

Teaching the Essence of a High-Frequency Wave Product for High School Students in Yogyakarta, Indonesia



Destination: Universitas Gadjah Mada (UGM)

Unit S. Takuya Fukuhara*, Tsugumi Okada**, Riho Oguni**



Duration: 16th February – 1st March, 2015

Place Visited: Universitas Gadjah Mada, SMA 3, SMA 6

*: Graduate School of Engineering

** : Faculty of Education

Study of Electromagnetic Wave

High-frequency wave

The use of electromagnetic wave is divided by its frequency. My research is directed to the **millimeter-wave band**. Its frequency is 30~300GHz. One can make higher frequency wave but it maybe useless, because of higher frequency wave than millimeter-wave, which is absorbed such as rain in the air. So millimeter-wave is highest frequency wave we can use in communication.

High-frequency wave has strong directionality, and can communicate in a high speed, high capacity. So this wave is used in communication such as Satellite, base station, and so on.

Post-wall waveguide

Traditionally, **waveguide** has been used for communication line. It is a tube of metal and it is difficult to process. So the cost of production is high and its products become large.

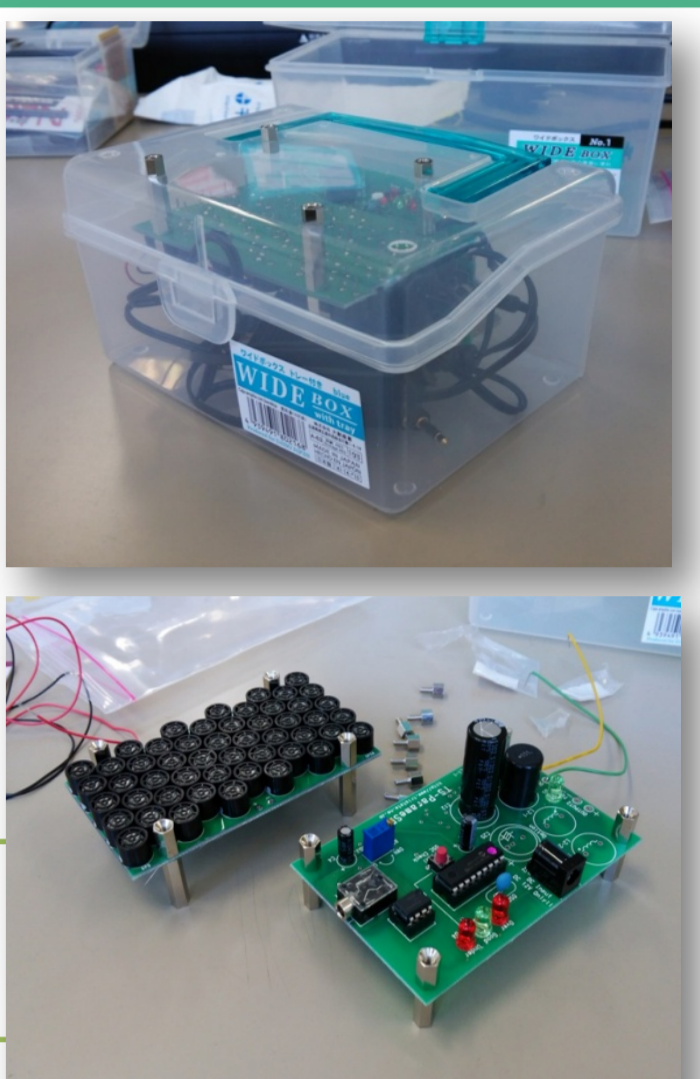
Post-wall wave guide is made by a column-shaped hole on the board. It can be made at a substrate processing technology. So the cost of production is cheap, and its products become smaller than waveguide's one.



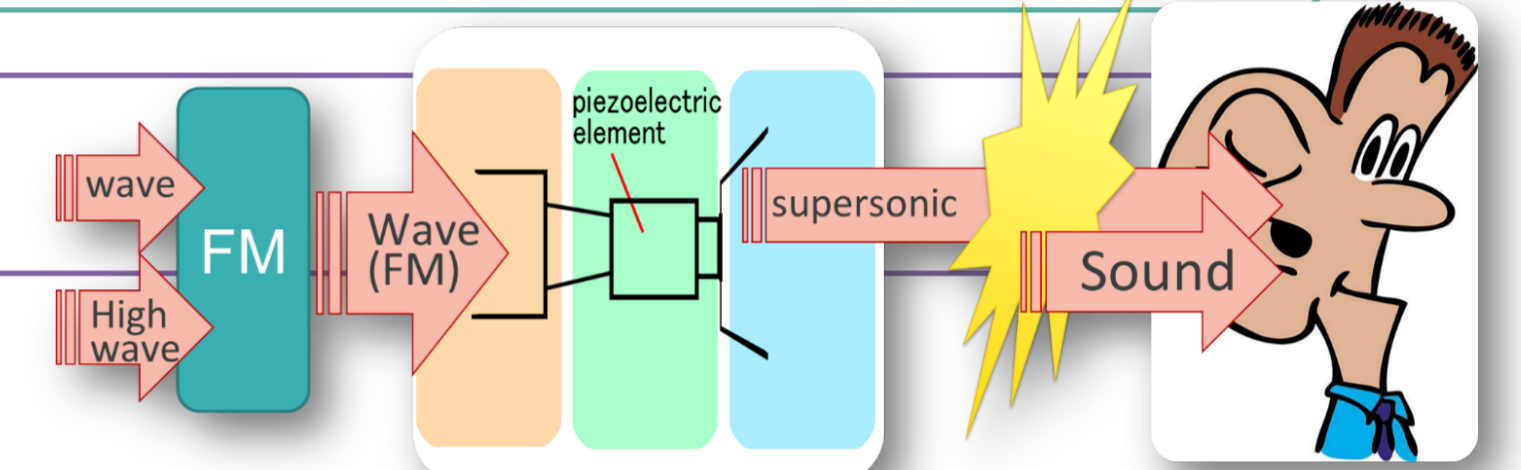
Structure of Our Lesson

Title: The secret of the wave

Contents: Takuya's research is about high frequency **electromagnetic wave**. Since it is hard to imagine, we used the parametric speaker which uses high frequency **sonic wave** to help students to understand the contents more easily.



- 1 • High frequency wave & parametric speaker
- 2 • How to use this wave & the mechanism of the speaker
- 3 • Takuya's research



Objective:

1. For students to understand **technology products** by comprehensible knowledge.
2. For students to understand the **electromagnetic wave** (unfamiliar and difficult for them) through the **sound wave** (familiar for them).

How We Created Lesson

Objective

1. How to make technology products
2. Conveying difficult contents in a comprehensible way

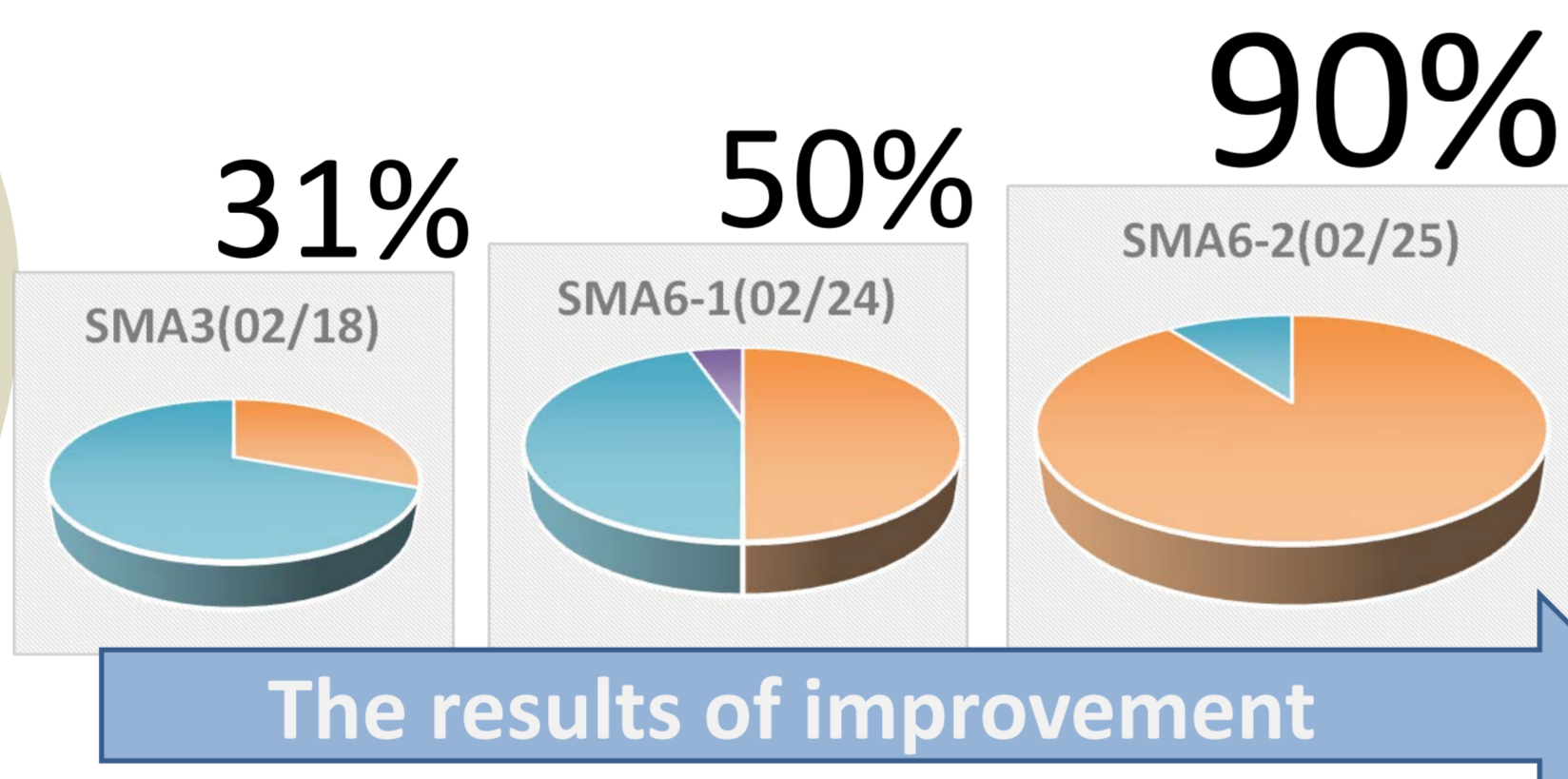
In class, we noticed the points where students stumbled. These points were where the flow of the structure from the beginning to the end and the complexity of the contents.

→ We remade our lesson by adding descriptions, pictures and student-centered activities in **stumble points** for them to understand the **beautiful flow** of the theory which makes complex products. We had our lessons with careful attention to the students' reaction.

>Questionnaire

How do you evaluate the lecture, experiment or some activities in your class?

1. All of them were good
2. Many of them were good
3. Fair



What We Learned

Samples of the Students' Comments

- The research about high frequency radio (Parametric speaker) is very good because it starts from simple thing become something big.
- Next time if we can make together, so we can try in our home.
- What is the other use of piezoelectric element?

What We Learned

We had lessons in a comprehensible way. It resulted in not only that the students **understood** our lessons, but also that they got **motivated** and **interested** in **deeper** contents and research.

We learned the effective way of expressing what we want to communicate. We also realized that languages did not matter in it.



Precious Experience

Kraton, Taman Sali: We visited historical royal palaces which are colored by the traditional culture.

On Feb 19th, we traveled around Yogyakarta, Taman Sali, Kraton, and Malioboro.

We also rode bechak, which was one of the most exciting experiences in Yogyakarta. This day was our first traveling in Yogyakarta, so everything was new for us. For example, we didn't know how to get on bus. Also we didn't know the way to Taman Sali well. So on the way to Taman Sali we got lost, but many Indonesian people helped us. Even though we spoke different languages, they kindly told us the way. We felt their hospitality and we want to say **"terima kasih"** to them.



Conclusion

As an **engineer**, the ability to convey my major field to others in a comprehensible way is essential. By teaching lessons, I learned it in practice. To learn Indonesian and Indonesia culture is very fun for me. –Takuya Fukuhara

It was a fruitful experience for me, a future **English teacher**, to learn how to create and convey lessons to EFL learners in a comprehensible and motivating way. Our teaching practice achieved significant results in getting students interested in studying in Japan or the research on a high-frequency wave product. –Tsugumi Okada

Teachers usually make lessons by ourselves, but this time we created our lessons with colleagues who had various background, such as science students, Indonesian and ASEAN students. It made it possible to expand my perspective and way of thinking. Also, I got motivated in a future job related to achieving one thing with working with others on a team project, and to communicating something to others. –Riho Oguni