Session 2pEDa

Education in Acoustics: Education in Acoustics for Children

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Chair's Introduction—1:00

Invited Papers

1:05

2pEDa1. Sound education in urban environment. Yoshio Tsuchida (Kanazawa Inst. of Technol., 7-1 Ohgigaoka, Nonoichi, Ishikawa, 921-8501, Japan)

There are various viewpoints for education and there are various levels for a sound. We have some cases to teach a ''sound.'' A certain person teaches a sound as music, another person teaches it as physics. But education is not teaching. It is more important to feel and enjoy. Then, one's sensitivity for a sound will be nourished. Experimental listening is called Sound Education based on soundscape. The case of a workshop on Sound Education is addressed in this paper. Sound Education finally aims at improvement of our environment. Many activities of Sound Education were devised by R. Murray Schafer [A Sound Education, 100 Exercises in Listening and Soundmaking, Arcana Editions]. Some activities were devised by Joseph Bharat Cornell as Nature Game [Sharing Nature With Children (Sharing Nature Series), Dawn Publications.] Sound Education has several aims. It differs according to the group that sponsors it. Here are the workshops executed by me. One aim for environmental preservation, and another one aim for community design.

1:25

2pEDa2. Music as a vehicle to do science in the elementary classroom. Uwe J. Hansen (Dept. of Phys., Indiana State Univ., Terre Haute, IN 47809)

During the past several years, a number of workshops were conducted for public school teachers at the elementary levels. Training and materials were provided to help teachers use music as a vehicle to introduce science concepts. Tools used in these workshops include a long spring to introduce standing waves and the concept of harmonics, a monochord to relate frequency ratios to musical intervals, and simple computer software to introduce wave addition and spectral analysis. All of these will be demonstrated and ways of introducing them in the elementary classroom will be discussed. [These workshops were supported with ASA and Eisenhower funds.]

1:45

2pEDa3. Exciting demonstration in acoustics by high-school teachers' group: "Stray Cats." Kanako Ueno (Inst. of Industrial Sci., Univ. of Tokyo and Tech. Committee on Education in Acoust. of ASJ, Komaba 4-6-1, Meguroku, Tokyo, 153-8505, Japan), Takayuki Arai, Fumiaki Satoh, Akira Nishimura, and Koichi Yoshihisa (Tech. Committee on Education in Acoust. of ASJ, Meguroku, Tokyo, 153-8505, Japan)

In Japan, to get students interested in a subject, high-school teachers often form a group to share their ideas and inventions on education. ''Stray Cats'' is one of the most active groups in physics. The group has been proposing many exciting demonstrations, which were contrived to support students' learning process with intuitive understanding of physics. Here, instead of using commercial equipment, they developed simple teaching tools that show physical phenomena in an exciting and attractive way, using quite common materials and daily goods. For example, the velocity of sound is measured by a pipe filled with a gas (air, CO_2, helium, etc), setting a loudspeaker and two microphones in the pipe. Interference of sounds is demonstrated by two pipes with attached cone-shaped horns at one end, which collect a source sound in different phase, and merging them into one at the other end, which produce louder or quieter sound as a result of interference. Hitting or rubbing different length of aluminum rods aids students' understanding of longitudinal waves and transverse wave with the relationship between rod's length and pitch, as well as a pleasant experience with beautiful tones. These educational tools will be presented with videos taken with the Stray Cats group.

2:05

2pEDa4. An acoustics education outreach program for young children. Ralph T. Muehleisen (Civil and Architectural Eng., Illinois Inst. of Technol., Chicago, IL 60616, muehleisen@iit.edu)

With limited time for science in the preschool and primary classroom, and limited science education of many preschool and primary school educators, the need for science professionals to engage in outreach education is ever increasing. Additionally, there is an increasing need for children to be aware of the problems of noise exposure, especially with regard personal sound systems. In this talk, a one-hour acoustics education outreach program developed for preschool and early primary school children is presented. In the program, children are involved in a discussion of the human auditory system and the dangers of noise exposure, engage in listening exercises using a keyboard synthesizer, construct a small musical instrument, and finally play the musical instrument with the rest of the class in a marching band.

2:25

2pEDa5. Let children experience speech science. Takayuki Arai (Dept. of Elec. and Electron. Eng., Sophia Univ., 7-1 Kioi-cho, Chiyoda-ku, Tokyo, 102-8554 Japan)

An education in acoustics is important for students of different ages: college, high school, middle school, and potentially even elementary school students, for whom such hands-on models are the most important. Because speech communication is a basic human activity, even for children, we expect that even the youngest students to be interested in speech science. With this in mind, we were motivated to develop intuitive and effective models for teaching speech science to all types of students. Our physical models of the human vocal tract [T. Arai, J. Phonetic Soc. Jpn., **5**(2), 31–38 (2001)] have recently been installed in an exhibition in a museum in Japan. Children can watch, listen to, and touch the models. Our recent head-shaped and lung models [T. Arai, Acoust. Sci. Technol. **27**(2), 111–113 (2006)] are also useful for educating students, because they are intuitive to produce a systematic and comprehensive education from the lungs to the head. Furthermore, we recently designed a sliding three-tube (S3T) model that has a simple mechanism for producing several different vowels [T. Arai, Acoust. Sci. Technol (to be published)]. This model is being used for an activity at a science workshop for children. [Work partially supported by JSPS.KAKENHI (17500603).]

Contributed Papers

2:45

2pEDa6. Development of educational software that supports study of sound environment for children. Hiroyuki Sakai (Ctr. for Promotion of Excellence in Higher Education, Kyoto Univ., Yoshida-Nihonmatsu, Sakyo, Kyoto 606-8501, Japan), Tadashi Shirakawa (NPO Onbunken, Tokyo, Japan), and Munetaka Tanaka (Sound Process Design, Inc., Tokyo, Japan)

A sound map, on which observed sounds are drawn as visual symbols, is well known as one of the nature games. Sound educational software, cultivating children's ecological view through their daily experiences focusing on sounds, was developed by using the sound map concept. Children record observed sounds through a sound-walk in outdoors into PC, and learn the sound environment through their collaborative work including classification, analysis, and group discussions in a workshop or a class. In a traditional approach on the field of educational technology, a lot of teaching materials introducing novel ICTs (information and communication technologies) are developed, but it is rather important to support usefulness for users (children and teachers), promote motivations for their learning, and support the smooth learning progressive process. In this presentation, the development concept of the software for the sound environment study based on socio-cultural approach is discussed, while an actual use example of this software is demonstrated.

3:00

2pEDa7. Stimulating children's interest in acoustics using models and toys. M. G. Prasad (Dept. of Mech. Eng., Stevens Inst. of Technol., Hoboken, NJ 07030)

Sound is an important means for sensory perception. Children, being naturally curious and sensitive, respond very well to sound. Simple acoustical toys attract their curiosity and attention. The use of simple sound- or music-producing tools draws their attention and then they ask questions. In answering their questions simple principles of acoustics and scientific reasoning can be taught to them. Simple principles such as tone change due to change of volume in a resonator, the role of length in the sound produced by a tube, the role of damping in cutting down vibration and sound, etc. can be taught to the children. Also, the description of noise being unwanted sound can be demonstrated using simple mechanical models with comparison to desirable sound as music through instruments such as the flute. A model of the human ear can be used to describe the way the sound is perceived. The use of models and encouraging children to ask questions will further enhance their curiosity. The author will share his experiences gained through making presentations for elementary school children.

3:15

2pEDa8. Re-equipping the University of Sydney's acoustics laboratory for teaching after a fire. Ken Stewart and Densil Cabrera (Faculty of Architecture, Univ. of Sydney, NSW 2006, Australia)

For some decades, the University of Sydney has taught and conducted research in architectural and audio acoustics from the Faculty of Architecture's acoustics laboratory. In October 2005, a fire in the anechoic room destroyed the laboratory mainly through heat and smoke damage. Recovery has involved a reconsideration of the systems used for teaching and research, and this presentation outlines our approach to this. One consideration is that measurement systems should be relatively self-contained, so that setup time for measurements is minimized, and several setups can be used simultaneously for hands-on teaching. New equipment tends to be computer based, which has the advantages of much greater measurement power, automation, recording, and interfacing, but can be less intuitive for students to understand than individual analog components. This presentation compares the preexisting and renovated laboratory, especially in terms of teaching strategies in audio and acoustics using technical equipment. We present examples of previous and envisaged student projects to illustrate how such infrastructure can support learning.