers to produce a computer plug in card that could serve as a digital replacement for the language lab tape recorder. The design also included a headset adapter that formed a link between the computer's sound card and the console electronics. This way, it was possible to maintain the integrity of traditional audio functions such as intercom, monitor, pairing, and teacher call. The headset adapter also guarantees that the sound card in the computer does not dictate what the teacher and student hear during intercom and monitor.

By the late 90's, improvements in computer hardware and operating systems made it possible to design a solution that would not require the use of an internal card.

The headset adapter and the electronics at the teacher console are the remaining links to the analog heritage of the language lab, as are the cables that connect the two together. These components are in use today, in our widely acclaimed Lab 300 system and they make it possible to provide a digital language lab that has none of the problems or limitations consistently present in software only solutions. Since these components use highly advanced technology, they normally last far longer than the average expected life time of the actual PCs used in the same environment.

Current technology does allow us to replace the above analog components with a fully software solution. However, we are also aware of the limitations that a software only solution presents. A total software solution requires that the teacher console will be able to communicate with each and all student workstations without separate dedicated cables and custom electronics.

Computers connected together by a network can make use of several network protocols. These protocols result in the ability to share data, to control applications (programs) running on connected computers, to launch files and programs, and to control the startup and shutdown functions of other computers. Many of these protocols are already used by Lab 300, our hardware-enhanced solution. However, the key protocol that makes software only labs possible is the Voice over Internet Protocol (VOIP) that enables audio communication.

5 Benefits of Hardware-enhanced Language Labs As Opposed To Software-only Solutions

5.1 Digitization of Analog Material

A very good phrase for describing hardware-enhanced language labs is that "they provide a link with the past (analog content material), a bridge to the future, and the best of today". This means that teachers can use any existing analog source material, whether it is an audiocassette, a reel-to-reel or a VHS tape, immediately without having to digitize the material prior to a tesson. This allows teachers to, for example, tape something at home and then simply bring it in and use it in the lab. Additionally, thanks to the digitization functions in hardware-enhanced labs, when the material has been played back once, the teacher can simply save it as a digital file for future use. All this provides a seamless path from analog to digital and removes the need for an immediate transition to new teaching practices. As teachers become more familiar with the new teaching technology, they will automatically come to embrace the benefits that pre-digitized learning material can offer. However, this learning curve is far less daunting if they can use the material and teaching methods they are already comfortable with while familiarizing themselves with the new technology.

The cost of having to digitize material before you can use it is considerable. The following presents a typical example of what an institution would immediately be faced with when adopting a purely digital laboratory.

An institution has 200 Audio Cassettes, 60 minutes each, that they wish to digitize into 15 minute clips

An institution has 50 VHS tapes, 120 minutes each, that they wish to digitize into 30 minute clips

The time taken to digitize these files, will add up to

= (200 x 60) + (50 x 120) = 12000 + 6000 = 18000 minutes

= 300 hours = 37.5-man-days work

It is also fair to assume that approximately a further 2.5 days would be spent in preparation and logistics giving a total of 40 man-days work.

This also raises some additional questions:

Will teachers always have a certain resource available to them?

Will teachers be able to get the analog material to the digitizer enough in advance so it will be ready when they actually need it?

Can teachers guarantee that the work will be done as they requested and be sure that everything is ready for their lesson?

In Lab 300, if a teacher should need to take an audiocassette into a lesson, then they can make use of the 4XTRANSFER feature saving significant teaching time.

5.2 Group Work

A hardware-enhanced language lab also allows the use of a number of headsets for each position, whereas a software-only solution normally only has one headset per each position, as the headset is directly connected to the PC soundcard. Hardware-enhanced solutions thus allow institutions to more effectively utilize student computers, as several students can work on a single computer.

A hardware-based language lab allows multiple simultaneous program transfers from both analog audio and anatog video sources. This, in turn, enables the teacher to divide a class into smaller groups that can be assigned to work on different material. The most common reason for grouping students is that a class can be comprised of students of highly varying skill levels. In this case, a hardware-enhanced solution allows the teacher to simultaneously use different material for different groups. In a software-only solution, only one program can be transferred at a time, due to limitations set by the teacher's PC and its sound card.

Both solutions offer similar possibilities for the use of digital program sources, as both types of solutions allow digital audio and video materials to be used as program sources and to be launched for students.

Additionally, there is no limit for group size in hardware-enhanced language labs, whereas in software-only solutions group size is usually limited due to issues with the LAN and with computer performance (in some systems group size can be as low as 6 students).

5.3 Program Transfer from Analog Source

In hardware-enhanced solutions, teachers can talk to and listen to a single student, at the same time as a program is being transferred to students. It is important for a teacher to have this possibility to interact with individual students even when a program is being transferred. In software-only solutions, the teacher is limited to listening to the student and does not have the possibility to talk to the student while a program is being played back.

Hardware-enhanced language labs also allow all types of program sources to be transferred without an additional server, whereas software-only solutions require an additional server to handle video streaming.

SANAKO Lab 300, our hardware-enhanced language lab solution, allows the teacher to transfer an audio clip to all students using 4X copy speed, and then to run the student recorders on top of a locked screen – thus providing access to the audio material only. This has proven to be a very useful way of conducting exams in Lab 300 and many existing Lab 300 users have adopted it.

Most examination boards still provide the source material either on an audiocassette or a CDROM (.cda file format) that can not be opened until, for example, an hour before the examination starts and some boards do not allow the material to be opened until the actual starting time of the examination. In these cases there is no time to digitize the material before the examination – some boards even prohibit digitizing entirely, as it could lead to abuse. In these cases, the benefits of an analog program transfer possibility are evident.

5.4 System Integration and Ease of Use

It is extremely easy to connect external sources to a hardware enhanced system. However, this is usually a far more complex task in a software-only lab, since its only available inputs are the sound card inputs at teacher PC. At least 8 program sources can be connected to a hardware-enhanced system.

Another advantage of hardware enhanced systems is their ease-of-use as all system controls are available in a single user interface (program source remote control, classroom speaker, video overlay card control etc.). In a software-only solution, different devices are normally controlled with separate applications that must be running simultaneously. Hardware enhanced solutions also allow the teacher's volume to be adjusted from a manual switch, adding to their practicality of use.

5.5 Sound Cards

Unlike hardware-enhanced solutions, software only solutions don't have the advantage of a headset adapter and, therefore, they have to assume control of the sound card in the target computer. Without this control, it is not possible to create the necessary audio paths between the teacher and the students and in many cases, the teacher will be able to hear the student, but not the program that the student is listening to.

It is of course possible to adjust the settings on each sound card, so that they will work adequately in the lab environment. However, the technical staff of an institution may not always have the time to manipulate and maintain those settings, in which case users will have to accept a lower level of functionality compared to a hardware-enhanced lab.

5.6 Audio Quality

All audio functions in a hardware-enhanced language lab can be 100% guaranteed due to the fact that separate and dedicated point-to-point cabling is used. The functioning of the lab is not affected by things such as, the number of students talking simultaneously, the type or quality of audio material that is being used, or whether the LAN is heavily loaded due to other use within the institution. Student and teacher volumes will be balanced and of the highest quality even if students have changed individual settings either deliberately or unintentionally. Teachers who have used an analog Sanako language laboratory in the past can be sure of the same audio quality and reliability in Lab 300.

Software-only solutions that rely upon a LAN for their audio communication will most likely, at one time or another, experience the following problems.

- Break up of audio: When talking with students the audio can be intermittent. This could be due to significant network traffic being generated elsewhere in the institution or due to limited local PC resources i.e. too many applications open at the same time.
- Large variations in volume levels and quality: This may be due to students changing their microphone and speaker settings. It can also result from the use of poor quality headsets.
- Conflicts between individual mixer sources: If a student is recording their voice along with the source material while being monitored by the teacher, then it is likely that the teacher will only hear the student's voice and not the source material. This can be very disconcerting to a teacher.
- Delay in audio transfer: Even when transfer works properly and without any data loss, the packet technology used in software-only labs will cause some delay in audio transfer that can be heard at the receiving end. This delay may be distracting to the teacher and the students, especially in various face-to-face communication exercises, such as group conference.

6 Conclusion

Many customers currently compare hardware-enhanced and software-only solutions without necessarily having full knowledge of the benefits of both systems. The following summary should provide a basis for the decision whether to choose a hardware-enhanced or a software-only language lab system.

When the following issues are a priority, a hardware-enhanced solution should be chosen:

- high quality audio and video is a must
- teachers would like to use different analog material to different groups
- there should be no delay in audio or video transmission
- institution still has the majority of its material in analog format and it should be digitized

When the following issues are in the forefront, a software-only solution should be chosen:

- no extra cabling should be installed in the lab
- audio and video quality is not the most important factor
- there is no need to transfer analog material to two or more groups
- high quality local IT support is always available