

Science-based comparative culture: new theme of experiment for freshmen in Tohoku University

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Tohoku University has created an introductory science experimental class for freshmen in 2004. The class is a compulsory subject for students in all natural science fields. The class is not designed as a professional education, but as a liberal education, in which students are expected to become familiar with nature and to find natural laws. We present here one theme, “science and culture: oscillation of string instrument and music” out of 12 themes, in which students are expected to learn two aspects 1) universality of natural laws and 2) variety of value judgments of ethnic groups.

We prepared classical guitars, by which the students will intuitively distinguish higher harmonic waves by themselves, by ears and eyes, without any special instruments (up to 6th harmonics). If the fundamental tone of the string is Do (C), tone names of the higher harmonics are Do (C), Sol (G), Do (C), Mi (E) and Sol (G), which are the origins (bases) of harmony and music scale. The ratios of frequency Sol/Do, Mi/Do are $3/2$ and $5/4$, respectively, which are rational numbers. Students will find the physical basis of music that is common over ethnic groups, because of the universality of natural laws.

In most science experiments, students are expected to learn only universality of natural laws. However, in this experiment, students are expected to find the variety of value judgments over ethnic groups through comparing to the equal temperament scale introduced in Europe, which is different from the natural scale of universality. Students will find that knowledge of natural law (universality) is useful to find cultural diversity, since the choice of the artificial scale is a result of the value judgments of an ethnic group. We will report the details of the experiment and the feedback from students.

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