THE CONTRIBUTION AND EFFECTIVENESS OF BLENDED LEARNING TO THE TRAINING OF MEDICAL STUDENTS IN EMERGENCY CARE: LESSONS FROM THE MOROCCAN EXPERIENCE IN COVID 19 ERA.

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ABSTRACT

Introduction: Experimental medicine/BLS (basic life support) combined program has become mandatory for medical students since 2015 in all Moroccan universities since when introduced as a module for 2nd-year students, but Covid hitting the world in 2020 made it vital for Moroccan faculties to adapt the delivery of this course to their students. This paper aims to evaluate the efficacy of Blended learning adopted in the module of Experimental medicine/BLS combined program, regarded on the perception of the students enrolled in the training and their evaluation performance. **Methods & Materials:** This is a two-part observational prospective monocentric study. Second-year medical students studying in the faculty of medicine of Rabat, Morocco of the 2021/2022 class were the main subjects of this study. These students attended our newly implemented blended Experimental medicine and BLS combined module. **Results:** Of the 515 students that enrolled in the course, 335 have filled out the satisfaction survey, 62.7% of which are female (210) and the mean age was (19.6 ± 0.6) .Regarding their satisfaction with the blended-learning format of the BLS/Experimental medicine module, they enrolled in. 75.7% (N=253) were satisfied with the format. The BLS (basic life support) exam results of group A ranged between 12 and 20 with a mean of 14.7 (2.2). Group B's exam results ranged between 14 out of 20, with a mean of 16.6 out of 20 (2.7 SD). A Student T-test was used to compare groups A and B's exam results and concluded to significant improvement of 1.86 with a p-value < 0.001. **Conclusion:** The Blended learning format of teaching seems to be an effective way of course delivery.

Keywords: Blended learning, Covid 19, Emergency Care, Medical Education, Morocco.

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INTRODUCTION:

The blended Learning is a learning model that combines traditional face-to-face training with distance learning based on online courses. There is not "one" blended learning model but "several" models from which, the course designer can choose the face-to-face/remote mix that seems most relevant and adapted to the targeted training program [1]. It is certainly interesting to vary the learning formats, but what matters most is adapting them to the educational objective, the profile of learners and to the organizational context in order to improve the training outcome [2].

Cardiopulmonary resuscitation (CPR) is a lifesaving procedure that can potentially save many cardiac arrest patients. As of 2022, more than 356 000 out-of-hospital cardiac arrests (OHCA) occur annually in the United States alone with a fatality rate exceeding 90%, which makes cardiac arrests a public health crisis according to the latest statistics delivered by the American heart association (AHA) [3].

Considering the seriousness of this matter, literature has widely documented the importance of implementing CPR training for the larger populations in general and healthcare professionals specifically [4], as it has been established that CPR education could potentially save lives and enables the trainees to take part in the chain of survival by recognizing the first symptoms of cardiac arrests and starting compressions the earlier possible [5,6]. Thus, CPR training became almost mandatory in European and American schools, let alone medical schools [7, 8].

In contrast, most middle eastern and north African countries haven't implemented mandatory Basic life support (BLS) courses for the general population, making OHCA's fatality rates, probably higher [9], although no specific data on the matter has been found in the literature. In the event of an OHCA, immediately administered CPR can double or triple the patient's chances of survival [10]. In order to lower the fatality rate of sudden cardiac arrest, BLS courses must be taught to all, but first and foremost to medical students and future healthcare providers. To this matter, medical students

need to build strong know-how to deliver CPR to enhance their skills for future purposes [11].

The BLS course became mandatory in Moroccan medical schools since 2015, and the BLS module has been introduced to the 2nd year's medical curriculum nationally. The course consisted of theoretical lectures and workshops, which take place face to face at the university's labs and taught by professors or senior residents to large groups of medical students.

During the Covid Era, medical schools had to adapt to the new restrictions of social distancing and lockdown and had come up with innovative teaching methods to ensure the safety of all students [12,13]. In this matter, the faculty of medicine and pharmacy of Rabat, Morocco was no exception and conformed to the delivery of the module of Experimental Medicine and BLS combined module, destined to 2nd- year medical students, to the new teaching restrictions implemented during the Covid Era.

In this study, we aimed to develop a covid-Friendly module composed of online-delivered courses and simulation-based small-group BLS training (2020/2021 class) with the purpose of lowering exposure to the virus for both students and teachers, without impeding the course's learning outcome. The endpoint of this study was to prove the efficacy of blended learning and simulation-based learning in the delivery of experimental medicine and BLS curricula.

MATERIALS & METHODS

This study is a two-part observational prospective monocentric study. Second year medical students studying in the faculty of medicine of Rabat, attended our newly implemented blended experimental medicine and BLS combined module. The module, usually taught in-person consisted of teaching physio-pathological basics of some emergency situations such as cardiac arrest or airway obstruction and the theoretical course of basic life support. In 2020/2021, we adjusted the module into two parts. The first one was delivered online in 12 Hours, in the format of a 2-hours session each week. Then a BLS interactive workshop simulation-based unfolded in 1 hour by group. A total of 515 students were dispatched into 32 groups of 15 students in order to ensure the workshop's interactivity and respect for the Covid 19 restrictions.

During the workshop, students learned how to correctly perform CPR, how to relieve foreign-body airway obstruction, and how to ensure a lateral safety position on high-fidelity manikins.

Each group was exposed to standardized clinical situations, simulated on high-fidelity manikins. Each student had the chance to perform BLS with feedback from the course's mentor. After each clinical emergency simulated situation, the group actively participated in a debriefing session, going through the recommendations and the mistakes that occurred, while also highlighting the importance of soft skills, such as leadership, good communication, and

management of the bystanders. Data collection was done through online questionnaires which also contained information about the occurrence of symptoms of a Covid 19 infection within 2 weeks of the workshops and whether or not a PCR was done.

The assessment of the blended learning course consisted of two parts. The first part evaluated students' satisfaction through an online google forms survey, which was sent to the students at the end of the course. The survey evaluated, through 5 points Likert scale, the general satisfaction with the university's existing courses as well as the preferred teaching method. The student's satisfaction with the blended course's format, its content, the tutors' performance, and the general organization were also evaluated. The second part consisted of a comparative analysis of the students' academic performance at the BLS exam, between those who attended the blended class (Group B), and those from the previous year (2019/2020), who attended the exclusively in-person BLS class (Group A).

Excel (Microsoft Office) was used for data coding and Jamovi Version 2.2 for analysis. Descriptive statistics were used for categorical and quantitative data. Student tests were used for quantitative statistics and the average comparison between the two groups. $P < 0.05$ values were accepted as statistically significant.

RESULTS

Students' satisfaction

Of the 515 students who enrolled in the blended course, 335 filled the satisfaction survey, 62.7% of which were female (210) and the mean age was ($19.6 \pm 0,6$). Regarding the students' overall satisfaction with the classic teaching format used in the university, 52.2% (N=175) were satisfied or very satisfied. When asked about their preferred teaching method, 74.9% (N=251) preferred "simulation-based learning" and 59.7% (N=200) chose "blended learning", while only 10% (N=33) were more interested in in-person lectures.

When it comes to the blended-learning format they experienced within the BLS/Experimental medicine module, 75.7% (N=253) of the participating students were satisfied. However, they most enjoyed the simulation component (88%, 295), rather than the online lectures (47.1%, 158). When asked what they would improve in the online lectures, most of the students chose to work on the interaction of the session (45%, 153) and the quality of video delivery (60%, 201).

Regarding the content of the module, 93.7% (N= 314) were satisfied with the simulation mentors and 71.1% (N=248) appreciated the structure of the course, thinking that the goals were clear and precise (86.3%, 289). We also asked the students to self-appreciate their knowledge and skills after the course and 67.3% (N = 229) of them were content with their acquisition (**Table 1**).

Table 1: Students satisfaction of the BLS/Experimental medicine combined module

Item	(N, %)
The teaching method	
Satisfaction regarding the teaching methods delivered by the faculty	
Very satisfied	47 (14%)
Satisfied	128 (38.2%)
Neutral	114 (34%)
Unsatisfied	40 (11.9%)
Very unsatisfied	6 (1.8%)
Teaching method preference	
Blended learning	200 (59.7%)
Simulation-based teaching	251 (74.9%)
Didactic videos	98 (29.3%)
In-person lectures	33 (9.9%)
In which format, did you learn?	
Blended learning	245 (73.1%)
In-person simulation	203 (60.6%)
Didactic videos	33 (9.9%)
Online courses	311 (92.9%)
Overall satisfaction of the Blended CPR/Experimental module	
Very satisfied	153 (45.7%)
Satisfied	100 (29.9%)
Neutral	67 (20%)
Unsatisfied	9 (2.7%)
Very unsatisfied	6 (1.8%)
Overall appreciation of the online lectures	
Very satisfied	45 (13.4%)
Satisfied	113 (33.7%)
Neutral	116 (34.6%)
Unsatisfied	52 (15.5%)
Very unsatisfied	9 (2.7%)
The trainers & content	
Self-appreciation of knowledge/Skills after the course	
Very satisfied	57 (17%)
Satisfied	172 (51.3%)
Neutral	85 (25.4%)
Unsatisfied	21 (6.3%)
Very unsatisfied	0 (0%)
Appreciation of trainers' efficacy in knowledge transmission	
Very satisfied	196 (58.5%)
Satisfied	118 (35.2%)
Neutral	21 (6.3%)
Unsatisfied	0 (0%)
Very unsatisfied	0 (0%)
Appreciation of the course content structure	
Very satisfied	138 (41.2%)
Satisfied	100 (29.9%)
Neutral	88 (26.3%)
Unsatisfied	9 (2.7%)
Very unsatisfied	0 (0%)
Appreciation of the course goals (were they precise and clear?)	
Very satisfied	181 (54%)
Satisfied	108 (32.3%)
Neutral	43 (12.8%)
Unsatisfied	3 (0.9%)
Very unsatisfied	0 (0%)
Covid-Compliance of the module	
Was the course covid-friendly (respect of social distancing…)	
Yes	264 (78.8%)
No	71 (21.2%)
Respect of mask wearing	
Yes	317 (94.5%)
No	18 (5.4%)
Respect of group slicing	
Yes	303 (90.4%)
No	32 (9.6%)
Availability of Hand sanitizers	
Yes	196 (58.8%)
No	139 (41.5%)
Incidence of Covid among students	

Did you present any covid related symptoms?	
Yes	6 (1.8%)
No	329 (98.2%)
If PCR realized, did you have a positive test?	
Yes	13 (3.9%)
No	322 (96.1%)
Were you vaccinated before the course?	
Yes	21 (6.9%)
No	284 (93.1%)

Covid compliance behavior

It was also important to assess the covid-compliance behavior as the whole initiative of innovating in the delivery of the BLS curriculum started from the need to adapt the classic teaching methods to Covid constraints. 78.8% of the students (N=264) found the course covid-friendly with respect to mask-wearing (94.5%, 317) and social distancing (90.4%, 303). Following the course, very few of the students presented symptoms of Covid (1.7%, 5) (fever, chills, cough, anosmia, agueusia, ...) ,09 students performed a PCR test for SARS Cov 2 and only 0,6% (N=2) of these tested positive. For COVID19 vaccination, 93.7% (N=313) reported having received a dose of vaccine prior to in-person simulation workshops with a one-month delay.

Students' academic performance

The performance of two classes' students (groups A and B) was compared. The mean age of both groups was comparable (mean 19.7, SD 0.6 for group A, mean 19.6, SD 0.6 for group B), and the female ratio was close in both groups as well (67%, 330 group A, versus 62.7%, 210 group B).

The BLS exam results of group A ranged between 12 and 20 out of 20, with a means of 14.7 +/-2.2. Group B's exam results ranged between 14 and 20 out of 20, with a means of 16.6 +/-2.7. A Student T-test was used to compare groups A and B's exam results, revealing a significant improvement of 1.86 with a p-value < 0.001.

DISCUSSION

This study has proved positive results supporting the efficacy of blended learning in the delivery of CPR training, whether was it, from the perceptions of the students or objectively based on their performance. Most students were satisfied with the course content and format. Significant improvement in the class' exam results compared to the previous class proved the importance of blended learning in knowledge acquisition. Several studies have discussed the contribution of blended learning as an educational approach, but no study has discussed its contribution to training medical students in emergency care in the COVID era in a developing country.

Moon and Hyun proved similar results regarding the efficacy of blended learning in the delivery of CPR training when comparing a group of students who were exposed to blended learning and another control group. Their course included videos and in-person lectures that were significantly effective in improving nursing students' knowledge and attitudes regarding CPR accomplishment (intervention: 16.40 ± 1.56, control: 6.46 ± 2, $p < .001$) [14]. The superiority of the blended learning method in our study with regard to the classic method (in-person lectures) could be explained by the introduction of the simulation course as it has provided the trainee hands-on experience practicing CPR compressions. Indeed, many studies have shown that participants in educational programs without access to hands-on experience manifest poorer CPR skills performance. [15,16]. Furthermore, Baldi & al. have demonstrated that real-time visual feedback during CPR training can significantly improve the quality of CPR delivery [17]. And this is consistent with the bloom Taxonomy framework by which the application of knowledge is superior to the simple fact of remembering and understanding concepts [18]. The students taking part in our study share similar needs of having more practical teaching in their curriculum as almost half of them were unsatisfied with the regular methods adopted by the faculty (48.8%, 172). This highlights the need to introduce new methods for the new generations of students.

One of the few gains from Covid, was the urge to act and endorse some innovative teaching methods which were greeted by most students according to our study and many others [19], and this could be an interesting opportunity to disrupt the business-as-usual teaching in medical schools to add up technological advancements and innovative ways in the delivery of medical education. Adjusting the teaching methods and formats to the expectation of this generation of students and future doctors is a necessity in the upcoming years if we long for higher quality healthcare delivery. It is worth noticing that the next generation of doctors and patients is highly connected and except services that meet their lifestyles and way of thinking [20,21].

Covid-19 posed a real challenge to teachers worldwide, yet it inspired us all to think of more creative and efficient ways to teach. This was an opportunity to implement a modified version of our BLS course that ensures the safety of our students and teachers. 98.3% of students didn't present any covid symptoms during the week that followed the course. The present study has some limitations. Firstly, its monocentric design could be a

selection bias, making the results non representative for the rest of medical faculties in Morocco. But considering that the pedagogical goals of BLS module and its structure are the same nationally, and that access to medical studies is standardized in Morocco for all high school graduates, our sample is comparable to the other Moroccan medical faculties' second year students. Secondly, the satisfaction survey was filled by 335 students with a 65% response rate. The survey was sent online to all participants, but the response time varied between participants. Late responders may tend to forget details of the experience which might influence their overall satisfaction rating. But considering that the time between the first response and the last was a week, this influence is probably small. Finally, the module exam was different between the two classes (groups A and B), which might cause a comparison bias. However, both exams followed the same pedagogical specifications and were delivered by the same teachers, which ensured comparable exams between the classes. In addition, the examination consisted of written multiple-choice questions that assessed students' knowledge of basic life support. No skills assessment was included in the exam. Our results therefore mainly reflect the retention of knowledge after a blended BLS course.

Further assessment of BLS students' skills (3rd and 4th level of the Kirkpatrik scale [22]) is needed to determine the quality and retention of skills after the course and also exploring the gap between knowledge acquisition and real-life practice of the emergency tools and skill-set, especially BLS for medical students.

CONCLUSION

The Blended learning format of teaching seems to be an effective way of course delivery. It enhances the knowledge-acquisition of the participants, which represents an invitation to generalize this method to other courses and modules of the medical education curriculum in Morocco.

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