

**Case based learning in orthodontic undergraduate education.
A pilot study at fourth-year dental students, in Bergen.**

**Maria Mavragani
Department of Clinical Dentistry
University of Bergen**

Abstract

Theoretical teaching in orthodontic education is based on traditional lectures. The aim of the present pilot study was to evaluate students' perceptions after a case-based learning attempt. Forty-two fourth grade dental students were asked to answer questions relative to six patient cases they were given, after theoretical knowledge was provided at a first meeting. Students recorded their responses using a web based application. Discussion on cases took place at a second meeting with the facilitator. At the end of the second meeting the 34 present students were asked to rate their experience. They found case-based learning to promote their attention, interest and learning effectiveness. Most of them found that it enhanced communication with colleagues, additional studying. All students found cases given to be relative to the topic. However, most of them experienced the additional work that was required as a burden to their already, probably due to the examination period, schedule.

Introduction

Case based learning

Case based learning (CBL) is an educational paradigm based upon the most common problem based learning (PBL). PBL is defined as a student-centered pedagogic method in which students learn through experience of solving open-ended problems. It is a type of active learning. The goal is to help students develop flexible knowledge, effective problem solving ability, self-directed learning, collaboration skills and intrinsic motivation (Hmelo-Silver, 2004). It represents a paradigm shift from traditional lecture-based teaching to an andragogical (adult teaching/learning) approach (Hung, 2011; Schmidt, 2000).

CBL's traits derived from PBL, in the context that a case, problem, or inquiry is used to stimulate the acquisition of knowledge, skills and attitudes. Cases promote authentic learning (Mullins, 1995). Cases are written as problems that provide the students with a background of a clinical situation, including research articles, clinical signs and symptoms, as well as laboratory results. CBL prompts students to develop team spirit, abilities for hypothesis generation, intrinsic and extrinsic motivation, self-evaluation, critical reflection and learning skills. It requires that the students provide scientific support for their conclusions and helps integrating knowledge and practice (Mullins, 1995; Barrows and Tamblyn, 1980; Barrows 1986; Schmidt, 2000). Students take on the learning responsibility, while the teacher's role is to prompt and guide. He is a facilitator.

However, despite the similarities between PBL and CBL, a clear distinction can be made. A significant difference is that PBL requires no prior experience or understanding of the subject, while CBL requires prior knowledge in order to solve the problem (Williams, 2005). According to Garvey *et al.* (2000), in PBL the problem drives the learning. The CBL format requires students to recall previously covered material to solve clinical cases, which are based on clinical practice.

Dental education

Dental education prompts students to interpret an enormous amount of information and be able to apply theory in clinical practice. Dental students have been used to passively attend presentations, getting handouts and perhaps taking notes. In an effort to improve dental education and nation's oral health, a committee named Commission on Change and Innovation in Dental Education (CCI) was established by the American Dental Education Association. One of the objectives of the CCI was to provide guidance to dental schools related to curriculum design (Hendricson *et al.*, 2006). Among the eight principles proposed, critical thinking has been considered the cornerstone of Dental Education Experience. Additionally, students should be encouraged to self-assess. Self-assessment is indicative of the extent to which students take responsibility of their own learning (Haden *et al.*, 2006). At many medical and dental schools, there is an effort to shift from pure lecture environments to active learning. The aim is to shift to a problem- and case-based learning methodology and student-centered instructional models. This is important for acquirement of critical thinking and problem-solving skills, necessary for professional practice (Engel and Hendricson, 1994; Moore, 2007).

Orthodontic undergraduate education in Bergen

The principal aim of the undergraduate orthodontic dental education is to train future dentists on diagnosis and treatment planning of occlusal deviations from normal. Dental students attend lectures in auditorium and routinely examine school children in the clinic, under the supervision of specialist orthodontists. In addition to these, they attend seminars in smaller groups. During lectures and seminars, apart from theoretical teaching, students are exposed to patient cases. The cases have been selected in such a way, in order to cover a broader spectrum of orthodontic problems, than their limited clinical training could offer. However, with the existing learning system, students have a quite passive attitude during their training, acting mainly as receivers.

The **aim** of the present pilot study was to apply case based teaching in orthodontics to fourth-year students, and evaluate their perceptions of this experience.

Subjects and Methods

Two lectures for the 42 fourth-year dental students on the need of tooth-extractions during orthodontic treatment were selected for the trial. The lectures were already scheduled for November-December 2015, with a two-week interval. At the first one theoretical teaching on the topic, including criteria for inclusion of tooth extractions in the orthodontic treatment plan took place.

At the end of the lecture, students were informed that until the next meeting, they should answer questions on six given patient-cases. The included questions were relevant to clinical thinking in order to reach the decision for extractions or not. It was suggested to work in groups. At the second lecture cases were presented by the facilitator (MM) and discussion guided by the responded questions took place. At the end of the second lecture, the students anonymously filled-in a questionnaire, judging their recent learning experience.

More analytically and considering tools used, both the theoretical presentation and the six clinical cases to be evaluated were made available at University's LMS. Each case comprised clinical photos of the face and denture, as well as x-rays (intraoral photos orthopantomographs, and cephalometry) (Figure 1). Those elements were sufficient for the

students to reflect on the need for orthodontic extractions, guided by the relevant questions per case.



Figure 1. An example of patient-case delivered to students for studying.

The same four multiple choice clinical questions were repeated for each case (Figure 2). Poll Everywhere application was used for this purpose. A survey with the multiple questions was created (Figure 3). The students, working in groups answered the series of polls in their own time during the time lapse between the two lectures, via the web (Figure 4).

Case 1.

1. Would you extract for orthodontic purposes:
 - None tooth?
 - 4 teeth?
 - 2 or 3 teeth?

2. Was your decision primarily based on:
 - Space conditions?
 - Skeletal relations?
 - None of the above.

3. Was patient's profile an important factor at your decision?
 - Yes
 - No

4. Was lower incisor position an important factor for your decision
 - Yes
 - No

Figure 2. Clinical questions per case given in order to guide case analysis.

During the discussion of the cases at the second meeting their responses were presented on screen (Figure 4) and comments were made by the facilitator and the students.

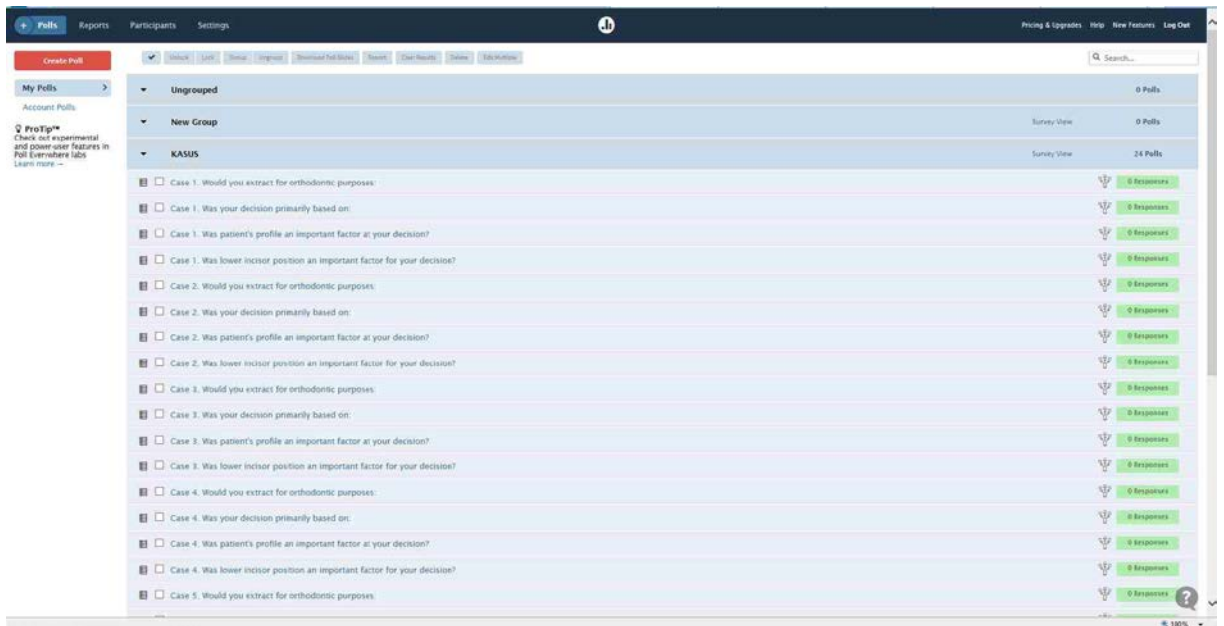


Figure 3. A part of the survey created at Poll Everywhere application, for the students to set their responses after case study.

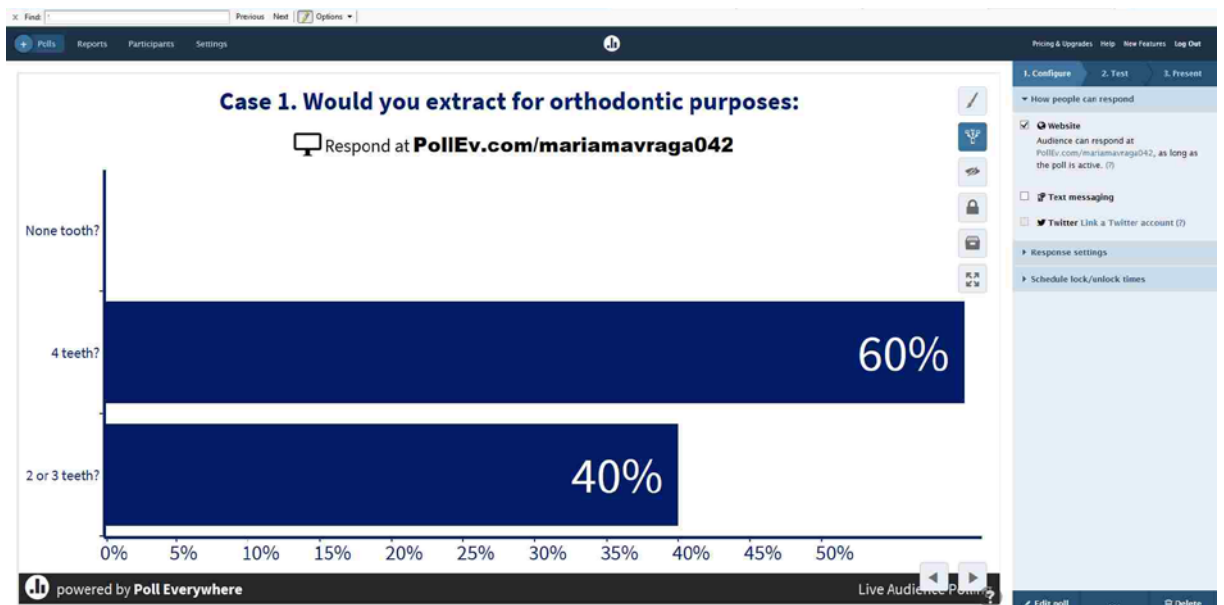


Figure 4. On screen presentation of students responses guided the discussion on the cases with the facilitator.

At the end of case discussion, the present 34 students received and filled-in a questionnaire on their perceptions of this case-based educational trial (Figure 5). The questionnaires were anonymous and collected before the end of the lecture.

Studying cases before the lecture:

Item	Assessment Scores			
	Strongly Disagree	Disagree	Agree	Strongly Agree
Made me pay more attention in the class				
Made the session more interesting and challenging in comparison to usual lectures				
Made my learning more effective due to the advanced preparation required before the lecture				
Increased communication and interaction with my classmates				
Motivated me to additional studying, that wouldn't have had taken place otherwise				
Burdened even more my already heavy schedule				
Selected cases were relevant to the topic of extractions in orthodontics				

Figure 5. Questionnaire for students' perceptions evaluation.

Responses were registered, using a ranking scale from 1 to 4 (1: strong disagreement, 2: disagreement, 3: agreement, 4: strong agreement). Descriptive statistics were applied, using SPSS for Windows statistical software (version 23; SPSS, Chicago, Ill).

Results

Questionnaires were delivered to all students present at the second lecture. All thirty four of them returned the filled in questionnaires. The response to the various questions rate was satisfactory and varied between 91% and 100% (Table I). There was a high rate of agreement in all questions (Table I, Figure 6) including the one about the additional imposed burden due to the extra work required for the case study between the meetings. Two students in order to support their answer have written as a free text, that this was due to the examination period there were running during that time. The highest rate of disagreement was recorded at the question about additional required studying (26.5%) and secondly at the relevant to

advancement of communication with the classmates (20.6%). None of them found the cases irrelevant to the topic.

Table I. Students' responses to questionnaire about case-based learning course in orthodontics, by number and percentage of respondents.

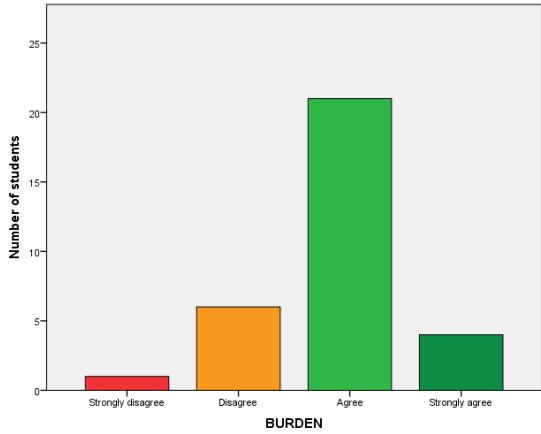
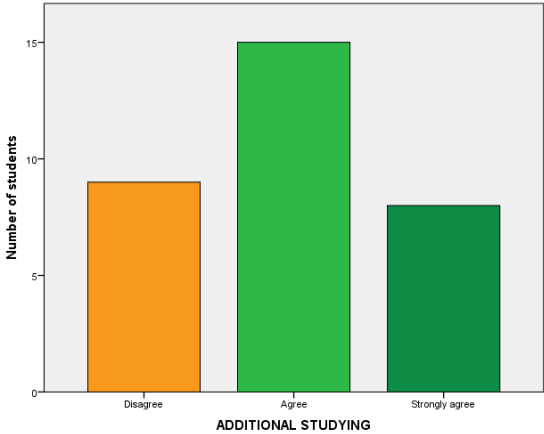
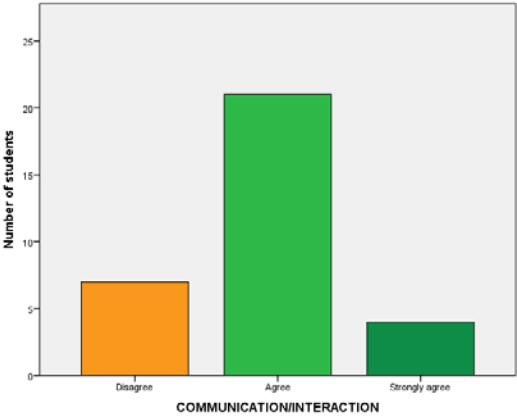
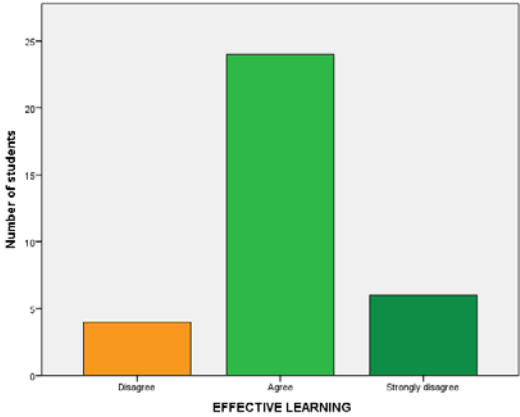
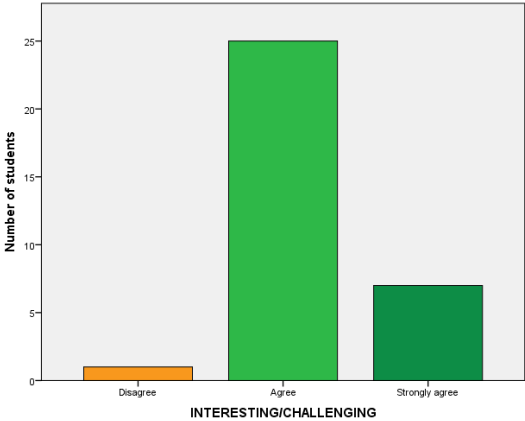
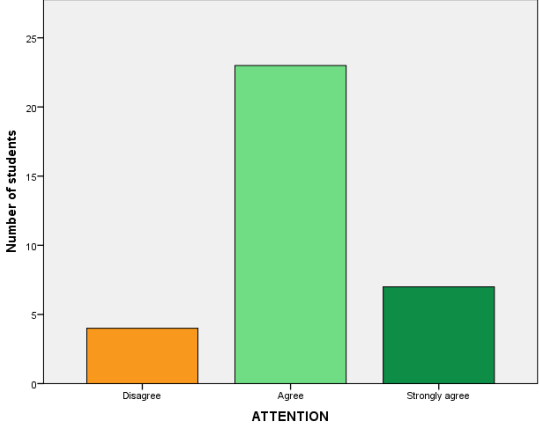
<i>Item</i>		STRONGLY DISAGREE (1)	DISAGREE (2)	AGREE (3)	STRONGLY AGREE (4)	TOTAL	Mean	SD
Attention	N	0	4	23	7	34	3.09	0.57
	%	0	11.8	67.6	20.6	100		
Interesting/ Challenging	N	0	1	25	7	33	3.18	0.46
	%	0	2.9	73.5	20.6	97.1		
Effective Learning	N	0	4	24	6	34	3.06	0.55
	%	0	11.8	70.6	17.6	100		
Communication/ Interaction	N	0	7	21	4	32	2.91	0.59
	%	0	20.6	61.8	11.8	94.1		
Additional Studying	N	0	9	15	8	32	2.97	0.74
	%	0	26.5	44.1	23.5	94.1		
Burden	N	1	6	21	4	32	2.88	0.66
	%	2.9	17.6	61.8	11.8	94.1		
Cases relevant	N	0	0	20	11	31	3.35	0.49
	%	0	0	58.8	32.4	91.2		

Discussion

On the study

Given the short term planning and the fact that the new method should have been integrated in the already established for the semester time-plan, this pilot trial was completed with relevant success. Students' participation was satisfactory. There was a 100% response rate by the present students to the questionnaire distributed. The fact that the questionnaires were collected at the same time, could be a reason for the high participation rate. However, the participation rate among all students that could potentially have attended the second meeting

was lower (34 out of 42). Given that lectures are not obligatory for students to attend, participation is still considered satisfactory.



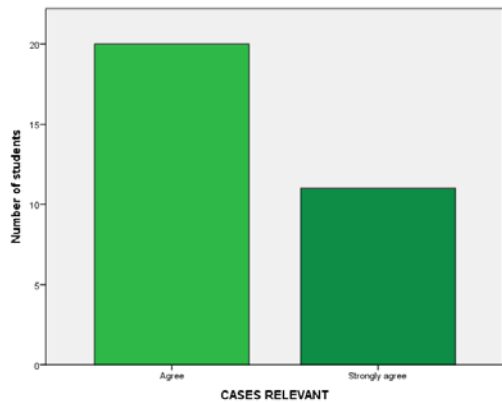


Figure 6. Charts demonstrating frequency distribution of students' responses to questionnaire.

Students at the dental school in Bergen, are used to work in groups. Therefore, there was no hesitation considering the required team work between the meetings. They were freely divided in groups. Students found using Poll Everywhere application exciting. For the facilitator, that has been an excellent way for the presentation of their responses, considering the cases. The clear demonstration of students' responses during the second lecture was a very helpful tool for case discussion in the class.

The need for an open field for free text remarks was shown by the addition of comments by two students, written on the questionnaire paper. While most of the students indicated that the additional studying burdened their schedule, very important details were given by these remarks which were written, even not asked or provided space for them.

At the interpretation of the results, the limitations of the study considering sample size, trial time and extend should be taken into account.

On results

According to their answers, most of the students recognized the benefits of case based learning and the trial was well received. Most of the students found that preparation of cases in advance, stimulated their attention, interest and effectiveness of the learning process in the class. Similarly, at a more extensive study on case-based learning model in orthodontics, students reported significantly higher levels of confidence after the seminars. Instructors also rated the seminars positively (Engel and Hendricson, 1994). At the present short study only one facilitator took place and no evaluation of this experience was done. However, since the author was also the facilitator, greater interest and attention by the students than a usual lecture was noticed. The discussion on the cases was more active, after having earlier been exposed to them, than what takes place when cases are presented during the lecture and

questions are asked to increase student's interest. Positive experience for students and facilitators has been also recorded in other fields and stages of dental education (McKenzie, 2013; Kumar and Gadbury-Amyot, 2012; Zhang *et al.*, 2012).

More than a fourth of them indicated that additional studying was not necessary. The reason could be that all necessary theoretical information for the case study was given at the first meeting. Some of the students did not find it necessary to study additionally, or even look through the published for them at University's platform presentation of the first lesson.

Overall students' response was positive, apart from the "burden question". Most of the students considered they have been overloaded from studying the cases and answering the relevant questions between the two meetings. The written comments by two of them pointed-out that the timing of the trial was bad, since they were in the middle of an examination period. That indicates that a shift from a traditional lecture based to case based learning requires changes at the student curriculum. Time should be allocated from the faculty during the working hours for this additional studying. Case based learning will have more chances to succeed, when students do not perceive it as "their free-time consumer".

Conclusion

This pilot study indicated a positive response of the students considering case based learning. The students recognized benefits related to teaching-learning process. The results from this pilot study showed that it is worthwhile to make a shift from lecture based to case based learning in orthodontic undergraduate education. This however, requires among other, the general reorganization of the student curriculum, allocating time for self-study and in advanced preparation of the given material.

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