

Standard vs mass training in basic life support and defibrillation: a prospective analysis among Italian high school students within a municipal project

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Abstract

Italian Law No. 116/2021 highlights the necessity of Basic Life Support (BLS) education in schools, especially for secondary school students. This study assessed the efficacy of two Basic Life Support

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and Defibrillation (BLSD) training models — standard teaching method (SE) and Mass teaching Method (ME) — focusing on student satisfaction and skill retention. Between January 2023 and April 2024, high school students attended either SE sessions (24 students per session) or ME sessions (100 students per session). Both groups completed a 5-hour course following Italian Resuscitation Council Guidelines with an instructor-student ratio of 1:6. Skill retention was assessed immediately and after four months; satisfaction was measured via the Likert scale. Among 1307 students, 899 completed the follow-up. ME students showed superior skill in environmental safety and compression frequency, while SE students excelled in hand placement. Satisfaction levels were high in both groups, with no significant differences, indicating both SE and ME methods were well received.

Introduction

Cardiopulmonary Resuscitation (CPR) is a critical skill that can significantly impact survival rates in Out-Of-Hospital Cardiac Arrest (OHCA) scenarios and reduce the damage caused by lack of cerebral oxygenation (anoxic brain injury). Early and effective CPR training, extended to as many individuals as possible, is essential for improving survival chances in these critical situations, especially considering that most cardiac arrests occur outside hospital settings. The importance of layperson training is also highlighted by legislation: Italian Law No. 116/2021 encourages the introduction of Basic Life Support (BLS) and Defibrillation (BLS-D) in schools, with particular attention to high school students.¹ This law recognizes the crucial role CPR can play in saving lives and assigns young people an important social contribution. Despite the existence of this legislation, the implementation of BLS and BLSD training in schools remains insufficient, limiting the potential benefits of this law.² The present study aims to evaluate the effectiveness of two different teaching methods for BLSD in secondary schools — “standard” and “mass” — in terms of student satisfaction and skill retention over time. The standard teaching method (SE) involves smaller classes with 24 students per session, allowing for more individualized theoretical instruction and greater interaction with instructors. Conversely, the mass teaching method (ME) includes larger groups of 100 students per session, potentially creating a more emotionally impactful and immersive learning environment.

Materials and Methods

The study was conducted over a 16-month period, from January 2023 to April 2024. High school students participated in both

standard (SE) and mass (ME) BLS courses. SE courses involved 24 students per event, while ME courses included 100 students per event. All students attended a 5-hour BLS course in accordance with the regulations of the Italian Resuscitation Council (IRC): students participated in a 1-hour interactive theoretical lesson, followed by small-group practical exercises on manikins. To register on the IRC platform, each student had to provide their personal data and authorize its processing through the digital system. Both teaching methods adhered to the IRC's recommended instructor-to-student ratio of 1:6, established after extensive discussions on effective transmission of practical skills in both small and large groups.³ Students were assessed on their BLS skills immediately after completing the course and again after four months (the evaluated skills are outlined in "Assessment Metrics").

Regarding the performance data collected four months after the course, each student provided written consent for data collection (anonymized) via a paper form that outlined the applicable Italian regulations and included the statement: "I declare that I have understood the purpose of the data collection and give my consent for their use to evaluate the progress of the BLS course and for research purposes."

Additionally, a satisfaction questionnaire was administered immediately post-course.

The ME method represented a highly impactful educational innovation: the venue used for participant registration, the theoretical lesson, and the final concluding session was a visually impressive auditorium typically used for large public events. Due to the unique nature of the mass event, a significant number of teachers, local political administrators, school authorities, and journalists were involved.

Student characteristics

A total of 1307 students (1207 SE / 100 ME) was included in the study, and 899 students (802 SE / 97 ME) took part to the followup. For SE, 21.4% of the students came from a Scientific High School and 19.3% from a Classical High School, who were not included in the study as they would not have been able to participate in the re-test phase, 22.7% from a Humanistic High School, 13.2% from a Technical Institute, and 23.4% from a Professional School. For ME there were 25.8% students from a Scientific High School, 23.9% from a Humanistic High School, 26.2% from a Technical Institute, and 24.1% from a Professional

School. All students were over 18 years old, and both genders were represented (418 males, 481 females). Teachers participating in this training are required to represent a balanced and equitable gender distribution. None of the students had ever previously participated in a course for BLS certification.

Assessment metrics

The metrics considered were: i) environmental safety assessment; ii) consciousness assessment; iii) frequency and accuracy of external chest compressions (ECC); iv) hand positioning in the center of the chest; v) a Likert scale questionnaire to assess overall satisfaction. A two-sample independent t-test was used to statistically analyze the results from the two samples, allowing for the comparison of means between the two populations (SE-ME).

Results

To obtain certification for Automated External Defibrillator (AED) use, the IRC regulations require all skill test items to be passed. Therefore, at the end of the initial training, 100% of candidates passed the skill test for all assessed items.

The follow-up evaluation results after four months, including skill retention and participant satisfaction, are detailed in Table 1, while student satisfaction ratings are presented in Table 2.

Significant differences were observed between the standard (SE) and mass (ME) teaching methods. Firstly, concerning environmental safety, ME students performed better, with 97.9% correctly executing the techniques, compared to 85.5% of SE students ($p < 0.001$).

Secondly, in assessing consciousness, ME students achieved a perfect score of 100%, significantly outperforming SE students, who scored 89.9% ($p < 0.0001$).

Regarding chest compression frequency, ME students consistently maintained correct compression rates at 97.9%, compared to 87.4% of SE students ($p = 0.001$). However, SE students demonstrated superior precision in hand positioning for compressions, with 91% achieving correct placement vs. 74.2% of ME students ($p < 0.001$). Overall satisfaction levels were uniformly high in both groups, with no statistically significant differences. This indicates that students in both SE and ME courses found the training

Table 1. Four-month rate of test passed according to teaching event.

Variable	Standard teaching method (n=802)	Mass teaching method (n=97)	p
Environmental safety	686 (85.5)	95 (97.9)	<0.001
Evaluation of the state of consciousness	721 (89.9)	97 (100)	<0.001
Aligns the victim and exposes his chest	742 (92.5)	87 (89.7)	0.32
Alert emergency services, send to AED	727 (90.6)	86 (88.7)	0.58
Start external chest compressions promptly	748 (93.3)	87 (89.7)	0.21
Correct position for CTEs	730 (91)	72 (74.2)	<0.001
Depth of CTEs	660 (82.3)	81 (83.5)	0.89
Rate of CTEs	701 (87.4)	95 (97.9)	0.001
Position and activate the AED - position the electrodes correctly	749 (93.4)	95 (97.9)	0.11
Guarantees safety	687 (85.7)	77 (79.4)	0.13
Delivers the shock promptly	694 (86.5)	80 (82.5)	0.28
Start CTE immediately after shock	724 (90.3)	85 (87.6)	0.37

satisfactory and useful, suggesting that both teaching methods are well received among secondary school students who expressed enthusiasm for the initiative, as highlighted in previous studies.⁴

Discussion

The data analyzed show that both standard and mass teaching methods effectively train high school students in BLS/D skills. However, the ME approach demonstrates a potential advantage in retaining specific skills.

Our findings suggest that the ME method may be more effective in imparting certain BLS/D competencies, such as environmental safety, consciousness assessment, and compression frequency. However, the SE method yielded better results in terms of hand placement precision. The ME group's superior performance in ensuring environmental safety during CPR may be due to the structured nature of group sessions in larger environments. The reinforcement provided by using large settings could lead to better

internalization of environmental safety as a prerequisite for effective aid. The perfect score achieved by the ME group in consciousness assessment suggests that larger training sessions better simulate real-world scenarios, helping students remember and apply these skills more effectively. The ME approach may include more peer interactions and practical examples, positively impacting the memorization of victim consciousness assessment. Maintaining the correct frequency of chest compressions is crucial for effective CPR. The ME group excelled in this area, possibly due to the rhythm set by instructors in a larger group context, making it easier for students to follow and replicate, aided by cues and suggestions emerging from group simulations. The SE group demonstrated better hand placement accuracy than those who participated in the ME. This finding warrants further investigation: the result may stem from prior BLS training (non-EAD certification) undertaken in a school or extracurricular setting (this aspect was not explored during participant enrollment), or it can be hypothesized that participation in the theoretical lesson within a smaller group may have led to greater attention to specific details, such as the correct hand

Table 2. Satisfaction according to teaching event.

Variable	Standard teaching method (n=802)	Mass teaching method (n=97)	p
Presentation of the course			0.15
Satisfied	768 (95.8)	89 (91.7)	
Indifferent	32 (4)	8 (8.2)	
BLS/D objectives			0.54
Satisfied	786 (98)	94 (96.9)	
Indifferent	14 (2)	3 (3.19)	
DP presentation			
Satisfied	770 (96)	89 (91.7)	
Indifferent	24 (3)	8 (8.3)	
AED technical presentation			1
Satisfied	787 (98.1)	96 (99)	
Indifferent	13 (1.6)	1 (1)	
Security algorithm			1
Satisfied	766 (95.5)	94 (96.9)	
Indifferent	32 (4)	3 (3.1)	
Clarity of sequence presentation			0.7
Satisfied	791 (98.6)	97 (100)	
Indifferent	9 (1.1)	-	
CTE station			0.43
Satisfied	784 (97.8)	94 (96.9)	
Indifferent	15 (1.9)	2 (2.1)	
Individual AED activation station			0.04
Satisfied	793 (98.9)	93 (95.9)	
Indifferent	9 (1.1)	4 (4.1)	
Sequence station with AED in another from place (for example in the garden)			0.14
Satisfied	753 (93.9)	90 (92.8)	
Indifferent	32 (4)	7 (7.2)	
The presence of the instructor			0.05
He made it easier	783 (97.6)	91 (93.8)	
He hindered	-	-	
Other	19 (2.4)	6 (6.2)	
The overall time available			0.06
Sufficient	769 (95.9)	98 (92.8)	
Insufficient	33 (4.1)	6 (6.2)	
I don't know	-	1 (1)	
Time for the practical part			0.04
Sufficient	771 (96.1)	90 (92.8)	
Insufficient	27 (3.4)	4 (4.1)	
I don't know	4 (0.5)	3 (3.1)	

positioning on the chest, although this remains an uninvestigated hypothesis. Specifically, as observed, there was no difference in the instructor-to-student ratio during practical training sessions.

High satisfaction levels in both groups indicate that students value the training regardless of class size. This demonstrates that BLS training content and delivery are effective in both formats, reinforcing the value of BLS education in secondary schools.

As noted, the ME course was held in a unique venue, with the presence of many teachers, local administrators, school authorities, and journalists. This may have influenced the level of attention maintained by each student throughout the morning, enhancing their retention of the BLS algorithm.

Several authors have described how learning experiences in emotionally impactful settings have concrete repercussions on learning and memory. For example, in 2017 Tyng *et al.* suggested that experiences during emotionally intense moments are more easily remembered over time: participation in an event that evokes emotions thus affects memory retention and experience processing.⁵

In the case of ME participation, which involves a large number of peers combined with the presence of numerous teachers, administrators, and journalists, the students are likely to have experienced a significant emotional impact. This emotional engagement may have contributed to improved long-term retention of the taught skills. However, this hypothesis remains a consideration of ours that would require further investigation for support.

We acknowledge that the discrepancies in sample size between the two groups represent an objective limitation of this study despite being accounted for in the statistical analysis. We believe that further research could help explore effective teaching methods and identify the optimal balance between the number of participants and the quality of instruction. Further investigation into the psychological and environmental factors contributing to the observed differences

in skill retention could also provide additional insights into optimizing BLS training programs in schools.

Conclusions

The analyzed results suggest that large-scale BLS training initiatives targeting students could be a valuable and effective strategy for improving public health outcomes and enhancing the quality of emergency training in schools.

A BLS training approach in secondary schools is, in any case, effective in maintaining skills over time.

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