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## Improving Listening Conditions In Agriculture And Forestry Higher Education Classrooms

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### Abstract

A number of factors detrimental to listening in college classrooms were identified by students in this study. One way to improve listening conditions in an environment with high ambient noise levels and poor acoustics is to improve the signal/noise ratio by use of sound field amplification. This system uses a microphone worn by the teacher, a base station, and a varying number of speakers strategically placed throughout the classroom. When such a system was utilized in classrooms in the College of Agriculture and Forestry, West Virginia University, students reported that they could hear and understand the instructor better than when the system was not used. This improvement is particularly important for groups anticipated to have a high prevalence of

hearing loss such as those in agriculture and forestry curricula.

### Introduction

Elementary and secondary education classrooms have been found to have unacceptably high levels of noise and acoustical properties far less than ideal (Sanders, 1965; Ross and Giolas, 1971; Markides, 1986). These conditions affect speech perception ability in both normally hearing and hearing-impaired persons (Tillman et al., 1970; Finitzo-Hieber and Tillman, 1978; Dirks et al., 1982). The detrimental effect of acoustic variables on speech perception abilities is greater in persons with some hearing loss than normal hearing subjects, but is a very significant factor in each group. The effect of poor listening conditions in college classrooms is apt to be more pronounced than in elementary and secondary classrooms due to the accelerated rate and scope of material pre-

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sented, larger classes and classrooms, and a high prevalence of high frequency loss of hearing in this age group in general (Lipscomb, 1972; Woodford and O'Farrell, 1983; Woodford and Lass, 1994) and in agriculture students in particular (Woodford et al., 1993).

One way to improve listening conditions in an environment with high ambient noise levels and poor acoustics is to improve the signal/noise ratio. This ratio is the level of the signal, in this case, the teacher's voice, to that of background noise. For example, a signal/noise ratio of +15 would indicate that the signal is 15 dB more intense than any background noise, whereas a signal/noise ratio of -5 would indicate noise 5 dB more intense than the signal. One means of improving the signal/noise ratio for an entire class is to utilize sound field amplification. Sound field amplification employs an equipment group consisting of a microphone and FM sending unit worn by the teacher, an FM receiving, decoding, and amplifying base station, and a number of speakers hard-wired to the base station. This system establishes the signal/noise ratio at the microphone which is worn about 6 inches from the teacher's mouth and that is the signal reproduced at each speaker. The speakers are strategically placed throughout the room to create as uniform a presentation as is possible. These systems have been found to be effective with students with minimal hearing loss (Flexer, 1995), and with children with learning disabilities (Blake et al., 1991; Flexer et al., 1990), but there is no information available regarding their application with normal hearing or hearing impaired young adults.

The purpose of this study was to assess perceived listening conditions in selected classrooms in the College of Agriculture and Forestry on the Evansdale campus of West Virginia University and to assess the effectiveness of sound field amplification in those classrooms. To this end 219 students enrolled in agriculture and/or forestry classes in three different classrooms completed questionnaires following lecture with and without sound field amplification.

## Methods

The sound field system used in this study was manufactured by Phonic Ear Company (model number PE210R-300T) and had a retail price of under \$800.00. The unit took about ten minutes to set up. The necessity for removing the equipment following each session and setting up just before each session precluded assessment for optimal positioning of speakers.

Two questionnaires, one long form and one short form, were designed to enable students to rate listening conditions under amplified and control conditions. The long form, shown in Table 1, asked students to identify communication problems that they had encountered in various university classrooms and to rate listening conditions of the day's

lecture. The short form included only the communicative environment rating scales.

Students who participated were enrolled in three different classes. These students represented diverse major areas of study, but were not selected nor screened to be particularly representative of WVU students taking agriculture/forestry courses. All three classrooms were capable of accommodating from 70 to 90 students.

The sound field amplification system was set up just prior to each class in which it was to be used. Each instructor was shown how to use the system prior to class. Instructors were asked to teach in their normal manner and to ignore the sound field system as much as possible.

## Results

Subjects represented every undergraduate class in nearly equal numbers. Seventy one percent of the subjects indicated they had encountered difficulty understanding what an instructor was saying. Table 2 lists the number of times each of the factors listed on the questionnaire as potentially detrimental to understanding, was cited. Other students talking, the quality of the instructor's speech, and acoustics of the classroom are the most frequent causes of difficulty.

In the amplified condition, 61% of the subjects thought they could hear and understand the instructor better or much better than usual with only a little over 1% feeling understandability was worse or much worse (Table 3). In the control condition 30% felt understandability was better or much better and 19% reported that it was worse or much worse. The ratings Chi square was 28.7 with associated probability of less than .001. Yates' correction for continuity was used when calculating the Chi square value. When subjects rated their ability to understand the instructor on a scale of one to ten in each condition, the mean rating in the amplified condition was 9.05 compared to 8.12 in the unamplified control condition ( $T=3.33$ ,  $p=.0013$ ).

In summary, results indicate that the majority of our students have had trouble understanding what an instructor says. Classroom amplification helps to improve this situation as judged by both numerical and comparative ratings in amplified and control conditions.

## Discussion

Results of this study indicate that an unacceptably large proportion of these students frequently encounter poor listening conditions in their classrooms. Regardless of the particular factors producing the listening difficulty in the classrooms studied here, classroom amplification improved listening conditions as rated by these students. Had time been available between classes to assess and adjust speaker position, improved listening conditions might have resulted for a

Table 1. Survey form

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Survey Form

Rank: Freshman      Sophomore      Junior      Senior      Graduate Student

Have you ever had trouble understanding what an instructor is saying?

Yes       No

What factors do you feel contributed to the difficulty?

- The speech of the instructor
  - Other students talking in the room
  - Noise from heating or air conditioning unit
  - Noise from outside the classroom
  - Acoustical (sound) characteristics of the room (i.e., "echoes" etc.)
  - Other - please list these \_\_\_\_\_
- 

Are there any particular classrooms in which you have difficulty?

Yes       No

If yes, please list these rooms by building and number.

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In this room, if you have difficulty hearing or understanding the instructor, what are the factors that cause this difficulty?

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Compared to other days in this room, today my ability to hear and understand the instructor was:

- much better
- better
- the same
- worse
- much worse

On a scale of 1 to 10 with 10 being excellent, I would rate my ability to understand the instructor's speech in this room today as a \_\_\_\_\_.

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Table 2. Number of times each factor potentially detrimental to communication was cited as a problem

Factor	Number of Times Cited
Speech of the instructor	106
Other students talking	109
Heating or air conditioning unit	61
Noise from outside the classroom	48
Acoustical characteristics of the room	93

Table 3. Percentage of students rating listening conditions in each category in amplified and control conditions

	Much Better	Better	Same	Worse	Much Worse
Amplified	18	43	38	1	0
Control	9	21	51	18	1

Chi square = 28.7 with 3 df ('worse' and 'much worse' categories collapsed) P = <.001

larger proportion of the students in a given classroom.

In addition to benefits realized by students, interviews with instructors involved in this study revealed that the classroom amplification system was viewed positively by them. The most frequent comments were "felt less fatigued at the end of the day" and "students were more attentive."

Overall, classroom amplification appears to be an effective means of improving listening conditions in college classrooms of the size studied, i.e., those which accommodate from 70 to 90 students. This improvement is particularly important for groups anticipated to have a high prevalence of hearing loss such as those in Agriculture and Forestry.

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