Your Name (List all student names if multiple authors.)

Zach L. Lipton

Project Title (Limit: 120 characters. Those beyond 120 will be ignored. See pg. 9)

Let's Hear It in the Gym Community Center: An Acoustical Study

Preferred Category (See page 5 for descriptions.)

10 - Materials Science

Abstract (Include Objective, Methods, Results, Conclusion. See samples on page 14.)
Use no attachments. Only text inside these boxes will be used for category assignment or given to your judges.

Objective: The purpose of this project was to determine the source of observed acoustical problems in the school#s Gym Community Center and to recommend remedial actions. It was hypothesized that a high reverberation time (RT60 time), caused by hard surfaces and high ceilings, was one source of the problem.

Materials and Methods: Three sets of measurements were taken, totaling 194 samples. Samples of a voice saying "hello" and handclaps were recorded from the stage at the position commonly used for assemblies. Samples were also recorded from three points on the stage to simulate a theatrical performance. Finally, samples were recorded from nine locations on the gym floor to simulate "all school sings." The sounds were recorded into PeakLE software, converted to text files, and processed with the reverb.m script in MatLab software to find the RT60 time, using the slope of best fit. Measurements were averaged by location to account for volume and pitch variations. The design of this project included several measures to improve the accuracy of the results. Data was gathered at even points on the floor using the points at which the sports markings intersect. Since data could not be collected during an actual event, measures were taken to approximate normal operating conditions. The sound system and microphones used were the same equipment used during school events, and the microphone was in its usual location on the stage. The soundboard unit that adds reverberation to sound was turned off, and the gain knob, which controls the volume of the sound, was set at its usual level.

The script used to calculate the RT60 times utilized a proven and tested algorithm. The multiple RT60 measurements that were obtained were averaged to ensure that the data was not influenced by any non-representative data. Since the presence of an audience would lower RT60 times, a value of 1.0 was added to each RT60 time to compensate for the lack of an audience.

Results: RT60 times ranged between 4.1 and 5.5, substantially higher than the ideal upper limit of 1.7 for a facility of this size.

Conclusions: Installation of transite board, a retractable ceiling, carpeting, and lowering of window and skylight shades (materials with high absorption coefficients) may improve sound quality by lowering RT60 times while maintaining the facility for its

Summary Statement (In one sentence, state what your project is about.)

This project was done to determine the source of observed acoustical problems in the school's Gym Community Center and to recommend remedial actions to improve the facility for all uses.

Help Received in Doing Project (e.g. Mother helped type report; Neighbor helped wire board; Used lab equipment at university X under the supervision of Dr. Y; Participant in NSF Young Scholars Program) See Display Regulation #8 on page 4.

I received assistance from several reference books on the basics of sound design. Internet research identified several sites that pointed me to the equation and script to calculate RT60 times. A teacher at the school gave permission to use the facility and sound system. In addition, my parents and the school art teacher assisted in the editing of the report.