HUMAN MEDIATION AND TECHNICAL-PROCEDURAL LEARNING: WHAT CANNOT BE REPLICATED BY SIMULATION. AN EXPLORATORY EX-POST STUDY OF A PEER-LED BLS COURSE IN LOWER SECONDARY SCHOOL

Maria Vincenza Pistillo[1]
Università di Bologna
maria.pistillo4@unibo.it

Double Blind Peer Review

Citation
Pistillo, M. V. (2026). Human mediation and technical-procedural learning: what cannot be replicated by simulation. An exploratory ex-post study of a peer-led BLS course in lower secondary school. *Italian Journal of Health Education, Sport and Inclusive Didactics*, *10*(4).
https://doi.org/10.32043/gsd.v10i4.1860

Doi: https://doi.org/10.32043/gsd.v10i4.1860

Copyright notice:
© 2026 The Author(s). This is an open access, peer-reviewed article published by Cares S.r.l. – REN Press and distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

renpress.it/index.php/gsdj
ISSN: 3103-5744

ABSTRACT
This paper presents an exploratory ex-post study of a Basic Life Support (BLS) course in lower secondary school, using instructor-led theory and peer-supported practice. Framed by the REN call 'Algorithmic Heartbeats', it takes algorithmic mediation as a context for examining relational dynamics in technical-procedural learning. Three months after the course, a questionnaire was given to 93 students in five Year 9 classes; one case was excluded, leaving n=92. Results show high recognition of the main BLS actions, with a specific difficulty regarding the rate of chest compressions. Students attach particular value to modelling, immediate feedback and correction during practice, rather than to the peer educator's age proximity. The study does not compare human and algorithmic mediation, but addresses the boundary between an affectively plausible response and a situated educational relationship, as BLS already incorporates an algorithmic device, the semi-automatic defibrillator.

KEYWORDS
Peer education; Basic Life Support; relational dynamics; technical-procedural learning; algorithmic mediation.

Received 2026-07-09
Accepted 2026-09-26
Published 2026-10-30

[1] The author is solely responsible for the entire manuscript.

1. Introduction

The growing prevalence of artificial intelligence in educational contexts has sparked a wide-ranging debate on the transformations in teaching practices and the relational dynamics that underpin them (Mustafa et al., 2024), making the issue of relational mediation in learning processes increasingly visible. According to Floridi (2014), the so-called fourth revolution does not merely introduce new tools, but reorganises the environment itself — the infosphere — within which individuals act, learn and interact. The issue of education cannot therefore be reduced to the acquisition of digital skills. Conversational systems, adaptive environments, generative AI tools and applications related to affective computing are redefining the nature of educational accessibility, feedback, personalisation and responsiveness. However, the effectiveness of these tools does not depend solely on their technical properties: a systematic review of intelligent tutoring systems in primary and secondary schools found overall positive effects on learning, though these were less pronounced when compared with non-intelligent forms of tutoring (Létourneau et al., 2025). In this context, it becomes necessary to examine not only what technology enables us to do, but also which aspects of the educational relationship are transformed, simulated, enhanced or rendered more problematic — and which, on the other hand, resist being delegated.

The REN call ‘Algorithmic Heartbeats: Affective Education in the Age of the Fourth Revolution’ (REN Journal, 2026) addresses precisely this transition, highlighting the transformation of relational dynamics in educational contexts and the shift from Digital Literacy (Gilster, 1997) — now understood not as a mere set of technical skills, but as an interweaving of technical, cognitive and socio-emotional dimensions (Ng, 2012) — to a broader concept of Digital Affective Literacy. The reference to artificial intelligence does not necessitate a

focus solely on AI-based devices: rather, it invites us to examine the conditions of affective and relational education in an era in which algorithmic mediation tends to reorganise the relationship between individuals, knowledge, feedback and learning environments.

This paper fits within this framework indirectly. The empirical subject is not an artificial intelligence system, but a school-based first-aid awareness course on *Basic Life Support* (BLS), delivered in lower secondary schools and characterised by a practical component conducted according to a peer-education model. The choice of a non-digital case study is deliberate: it allows us to isolate the relational functions that pupils recognise as relevant, and then to ask which of these can be simulated by algorithmic mediation and which require physical co-presence, situated correction and the assumption of responsibility for risk.

Within this framework, the study does not argue that human relationships are valued by students in opposition to artificial intelligence — a claim that the research could not substantiate — but puts forward a more limited proposition: in a peer-led BLS course, students value situated forms of human educational mediation, such as modelling, immediate correction and feedback during the practical exercise, when learning technical and practical procedures.

The case of BLS is particularly suited to this investigation because it is not purely declarative learning: it involves recognising an emergency, calling for help, performing manoeuvres, adhering to technical parameters and using devices such as the semi-automatic defibrillator. It is therefore a cognitive, procedural, bodily and relational process, and requires the learner not only to know which action is correct, but also to perceive the procedure as feasible in a simulated situation. Precisely because technique is an integral part of it, this approach helps to avoid a simplistic dichotomy between relationship and technology: the

question is not whether the relationship replaces technique, but how educational mediation supports the mastery of procedures and devices.

This paper presents the results of an ex-post survey conducted approximately three months after the end of the programme. The aim is not to assess the effectiveness of the intervention causally — in the absence of a pre-test, an immediate post-test and a control group — but to describe which procedural knowledge is still recognisable and which aspects of the practical experience with the peer educator are retrospectively associated by the students with learning and perceived confidence during practice.

2. Theoretical framework

2.1. Algorithmic mediation and relational dynamics

Reflection on artificial intelligence in education has progressively broadened its scope: from the analysis of tools, environments and systems supporting learning to a broader examination of the transformations in the educational experience (Mustafa et al., 2024). Within this framework, relational dynamics play a crucial role. Feedback, personalisation, emotional support, the perception of being supported, and the possibility of receiving timely guidance are not marginal aspects of learning; they influence the way in which the learner interprets the task, takes risks, and develops their readiness to act.

The concept of *affective computing* (Picard, 1997) has opened up a field of research into the relationship between computational systems and emotions, raising the question of how computers can recognise, express or influence affective states. In the field of education, however, this question encounters a tradition that predates AI and sheds light on its limitations. In this paper, '*education in affectivity*' does not refer to a curriculum that treats emotions as content, but rather to a focus on *the affective conditions* of the learning

relationship — security, trust, the ability to manage error, and a willingness to take risks — which enable a technical skill to be effectively mastered. In this sense, consistent with the tradition that views care as a relationship (Noddings, 2013) and recognises the emotional dimension as playing a constitutive, rather than an ancillary, role in educational processes (Boler, 1999; Zembylas, 2005), affectivity is not something added to technical knowledge, but rather what enables its acquisition: one learns to perform a difficult action when the context makes error tolerable and trial and error possible. From this perspective, the *educational relationship* is not an emotional shell surrounding content, but a condition through which knowledge becomes accessible and practicable. Whilst an increasing proportion of educational interaction may be mediated or simulated by digital systems, the crucial question is not whether the simulation is emotionally convincing, but what distinguishes a plausible response from a situated caring relationship, exposed to the other's body and to the responsibility for error.

From this perspective, it becomes crucial to ask in which contexts the presence of a human subject — bodily modelling, immediate feedback, situated correction — is perceived by students as a resource for learning, especially where learning involves the execution of a gesture and not merely the processing of information.

2.2. Peer education and learning through modelling

Peer education is a widely used form of intervention in school settings, particularly in health promotion programmes. The literature shows that peer-led interventions can take very different forms and that their effectiveness cannot be assumed across the board. Systematic reviews highlight variable results and emphasise the need to analyse not only whether a peer-led

intervention produces effects, but also through which mechanisms and under what conditions it may work (Dodd et al., 2022; Widnall et al., 2024).

A key element is what is known as *'peerness'*, that is, the perception of the peer educator as someone who is approachable, credible and relatable. However, closeness between peers is not sufficient in itself. It becomes pedagogically significant when it supports more specific processes: modelling, identification, shared language, a reduction in hierarchical distance, a willingness to seek clarification, and the perception of a less threatening environment. From this perspective, the peer educator is not simply a substitute for the teacher, but a mediator who can alter the relational quality of the learning setting.

In the case of technical and procedural learning, reference to Bandura's (1977) social learning theory is particularly useful. Observational learning and modelling are central processes when the learner must move from understanding a procedure to carrying it out. Watching another person perform an action, observing the sequence, receiving corrections and practising in a guided context can help to make the action more understandable and feasible. In the BLS programme, this dynamic appears particularly relevant: students must not only remember instructions, but also practise gestures, coordinate movements, use teaching aids and become familiar with a sequence of interventions.

The study by Kesici et al. (2021), which focuses on a peer-education model for BLS training among secondary school pupils, provides a specific reference point for this field. Although it differs in design and objectives from the present study, it demonstrates the relevance of the peer-led model in BLS training and confirms the value of learning approaches in which trained pupils take on a supportive role in facilitating their peers' practical learning.

2.3. BLS as situated technical-procedural learning

The European Resuscitation Council Guidelines 2025 on Adult Basic Life Support address the recognition of cardiac arrest, alerting the emergency services, chest compressions, rescue breaths, the use of an automated external defibrillator, safety considerations for rescuers, and CPR quality, which is embedded within the relevant sections (Smyth et al., 2025). These elements demonstrate that BLS is a multifaceted field of learning, in which knowledge, procedures and devices must be integrated.

The semi-automatic defibrillator is, after all, already an algorithmic device: the analysis of the heart rhythm and the decision on whether or not to recommend a shock are based on classification algorithms, which are currently the subject of research, including the use of machine learning techniques for the recognition of shockable rhythms (Figuera et al., 2016). The case of BLS therefore contains, within it, a concrete point of contact with algorithmic mediation: the student does not learn 'in opposition' to the technique, but learns to coordinate with a device that already incorporates computational logic. The question is therefore not whether the relationship replaces the technique, but how human educational mediation supports the mastery of technical procedures and devices, some of which are themselves algorithmic.

From an educational perspective, BLS can be defined as situated technical-procedural learning. It is technical because it concerns devices, parameters and protocols; it is procedural because it requires an ordered sequence of actions; it is situated because the procedure acquires meaning within a concrete scenario – even if simulated – in which a person may be in danger and other individuals must coordinate their actions.

In such a context, the relational dimension is not external to the technique. On the contrary, it can support the acquisition of the technique itself. The peer educator who demonstrates a manoeuvre, observes the student whilst they

practise and provides real-time corrections acts as a mediator between protocol and action. The relationship does not replace procedural knowledge, but makes it more accessible and more practicable.

3. Context and description of the intervention

The BLS first-aid awareness project was carried out at the Granarolo dell'Emilia Comprehensive School in the final months of 2025 and was aimed at all Year 9 classes in lower secondary school. All pupils in the classes involved took part, with the exception of those who were absent on the day of the training. According to the available project documentation, these pupils were not expected to take part in either the training session or the subsequent assessment.

The session was divided into two distinct parts. The first part, which was theoretical in nature, lasted 30 minutes and was led by a qualified instructor. During this phase, the pupils were introduced to recognising the most critical medical emergencies, with particular reference to cardiac arrest and airway obstruction. The criteria for activating the local emergency services by calling 112/118 were also presented, along with the basic principles of cardiopulmonary resuscitation.

The second part, which was practical in nature, was delivered using a peer education model. It was led by students from the Aldini-Valeriani Institute in Bologna who had already completed a curricular training course on BLS and who, on a voluntary basis, had chosen to take on the role of peer educators. Their selection was not random: the teacher-instructor in charge had assessed the candidates' motivation, availability and prerequisites in advance. Before entering the classrooms, the peer educators attended a preliminary briefing, during which their roles, the session's objectives, the communication

approaches to adopt with younger students and the safety protocols to be followed were clarified.

A total of 21 peer educators took part in the practical training, each responsible for a group of up to six pupils, giving a tutor-to-pupil ratio of approximately 1:6.

During the practical exercises, the peer educators worked with the Year 9 pupils in their small groups. The pupils were guided through the BLS procedure using manikins and training defibrillators. Training feedback was provided not only by the instructor but also by the peer educators themselves, who observed the manoeuvres being performed, highlighted the most common errors and offered immediate guidance to correct performance during the activity. The instructor maintained a supervisory role, stepping in to clarify any issues and to ensure the procedures were carried out correctly and safely.

The methodological choice to entrust the theoretical part to a qualified instructor and the practical part to slightly older students, selected and trained for the role of peer educators, is the defining feature of the project. This approach combines the technical and procedural assurance provided by the instructor's presence with the personal rapport characteristic of peer education.

4. Objectives and research questions

The study adopts a descriptive-exploratory approach. It does not aim to assess the causal effectiveness of the intervention, nor to compare peer education with other training methods. Instead, it aims to describe, approximately three months after the programme, which procedural knowledge relating to BLS is still recognisable and which aspects of the practical experience with the peer educator are retrospectively associated by the students with learning and perceived confidence.

The research questions are as follows.

RQ1. Approximately three months after the peer-led BLS programme, which actions in the intervention sequence do students recognise as correct in simulated emergency situations, and for which technical parameters is this recognition less consistent?

RQ2. Which aspects of the practical training with the peer educator do students retrospectively perceive as most useful for learning, and to what extent is this usefulness attributed to the peer's similar age rather than to their role as an operational facilitator (modelling, correction, guidance)?

RQ3. Which elements of the practical experience do students associate with a greater sense of confidence whilst practising the manoeuvres?

RQ4. How do students retrospectively reinterpret the relationship between the theoretical and practical components of the course?

RQ5. Which of the relational functions that students associate with learning and perceived confidence appear, in principle, to be attributable to forms of mediation that can be simulated, and which, by contrast, seem to presuppose physical co-presence, situated correction and the assumption of responsibility for risk?

The first four questions are empirical and descriptive in nature and are directly answered by the questionnaire data. The fifth is interpretative in nature: it is not resolved by measuring attitudes towards artificial intelligence — which the tool does not assess — but by arguing, on the basis of the relational functions identified empirically, which of these can be traced back to a simulable logic and which presuppose conditions that are difficult to delegate. In this sense, RQ5 links the study to the question — now made particularly visible by

algorithmic mediation — of the boundary between simulation and situated educational relationships.

5. Method

5.1. Research design

The research adopts an exploratory ex post design with deferred data collection. The questionnaire was administered between February and March 2026, approximately three months after the conclusion of the training programme. This approach allows us to analyse what, after a time interval, the students recognise as correct with regard to the BLS sequence and what they report having perceived as useful or reassuring in their practical experience with the peer educator.

The questionnaire was administered in paper form during school hours, in the classroom, under the supervision of a teacher responsible for the project. It was completed anonymously: the dataset contains no data identifying the students, who are referred to solely by a sequential number and their class. Participation in the training programme and the subsequent survey took place as part of the school's teaching activities, following the provision of information to and the obtaining of consent from parents in accordance with the procedures adopted by the school. The data were processed in aggregated form for research purposes only.

The study design has significant limitations. In the absence of a pre-intervention assessment, it is not possible to ascertain the students' initial level. In the absence of an immediate post-test, it is not possible to distinguish between initial learning and retention over time. In the absence of a control group, it is not possible to causally attribute the observed outcomes to peer education or to establish whether it is more effective than other teaching methods. The

design therefore allows for an exploratory description of recognisable procedural knowledge and retrospective perceptions, not a causal impact assessment.

5.2. Participants

A total of 93 pupils from five Year 9 classes in lower secondary school took part in the assessment. In the dataset, one case is noted as 'pupil not present at the training session but who used only the VR app'. Although this case was classified as a non-participant, it was nevertheless included in the data collection: its presence indicates a deviation in the administration conditions from those specified in the protocol, and this is the reason for its exclusion from the main analysis. The analytical sample therefore consists of 92 pupils. The distribution by class is shown in Table 1.

Table 1: Distribution of participants included in the analysis by class

Class	n	%
3A	18	19.6
3B	17	18.5
3C	21	22.8
3D	16	17.4
3E	20	21.7
Total	92	100.0

Excluding the noted case does not substantially alter the overall picture, but makes the analysis more consistent with the study design.

5.3. Tool

The instrument used is a questionnaire entitled 'BLS: how prepared do you feel?'. The introductory instructions specify that the questionnaire collects responses regarding the participants' experience of the BLS course undertaken a few months earlier. The questionnaire comprises ten questions.

The first seven questions are single-choice and ask students to indicate the most appropriate action in situations related to the BLS sequence. The items cover: assessing the safety of the scene and initial approach; organising roles in the presence of other peers; making a hands-free call to 112 and starting chest compressions; how to perform chest compressions; the correct rate of chest compressions; when it is appropriate to stop chest compressions; and the function of the semi-automatic external defibrillator (AED).

Questions 8 and 9 concern the practical training carried out with the peer educator and allow for multiple answers. Question 8 asks what helped the students learn the most during the practical exercises. The options relate to the fact that the peer educator was a student, the opportunity to watch the manoeuvres and receive corrections whilst practising, repetition, and an open-ended option. Question 9 asks what made students feel most confident whilst practising the manoeuvres. The options include the non-assessment nature of the activity, immediate corrections, the opportunity to see an example first, and an open-ended option.

Question 10 concerns the balance between the theoretical and practical parts of the course and allows respondents to select one or more statements. The options allow respondents to indicate whether the theory was useful as preparation for the practical session, whether it helped them understand the importance of the procedure whilst recognising that the practical session was more useful, or whether the practical session with the peer educator alone would have been sufficient.

5.4. Data analysis

The responses to the first seven questions were analysed by calculating frequencies and percentages of correct answers for each item. An overall procedural recognition score was also constructed, with one point awarded for

each correct answer, resulting in a score ranging from 0 to 7. This score was used solely for descriptive purposes, without any strong psychometric claims.

For questions 8, 9 and 10, given the option to select multiple answers, the frequencies and percentages of selection for each option were calculated out of the total number of participants included in the analysis. Open-ended responses were treated as qualitative elements to support the descriptive interpretation, without undertaking formalised thematic coding, given the small number of occurrences.

6. Results

6.1. Recognition of BLS procedural knowledge

Table 2 shows the percentages of correct answers for each of the first seven questions, calculated from the analytical sample of 92 students.

Table 2: Correct answers to the BLS procedural items

Item	Main content	Correct answers	% correct
D1	Scene safety and initial approach	89/92	96.7
D2	Organisation of roles within the group	91/92	98.9
D3	Hands-free call to 112 and start of chest compressions	89/92	96.7
D4	Method of performing chest compressions	69/92	75.0
D5	Correct compression rate	29/92	31.5
D6	Correct timing of compression pauses	89/92	96.7
D7	AED function	90/92	97.8

The results show a high level of recognition of most of the proposed procedural actions. The percentage of correct answers exceeds 96% in five out of seven items: securing the scene, organising roles, calling for emergency services whilst commencing chest compressions, stopping chest compressions only at specific times, and the function of the AED. The data suggests that,

approximately three months later, students broadly recognise the main operational decisions in the BLS sequence.

Two items showed lower results. Question 4, concerning the method of performing compressions, recorded 75.0% correct answers. Question 5, concerning the correct rate of compressions, recorded only 31.5% correct answers. This result highlights a specific issue: the numerical parameter of compression rate appears less firmly established than the more situational procedural decisions. Students seem to recognise with greater confidence what to do and how to organise the intervention, whilst showing greater uncertainty regarding a specific technical parameter.

The average overall score for the seven procedural questions is 5.93 out of 7, with a sample standard deviation of 0.85. The distribution of scores is shown in Table 3.

Table 3: Distribution of the overall procedural recognition score

Score out of 7	n	%
7	21	22.8
6	50	54.3
5	17	18.5
4	3	3.3
2	1	1.1

Overall, 71 out of 92 students, or 77.2 per cent, achieved at least six correct answers out of seven. The result is descriptively relevant, but must be interpreted with caution: it does not allow us to infer any learning gain nor to causally attribute the outcome to the programme, as no pre-intervention data or a control group are available.

The class averages are relatively close: 3A = 6.17; 3B = 6.06; 3C = 5.57; 3D = 6.06; 3E = 5.90. Class 3C has the lowest average, but the small sample size and

the lack of contextual information do not allow for robust interpretations of the differences between classes. The result appears to depend primarily on the item concerning the rate of compressions.

6.2. Aspects perceived as helpful for learning

Question 8 asked students what had helped them most in their learning during the practical sessions with the peer educator. The responses are shown in Table 4.

Table 4: Aspects perceived as useful for learning during practice with the peer educator

Option	n	%
Knowing that they were a student just like me	15	16.3
Watching how he performed the manoeuvres and receiving corrections whilst I was trying	82	89.1
Repeating the same things over and over again	9	9.8
Other	3	3.3

The most striking finding concerns the second option: 89.1% of students cited seeing the peer educator perform the manoeuvres and receiving corrections during the practical test as a useful element. The simple generational proximity, expressed by the option 'knowing that they were a student like me', was selected by 16.3% of respondents. This result suggests that the educational value of the peer educator does not lie primarily in mere age or academic similarity, but in their role as a practical facilitator: demonstrating, observing, correcting and guiding the performance.

The open-ended responses, although limited in number, reinforce this interpretation. Some students highlighted the ability to understand what to do in a similar situation, the calm demeanour of the peer educators and the fact that they explained things in a friendly manner. These elements indicate that

peer mediation is perceived as useful when it combines practical competence, clear communication and a reassuring attitude.

6.3. Perceived confidence during the manoeuvre practice

Question 9 asked what had made the students feel most confident whilst practising the manoeuvres. The results are shown in Table 5.

Table 5: Factors associated with perceived confidence during practical exercises

Option	n	%
Knowing that it was not a school assessment activity	20	21.7
Receiving immediate feedback from the peer educator whilst I was practising	56	60.9
Seeing an example demonstrated by the peer educator first	51	55.4
Other	5	5.4

Perceived confidence is associated primarily with immediate feedback and modelling. 60.9% of students cited the immediate feedback received from the peer educator, whilst 55.4% mentioned the opportunity to see an example first. A non-judgemental atmosphere was selected by 21.7% of respondents. Here too, the data suggests that the relevant relational dimension is not generic, but closely linked to practice: the example, feedback, observation and on-the-spot correction.

The open-ended responses add a further interpretative element. Some students stated that they felt more confident because it was not a real-life situation, because it was ‘just an example’, because the person was represented by a manikin, or because the corrections were provided ‘in a calm manner’. These elements show that perceived confidence stems from the interplay between a safe simulation, immediate feedback and a non-threatening relational atmosphere.

6.4. Relationship between theory and practice

Question 10 asked students to reflect on the course as a whole and to indicate which statement best described their experience. The results are shown in Table 6.

Table 6: Perception of the relationship between the theoretical and practical components

Option	n	%
The theoretical part was useful because I already had an idea of what to do during the practical sessions	33	35.9
The theory section helped me understand why the procedure is important, although the practical part was the most useful	59	64.1
I could have gone straight to the practical part, as simply watching and trying it out with the peer educator would have been enough	13	14.1
Other	2	2.2

The majority of students recognise the value of the theoretical part, particularly as a means of understanding the significance of the procedure. In fact, 64.1% selected the option stating that the theory helped them understand why the procedure is important, whilst still considering the practical part to be the most useful. 35.9% indicated that the theory was useful because it provided a preliminary idea of what to do during the practical session. Only 14.1% felt that the practical session with the peer educator would have been sufficient on its own.

This finding helps to avoid a simplistic interpretation of the programme as a dichotomy between theory and practice. Instead, the results suggest an integrated model: theory provides guidance and meaning; practice allows participants to observe, try things out and make corrections; the peer educator supports the transition from understanding to perceiving the action as feasible.

7. Discussion

The descriptive results paint a nuanced picture. Around three months after the course, students broadly recognise the main procedural steps of BLS, but a specific issue emerges regarding the rate of chest compressions – that is, a specific technical parameter. The difference is pedagogically significant: situational operational decisions are retained with greater consistency, whilst precise technical details remain more uncertain.

From an educational perspective, the data from questions 8 and 9 are the most significant. Students do not value the peer educator primarily because they are 'students like themselves', but because they demonstrate, correct and guide the performance: peer proximity is not sufficient in itself, and only gains value when it translates into practical guidance — modelling, immediate feedback, identification of errors, and real-time correction. This is an interpretation of peer education centred on mechanisms rather than on a generic assumption of its effectiveness. Perceived confidence follows the same logic: students report feeling more confident above all when they receive immediate corrections and when they can observe an example before trying it themselves, whilst a non-judgemental atmosphere is present but not exclusive. Confidence appears to be built into the relationship between action, feedback and safe practice — precisely the affective dimension which, in the terms introduced above (§2.1), makes a technical action something that can be mastered: not an emotional element added to knowledge, but the condition that enables the transition from information to action by reducing the uncertainty of trying.

These findings help to sharpen the connection with the call. What students associate with learning and perceived confidence is not age proximity as such — the statement 'knowing that they were a student like me' was selected by only 16.3 per cent — but a set of operational functions: seeing a model,

receiving corrections whilst trying, and making mistakes in a safe simulation. A recent systematic review of the pedagogical roles that AI assumes in teaching practices distinguishes, amongst other things, functions as an instructional partner and functions as an assessment partner (Shi & Choi, 2024). Several of the functions identified here can be traced back to roles that the literature attributes to AI systems in teaching practices — demonstrating an example, setting a pace, and flagging deviations from a parameter are all part of the instructional and assessment tasks that such systems can undertake (Shi & Choi, 2024).

More difficult to delegate, however, appear to be the correction of a bodily gesture whilst it is in progress, the ability to recognise the moment when a student hesitates, and the non-threatening atmosphere that arises from knowing one is accompanied by someone who takes responsibility for the outcome. The relevance to this discussion therefore lies not in asserting the superiority of humans, but in identifying which relational functions, within technical and physical learning, remain difficult to reduce to simulation.

The case is significant precisely because it concerns learning that is already highly technical — procedures, operational sequences, compression parameters, criteria for stopping, use of the AED — rather than an expressive or relational activity in the strict sense. It is in this context, where technique is fundamental, that students highlight the peer educator's example, immediate correction and the opportunity to practise in a safe environment as decisive factors.

The peer-led BLS programme can therefore be interpreted as a case of technical learning within a relational context: an approach that avoids two opposing oversimplifications — reducing learning to the mere possession of procedural information, on the one hand, and transforming it into a generic discourse on

affective education, on the other. Here, learning is simultaneously technical and procedural, as it concerns the correct use of equipment and sequences; physical, because it requires manoeuvres; relational and affective, because it involves observation, guidance and feedback, and brings into play feelings of security, fear of making mistakes and trust. The contribution to this call for papers lies in demonstrating that reflection on affective education in the age of AI can also include non-digital cases, provided they allow us to examine relational dynamics that are now made more visible by algorithmic mediation.

8. Limitations of the study

The study has significant limitations. The first concerns its ex post design. As no pre-intervention assessment was available, it is not possible to establish the students' initial level. Some may have had prior knowledge of BLS or first aid, as also suggested by an open-ended response in which one student stated they had already undertaken similar activities.

The second limitation concerns the absence of an immediate post-test. The assessment carried out approximately three months later allows us to observe what remains recognisable after a time interval, but does not enable us to distinguish between initial learning and retention over time. It is therefore not possible to reconstruct the learning trajectory.

The third limitation concerns the absence of a control group. The results do not allow us to determine whether peer-led training produced better outcomes than training delivered entirely by adults, healthcare instructors, teachers, digital tools or simulation environments.

The fourth limitation concerns the nature of the assessment tool. The first seven questions measure the ability to identify the correct answer from a set of options, not practical performance. Operational competence in BLS would

require direct observation, performance checklists, measurement of the rate and depth of compressions, assessment of correct interaction with the AED, and analysis of group coordination.

The fifth limitation concerns the items on perceptions. Retrospective responses may be influenced by selective memory, social desirability, the salience of the experience and subsequent reconstructions. They should therefore be interpreted as self-reported perceptions, not as objective measures of training mechanisms.

The sixth limitation concerns the relationship with the REN call for papers. The study does not survey opinions on artificial intelligence, nor does it compare human intervention with algorithmic intervention. The reference to AI must therefore be understood as an interpretative framework and not as an empirical subject of the investigation.

Finally, the presence in the dataset of a case annotated as not having participated in the training – and excluded from the main analysis – suggests the need for a thorough verification of the inclusion criteria and the actual conditions of participation in the survey.

9. Conclusions

The study allows us to draw three main conclusions.

Firstly, approximately three months after the course, the students demonstrate a high level of familiarity with the main procedural steps of BLS. However, the difficulty regarding the rate of compressions indicates the need to reinforce the learning of specific technical parameters, for example through rhythmic repetition strategies, more explicit feedback and mnemonic aids.

Secondly, the peer educator is valued above all for their role in practical guidance: not merely generational similarity, but the opportunity to observe a

role model, practise, receive corrections and feel supported during the procedure. Peer education therefore appears to be more effective when designed not simply as ‘teaching amongst peers’, but as a structured framework for modelling and feedback.

Thirdly, relational dynamics remain relevant even in the learning of technical procedures and life-saving devices, some of which — such as the AED — are already algorithmic. This is the point of connection with the call. In the era of the Fourth Industrial Revolution, in which algorithmic mediation is redefining the forms of the educational relationship, the case of peer-led BLS does not serve to defend the human from technology, but to distinguish between what can be simulated and what requires co-presence, physicality and responsibility: the modelling of an action in context, the correction of an error as it occurs, and the creation of a context in which one feels safe to practise. Recognising these functions as central is essential for designing an integration of human and algorithmic mediation that does not confuse the plausibility of a response with a situated caring relationship.

This approach is therefore not presented as an alternative to technology nor as a critique of AI, but as a case study that allows us to examine, by contrast, what remains pedagogically central even as technologies become more sophisticated: contexts in which students can observe a model, practise, receive feedback and feel sufficiently confident to transform a procedure into a feasible action.

Future studies may verify whether the relational functions reported here by the students correspond to actual learning of the procedure. A design involving pre- and post-intervention assessments, combined with direct observation of performance (checklists, compression parameters, interaction with the AED), would make it possible to distinguish retrospective perception from the actual

outcome of learning, whilst a control group would help establish whether peer-to-peer mediation produces different results from other training methods, including those supported by digital tools. It is precisely this latter comparison—which the present study was unable to address—that marks the point at which the question raised by the call—namely, what aspect of the educational relationship resists simulation—could shift from an interpretative query to the subject of empirical investigation.

References

Bandura, A. (1977). *Social learning theory*. Prentice Hall.

Boler, M. (1999). Feeling power: *Emotions and education*. Routledge.

Dodd, S., Widnall, E., Russell, A. E., Curtin, E. L., Simmonds, R., Limmer, M., & Kidger, J. (2022). School-based peer education interventions to improve health: A global systematic review of effectiveness. *BMC Public Health, 22,* Article 2247. https://doi.org/10.1186/s12889-022-14688-3

Figuera, C., Irusta, U., Morgado, E., Aramendi, E., Ayala, U., Wik, L., Kramer-Johansen, J., Eftestøl, T., & Alonso-Atienza, F. (2016). Machine learning techniques for the detection of shockable rhythms in automated external defibrillators. *PLOS ONE, 11*(7), Article e0159654. https://doi.org/10.1371/journal.pone.0159654

Floridi, L. (2014). *The fourth revolution: How the infosphere is reshaping human reality.* Oxford University Press.

Gilster, P. (1997). *Digital literacy*. Wiley.

Kesici, S., Bayrakci, Z., Birbilen, A. Z., Hanalioglu, D., Öztürk, Z., Teksam, Ö., Hüyüklü, İ., Durgu, E., & Bayrakci, B. (2021). Peer education model for basic life support training among high school children: A randomized trial. *Prehospital and Disaster Medicine, 36*(5), 553–560. https://doi.org/10.1017/S1049023X21000674

Létourneau, A., Deslandes Martineau, M., Charland, P., Karran, J. A., Boasen, J., & Léger, P. M. (2025). A systematic review of AI-driven intelligent tutoring systems (ITS) in K-12 education. *npj Science of Learning, 10*(1), Article 29. https://doi.org/10.1038/s41539-025-00320-7

Mustafa, M. Y., Tlili, A., Lampropoulos, G., Huang, R., Jandrić, P., Zhao, J., Salha, S., Xu, L., Panda, S., Kinshuk, López-Pernas, S., & Saqr, M. (2024). A systematic review of literature reviews on artificial intelligence in education (AIED): A roadmap to a future research agenda. *Smart Learning Environments, 11,* Article 59. https://doi.org/10.1186/s40561-024-00350-5

Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education, 59*(3), 1065–1078. https://doi.org/10.1016/j.compedu.2012.04.016

Noddings, N. (2013). *Caring: A relational approach to ethics and moral education* (2nd ed., updated). University of California Press.

Picard, R. W. (1997). *Affective computing*. MIT Press.

REN Journal. (2026). *Call for Papers 2026: Algorithmic Heartbeats. Affective Education in the Age of the Fourth Revolution*. Research Educational Network.

Shi, L., & Choi, I. (2024). A systematic review on artificial intelligence in supporting teaching practice: Application types, pedagogical roles, and technological characteristics. In X. Zhai & J. Krajcik (Eds.), *Uses of artificial intelligence in STEM education* (pp. 321–347). Oxford University Press. https://doi.org/10.1093/oso/9780198882077.003.0015

Smyth, M. A., van Goor, S., Malta Hansen, C., Fijačko, N., Kondo Nakagawa, N., Raffay, V., Ristagno, G., Rogers, J., Scquizzato, T., Smith, C. M., Spartinou, A., Keck, W., & Perkins, G. D. (2025). European Resuscitation Council guidelines 2025: Adult basic life support. *Resuscitation, 215,* Article 110771. https://doi.org/10.1016/j.resuscitation.2025.110771

Widnall, E., Dodd, S., Russell, A. E., Curtin, E., Simmonds, R., Limmer, M., & Kidger, J. (2024). *Mechanisms of school-based peer education interventions to improve young people's health literacy or health behaviours: A realist-informed systematic review. PLOS ONE, 19*(5), Article e0302431. https://doi.org/10.1371/journal.pone.0302431

Zembylas, M. (2005). *Teaching with emotion: A postmodern enactment.* Information Age Publishing.