Self-rated clinical competence in prosthodontics among undergraduate dental students following traditional versus problem-based learning curricula.

RUNNING TITLE: Clinical completence in prosthodontics among dental students

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Self-rated clinical competence in prosthodontics among undergraduate dental students following traditional versus problem-based learning curricula.

SUMMARY

Objectives: to compare the perceived competence for treating prosthetic patients between two samples of fourth-year dental students belonging to the traditional dental curriculum or to the current problem-based learning (PBL) curriculum.

Methods: a consecutive sample of fourth-year dental students following the traditional study plan and the new problem-based learning plan were surveyed regarding their perception of the teaching they had received in Prosthodontics. The number of prosthetic treatments carried out during the academic year and the level of competence perceived by the students to perform such treatments was quantified on a scale from 0-10.

Results: The average number of treatments performed was similar for both groups, except for metal-based removable partial dentures which was significantly higher for the group belonging to the traditional curriculum (0.8±1.0) than the PBL curriculum (0.4±0.6). The level of competence perceived by the students to treat full denture patients was significantly higher (7.3±1.1) than that of partial acrylic dentures (6.7±1.5) or combined dentures (5.7±1.3). Clinical competence in dental prosthetics mainly depends on the number of treatments conducted as the operator, as well as the assistant. Furthermore, the students following the traditional curriculum considered themselves to be significantly more competent at treating patients for removable partial and fixed prostheses (7.8±1.1 and 7.6±1.1 respectively) than counterparts (6.4±1.5 and 6.6±1.5 respectively).

Conclusions: The level of competence perceived by the students following the traditional study plan was significantly higher than those following the new PBL study plan in the treatment of removable partial dentures and fixed prostheses. Thus the practical experiences are more important than the theoretical teaching method in the student's preparedness.

Keywords: Academic training, clinical skills, proshtodontics

INTRODUCTION

Dentistry is a profession that requires a broad understanding of a wide spectrum of basic and health-related sciences. The dental curriculum has changed worldwide in the last two decades towards a new strategy based on a student-centered approach with competence-based learning, which replaces the classical teacher-centered strategy of information-oriented learning.[1]

Competency-based education was introduced to North American dental schools in 1993 when David Chambers proposed that "Competencies are skills essential to beginning the practice of dentistry" .[2]

Dental competence may be defined as the combination of knowledge, skills and attitudes appropriate to the individual aspects of the dental profession;[3] although, this requisite is usually denoted as the minimum acceptable level of performance for a graduating dentist.

Also, in comparison to other health-related degrees, the clinical skills of general dentistry require mechanical hand activities that rely on developing psychomotor skills,[4] which are strategically learned during preclinical and clinical training practices that have essentially remained the same over the years (typodonts, laboratory tasks, and prosthetic patients). The undergraduate clinical training in dentistry involves performing irreversible operative procedures on patients of which the students are personally responsible for, but with the tutor assuming the legal risks.

In 2010, within the European Higher Education Area, the Bologna Process for University Degrees was compulsorily implemented for all countries who signed the Bologna Accord. As a result, this initiative created a change in the structure of the

dental curriculum, but above all, reoriented teaching methodologies towards student-centered learning to ensure proper acquisition of the various clinical competences.[5] According to Plasschaert et al., the implementation of this new plan among European Dental Schools,[3] should make teaching more student-centered and flexible, and at the same time support a variety of learning styles.

Problem-based learning (PBL) is defined as an approach in which a problem serves as the stimulus for active learning. This pedagogy is based on small groups of students working together and collaborating with faculty facilitators to achieve understanding.[6] PBL is intended to enhance learning skills by engaging students through self-direction and problem-solving, and also to nurture clinical reasoning, teamwork, and communication skills.[6]

Until the new dental curriculum was initiated, traditional teaching mainly involved transmitting knowledge from the teacher to the students, and was very much teacher-centred. However, in comparison with other degrees (such as degrees in engineering, architecture and law), dental graduates have been traditionally formed enough for an early and gradual transition to the professional activity.

Prosthodontic training is one of the largest components of the dental curriculum, and therefore, competence in prosthodontics is essential. In the current profile of the European dentist, it is stated that "a dentist must be competent at designing effective indirect restorations, anterior and posterior crowns, bridges, complete and partial dentures, including a combination of fixed and removable dentures, and occlusal splints, and undertaking some of these procedures as is relevant to the country of practice".[7]

Most surveys of education in prosthodontics have been oriented towards clinical materials and techniques,[8-10] preclinical skills[11] and teaching strategies for complete[12]

or partial dentures,[13] but currently there are very few studies that address the students' perception of their own clinical competence for treating prosthetic patients.[14]

The present study aims to compare the perceived competence for treating prosthetic patients between two samples of fourth-year dental students, belonging to either the traditional dental curriculum or to the current PBL curriculum.

MATERIAL AND METHODS

This study was approved by the Institutional Plan for the Innovation of Teaching of the XXXXXXX University (PID_ ID12/190). To carry out this work, we conducted a survey on two groups of fourth-year dental students: one group representing the traditional curriculum (n=46), comprised of students from two consecutive academic years, 2012 and 2013, and the other group representing the PBL curriculum (n=57), comprised of students from academic years 2014 and 2015.

The survey was carried out at the end of the teaching period, but before final exams (June-July), and was designed using a 5-point Likert scale to capture the dental students' perception of their competence to diagnose and treat patients with prosthodontic needs. The number of prosthetic treatments performed by each student as the operator and as the assistant, and the perceived level of competence to perform prosthetic treatments, such as complete dentures (CD), acrylic removable partial dentures (A-RPD), metal-based removable partial dentures (M-RPD), fixed partial dentures (FPD), or a combination of the latter two by mean of frictional attachments, i.e mixed prostheses (MP) was recorded. The self-rated competence was assessed using a visual analogue scale of 0-10.

Currently within the dental degree program of the Faculty of Medicine at the

XXXXXXX University, the subject of Prosthodontics is taught via a hybrid PBL format (lecturers+problem-based seminars), which includes Prosthesis I (12 ECTS) in the third year, Prosthesis II (12 ECTS) in fourth year, and Prosthesis III (6 ECTS) during the first semester of the fifth year. However, previously, Prosthodontics was taught during the third and fourth years and was comprised of 2 subjects of 13 credits each (1 Spanish credit was equal to 10 hours of face-to-face teaching). Within the PBL program all didactic topics are summarized in videos lasting 10-15 minutes that are then discussed during the 1-hour per week seminars with the guidance of a lecturer. Also, clinical sessions with small groups are frequently used to complement the lectures and to stimulate clinical decision making. By contrast, the students following the traditional curriculum receive lectures delivered face-to-face, lasting 2 hours per week, which include a brief discussion or summary of the lecture at the end of the class. However, both preclinical and clinical skills are based on the same teaching experiences (typodonts and patients, respectively) during 3 hours per week. In both programs the preclinical practice is carried out individually, but in clinical practice students work in trios (operator, nurse and assistant). In both programs the thematic modules teaching material on physiological dental occlusion and removable dentures are taught in the third year, and fixed prosthodontics and frictional attachments are taught during the fourth year. However, the modules regarding implant dentistry and occlusal pathology are taught during the fourth year in the traditional curriculum, but in the new PBL program are imparted during the first semester of the fifth year. A summary of both programs are shown in Figure 1.

For statistical analyses, we compared the data distribution of both groups of students (Traditional vs PBL) by means of the Chi-square test and the Student's t-test. The paired t-test was used to compare the level of competence for each different type of intervention for

each group. Pearson correlation coefficients were used to assess the linear association between the final teacher-based evaluation with the number of treatments performed and the level of competence perceived. A linear regression analysis was made for predicting the prosthodontic clinical competence after the inclusion of the potentially related variables. The Statistical Package for the Social Sciences (v.20, (SPSS Inc. Chicago. IL) was used for the statistical analyses. The cut-off level for statistical significance was 0.05.

RESULTS

Table 1 shows a comparable distribution of the sociodemographic variables, where students were mostly female (66%) with an average age of 21.7±0.7 years. In general, both groups of students felt quite or very confident of their clinical practices (92.2%), and considered that the time allocated to carrying out the various treatments matched the actual time spent (70.9%) treating the patient. They also felt they had coordinated with the student acting as the dental assistant in an efficient manner (87.4%), where they formed a good team (94.2%) and helped each other (95.1%). Ninety point three percent of the students had previously utilized the materials used in the practical training sessions, and 96.1% felt supported by the teacher. A high proportion of the students belonging to the traditional curriculum (89.1%) considered themselves to be quite or very manually skillful as compared to 73.7% of the students belonging to the PBL curriculum.

Overall, the students considered that their preclinical training had allowed them to acquire the required competences for treating patients (76.7%), and that the theoretical education they had received was also satisfactory for treating patients (88.3%); although, students felt the differences between the practical training using typodonts and real-life patients (89.3%) were either many or quite different.

As shown in Table 2, the students identified their weak points as oral expression (47.6%), theoretical knowledge (26.2%) and the required manual skill (17.5%). The difficulties perceived regarding clinical practices were significantly different between the two groups, where students following the traditional curriculum felt laboratory work was the main difficulty (71.7%), and students following of the PBL curriculum felt the main difficulty was manual technique (38.6%). In fact, in the group of students following the traditional curriculum, the majority considered that laboratory work had not fulfilled their expectations (80.4%) as compared to the other group of PBL students (43.9%). The majority of the students believed they were able to transmit a confident attitude to the patients they had treated (92.2%), and that the patients had demonstrated a collaborative attitude (92.2%), respecting the given instructions and follow-up appointments (89.3%). The majority of students also felt their training would be improved by increasing the amount of practical training (51.1%) and clinical sessions (36.9%).

In Table 3, clinical performance is quantified and evaluated. The fourth-year students, acting as the operator, conducted on average 0.8±0.7 complete dentures, 0.7±0.6 A-RPD, 0.8±0.6 M-RPD, 0.4±0.7 FPD and 0.1±0.4 MP and also, on average, 1.3±1.3 dental extractions. The average number of treatments acting as the assistant was similar. Except for the number of M-RPD, which was significantly higher for the group of students belonging to the traditional curriculum, the average number of treatments conducted was similar for both groups. On average, the level of competence perceived by the students was satisfactory (>5) for all of the treatments assessed, but was significantly higher for complete dentures (7.3±1.1) than for A-RPD (6.7±1.5) or frictional attachments prostheses (5.7±1.3).

There were no significant differences among males and females in all the competences

assessed. An interesting finding was that the teacher-based final evaluation of the students was not significantly correlated with the level of competence perceived by PBL students for all the prosthetic treatments evaluated. However, among the students following the traditional curriculum the final evaluation was significantly correlated with the level of competence for complete dentures ($r=0.31$; $p<0.05$), acrylic RPD ($r=0.42$; $p<0.01$) and metal-based partial dentures ($r=0.26$; $p<0.05$). The overall academic performance of both groups was similar within the traditional curriculum students (6.5±1.3) and PBL students (6.6±0.9).

As shown in Table 4, the perceived clinical competence in prosthetics mainly depended on the number of treatments carried out as the operator as well as the assistant. For both complete and acrylic partial dentures the perceived competence depended on the number of prosthetic treatments carried out as the assistant, while for fixed and metal-based removable partial dentures (retained by either cast clasp or attachments) the competence was influenced by acting as both assistant and operator. In addition, there were other qualitative factors that proved to be meaningful predictors of performance. For example, in the case of the A-RPD prosthesis, the lack of theoretical proficiency reduce significantly (between 0.1 and 1.3) the self-evaluation of clinical competence. Furthermore, the type of teaching plan (traditional versus PBL curriculum) also proved to be an influencing factor in the level of clinical competence perceived when carrying out A-RPD, M-RPD and fixed prostheses. Students following the traditional curriculum were significantly more competent, according to the self-assessment based on the 0-10 scale, to carry out treatments involving acrylic RPD (0.1-1.1), metal-based removable partial dentures (0.7-1.6) and fixed prostheses (0.4-1.4). The predictive capacity of the said models (R^2) ranged between 0.11 and 0.34; therefore, it is necessary to identify more predictive variables in order to increase the amount of variance explained (See

footnote of Table 4).

According to these models, each student would need to participate as the assistant in treatments involving 10 complete dentures, 6 acrylic partial dentures, 10 removable partial dentures retained by cast clasps, 8 fixed prostheses and 10 metal-based removable partial dentures retained by attachments.

DISCUSSION

The acquisition of clinical competence is the motive for remodeling university study plans (Bologna Process) for teaching Odontology, which should be periodically reassessed. Although it is true that the teacher/tutor judgement influences this assessment in a decisive way, the students' self-assessment (as those receiving instruction) is not any less important. The students' evaluation of their level of competence and academic performance acts as an indicator of the instruction received, and could aide in redirecting how students are taught. The teaching of odontology has been analyzed in various studies, however, the approach was based exclusively on the opinions of the heads of department and the professors themselves,[15, 16] which carries a certain degree of subjectivity. Moreover, since the implementation of the new plan in 2010, there has been no post-evaluation regarding the effectiveness of the methodology applied in the acquisition of competences and the weaknesses in teaching perceived by the students. Keeping in mind that it is difficult of objectify or quantify the effectiveness and performance of the new plan, we believe the information provided by the students is a valuable approach. However, the results obtained for each study plan may be influenced by the teacher-student relationship and not necessarily reflect the effectiveness of the plan.[17] In addition, self-perceived competency does not necessarily guarantee real competency, and some feel that other terms, such as "confidence" or

"preparedness", may be more accurate for describing an individual's self-appraisal of how well prepared he or she is for prosthetic practice.

In this study we assessed the self-perceived clinical competence by means of a VAS with a range of 0-10, which is an easy and valid method that most students are familiar with, and which is commonly applied to university evaluations. This simple method has recently been used to measure the preparedness of 525 final-year undergraduate dental students in the UK.[18]

The design of the present study involving two groups of students belonging to two separate study plans did not allow the effect of the intervention of the new plan to be evaluated in an unbiased way. However, for operative reasons and legal obligations the random application of the two study plans between students would not have been approved, and the same for parallel or crossover study designs. Also, it should be kept in mind that there is inherent variability with respect to the manual skills, cognitive capacity and motivation within the individuals of each academic year. This study was conducted in the fourth year with the aim to compare the effectiveness of the plan within the area of prosthodontics. However, in the fifth year the clinical prosthodontic competences are further reinforced during the subject "*Practicum*" (new plan) and "*Integrated Dentistry*" (old plan), which is more than 90% clinical teaching.

As pointed out by Scott,[19] there is still large variability in the number of credits assigned to the material of prosthetics within the different Spanish faculties (from 18 to 30 ECTS). Furthermore, the study carried out by Brand[20] found considerable variation among the 10 European dental schools (from Finland, France, Netherlands, Slovenia, Sweden and UK) within the teaching of fixed prosthodontics, and concluded that dental curricula vary in prosthodontics training with regard to the year in which teaching

begins (from year 2 to 5), and in the materials and techniques used for fixed prosthodontics, as well as the compulsory number of treatments students should perform before graduating. In Spain the number of credits assigned to the material of prosthetics within the different Spanish faculties varied from 18 to 30 ECTS.

Even though it is true that we have assisted in changing the methodology used in teaching (applying more guided work in small teams, more clinical sessions and the creation of repositories of multimedia contents to be used by the learners), manual skills are still acquired during preclinical and clinical practices that have changed very little over the decades. It is quite likely that the Degree in Dentistry was already adapted towards the acquisition of competences, allowing graduates to start their professional careers, upon its approval as a Spanish university title in 1986 according to the Royal Decree 970/1986 by the Spanish government. In fact in the fifth year, credits were assigned almost exclusively to the teaching of the complete clinical care of different target groups (adult patient, infant patient, patients with special medical situations), and was comprised of subjects included within the traditional curriculum of Integrated Dentistry, which in the new plan is called "Practicum".

Greenwood *et al*.[21] compared PBL and traditional dental curricula in terms of self-perceived competence upon graduation and found great similarity between the two. In this study, a significantly high proportion of the traditional curriculum students felt they were competent enough to treat patients with FPD (81%), as compared to the PBL students (29%).

In addition, Yiu et al.[22] found significant differences between the self-perceived preparedness responses of graduates of the Hong Kong University Faculty of Dentistry's new PBL curriculum, and the responses previously obtained to the same

questionnaire by graduates of the traditional curriculum with respect to nine domains.

In our study the PBL methodology did not appear to be superior to the old plan, and in fact, it seemed that perhaps due to the lower manual skills perceived by the PBL students (Table 1), the level of clinical competence perceived was also less, particularly regarding some of the treatments that required dental preparations such as metal-based removable partial dentures and especially fixed prostheses. This could be a spurious result based on the specific manual skill of the group of students rather than being attributable to the plan itself. Additionally, this may also be due to the fact that the new curriculum group was made up of the first two academic years of the new plan, where the new methodology was implemented in an almost experimental way, and that the teachers as well as the students had to apply new methods that required previous experience in order to be completely effective.

To date, only few studies have evaluated the effect of PBL in the students' manual skills (one on preparing CAD/CAM ceramic inlays[23] and the other on performing nonsurgical periodontal treatment)[24]. In both works no statistically significant differences were found between PBL and traditional learning. In the Reich study[23] it was also concluded that the PBL students were less satisfied with their performance and the study plan, perhaps due to the greater effort that is required by self-directed learning without the traditional lectures support.

Thus, it seems that the key to competence in prosthodontics lies in clinical practice since the number of patients treated is a significant indicator of the level of acquired competence (Table 4), which means that the "theoretical " teaching is less important, because in both programmes the confidence of clinical skills is adquired in the simulation laboratory and on patients.

There is not a consensus with respect to the minimum number of treatments needed to acquire the basic competences of prosthetic care. In UK dental schools, the students are expected to have carried out between one and three complete denture treatments during their studies, with most schools expecting at least three complete denture treatments.[25] In the case of Spanish dental students this treatment cutoff point would be achievable after having completed the subject "*Integrated Dentistry*", which is offered during the fifth year, since according to our study, half of the students had carried out at least one complete prosthesis as operator and another as the assistant.

Likewise, the average number of fixed partial dentures observed in this study on fourth-year dental students was greater than that reported by Lynch *et al.*[16] in which the average number of conventional fixed partial dentures performed by undergraduate dental students from the UK and Ireland was 0.27 (range 0-1) for the UK and 0.44 (range 0-1) for Ireland. Hence, it is possible for dental students of these two countries to graduate without any clinical experience with FPDs. By contrast, in Norway, the competence level of dental students with respect to fixed prosthodontics is expected to be high, since the number of dental preparations for FPD increased from nine in the old curriculum to 11 in the new curriculum (implemented in 2000).[26] Even better results have been found at the Harvard School of Dental Medicine, in which students completed an average of 2.6 RPDs per student, 2.6 CDs per student, and 12.7 FPD per student.[27]

These figures are greater than those calculated in this study, according to the models of linear regression (Table 4), in which it is inferred that the students perceived maximum competence after carrying out 6 complete dentures and 3 RPD as the assistant, and 6 metal-based removable partial dentures and 5 fixed partial prostheses as the operator, independently of the remaining modulating variables.

In addition, both groups of students recognize the fact that there is a great deal of difference between preclinical practical training using typodonts and the care of real-life patients. Some authors have not found a correlation between the preparations involving complete crowns carried out on typodonts and those using real patients;[28] however, other authors have found a positive and significant correlation between preclinical and clinical performance[29] for operative dentistry and fixed prosthodontics.

All of the students were in agreement that there was a need for more clinical sessions and more practical training in order to increase the level of prosthodontic competence (Table 2). It is also worth noting that both groups of students identified a weakness in oral expression, despite having practiced during other public clinical discussions with groups of graduating students. Perhaps it might be advisable to increase the teaching effort regarding this since oral expression is a transversal competence that should be applied in other subjects throughout the degree course and in different settings in order to be acquired.[30]

In our study the majority of the students had a positive perception of their teaching experiences, but some authors conclude there is a need to improve practical training within the laboratory and the clinical sessions to properly prepare the students for prosthodontic practices[14]. In fact, only two-thirds of the respondents considered that the preclinical fixed prosthodontics courses were helpful for diagnosing and treating patients.[14]

Similarly, at Harvard School of Dental Medicine (HSDM), a university that also teaches using hybrid PBL, the majority of students felt they had not acquired enough knowledge from the lectures, and the majority did not feel confident in treating prosthodontics patients in the clinic[27]. However, based on our results the majority of the students considered that they had received the appropriate amount of theoretical teaching to be able to carry out clinical practice, and also the majority felt confident (Table 1). Most probably this is due to, according to Sukotjo at the Harvard School of Dental Medicine[27], the fact that the prosthodontics curriculum is taught mainly during the first 6 months of the third year, which is when the students should learn about FPs, RPDs, CDs, dental materials, and implant dentistry. Thus, our students had received more in-

class hours allowing additional time to acquire the knowledge presented to them and manual skills. Recently, in this University (HSDM), a newer approach called Flipped Classroom has been applied for teaching anatomy among second-year dental students, obtaining great acceptance among students and faculty members. [31] The flipped classroom is a blended learning model in which students access foundational contents online before class time, take a pre-class quiz and latter participate in group discussions and collaborative activities during class. [31]

There are probably many valid and effective models for building competence in prosthodontics. If we used the clinical competence data regarding the fixed partial dentures performed as a proxy of the students' global rating of the fixed prosthodontic education, using a 0-10 range, our results (6.6±1.5 for PBL-Students; 7.6±1.1 for TL students) are within the average range of 5.6±2.2, as reported by students from Ljubljana University (Slovenia), to 8.0±1.1, observed among the students from Nijmegen University (Netherlands), as reported by Brand et al [20]. Moreover, we also did not find any significant differences regarding gender, which is in agreement with several authors[18].

According our criteria the main advantage of PBL is that the teachers have more control over the students' strengths and weaknesses. Also, the weekly small group tutorials and interactive seminars allow the continuous evaluation of the learning process and the student-teacher relationship to improve. Furthermore, the application of PBL has allowed teachers to refine and update the contents given to the student because of the need to change teaching styles. Each year we are able to optimize the methodology used, learning more about the effectiveness of the different teaching strategies, such as role playing, clinical sessions of pathognomonic cases, etc.) for specific subject matter. Nevertheless, PBL requires a greater effort on the part of the student in the attempt to accumulate knowledge and skills, without the presence of a clear guide of what to do, given that PBL promotes tutored self-directed learning. Perhaps this is the reason why

the students are more doubtful about their own level of theoretical knowledge, and also because they are aware of the large quantity of available information and the divergent facts presented in the literature with respect to any subject matter. It may be better to give both the teacher and the student predefined structured teaching over which they base their learning.

CONCLUSIONS

The level of competence perceived by the students following the traditional study plan was significantly higher than those following the new PBL study plan in the treatment of removable partial dentures and fixed prostheses. Thus the practical experiences are more important than the theoretical teaching method in the student's preparedness.

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TABLES

Table 1. Distribution of the sociodemographic and the self-rated praxis performance among the study sample (n=103).				
Sociodemographic variables	Students following traditional curriculum (n=46)		Students following PBL curriculum (n=57)	
	Mean	Sd	Mean	Sd
Age (yrs)	21.5	0.7	21.8	0.7
Gender	N	%	N	%
Female	31	67.4	37	64.9
Male	15	32.6	20	35.1
Qualitative Clinical Performance - How well was the program carried out?				
How sure are you of your clinical practice?				
Confidence	N	%	N	%
Very confident	2	4.3	3	5.3
Quite confident	42	91.3	48	84.2
Normal	2	4.3	3	5.3
Not very confident	0	0.0	3	5.3
Did the time allocated to carry out the treatments match the actual time taken?				
Perfectly matched	4	8.7	8	14.0
Well matched	31	67.4	42	73.7
Regular	7	15.2	4	7.0
Quite unmatched	4	8.7	2	3.5
Very unmatched	0	0.0	1	1.8
Do you feel you have a sufficient amount of theoretical knowledge to carry out clinical training?				
All	5	10.9	2	3.5
Enough	37	80.4	47	82.5
Some	4	8.7	8	14.1
Do you feel you were able to coordinate the clinical tasks with the student assistant in an effective manner?				
Very effectively	12	26.1	8	14.0
Quite effectively	26	56.5	44	77.2
Normal	6	13.0	2	3.5
No	2	4.3	3	5.3
Did you feel you worked well with your classmate?				
Not really	2	4.3	3	5.3
Yes	44	95.2	54	94.7
Do you feel you learned from your classmate?				
Little or nothing	5	10.9	11	19.3
A lot or some	41	89.1	46	80.7
Had you previously utilized the materials used in the clinical training?				
Yes, frequently	10	21.7	4	7.0
Once	33	71.7	46	80.7
Never	3	6.5	7	12.3
Do you consider yourself manually skillful enough to carry out the clinical training*?				
Very skillful	3	6.5	0	0.0

Skillful enough	38	82.6	42	73.7
Normal	5	10.9	15	26.3
Do you consider the preclinical training (classes, seminars, and clinical sessions) was sufficient enough to treat a patient?				
Yes	11	23.9	16	28.1
Quite	26	56.5	26	45.6
Normal	8	17.4	8	14.0
A little	1	2.2	7	12.3
Have you felt supported by your teacher during clinical training?				
Yes	30	65.2	36	63.2
Quite	14	30.4	19	33.3
Normal	1	2.2	1	1.8
A little	1	2.2	1	1.8
Have you found any differences when training with typodonts versus real-life patients?				
Yes, many	20	43.5	20	35.1
Quite different	21	45.7	31	54.4
Slightly different	5	10.9	6	10.5
*: significant intergroup differences after Chi Square Tests				

Table 2. Distribution of the sociodemographic and the self-rated praxis performance among the study sample (n=103).				
Qualitative Clinical Performance. In what areas do you feel you could improve?				
	Students following traditional curriculum (n=46)		Students following PBL curriculum (n=57)	
	N	%	N	%
**In your opinion, what was the cause of the difficulties experienced during practical training?				
Laboratory	33	71.7	11	19.3
Not preparing for the case properly	3	6.5	14	24.6
Manual technique	8	17.4	22	38.6
Handling of the materials	1	2.2	8	14.0
Lack of theoretical knowledge	1	2.2	2	3.5
I consider my weak points to be:				
Theoretical knowledge	13	28.3	14	24.6
Oral expression	21	45.7	28	49.1
Communication with the patient	5	10.9	4	7.0
Manual skill	7	15.2	11	19.3
Do you feel it was helpful for the teacher to give you more freedom while carry out clinical training?				
Yes, for some of the treatments	36	78.3	44	77.2
No	10	21.7	13	22.8
**Has the Dental laboratory fulfilled your expectations?				
No (Somewhat or Normal)	37	80.4	25	43.9
Yes(A lot or Quite)	9	19.6	32	56.1
Have the patients treated respected follow-up appointments?				
No (Somewhat o Normal)	6	13.0	5	8.8
Yes (A lot or Quite)	40	87.0	52	91.2

Do you feel you transmitted a confident attitude to the patients you treated?				
No (Somewhat o Normal)	5	10.9	3	5.2
Yes (A lot or Quite)	41	89.1	54	94.8
Do feel the patients showed a collaborative attitude?				
No (Somewhat o Normal)	5	10.9	3	5.2
Yes (A lot or Quite)	41	89.1	54	94.8
Which teaching activity would you increase in order to improve your training?				
Theory	0	0.0	4	7.0
Clinical sessions	15	32.6	23	40.4
Practical training	25	54.3	28	49.1
Seminars	2	4.3	0	0.0
None of the above	4	8.7	2	3.5
**: significant intergroup differences after Chi Square Tests ($p<0.01$)				

Table 3. Distribution of the number of prosthetic treatments applied as operator (dentist) and dental assistant during the academic year, and the self-rated clinical competence among the study sample (n=103).

Quantitative Clinical Performance	Students following traditional curriculum (n=46)			Students following PBL curriculum (n=57)		
	Mean	Sd	Range	Mean	Sd	Range
Complete Dentures						
Operator	0.6	0.9	0-4	0.8	0.8	0-3
Assistant	0.5	0.9	0-4	0.6	0.6	0-2
Clinical Competence 0-10	7.5	1.2	5-10	7.2	1.1	5-10
Acrylic Partial Dentures						
Operator	0.5	0.7	0-2	0.6	0.7	0-3
Assistant	0.5	0.7	0-2	0.6	0.7	0-3
Clinical Competence 0-10*	7.1	1.4	3-10	6.4	1.6	1-9
Metal-based Partial Dentures						
Operator*	0.8	1.0	0-3	0.4	0.6	0-2
Assistant**	1.1	1.0	0-5	0.4	0.6	0-2
Clinical Competence 0-10**	7.8	1.1	5-10	6.4	1.5	3-9
Fixed Partial Dentures						
Operator	0.5	0.7	0-3	0.4	0.7	0-3
Assistant	0.5	0.6	0-2	0.3	0.7	0-3
Clinical Competence 0-10**	7.6	1.1	4-10	6.6	1.5	2-9
Frictional attachments prostheses						
Operator	0.1	0.4	0-2	0.2	0.5	0-2
Assistant	0.1	0.3	0-1	0.2	0.5	0-2
Clinical Competence 0-10	5.8	1.0	4-8	5.7	1.5	2-9
Tooth Extractions						
Operator	1.3	1.3	0-4	1.3	1.2	0-5
Assistant	1.6	1.4	0-5	1.2	1.0	0-4
Clinical Competence 0-10	6.8	1.5	3-9	6.9	1.2	4-9

Table 4: Forward Stepwise Linear Regression analysis for predicting the clinical competence for the different interventions after the inclusion of all the potential variables (sociodemographic, type of student and all the qualitative and quantitative self-rated performances items).

MODELS/PARAMETERS	Hypothesis Contrast				CI-95%	
PROSTHODONTICS COMPETENCES	B	Error	Standardized B	p-value	Lower	Upper
Complete Dentures [A]						
(Intersection)	7.1	0.1		<0.001	6.8	7.3
Number of complete dentures made as the assistant	0.5	0.2	0.30	0.003	0.2	0.8
Acrylic Partial Dentures [B]						
(Intersection)	7.5	0.7		<0.001	6.2	8.8
Number of partial dentures made as the assistant	0.9	0.2	0.39	<0.001	0.5	1.3
Theoretical proficiency (*theoretical skill*)	-0.7	0.3	-0.22	0.02	-0.1	-1.3
Student Type (PBL vs Traditional)	0.6	0.3	0.18	0.04	0.1	1.1
Metal-framed Partial Dentures [C]						
(Intersection)	5.9	0.2		<0.001	5.5	6.3
Student Type (PBL vs Traditional)	1.2	0.3	0.39	<0.001	0.7	1.6
Number of clasp-retained removable partial dentures made as the operator	0.7	0.2	0.36	<0.001	0.4	1.0
Number of partial dentures made as the assistant	0.4	0.2	0.19	0.02	0.1	0.8
Fixed Partial Prostheses [D]						
(Intersection)	6.4	0.2		<0.001	6.0	6.7
Number of FPD made as the operator	0.8	0.2	0.37	<0.001	0.4	1.2
Student Type (PBL vs Traditional)	0.9	0.3	0.31	0.001	0.4	1.4
Removable partial dentures combined with fixed prostheses by attachments [E]						
(Intersection)	5.6	0.1		<0.001	5.3	5.8
Number of attachment-retained prostheses made as the operator	1.3	0.3	0.42	<0.001	0.8	1.9

[A] F=9.56 df=1; p<0.01; Corrected R^2=0.11;
[B] F=9.5 df=3; p<0.01; Corrected R^2=0.20;
[C] F=18.5 df=3; p<0.001; Corrected R^2=0.34;
[D] F=17.3 df=2; p<0.001; Corrected R^2=0.24;
[E] F=21.9 df=1; p<0.001; Corrected R^2=0.17;

FIGURES

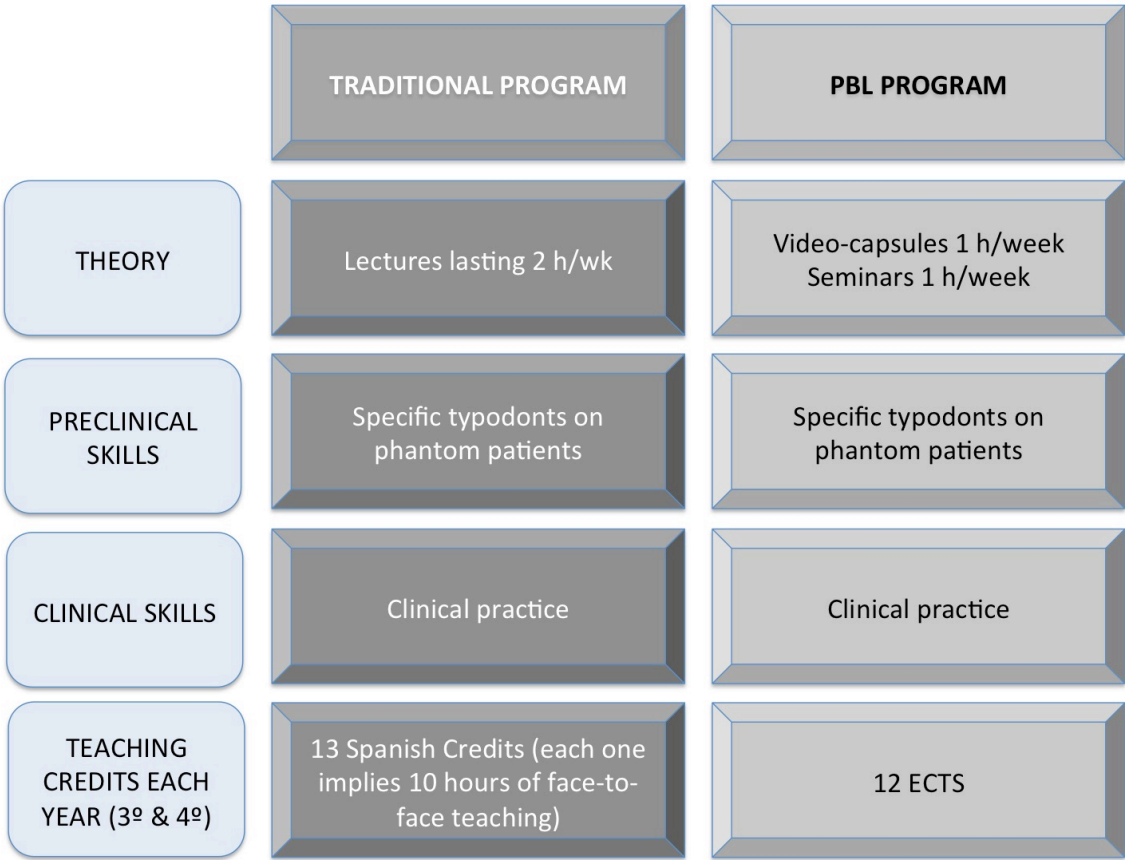

Figure Legends:

Figure 1: Comparison of the main similarities and differences of both Traditional and Problem-Based Learning programs