Is peer tutoring beneficial in the context of school resuscitation training?

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Abstract

First year pupils at a Cardiff comprehensive school were trained in cardiopulmonary resuscitation, 106 by the teacher only and 137 by the teacher assisted by older pupils (peer tutoring). Scores in a multiple choice theory test and in practical skill assessment showed no significant difference between instruction methods, but boys taught by the teacher assisted by older pupils expressed less willingness to resuscitate in an emergency than girls instructed by either method ($P < 0.01$). Girls had higher scores in the multiple choice paper ($P < 0.025$) and in the skills assessment ($P < 0.01$). Those pupils who reported some prior knowledge of resuscitation techniques performed better during skill assessment than novice trainees ($P < 0.025$).

Introduction

Community cardiopulmonary resuscitation (CPR) schemes tend to attract white middle class volunteers (Cobb and Hallstrom, 1982; Marsden, 1988), and it has been recognized that rejection of preventive health services and health education often seems to be correlated with lower social class and increased morbidity and mortality. One method of reaching those most in need is to provide the service in ‘the place where people are’ (Scott-Samuel, 1980). Instruction in school as part of a core curriculum would require no voluntary commitment and would have the advantage of covering all social classes and ethnic groups, leading to the systematic training of all school students and eventually the entire population.

Currently life support is not a requirement of the UK national curriculum but is sometimes included by enthusiastic teachers, e.g. by biology teachers in association with the science curriculum or by physical education staff on an ad hoc basis. There is no consensus regarding the optimum age for instruction and teachers often fail to use a standard course. Furthermore, for some teachers it is several years since they have been trained in CPR, with the result that they may be passing on outdated techniques which do not conform to current European Resuscitation Council (ERC) guidelines (Basic Life Support Working Party of the European Resuscitation Council, 1992).

Countries other than the UK, e.g. Australia and the USA, have shown more enthusiasm for teaching life support skills to schoolchildren and in Norway instruction in rescue breathing has been compulsory in school since 1961 (Lind and Stovner, 1963). There is evidence from Australian studies that children as young as 11 and 12 can learn and retain life support techniques (Plotnikoff and Moore, 1989; Moore et al., 1992), and an American schools study has shown that the quality of performance is not dependent on the size or weight of the student (Vanderschmidt et al., 1975). A more detailed argument for CPR instruction in schools (Lester et al., 1994a), and the rationale for setting up Heartstart Schools as a part of Heartstart...
Cardiff and the Vale have been discussed elsewhere (Lester et al., 1994b). Following consultation with teachers, educationalists and psychologists, a Cardiff comprehensive school was asked to instruct their first year pupils (11-12 year olds) in life support techniques using two different teaching methods. Whilst it would be unlikely that a short course in CPR for children of this age would immediately produce competent life supporters, it could lay down a base of knowledge and skills which could be built upon throughout the school career.

Peer tutoring has been used in health-related subjects, particularly in sex education, substance misuse and smoking, but often without formal evaluation (Milburn, 1995). Interventions which have been evaluated include anti-smoking education in New York high schools, where fewer children tutored by peers began smoking compared with a control group (Botvin and Eng, 1982), and sex education in South West England, where peer leaders aged 16-17 were shown to be effective communicators with those aged 13-14 years (Phelps et al., 1994).

There has been no evaluation of peer tutoring in CPR for school children, which differs from theoretical health education in that it not only provides information as a basis for decision making, but teaches a motor skill with practical applications. CPR is therefore analogous to the usual classroom situation where peer tutoring has been shown to increase ‘engaged time’ (time spent making active academic responses), provide immediate error correction, and greater opportunities for help and encouragement (Greenwood et al., 1990). Greenwood reported that children receiving peer-mediated instruction had been shown by several studies to spend more time on learning related tasks than children instructed by the teacher only. These attributes of peer tutoring are applicable to CPR instruction, as faulty techniques can be corrected more promptly than would be possible in a class of up to 30 supervised by one teacher. Peer tutors can ensure that children continue to practice after achieving an adequate performance and it has been shown that over-training aids skill retention (McKenna and Glendon, 1985).

**Method**

The study took place in a suburban Cardiff comprehensive school, which serves two small council estates, an established ‘village’ area of private housing, a large new private housing development and a more affluent suburb to the north of the area. Of the 26 comprehensives in the county, this school is ranked seventh based on examination results.

Six teachers and 11 senior pupils aged 16 or over attended a 2 day CPR instructor’s course at the Centre for Applied Public Health Medicine. The school was then asked to teach half their first year pupils using a teacher alone and half using the teacher assisted by senior pupils. In the latter case the class was led by the teacher and practice was supervised by pupil instructors, whilst in the former pupils were paired for practical training and the teacher moved between pairs. The advice given to teachers was that pupils should be shown a short film on emergency life support produced by the British Heart Foundation (BHF), followed by 2 h of training in life support (split into two 1 h lessons), including ‘hands-on’ practice of CPR using a ‘Little Anne’ training manikin (Laerdal, Norway). Following skills instruction teachers were asked to spend at least one lesson discussing the ethics of CPR, possible dangers to the life supporter and the type of emergency where people of a similar age might be able to use their skills. To aid discussion teachers were provided with case reports where CPR had been or could have been used successfully. Equipment was loaned to the school by Heartstart and included the BHF video, a flip-chart, a torso with a light meter which would indicate whether or not CPR was being performed correctly (Laerdal) and sufficient Little Annes for pupils to share one between two.

After instruction pupils completed a 10-point multiple choice test on the theory of CPR, trainees were paired and carried out mutual peer assessment of practical skills, and finally were tested by a pupil or teacher instructor. Pupils were also randomly
sampled for assessment by a member of the research team. In all assessments the procedure observed was single rescuer CPR for adult cardiac arrest, marked according to ERC guidelines. An overall score for skills was calculated by allocating points for each component of a rescue attempt with 10 points for a satisfactory performance, 5 points for attempted but unsatisfactory and none if the component part was omitted: this score was converted to a percentage.

Following discussion of the issues surrounding the provision of CPR in an emergency, trainees completed an attitude assessment with questions on whether all who were capable should learn CPR, whether the trainee thought that they personally could use CPR to save a life, a Likert scale on which they were asked to indicate their willingness to provide life support to different categories of person and an open-ended question asking in what circumstances they would be unwilling to perform CPR. Pupils' overall willingness to respond in a medical emergency was calculated by allocating points to the expressed willingness to perform CPR for 13 different categories of person. Using the Likert scale ‘definitely would’ scored 10 points, ‘probably would’ 5 points, ‘probably would not’ 1 point and ‘definitely would not’ 0 points. The total was converted to a percentage score which was banded into four categories, i.e. less than 50% ‘unlikely to respond’, 50–69% ‘possibly would’, 70–89% ‘probably would’ and 90% or more ‘very probably would respond’.

### Results

Two hundred and forty three pupils were trained, 106 (four classes) by the teacher only and 137 (five classes) by teacher and pupils: numbers vary slightly throughout due to absences for some tests or insufficient time for the instructor to test every pupil. The mean number of pupils per class was 27 and all classes were mixed sex and mixed ability. There were 128 (53%) boys and 115 (47%) girls, and the ethnic mix was representative of South Glamorgan as a whole with 5.5% describing themselves as non-white, the majority of these being Indian or Pakistani. Only seven pupils had a first language other than English. Eighty-one (33%) claimed to have had some prior training in CPR, more than half of these having been instructed in scouts or guides. Other sources of instruction included sports and youth clubs, St John Ambulance, previous schools, parents and the media.

### Theory

After instruction 233 (96%) pupils completed the multiple choice test on the theory of CPR. Twenty (9%) had five questions or less correct, 82 (35%) six or seven correct and 131 (56%) eight or more. Most questions were answered well (Table I), but the weakest topics were those involving timing and the purpose of CPR. The majority of those who were mistaken on the purpose of CPR thought that it was to restart the heart rather than primarily to buy time until help arrives. Girls answered significantly more questions correctly than boys, with 72 (64%) having eight or more correct, compared with 59 (49%) boys ($P < 0.025$). The theory score was not effected by previous CPR knowledge or by the method of instruction (teacher alone versus teacher and senior pupil). There were 194 trainees (83% of theory tests) where the social class of their household’s main wage earner could be classified as manual or non-manual. Eighty (66%) of those from non-manual households answered eight or more questions correctly com-
pared with 35 (48%) from manual households ($P < 0.025$).

**CPR skills**

At the end of the final instruction lesson pupils were paired and asked to assess each other's CPR skills, using an 11-point check list including the approach to the casualty, assessment, summoning assistance and performance of CPR on a manikin. Table II shows that shouting for help following the establishment of unconsciousness had the highest non-performance rate, omitted by 56 (25%). Ventilations and compressions were attempted by 98% of those trained, but 27 (12%) did not ventilate correctly and 44 (19%) performed compressions poorly.

Of the 227 (93%) peer assessments completed 150 (66%) scored 90% or more. Once more girls had significantly higher scores than boys with 82 (76%) scoring 90% or more, compared with 68 (57%) boys ($P < 0.01$). Eighty-eight (69%) pupils taught by the teacher assisted by older pupils scored 90% or more, compared with 62 (62%) taught by the teacher only but this difference was not significant. Fifty-seven (78%) of those who had some knowledge of CPR prior to the present course scored 90% or more, compared with 82 (61%) of the novice trainees ($P < 0.025$). More girls (46, 43%) claimed prior knowledge of CPR than boys (35, 31%), which was just below significance ($P = 0.051$).

Table III shows marking for individual categories by co-trainees, instructors and researcher. Instructor assessment followed mutual assessment and for eight of the 11 components the percentages assessed as satisfactory are slightly higher in instructor assessments. The teachers and sixth form instructors assessed 204 (84%) pupils and these assessments produced similar results to those of mutual assessment, with 80 (81%) girls scoring 90% or more, compared with 60 (57%) boys ($P < 0.001$). However, the instructors' scoring showed no difference between the two teaching methods, nor between those with and without prior knowledge of CPR. There was no evidence of differences in marking criteria between teachers and senior pupils and there was cross-over marking between instructors and assessors, i.e. a pupil who was instructed by a teacher could be assessed by a senior pupil and vice versa. Scores from mutual peer assessment and from instructor assessment showed no significant differences between classes led by individual teachers and there were no significant social class differences in practical skills.

Thirty-eight pupils (16% of those taught and 19% of those assessed by instructors) were ran-
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Table IV. Likelihood of trainee providing life support in an emergency (n = 228)

<table>
<thead>
<tr>
<th>Likelihood of response</th>
<th>Method of instruction</th>
<th>Boys (n = 118)</th>
<th>Girls (n = 110)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teacher only</td>
<td>Teacher + older pupils</td>
<td>Teacher only</td>
</tr>
<tr>
<td></td>
<td>[N (%)]</td>
<td>[N (%)]</td>
<td>[N (%)]</td>
</tr>
<tr>
<td>Unlikely (&lt;50%)</td>
<td>11 (23)</td>
<td>19 (26)</td>
<td>6 (12)</td>
</tr>
<tr>
<td>Possibly (50–69%)</td>
<td>12 (25)</td>
<td>33 (48)</td>
<td>18 (35)</td>
</tr>
<tr>
<td>Probably (70–89%)</td>
<td>20 (43)</td>
<td>16 (22)</td>
<td>22 (45)</td>
</tr>
<tr>
<td>Very probably (&gt;89%)</td>
<td>4 (9)</td>
<td>3 (4)</td>
<td>4 (8)</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>71</td>
<td>50</td>
</tr>
</tbody>
</table>

Boys more willing when instructed by teacher only, P < 0.01. Girls no significant difference.

Domestically chosen for independent assessment by researchers. Scores were appreciably lower on independent assessment with only 12 (32%) scoring 90% or more. No differences in the scores by sex, method of instruction or previous knowledge of CPR were discernible from this small number, which was governed by the time which the school was able to allocate for independent testing.

There was no association between theoretical knowledge and performance skills when assessed by co-trainees, instructors or researcher.

Willingness to perform CPR

The 228 (94%) pupils who completed this questionnaire fell into the following categories: 40 (18%) unlikely to respond, 83 (36%) possibly would, 87 (38%) probably would and 18 (8%) very probably would. There was no correlation between willingness to respond and practical CPR skills. Girls expressed greater willingness to respond with 62 (56%) in the probably or very probably would respond categories, compared with only 43 (36%) boys (P < 0.01) and this seems to be partially attributable to the method of instruction. Table IV shows likelihood of response by sex and method of instruction. The boys expressed greater willingness to respond if instructed by the teacher only (P < 0.01) but there was no significant difference between teaching methods for the girls.

Of those who answered the question on whether they thought themselves capable of saving a life using CPR 79 (75%) girls believed that they would be capable compared with only 66 (55%) boys (P < 0.01). Those taught by the teacher only showed greater confidence with 73 (74%) who thought they were capable, compared with 72 (56%) in the teacher and pupil group (P < 0.01). However, despite the lack of confidence in some pupils, 216 (95%) of those who expressed an opinion thought that everyone should be taught CPR.

Pupils expressed reluctance to resuscitate those with unpleasant physical characteristics: 160 (69%) probably or definitely would not if vomit was present, 115 (49%) if the casualty was dirty and 120 (52%) if there was an unpleasant smell. These characteristics were reiterated in responses to the open-ended question. Other deterrents mentioned were bleeding in or around the mouth (54 respondents), serious injuries (33), situations dangerous to the rescuer (25), HIV-positive status (16), other known disease (11), being in a public place (14) or a casualty unknown to the life supporter (16).

Response to individual categories in this questionnaire showed that more than 80% would be willing to resuscitate a close family member. and, when questioned before CPR instruction, 48% of the children were aware of a relative who had a heart-related health problem or who had suffered a previous myocardial infarction (termed ‘heart attack’ in the children’s questionnaire). For 86 of these the relative named was a grandfather and for 25 a grandmother.


Discussion

Theoretical knowledge

Answers to theory questions showed that the weakest topics were those on timing of ventilations and compressions, but it could be argued that knowing the exact recommended rate per minute is of little practical value. The emphasis during instruction is on timing ventilations by watching the chest fall before re-inflating and timing compressions by rhythmic counting. Some children of this age find rates per minute a difficult concept, especially when, as with ventilations and compressions, the action described does not take place continuously for 1 min.

The third question with a low rate of correct answers was on the primary purpose of CPR. Perhaps it is not too serious a matter if life supporters are over-optimistic about what CPR can achieve, but a possible danger of the misguided belief that CPR is likely to restart the heart could be to deter the rescuer from promptly phoning for an ambulance. However, a study of the potential impact of emergency intervention in Glasgow reported that in 91% of witnessed cardiac arrests where CPR was not performed, the person was dead before a call for assistance was made (Fitzpatrick et al., 1992). Furthermore, a recent Swedish study reported that following a successful mass CPR training campaign, there had been no increase in the median interval between cardiac arrest and phoning the emergency number and that 76% of calls were made within 2 min of collapse (Ekstrom et al., 1994), thus demonstrating that knowledge of life support techniques does not delay summoning professional assistance.

Assessment of practical skills

Peer assessment may cause some reservations. As the children were unskilled assessors they may have been more likely to mark an action as correct which would not have been passed by a more experienced person. However, mutual peer assessment not only provided a source of information on performance but also reinforced learning by correction of errors using the check list. Most trainees were also formally assessed by instructors, but initially teachers were unsure if this would be possible in the time available. We believe that the similarity of scoring between peers and instructors validates mutual peer assessment, slightly higher scoring by instructors explained by preceding mutual assessment and correction of errors.

The reported errors in ventilation and compression indicate that more practice was needed, preferably with the Laerdal CPR Torso, which gives feedback via coloured lights for correct and incorrect performance. Failure to ventilate adequately is often caused by not maintaining an open airway, whilst compressions are often poor because the hands are incorrectly positioned on the sternum. The relatively high scores recorded during internal CPR skills assessment do not therefore imply that a rescue attempt by a pupil would have been successful, but merely demonstrate the proportion who performed as taught. However, in broad terms it can be expected that those with higher scores were more likely to succeed, though it would have been possible to obtain a high overall score even if ventilations and compressions were ineffective.

Pupils with a stated prior knowledge of CPR attained higher scores in their skills assessment, indicating that repeat instruction is beneficial. It is likely that previous training, together with earlier maturity contributed to the higher scores among girls. In this study it was not possible to determine the quality or duration of previous instruction from the many different sources stated, or the length of time elapsed in relation to the current course. Planned revision in school, working to a standardized curriculum with 'hands-on' practice is likely to enhance skills to an even greater extent. The benefits of retraining (Berden et al., 1993) and of practice (Moser and Coleman, 1992) are well documented.

Regarding the differences between the independent assessment and those of the instructors and pupils, it is possible that skills had actually deteriorated between the 'in house' assessment immediately after training and that of the researchers, even though this was carried out within a week of instruction, but the probability is that more rigorous
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standards were applied by the external assessors. It has been demonstrated that discrepancy exists between observational assessment and a recorded printout (Kalmhout et al., 1985) and a study by Kaye et al. (1991) has shown that instructors are more likely to rate their trainees as proficient than are independent researchers. A recent study of workplace CPR training also questioned the role of instructors as assessors and, using video-recording, demonstrated that instructors often overlooked errors in performance (Brennan and Braslow, 1995). Although we were aware of this potential problem when planning the study we believed that school teachers were more likely to be disinterested assessors. Teachers may not have achieved complete objectivity in overall marking, though they appeared to be impartial in individual assessments.

Children from manual households had lower scores in the theory test, but there were no social class differences in practical skills and this may encourage those wishing to train the public, particularly families of those at greatest risk in the lower socio-economic groups (Rose and Marmot, 1981; Townsend et al., 1988). The lack of association between theoretical knowledge and practical skills has been reported in previous studies of CPR training for lay people (Moser et al., 1990) and medical students (Fossel et al., 1983).

Attitude to CPR

Despite their skill deficiencies, 65% of this sample thought that they would be able to save a life using CPR and this level of belief is similar to that expressed by adults in other studies, who were more confident than their skills would justify (Kaye et al., 1991; Brennan and Braslow, 1995).

The children's degree of willingness to use their skills in an emergency situation probably reflects the emphasis both by Heartstart Cardiff and the Vale and by the teachers on the primacy of the rescuer's safety. Although many trainees expressed a reluctance to resuscitate those not known to them or with unpleasant characteristics, the majority would be willing for a close family member. However, a previous study has shown that lay people have performed emergency life support without hesitation when such characteristics are present, though some respondents stated that they had not been adequately prepared to deal with vomit (McCormack et al., 1989). Most sudden cardiac arrests occur outside hospital and more than 70% of these are in the patient's home (Litwin et al., 1987) so a family member is the most likely casualty to need resuscitation from a lay person.

Specific mention of HIV-positive status, linked to concern about blood around the mouth, showed that pupils were very aware of the danger of infection. Whilst it is very unlikely that transmission of HIV can occur via saliva (Cummins, 1989), it is acknowledged that the risk of infection increases if the rescuer has any cuts or lesions around the mouth or hands and makes contact with the casualty's blood. The risk remains small for HIV transmission but is greater for hepatitis B and the American Heart Association has included in its guidelines on training that courses 'should always include mouth to mask ventilation' (Editorial, 1992). There is no such recommendation for UK courses, as the most likely recipient of community CPR will be a person whose health status will be known to the rescuer.

This study has shown that children in the first year of secondary school are able to learn CPR and are willing to use their skills in emergencies, especially those involving family members. If annual revision takes place they should be proficient life supporters by the time they leave school. Peer tutoring is an effective method of training in CPR skills, but may have a detrimental effect on boys' confidence and willingness to use CPR in an emergency, when compared with instruction by teachers only.

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References


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