

A Comparative Study of Online and Face-to-Face Learning in Dental Education

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Abstract

Aims: This study assessed students' perception of blended learning in teaching the Growth and Development course. Another objective was to determine the effectiveness of a blended learning approach compared with a face to face instruction and highlight its impact on the learning experience of second year dental students.

Methods and Procedures: 141 second-year students took part in the study. Data required for this study were collected through a questionnaire. The responses were collected as soon as the students finished completing them. The study was approved by the research ethics committee, and all students gave informed consent.

Outcomes and Results: Participation rate reached 93%. 79.4% of the students attended lectures regularly. About 77.4% of the students believed that course objectives were reached and 70% of them thought that the course objectives were well-defined. Only 58.8% of the students used the e-learning platform (Moodle), 66.7% had difficulty understanding study materials online; 65.4% thought interactive evaluation was not sufficient. 41.9% of the students thought that online education was an addition to face-to-face provision. In fact, 53.8% of the students believed that teaching could not be totally done online; the teacher could provide more explanations.

Discussion: The fact that a small number of students used the e-learning platform could be explained by the fact that both formative and interactive evaluations were not enough. Establishing a tutorial system along with a regular use of the e-learning platform and related activities (i.e. forums, chat rooms, etc.) could boost students' motivation to achieve their desired outcomes.

Keywords: Blended Learning; Face to Face Instruction; Evaluation; Casablanca School of Dentistry; Morocco

Background

Tertiary education has been a major priority on the agenda of consecutive Moroccan governments since 1956. It has also undergone a series of educational reforms, designed to elevate education quality to international standards, reduce the high number of drop-outs and fit a gradually demanding labor market.

In the early 2000s, Morocco undertook major reforms as evidenced by the National Charter for Education and Training (2002 - 2003) and the National Education Emergency Plan (2009 - 2012). The goals of the National Charter for Education and Training were (i) to grant universities more autonomy, (ii) adapt curriculum to meet labor market's needs and (iii) eliminate gender disparities in education. How-

ever, despite the efforts deployed, the reform did not produce all of the expected results. This is partly due to resistance to change and negative attitudes of students and faculty, poor administrative support and lack of financial and administrative resources.

The failure of the National Charter for Education and Training pushed the Moroccan government to launch 'the National Education Emergency Program' (2009 - 2012) [1], the goals of which were (i) compulsory school enrolment (ii) adaptation of curricula to meet labor market needs (iii) research enhancement and (iv) rational management of financial resources allocated to universities [2]. The implementation of the National Education Emergency Program enabled Casablanca Dentistry School to increase its staff by 57% to meet the increasing demand for dental education and maximise student learning. It has also provided support for the introduction of two new dental programs to improve training quality and student learning, namely, the Dental Prosthetics Program and the Dental Assistant Program [2]. However, despite the efforts deployed, results have not matched expectations. Despite the increase in numbers and quality of applicants to dental schools, the actual education of new dentists in Morocco is facing various challenges. Foremost among these is the major shortfall in new orthodontics, particularly academicians who can both educate and continue the research necessary to advance the field of orthodontics. In fact, according to a study, carried out in European universities, eight European universities have a shortage of orthodontics teachers. Similar results were reported in studies undertaken in the United States [4], where there is a cumulative shortfall of 500 - 1000 unfilled academic positions in United States dental schools. The lack of resources makes the funds available for dentistry scarce for European [3] as well as American dental schools [5]. Such problems have an adverse effect on training and clinical practice [6]. A further challenge is the critical lack of financial and administrative resources.

To meet these challenges, several universities have implemented innovative teaching practices, which include online technologies such as e-learning, a type of learning which uses technologies to enable learning and improve students' performance. A major advantage of e-learning is its focus on the needs of learners; specifically, it ensures a learning environment which is independent of time and place [13], allows learners to manage time effectively [8], have access to information [14]. Overall, e-learning encourages students to learn in an interactive and collaborative environment, at their own pace and in their own. Despite its advantages, e-learning suffers from disadvantages, these include the complete absence of personal interactions (i.e. hindrance of the socialization process of individuals), the lack of sufficient recognition between the teacher and the learner, and limitations concerning the communication among learners. The aforementioned pitfalls have led to the search for an alternative learning mode which combines the benefits of traditional learning and e-learning. This new learning mode is termed "blended learning". As a new innovative learning tool, blended learning is characterized as reducing costs as well offering students increased access and equal quality [7].

Blended learning is an approach which combines traditional face-to-face classroom instruction and e-learning; it has been designed to meet the needs of students with divergent learning styles. This innovative teaching approach allows learners to operate smoothly in an interactive and collaborative environment and motivates them to become actively involved in the content.

Much research of the last decades has discussed the relative merits of the use of new learning technologies in orthodontic education, nevertheless, only a limited number of studies have evaluated the effectiveness of e-learning compared to traditional face-to-face instruction. For example, Gupta, *et al.* asserted that students considered the e-course as a positive method of supplementing face-to-face learning in dentistry. In the same vein, Pahinis, *et al.* [6], in their turn, maintained that face-to-face and online learning complement each other. They were similarly understandable and valued. A study by Marriot, Marriot and Selwyn (2004) reported that learners preferred face-to-face teaching because it facilitated interaction and allowed acquisition of communication skills. While no significant difference was found between online learning and face-to-face instruction in Clark, *et al.* study [9], in Hobson, *et al.* research [10] face-to-face was more effective than e-learning. In contrast, other studies have highlighted different results relative to the effectiveness of blended learning [11,12]. The authors claimed that students in an online learning environment performed better than students in face-to-face instruction. Overall, studies reported in both the dental and orthodontics literature have shown that students are satisfied with their e-learning experience; however, they do not consider online learning as a substitute for face-to-face learning, but it rather serves as a complement, forming part of a blended learning strategy.

To meet the growing needs of its students and staff, Casablanca Department of Dento-Facial Orthopedics converted a second-year face-to-face course 'Growth and Development' to a hybrid course. Through this online course conversion, it aimed to integrate information technology into its dental curriculum. The aim of the present study was twofold. Firstly, it sought to compare the face-to-face and online learning experiences of Casablanca dental students who were enrolled in traditional face-to-face course which incorporated some online components. Secondly, it purported to explore the impact of online learning on their learning outcomes.

Materials and Methods

Study design

The study was carried out at the College of Dentistry, Hassan II University, Casablanca, Morocco. 141 second-year dental students took part in the study as part of the course 'Growth and Development', a course taught to second-year dental students in semester one.

The study was approved by Dental School research ethics committee, and all participating students gave informed consent.

Data collection and instruments

To compare face-to-face learning and blended learning, a self-administered questionnaire was administered to the students after exam results. The questionnaire consisted of three parts; part one examined how often students attended the lectures, whether or not the teacher clearly outlined the learning objectives, whether or not these objectives were attained, if the various chapters of the course kept running smoothly, if the number of hours allocated to this course was appropriate and whether the presentation of the lecture facilitated understanding and students' assimilation. Part two of the questionnaire investigated the impact of online learning on the whole course and included the use of a platform to deliver e-learning materials. Given that the e-platform had multiple choice questions for formative assessment purposes, the students were asked if formative assessment was sufficient, if e-learning materials facilitated a better understanding the course material, and finally if this new mode of learning could be delivered through distance-education only. Part three of the questionnaire consisted of open questions, related to the reasons why the course was challenging, ways of how teaching the course could be improved, and what the most effective ways were to assess this course. The questionnaire was administered to students at the end of practical work. No time limit was set up. Questionnaire forms were immediately collected to minimize data loss and check the non-response bias.

Data were analysed with Epi-Info version 3.5.1 2008. Statistical analysis, which involved calculating central tendency and dispersion measures for each question.

Results

In total, 141 questionnaire forms were collected from a potential 181 forms, yielding a response rate of 93%.

Of 131 students who responded to the questionnaire 104 (being 79.4%) said they attended the lectures regularly. 82 students (77.4%) felt that the teacher clearly defined the course objectives (Table 1). Only 51 students (39.8%) felt that the course units were well designed, and they were not repetitive (Table 1). As for the number of hours, 34.6% of students considered that the amount of time devoted to teaching was not sufficient (Figure 1). 51.2% of students felt that the presentation of lectures facilitated understanding of the program (Table 1).

With regards to the use of the Moodle platform, of 131 students who responded to this question, 77 (58.8%) said they used the platform E-learning before. 85 students (65.4%) felt that the multiple-choice questions that assessed various chapters of the course were insufficient (Figure 2).

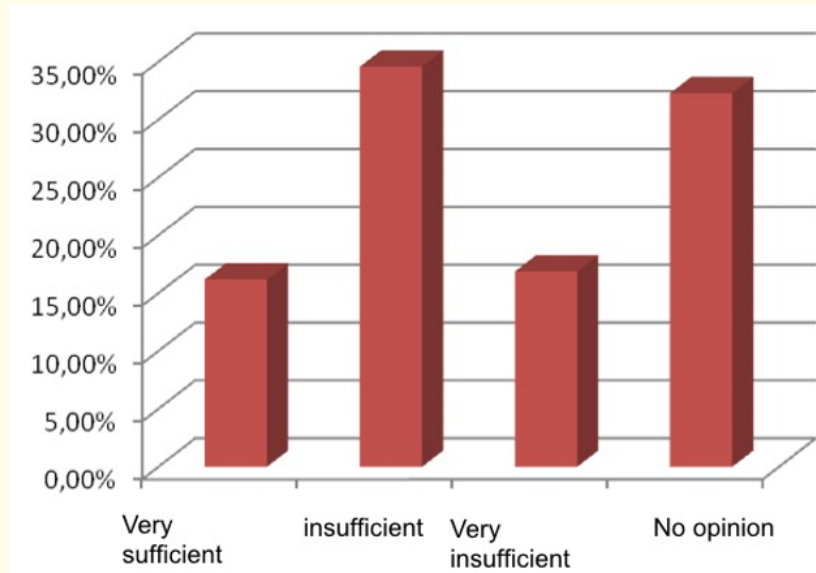


Figure 1: The number of hours allocated to the lecture course.

Items	Effective	Percentage
Well-defined course objectives	92	70,2%
The course content meets the objectives	82	77,4%
Harmony of chapters	51	39,8%
Lecture course facilitates assimilation	66	51,2%

Table 1: Assessment of the lecture course.

Overall 86 students (66.7%) had difficulty assimilating course materials online only (Table 2). 53.8% of the students preferred face-to-face while 46.2% of students preferred forums and online chats (Table 2). 61.1% of students reported that the online courses were effective in helping me understand the course materials (Table 2). Only 41.9% of the students thought that the course should be offered in the online format only (Table 2). In fact, 53.8% of the students believed that teaching cannot be totally done online; the teacher can provide more explanations (Figure 3). 50% of the students believed that multiple choice questions were the most appropriate assessment instrument while 16% of students (Figure 4-6) claimed that essay questions were the most appropriate forms of assessment.

Items	Effective	Percentage
Difficulties in assimilating the course on the online support versus the lecture course	86	66,7%
Interaction at the online course	60	46,2%
Face to face with the teacher	70	53,8%
E-learning course strengthens assimilation	80	61,1%
Completely online course	49	41,9%

Table 2: Evaluation of the E-Learning platform.

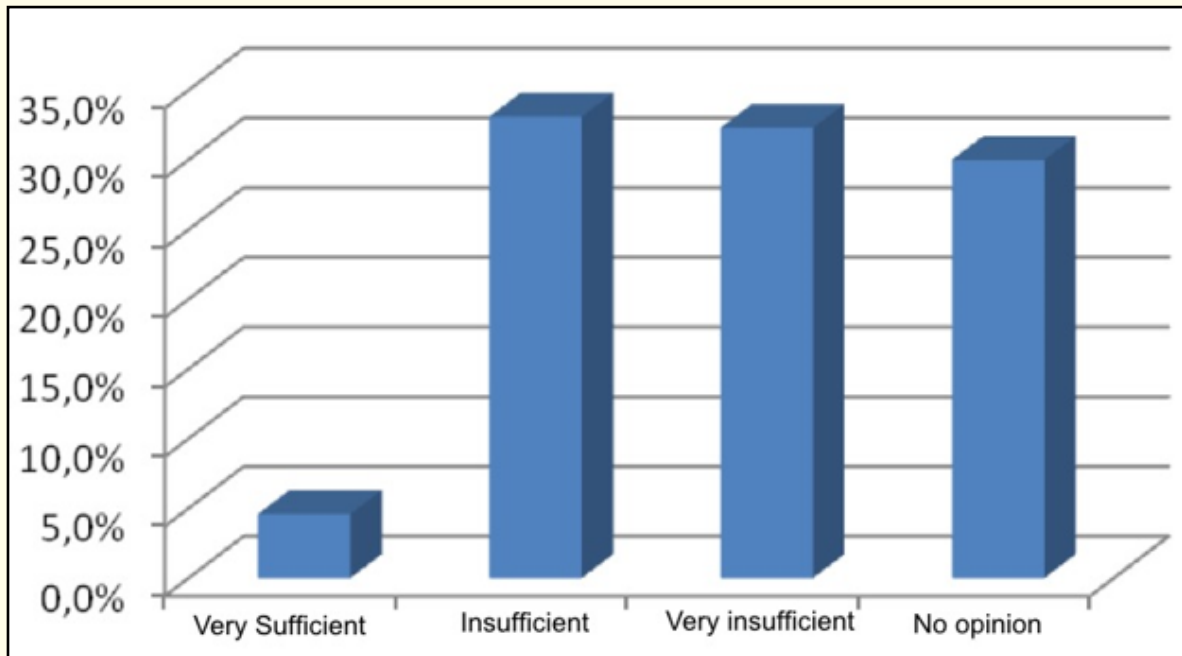


Figure 2: Online formative evaluations.

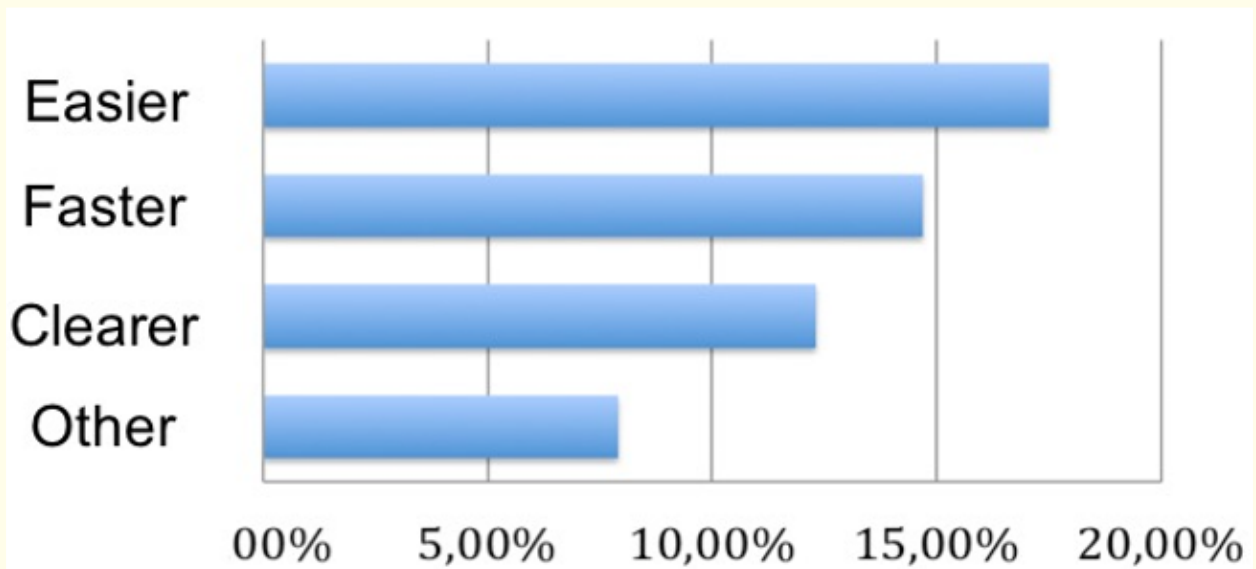


Figure 3: Why would e-learning facilitate the assimilation of the course?

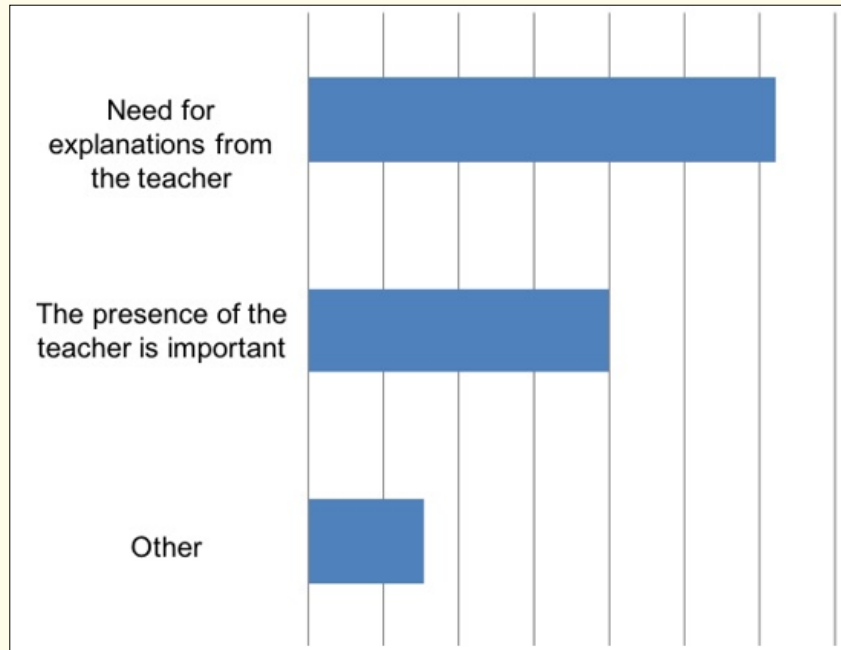


Figure 4: The reason why the course cannot be delivered completely online.

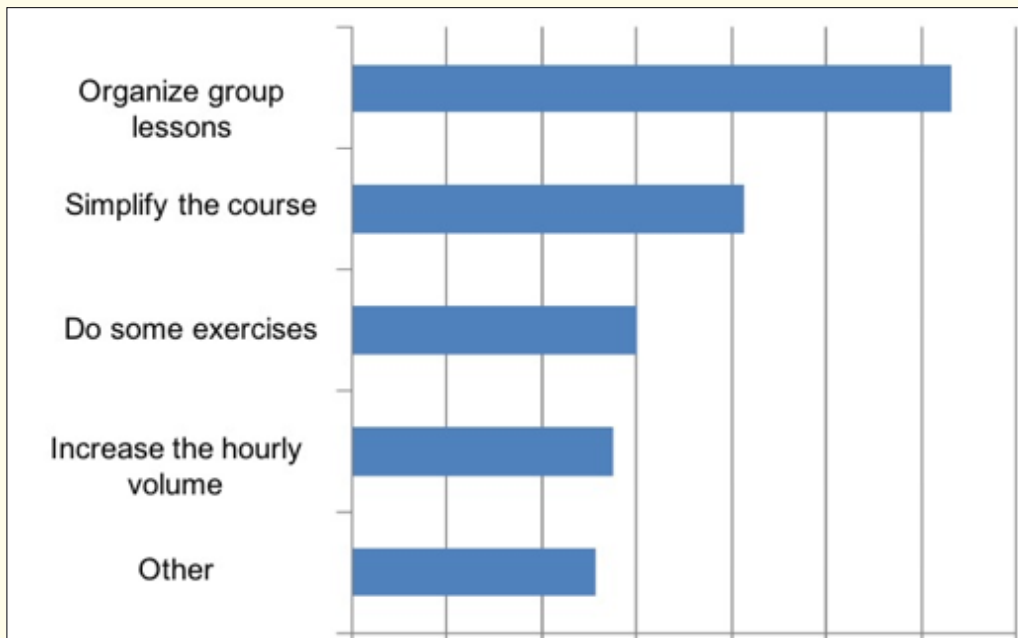


Figure 5: Proposals to improve the learning of the course.

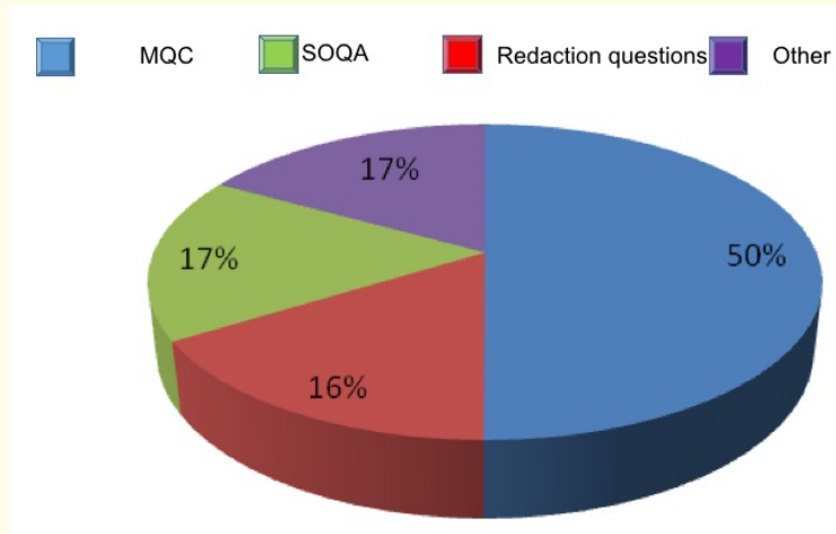


Figure 6: Proposals for evaluation tools.

Discussion

The results of the present study would certainly enrich the literature on blended learning and enhance students' perception of the learning environment. It would also have a positive impact on the course of growth and development, which constitutes prerequisite for the acquisition of foundations of orthodontics.

Assessment of this teaching experience has shown that students who attended this course regularly exceeded 79.4%. About 77.4% of the students felt that course goals and objectives were met. About 70% of the students indicated that the teacher defined and explained learning objectives at the beginning of the course. Only 58.8% of the students used the e-learning platform, 66.7% of whom found difficulties to assimilate the course online and 65.4% thought that interactive assessment was not sufficient. Only 41.9% of the students considered that a transfer from face-to-face instruction to online instruction is possible. Indeed, 53.8% of the students claimed that a teacher was required to provide explanations.

The data used in this study indicates that the face-to face instruction was popular among students compared to distance learning. Our results are in agreement with the findings of Dewhurst and Williams [18], Maki and Maki [19], Williams., *et al.* [20] and Julie., *et al* [21]. Yet, other studies found the opposite. Tvedten., *et al.* [22] and Holt., *et al.* [23] for example, conclude that there was no statistical evidence that one method teaching method was better than the other.

According to 70% of students, the large number of students attending the lectures (80%) could be explained by the fact that the Growth and Development course was very technical, and as such required explanation. In addition, the objectives and the way the different chapters of the course were articulated were also responsible for the large number of students attending the lectures. More than half of the students felt that the presentation of lectures facilitated assimilation of the content. They claimed that the teacher explained material clearly, and effectively directed and stimulated discussion. That a smaller number of students used e-learning platform was due to the fact that interactive formative assessment made available to them was deemed inadequate for two-thirds of students surveyed (65.4%). Indeed, Evans., *et al.* [24] demonstrated that carefully designed interface could significantly improve students' learning experience and the use of the tool among students compared to presenting content as Web pages consisting of pictures and text.

The results of the present study are consistent with previous research that suggested that the design of an interactive interface was a determining factor if distance learning was to be used as an alternative to traditional face-to-face instruction. Some researchers found that blended learning was equivalent or better than traditional face-to-face courses, and the interactive activities were more effective [25-29]. González, *et al.* 2010 reached the same conclusion; they found out that interactive exercises had direct effect on learning numerical operations related to biostatistics [30].

There are also many issues in connection with learning that are highly dependent off students and teacher for each form of delivery. For example, a group of students may be less receptive than another because they are experiencing e-learning for the first time [21].

Our results have showed that only 41.9% of participants the students were reluctant to move from learning in a face-to-face environment to blended learning. It is important to note that 66.7% of them had difficulty assimilating the course electronically and 53.8% considered that the presence of the teacher was required to provide explanations. Students who were less enthusiastic to learn in an on-line environment had a face-to-face classroom meeting every week. This face-to-face meeting with the teacher offered them a direct and interactive form of communication. Thus, the direct need to communicate with the teacher seemed satisfied. Put differently, the students seemed to have reduced the teaching materials made available to them through the use of the e-learning platform. The added value of the technical and the pedagogical teaching materials in terms of individualized learning was undervalued or ignored.

Indeed, coaching students is one of the key conditions for the success of blended learning. Being socially isolated, students need appropriate support to overcome distance. In this sense, the tutor is presented as a “resource person”. Lebel (1994) described the tutor as one who is ‘the intermediary found in classes where there is no teacher in direct contact with the students’ (p. 24). Olivier (1992) argued that tutoring would be “a response to the geographical dispersion, a response to the failures and dropouts and less commonly as a new definition of professionalism teacher’ [32]. Gillios, *et al.* (2012) carried out an evaluation of the educational reform at Grenoble Medical School, where the course was completely offered online. Exploring the potential of multiple-choice questions, they concluded that the advantage of offering a series of exercises in connection with tutoring was to provide feedback on students’ learning progress and their personal ranking. The study supported the observation that tutoring had a positive effect on student achievement and their learning process; students were enthusiastic and highly motivated. Tutoring involved time constraints and limited access to documents students usually face at the entrance exam. The authors showed that there was a positive correlation between students’ attendance of tutorials and their performance at first-year medical entrance exam [33]. Put differently, attendance was shown to have been beneficial in increasing students’ performance.

In the present study, the tutorial system was non-existent and as such it did not play any important role in the educational system. In fact, online content development and educational resources were carried out following a learning hybrid type scenario. The management scenario was limited to face-to-face instruction. Online interaction was limited to a few sessions, undertaken by the teacher in charge of discussion forums.

In terms of assessment, half of the students surveyed favored multiple-choice questions as a method of evaluation. This could be explained by the fact that almost 80% of students surveyed claimed to have attended the course, where different explanations were given by the teacher. Indeed, in a similar study, Garland (2010) compared e-learning with classroom instruction in infection control in a dental hygiene program. One of the consequences of Garland’s study was that students who attended the lectures scored higher in the multiple-choice examination than students who had an online course. Put differently, Garland’s study indicated a statistically significant difference between the two groups’ mean scores on the multiple-choice examination ($p = 0.011$) [34].

The present research was conducted to measure students’ perceptions of a blended course, composed of both web-based learning environment and face-to-face instruction. The first attempt to initiate an internet-based dental program was undertaken by the Dento-

Facial Orthopedics Department at the School of Dentistry in Casablanca, Morocco. Through this program, the Department of Dento-Facial Orthopedics aimed to develop and implement an interactive, student-centered, and internet-based program; its objective was to lead to changes in curriculum content as well as in methods of teaching and learning.

Evaluation of the use of the present hybrid program in dental education should impact the roles of both teachers and learners and pave the way to the emergence of new teaching and learning environments and methodologies. In other words, it should be used to help students and teachers meet the demands of student-centered learning. Blended learning should result in impacting teachers' attitude towards educational issues that are, most of the time, overlooked. The use of appropriate technologies should ensure more transparency towards curriculum design and development, the relationship with learners and modalities of evaluation.

The present study has both strengths and weaknesses. An assessment of the strengths and weaknesses will allow us to develop an action plan, tailored to meet the specific needs of our educational resources. Certainly, there is no fear that face-to-face teaching would cease to exist; but e-learning has positioned itself as an efficient alternative to face-to-face traditional classroom in orthodontics because of its limited available resources.

The overall results support the argument that this hybrid system can be reliably implemented; it is a highly valued experience by most students. However careful planning and analysis are necessary to gain the potential benefits. For example, establishing a tutorial system to encourage interaction with students, and using formative and interactive assessment to measure students' progress and understanding could encourage students to accept e-learning as an alternative medium of learning, and will be ready to have an online course delivered exclusively at a distance in the coming years. Another important point to highlight is that the successful implementation of blended learning depends on the segment of students catered for. Not all students have the adequate and right motivation to engage actively in learning. To this segment of students, blended learning is a weakness. Thus, motivation is critical; blended learning seems ideal as long as the learners are relatively motivated.

In sum, further research is needed to determine how both teachers and students make use of blended learning in their teaching and learning process. It is also important to note that a larger sample size is needed because the present study involved only 141 students compared to the whole population of dental students at the School of Dentistry, Hassan II University, Casablanca in Morocco.

Conclusion

The findings suggest that Moroccan dental schools were open to new innovative methods of learning. This The blended learning approach is an effective interactive teaching technique that shifts teaching from a teacher-centered to a more student-centered approach and encourages students to be fully deeply engage in the experience of learning.

Conflict of Interest

The authors have no conflict of interest to declare.

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