Microteaching: a new way to perform oral presentations by engineering students

Rodrigo F. Herrera†‡, Juan C. Vielma† & Felipe C. Muñoz†

Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile†
Pontificia Universidad Católica de Chile, Santiago, Chile‡

ABSTRACT: Oral presentations are an increasingly used tool in the field of high school and university education. This tool is often used without taking full advantage of all its potentialities, especially those that have to do with the training of lecturers and, specially, with the positive impact it has on the audience. This article reports the results of applying the microteaching technique with the purpose of improving the process of learning of the lecturers, through the learning of the contents that they have to present, focusing this learning on four simple steps that will allow a better understanding of the theme and better learning from the audience. The results show that the incorporation of microteaching in the process of preparation of expositions generally improves the work done to prepare the presentations and improves the degree of comprehension on the topics exposed to the class.

Keywords: Oral presentations, microteaching, engineering, students, teamwork

INTRODUCTION

In teaching engineering, it is becoming more usual to use oral presentations of students to address diverse contents related to subjects belonging to the academic curriculum [1]. This instance arises under the expectation of the teacher to be able to implement various types of learning and this will enable students to develop teamwork skills, oral and stage expression, recollection and synthesis of information, research and analysis, among others, generating an opportunity, where students can *teach others* and contribute to a more complete development thereof [2]. However, this goal is not always met, since students usually do a split of the contents; in this way, not all of them handle the topic of the presentation in an integral way, they do not manage to deepen or analyse it, and consequently, they do not manage to explain it to their peers effectively, transforming themselves into instances of a simple demonstration of contents towards the teacher, losing the most important focus, which is to teach their peers [3].

The teaching of engineering has traditionally focused on the lecture, the demonstration of experiences in the laboratory and intuitive resolution of theoretical formulations; however, it should not only be limited to that [4]. According to Dale's learning pyramid theory (and subsequent authors), it corresponds to a passive way of learning, where the student listens, reads and supports his learning in audio-visual tools and demonstrations. The same author and others point out that to achieve better retention of content, one must move to an active learning area, where one has the development of discussion, practical work and teaching the other [5-7].

Microteaching is a technique to train teachers that is currently used around the world. This technique employs a real teaching situation to develop teaching skills and helps to gain knowledge regarding the art of teaching [8]. Allen and Ryan originally developed the microteaching model at Stanford University, which consisted of six stages: plan, teach, observe, re-plan, re-teach and re-plan [9]. One of the main advantages of this tool is that it positively affects the feeling of self-efficacy of the teachers who train with it [10].

In engineering, the impact of microteaching has been more limited. In a work in engineering, it was reported that the process of microteaching contributes to improving not only the process of self-learning for the acquisition of new skills, but also the process of self-regulation by the students [11]. The microteaching technique allows the audience to be able to participate actively, since it focuses the development of scheduled activities for the whole group, an aspect that encourages intervention and group work [12]. In medical education, microteaching is used to teach teaching to tutors who have not received any type of training in teaching [13].

Given the favourable effect of *teaching others* and the reality of oral presentations nowadays, it is attractive to replace traditional oral presentations with microteaching sessions, since this technique, linked to several branches of knowledge, can improve oral presentations [14].

In this article, the authors seek to answer the following questions: How can microteaching be applied in oral presentations of engineering students? What are the advantages of this methodology versus a traditional expository presentation?

The research methodology seeks to answer these questions, following these steps:

1. A review of microteaching and teaching didactics.
2. A proposal for the application of microteaching.
3. A qualitative and quantitative comparison between microteaching and traditional oral presentations.
4. Data analysis and discussion of results: frequency analysis and McNemar test.

MICROTEACHING APPLICATION PROPOSAL

Before asking students to prepare their oral presentations, it is necessary to teach them what microteaching is, what its advantages are versus a traditional presentation and how it is applied [15]. During this explanation, it is necessary to emphasise that the idea of oral presentations is that both the lecturers and the audience learn, and it is for this reason that the audience must have an active role during the presentation.

At an early stage, students should plan the presentation. At this stage, basic information should be included, such as the topic of the presentation, who will explain, how much time, when and how long. Then, the session should be planned to follow a 4-steps guide: start, introduction to new content, practice and closure. Each of these stages has a purpose and a guiding question (Figure 1).

Start	Introduction to the contents	Practice	Closing
Purpose: connect the audience with what they are going to learn. Key question: how will I make the audience feel that what they are going to learn is necessary/ useful/interesting?	Purpose: deliver key concepts and ideas that the audience must retain regarding the subject being addressed. Key question: what does the audience need to understand? (The instructor emphasises that only the strictly necessary content is retained, since time is not available to develop all ideas).	Purpose: allowing the audience to have the ability to use/apply the knowledge you just acquired to a particular problem. Key question: what practical or application exercise can I present to the audience to internalise the new concepts?	Purpose: assess the level of achievement of the objective of the session. Key question: to what extent was the objective of the session fulfilled?

Figure 1: Purpose and guiding question of each stage of the session.

In addition, when planning each of the stages, students should answer the following questions: How long will the stage last? What will be the performance of the presenter? What will be the performance of the audience? And, what materials or resources will be needed? (Figure 2).

Presenters:			Time (min):	Date:
Topic:				
Time (min)	Step	Presenter role	Audience role	Materials or resources
	Start			
	Content			
	Practice			
	Closing			

Figure 2: Session planning sheet.

After the students have planned the session, they should perform it in front of their peers for 10 to 15 minutes. In the execution of the microteaching session, students take control of the subject and they become the learning facilitators of their peers. To achieve this, it is important that all participants are active characters during the session and, therefore, the teacher should foster an open and trustworthy environment among all participants of the course.

At the end of the presentation, the presentations will receive feedback and questions from the teacher and his/her peer, which can focus on both the technical elements of the presentation theme and how to present the presentation. It is important to mention that the teacher should plan student expositions based on the following criteria: the topic is related to the class; the topic is sufficiently detailed to make a presentation of 10 to 15 minutes; and it should not expose more than two groups each session.

DISCUSSION OF RESULTS

A comparison was made between microteaching and traditional presentations based on the following parameters: time to plan an oral presentation, teamwork in the preparation of the presentation, learning about the subject as a presenter and learning about the topic as an audience.

This information was collected from a group of 116 students who were trained in the microteaching methodology explained in the previous section. McNemar's test was used to verify if there were differences between one presentation and another. This test is used to decide whether to accept that the application of the technique of microteaching induces a change in student response. The results were then analysed for each of the measured parameters.

As for the time of preparation of an oral presentation, it can be deduced that applying the technique of microteaching contributes to reducing the time of preparation of a presentation, in the case of students who declare originally to take less than three hours. However, students who take more than 10 hours declared that microteaching did not reduce their preparation time (Figure 3).

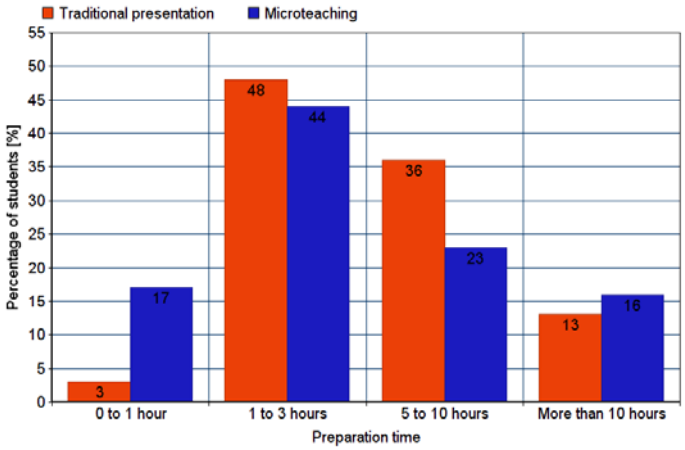

Figure 3: Preparation time for oral presentation.

For the percentage of teamwork in the preparation of an oral presentation, it can be deduced that applying the technique of microteaching increases the percentage of teamwork in the preparation of a presentation, in the case of students who originally declare to work as a team in more than 40% of the total time spent; however, students working in teams less than 20% declared that microteaching did not increase their percentage of collaborative work (Figure 4). This is one of the elements that stands out within the study that the ability of teamwork is an important element in the training of engineers [16].

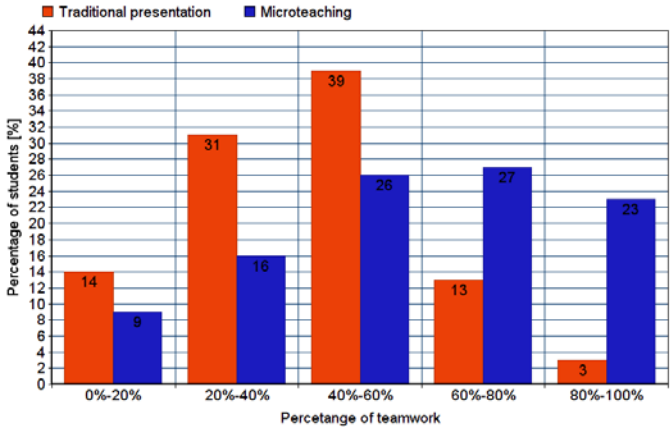

Figure 4: Percentage of teamwork for preparation of oral presentation.

For the percentage of significant learning on the part of the lecturer, it can be deduced that applying the microteaching technique increases the percentage of meaningful learning of what it exposes, in the case of the students who originally declare to have a significant learning superior to 40%. However, students who originally claimed to learn less than 20% of what they exposed did not increase their learning level with this technique (Figure 5).

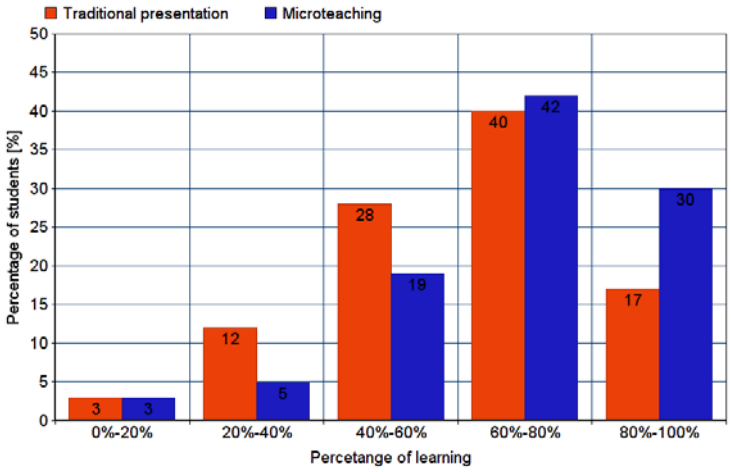

Figure 5: Percentage of audience learning.

On the other hand, in regard to the percentage of significant learning on the part of the audience, it can be deduced that applying the microteaching technique increases the percentage of significant learning about the subject, in the case of the students who originally declared having a significant superior learning of less than 80%; however, students who originally learnt more than 80% stated that this technique did not improve their learning level (Figure 6).

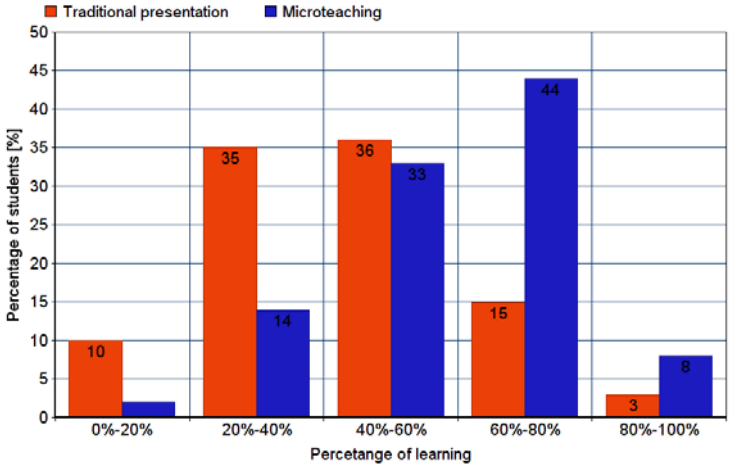

Figure 6: Percentage of lecturer's learning.

Finally, the perception of students was measured through an anonymous survey of open questions, to identify the main advantages of microteaching, among which can be highlighted: interaction with the audience makes them feel more committed; practice is necessary to internalise the contents; both the lecturer and the audience achieve meaningful learning; it allows better organisation of the presentation (which helps the presenter and the audience).

Also, it allows the audience to be more attentive and participative, because every minute is interacting with them; the planning delivers clear guidelines on where to emphasise the presentation; it allows participants to work in a more effective way; it is simple to realise thanks to a clear format; and the closing questions of the presentation manage to consolidate what has been learned.

CONCLUSIONS

In accordance with the results, it is possible to draw the following conclusions:

The microteaching technique can be implemented for students to prepare and develop their oral presentations, through an initial training workshop, and systematic follow-up and feedback to students during a specific course. However, this does not ensure that students are able to apply the technique, but rather that they have knowledge of it. Strengthening implementation should be done through practice among the students themselves, in conjunction with continuous feedback.

The technique of microteaching has several advantages, such as: it can decrease the preparation time of an oral presentation; it increases the percentage of teamwork among students when they prepare the presentation; it increases the percentage of learning of lecturers who are presenting their subject; and it increases the percentage of audience achievement about the topic being presented.

From the opinions gathered by the students, the following comments can be positively highlighted: the active role of the audience is motivating, the closing questions of the presentation manage to consolidate what has been learned, the presentation becomes more dynamic, the presentation is a system and is not fragmented, among others.

ACKNOWLEDGEMENTS

The following investigation was made thanks to the contributions of the Corfo Project 14ENI2-26905 Ingeniería 2030-PUCV. In addition, the Collaborative Group of Engineering Education and the School of Civil Engineering of the PUCV. The doctoral studies of Professor Herrera are financed with the VRI Grant of the Pontifical Catholic University of Chile. Finally, the authors thank the Fundación Enseña Chile for the advice regarding the planning of classes.

REFERENCES

1. Imbernon, F., Mejorar la enseñanza y el aprendizaje en la universidad. Barcelona: Editorial Octaedro (2009) (in Spanish).
2. González, J., Reflexiones y experiencias sobre la evolución y el desarrollo de las competencias transversales de trabajo en equipo y presentaciones orales. *XXI Jornadas de la Enseñanza Universitaria de la Informática*, Andorra La Vella (2015) (in Spanish)
3. Van Ginkel, S., Gulikers, J., Biemans, H. and Mulder, M., Towards a set of design principles for developing oral presentation competence: a synthesis of research in higher education. *Educational Research Review*, 14, **2**, 62-80 (2015).
4. Martínez, J.M., Coltell, O. and López, J.M., Innovación en la Enseñanza en Grupos Numerosos (2016) (in Spanish).
5. Dale, E., *Audiovisual Methods in Teaching*. (3rd Edn), New York: The Dryden Press; Holt, Rinehart and Winston (1969).
6. Blair, C., Cómo Aprenden y Recuerdan los Estudiantes de Manera Más Efectiva (2016), http://studyprof.com (in Spanish)
7. Herrera, R.F. and Muñoz-La Rivera, F.C., Academic performance of teaching assistants/trainers in engineering degrees. *Ágora de Heterodoxias*, 3, **1**, 118-132 (2017).
8. Remesh, A., Microteaching, an efficient technique for learning effective teaching. *J. of Research in Medical Sciences*, 18, **2**, 158-163 (2013).
9. Allen, D. and Ryan, K., *Microteaching Reading*. Boston, MA: Addison Wesley (1969).
10. Arsal, Z., Microteaching and pre-service teachers' sense of self-efficacy in teaching. *European J. of Teacher Educ.*, 37, **4**, 453-464 (2014).
11. Campos-Sánchez, A., Sánchez-Quevedo, M., Crespo-Ferrer, P.V. and García-López, J., Microteaching as a self-learning tool. Students' perceptions in the preparation and exposition of a microlesson in a tissue engineering course. *J. of Technol. and Science Educ.*, 3, **2**, 66-72 (2013).
12. Luna, E., El docente presencial. Técnicas de enseñanza para enriquecer su desempeño académico. Plaza y Valdez Editores, 19-28 (2002) (in Spanish).
13. Gavriliovic, T., Ostojic, M., Sambunjak, D., Kirschfink, M., Steiner, T. and Stritmatter, V., *Handbook of Teaching and Learning in Medicine*. Bour Brussels: Tempus, European Union (2009)
14. Gess-Newsome, J. and Lederman, N., The preservice microteaching course and science teachers' instructional decisions: a qualitative analysis. *J. of Research in Science Teaching*, 27, **8**, 717-726 (1990).
15. Herrera, R.F., Vielma, J.C., Muñoz-La Rivera, F. and León, N., Microteaching como herramienta para mejorar las presentaciones orales de estudiantes de ingeniería. *XXX Congreso Nacional de Educación en Ingeniería* (2017) (in Spanish).
16. Herrera, R.F., Muñoz, F.C. and Salazar, L.A., Perceptions of the development of teamwork competence in the training of undergraduate engineering students. *Global J. of Engng. Educ.*, 19, **1**, 30-35 (2017).

BIOGRAPHIES

Rodrigo F. Herrera is a civil engineer and Bachelor of Science Engineering from the Pontificia Universidad Católica de Valparaíso, has a Master's degree in project management from the University of Viña del Mar, and is currently a PhD student in engineering sciences at the Pontificia Universidad Católica de Chile. He is currently a Professor for several courses, such as Applied Computer Science, Introduction to Civil Engineering, Planning and Project Control and Project Management in the School of Civil Engineering at the Pontificia Universidad Católica de Valparaíso, Chile. He is the coordinator of the Collaborative Group of Engineering Education at the Pontificia Universidad Católica de Valparaíso, Chile. His main research is project management and lean construction, besides having a strong focus on engineering education.

Juan Carlos Vielma is a civil engineer from the Universidad Centroccidental Lisandro Alvarado. He was awarded his MSc on structural engineering by the Universidad de Los Andes, Venezuela, and his PhD was on structural dynamics and earthquake engineering at Universidad Politecnica de Cataluña. He has been a Professor at Pontificia Universidad Católica de Valparaíso since 2016. His areas of interest are seismic vulnerability, numerical methods for non-linear analysis and innovative techniques to improve learning processes.

Felipe C. Muñoz-La Rivera is a Bachelor of Science Engineering from the Pontificia Universidad Católica de Valparaíso. He is currently a teacher assistant in several courses: Structural Analysis, Solid Mechanics, Numerical Analysis and Geotechnics at the School of Civil Engineering at the Pontificia Universidad Católica de Valparaíso, Chile. He is a research assistant of the Collaborative Group of Engineering Education at the Pontificia Universidad Católica de Valparaíso, Chile. His current research is in project management and engineering education, data analysis on a large scale and impact of active teaching in engineering.