



K –12 Reading Labs

K-12 Reading Labs allow a child's reading skills to be monitored by other teachers in a focus group style environment. The child reads with a teacher in a Work Room while other teachers monitor from an Observation Room. The child is not able to see or hear the teachers in the Observation Room. Two-way communication is required between teachers in each room. This paper defines a system that is capable of overcoming the marginal acoustics of a classroom and the challenges of a full duplex 2-way communication system.

Reading Lab Description

The lab consists of two rooms:

Work Room – The child reads in the Work Room with a teacher. The child's reading is captured by a microphone and transmitted over the speakers mounted in the Observation Room. The teacher in the Work Room wears a personal monitor.

Observation Room – Teachers in the Observation Room have a microphone so they may communicate to the teacher in the Work Room. The Observation Room's microphone(s) is transmitted to the personal monitor.

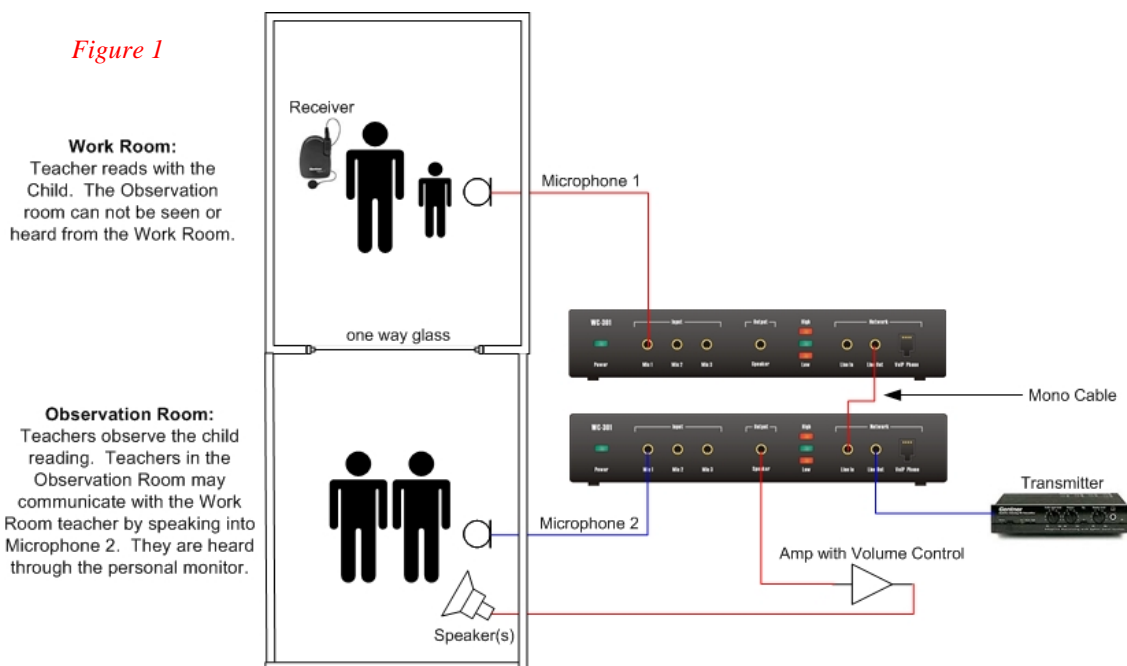
Audio Challenges

This application has three primary challenges:

1. Room noise
2. Low speaking levels
3. Acoustic echo

First, the noise floor in most classrooms is very high due to the HVAC system and marginal acoustics. A high noise floor degrades speech intelligibility. The child's voice should transmit at least 12dB above the noise floor. The WC301 employs 15dB of Noise Reduction (NR) on each microphone channel. The HVAC noise is digitally removed from the speech to improve intelligibility.

Children (and adults) do not always project when they speak or read. The WC301 uses Automatic Gain Control (AGC) on each microphone channel to raise the level for softer voices and lower the level for louder voices. The NR works hand in hand with the AGC by removing noise so the level may be increased.



Acoustic echo is a problem for the teacher in the Work Room. The microphone in the Observation Room transmits speech to the receiver but will also pickup the loud speaker. The WC301 uses Acoustic Echo Cancellation (AEC) on each microphone channel to digitally subtract the speaker. The signal sent to the personal monitor worn by the teacher is the speech captured by Microphone 2 (in figure 1) minus the loud speaker. By subtracting the loud speaker the Observation Room experiences comfortable listening levels.

Equipment List

Signal Processing – (2) WideBand WC301 Echo / Noise Cancellers

Microphones – Supports up to three microphones per room. An auto-mixer may be used to support more than 3 microphones. The Shure MX692 wireless microphone system may be used to eliminate microphone wiring.

Microphones supported:

- Shure MX 391
- Shure MX 692 Wireless System
- Audio Technica AT 841VC
- Audio Technica AT 851VC
- CTGaudio TM-01s

Amplifier – An amplifier with volume control or a mixing amplifier is recommended.

Speakers – Wall or ceiling mounted speakers optimized for speech are recommended.

Transmitter – The Gentner TX-37A is available through Starin Distributing
www.starin.biz.

Personal Monitor – The Gentner Digital 1 is available through Starin Distributing.

Summary

A Reading Lab requires clear transmission of a child's speech to achieve the desired results. The room noise, low speaking levels and acoustic echoes present challenges to the audio system. A WC301 solution overcomes the room and communication challenges with an adaptive approach. Loud and clear levels allow the participants to focus on the challenges of reading, not audio.





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