Self-efficacy and outcome expectancies of secondary school students in performing basic life support

Rico Dumcke, Niels Rahe-Meyer and Claas Wegner

ABSTRACT

Background: *Basic life support (BLS) is recommended to be a part of the health education curriculum in secondary schools to increase the bystander resuscitation rate in Europe. Bystander efforts in cardiac arrest can increase survival up to fourfold. Important determinants to change behaviour and encourage altruism stem from good self-efficacy and positive outcome expectations. This study aims to investigate improving these beliefs after providing BLS training to secondary school students.*

Methods: *A closed questionnaire was handed out to N = 365 secondary school students in North Rhine-Westphalia (Germany) before and after a BLS intervention of at least 90 minutes. Six-point rating scales for self-efficacy (9 items) and outcome expectancies (10 items) with two sub-dimensions each were specifically developed for BLS training. To review the 4-factorial design, a factor analysis was conducted. T-tests were performed to calculate time and gender-related differences.*

Results: *Self-efficacy increased after intervention, in general ($p < 0.001$), and for overcoming possible psychological and social barriers (both $p < 0.001$). Males and females equally stated higher self-efficacy values after training (both $p < 0.001$), but females were significantly more self-efficacious at t_1 ($p < 0.01$). The perception of positive outcome expectancies increased significantly from baseline to final test, whereas negative ones decreased ($p < 0.05$). Positive expectancies were higher for females than males ($p < 0.05$).*

Conclusion: *BLS training improves situational self-efficacy and outcome expectancies and those beliefs should be discussed in future BLS teaching concepts, especially regarding negative barriers.*

Keywords: *basic life support; health education; self-efficacy; cardiopulmonary resuscitation; outcome expectancies*

***The Journal of Health, Environment, & Education, 2021*; *13, 1-12.* doi: 10.18455/13001**

Introduction

In Germany, secondary schools usually do not have a specific subject dealing with diseases or a healthy lifestyle. A substantial proportion of health-related knowledge and activities is traditionally provided in biology and more practically in physical education (P.E.), as required by local curricula [1].

More than 350.000 individuals annually die in Germany from diseases related to the circulatory system, underlining a crucial health problem within modern societies [2]. Besides possible prevention measures, effective first aid is considered crucial when saving lives. An estimated 65,000 to 97,000 German cardiac arrests annually occur out of the hospital, with a 14% survival rate [3; 4]. Bystander cardiopulmonary resuscitation (CPR) was administered in only 40% of the cases in 2018 [4]. However, until professional help arrives, immediate first aid from bystanders has been shown to lead to at least a doubled chance of survival [5; 6; 7].

To encourage citizens to react to this emergency and start basic life support (BLS), an integration into regular secondary school education is highly recommended by medical initiatives worldwide [8; 9]. According to these initiatives, students should be educated several times within the scope of their school career by learning about medical causes, how to perform chest compressions and to use an Automatic External Defibrillator. This basic concept may be expanded upon by other first aid and health subjects.

The aim of this study is to assess the perceived competency (i.e. self-efficacy) and outcome expectancies of students who participate in cardiopulmonary resuscitation (CPR) trainings for laypersons. In the last

few decades, students' knowledge and practical performance were a part of many research projects [10]. However, an analysis of the "competency perception" and "associated thought on consequences" following Banduras (1997) "self-efficacy theory" [11; 12] is missing. Self-efficacy beliefs are predictors for behavioural change. These beliefs could indicate a prospective improvement in altruism and social responsibility.

Theoretical background

Self-efficacy and outcome expectancies are components of the self-efficacy theory (SET) and are a subset of the social-cognitive theory (SCT). Both were developed by the Canadian psychologist Albert Bandura [12; 13]. According to this psychological approach, self-efficacy and outcome expectancies are key determinants of our behaviour and for behavioural changes (Figure 1).

Self-efficacy

Bandura [13] described perceived self-efficacy as a main influencing factor of a person-environment interaction. Self-efficacy expectations are personal beliefs that strongly influence thinking, feelings, motivation, and action [13; 14]. They describe an individual's confidence to master new or difficult tasks based on their own capabilities [14]. Academic self-efficacy is, more than self-concept, considered as a multidimensional task- and domain-specific construct. Compared to self-concept, self-efficacy is less hierarchically organized, is prospective, predicts current abilities, and is strongly affected by hands-on activities [15; 16]. Academic situational self-efficacy is focused on specific tasks or challenges [14]. Highly self-effective students are confident in their ability to successfully solve a task, such as describing human circulation or voluntarily conducting CPR even if nobody else is willing to help. In education, self-efficacy can be promoted by the following four principles [13]: 1) mastery experiences, such as prior own experience with similar tasks; 2) vicarious experience, when observing other students or teachers; 3) social persuasions and positive feedback and 4) psychological state when interpreting their capabilities while comparing their situation-specific emotions [15].

With respect to CPR, evidence about self-efficacy is rare in this field as students are unlikely to have experience with the topic. Lukas et al. [17] reported increased self-efficacy after two hours of CPR training. However, sex-specific differences regarding specific school subjects have been inconsistently observed [18; 19]: For example, male students often show higher self-efficacy in mathematics or science, whereas females are more confident in self-regulatory assessments. With respect to confidence in first aid, men (especially helping women) have been shown to struggle with stereotypes (e.g. touching them inappropriately) and barriers (like possibly causing injuries because of their male strength) [20]. Female students are already shown as more effective multipliers in passing their knowledge on to others. Females are also more motivated to learn about CPR [21].

Outcome expectancies

Outcome expectancies are the second central construct of Bandura's self-efficacy theory (Figure 1). They are defined as the "believed consequences of a person's behaviour" [22]. More specifically, they describe the estimate of a person that a given behaviour will lead to certain outcomes [11]. According to Bandura, human behaviour is driven by forethought, reflecting a forward-directed planning. The construction of outcome expectancies out of observed

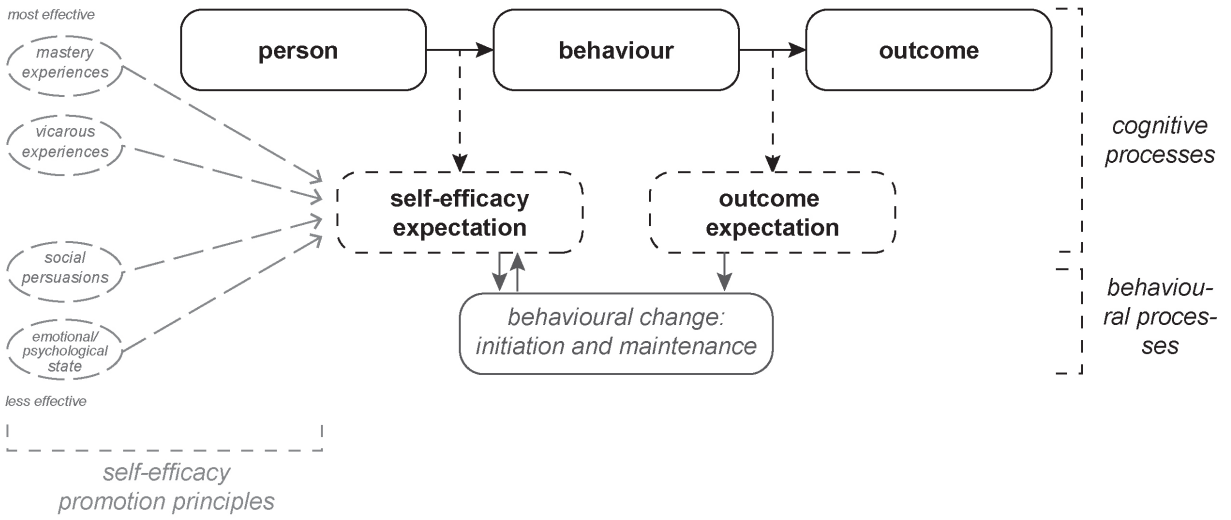

Figure 1. Outline of the difference between self-efficacy expectations and outcome expectations with principles for enhancing self-efficacy beliefs being named. According to [11; 38].

relations between environmental events and peoples' interaction is a part of forethought [22]. Self-efficacy as the perceived ability to perform a behaviour is clearly distinguished from outcome expectancies, which refer to estimated consequences ("what happens if I try…") [13].

Outcome expectancies may be organized along three dimensions: (a) valence, (b) temporal proximity and (c) area of consequences [22; 23]. Valences describe the expected quality of consequences, which can either be positive (beneficial) or negative (harmful). Temporal proximity is connected to long- or short-term consequences. It refers to the description of when people expect consequences to take effect. Area of consequences includes self-evaluative (affective) and physical outcomes, which can either be described positive or negative and long or short-term [23; 22]. There are no expected long-term and self-related physical consequences for the person providing first aid and emergency behaviour, as they are not directly physically affected and the circumstances are quickly over. Bandura states that self-efficacy causally influences outcome expectancies [13]. However, research has criticized this unidirectional pathway and has instead proposed a causal influence of outcome expectancies on self-efficacy beliefs [cf. 24]. Williams concluded that outcome expectations should be viewed as trivial reasons for (not) performing behaviour [24].

Prior research has not explicitly investigated expected outcomes of secondary school students when trained in first aid or BLS measures. Alternatively, some studies have examined fears and barriers of adult first aid course participants: The fear of causing injuries was major, followed by an uncertainty about one's skills and the fear to do something wrong [25; 26]. For males, the most common barrier was to touch the breast/be accused of violence [26]. Disgust, i.e. when the person looked like a drug user or vomited, was often reported [25].

Hypotheses

Self-efficacy and outcome expectancies are described as important predictors for human change processes. Therefore, we examined if the perception of these two beliefs is different after a BLS training (H1). Since we do not know how people categorize the information they receive during the intervention and practice, we assume either positive or negative development in outcome expectancies between baseline and final tests. However, positive and negative expectancies are expected to change in equal directions (H2).

H1 Situational self-efficacy increases from baseline (t_0) to after intervention (t_1), in general, and also for the subdomains (psychological and social challenges[1]).

H2 Specific outcome expectancies (positive and negative) differ from baseline (t_0) to after intervention (t_1).

By taking prior evidence of potential gender disparities in education-based resuscitation research into account [21], we analysed self-reported differences over time and between males and females (H3, H4). The following was hypothesized:

H3 After intervention (t_1), females and males show increased
a) self-efficacy (psychological and social challenges) and
b) positive outcome expectancies, as well as lower values for negative outcomes.

H4 Female students state higher self-reported beliefs (self-efficacy, outcome expectancies) than male participants.

Finally, we conducted an additional content-based, descriptive analysis to explore potential differences in the evaluation of the scale items before and after our intervention: "Does the intervention similarly affect all given items or specific ones"? (Figure 4).

Methods

Setting and test instrument

As part of a mixed-methods interventional design in secondary schools, student beliefs were assessed with a paper-pencil questionnaire.

Questionnaire data was collected between 5 and 10 days before and after the intervention. The intervention lasted at least 90 minutes dealing with basic CPR instruction and training for all participants. For intended later comparisons participating schools either choose to absolve the basic training or, if suitable to circumstances, additional lessons with extended knowledge and competency transfer (e.g. on biological and medical issues, such as the heart conduction system, basic methods of circulation diagnosis, and further first aid issues; see Figure 2). In this study, for a general analysis of the influence of the intervention on efficacy beliefs and of the test instrument, no distinction between the formats was made.[2]

The complete questionnaire was established specifically for this study, as no suitable instrument was available. Only students with parental signed infor-

1 For further explanation of the scale conception see methods section (Scale development).

2 In addition, data could not be collected in some age groups of the intervention formats because of the COVID-19 pandemic, so that comparative analyses were postponed.

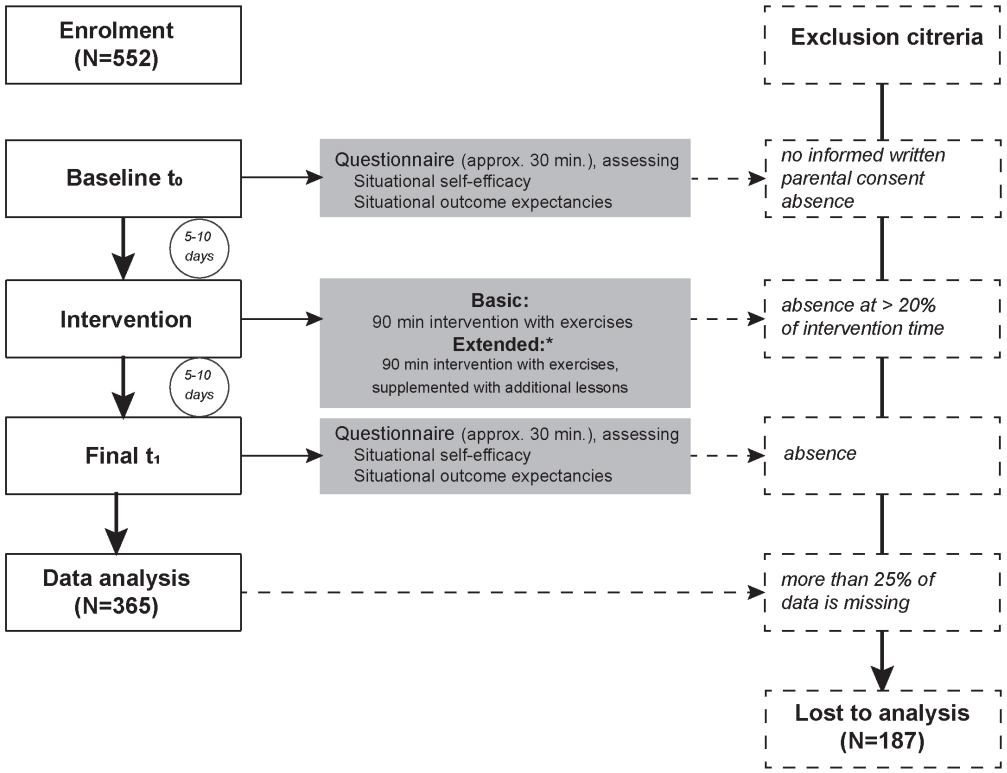

Figure 2. Study flow-chart with description of the intervention and exclusion criteria. Cf. for examples of additional content: [39].

med consent could participate. It contained an individual six-character code (identifier) for anonymization and consisted of four parts: (1) demographics and general information, (2) individual beliefs (33 items, like situational self-efficacy, outcome expectancies), (3) knowledge test (8 multiple-choice questions), (4) teaching quality assessment *(final test (t_1) only)*.

The students' class, age, biology and physical education grades, prior first aid activities and prior experience with cardiac arrest/CPR were assessed. Details of the used SET scales were given with the following scale's description.

Scale development and validation

This article focussed on the SET-relevant scales which are described in detail below and were applied to the context of BLS in the case of a cardiac arrest.

Situational self-efficacy is necessary to manage a cardiac arrest situation and successfully overcome potential barriers. Thus, we assumed a self-regulatory kind of efficacy to be required by individuals [11]. This efficacy does not address physical motor skills; it predominantly addresses the perceived capabilities to perform a certain behaviour in the context of competing demands or obstacles [11].

Therefore we derived our scale from an exercise self-efficacy which Bandura provided as a regulatory self-efficacy example. We used a "self-efficacy in sportive activities" scale developed from Fuchs and Schwarzer [27]. The original scale contained 12 items and states specific barriers to do sports. These are subdivided into mental state, social circumstances and external factors [27]. To adopt this scale to the first aid situation, modifications were made: (1) the originally assessed external factors (e.g. bad weather, favorite TV series) are negligible in a case of emergency so that only (2) mental (psychological) and social factors were chosen and extended as subscales according to prior evidence [26; 25]. Items in the psychological domain refer to fears or negative emotions, whereas social factors depict interactions between the respondent and others with competing demands (e.g. ignorance, obligations, critique). The scale resulted in eleven items, of which two items were eliminated due to low discriminatory power and scale consistency. The final scale incorporates 5 items in the psychological domain and 4 items in the social domain (Table 1).

The outcome expectancies scale was developed by the authors. According to missing prior empirical work, it was composed based on the theoretical SET framework as outlined above (cf. Theoretical background). We decided to capture short-term (according to the transient behavioural situation) value-

based (according to beneficial or inhibitory attitudes) outcome expectancies. The scale was subdivided into a positive and negative domain. Each domain represents self-evaluative and social components (see Table 1) because the focus on self-evaluative and interactive (i.e. social) areas refers to mental, self-reflexive thoughts on behaviour when performing CPR (cf. Theoretical background) [25]. Other investigations reported teamwork and responsibility considerations as important facilitators, thus depicting relevant social expectancies [28]. One positive and one negative item were eliminated due to insufficient psychometric characteristics. The final scale consists of 5 items in each sub-dimension.

Table 1: Mean values, standard deviation and corrected selectivity for the instruments' scales given for each subscale. N = 365. Square brackets indicate the "area of consequences" of outcome expectancy items.

Situational self-efficacy scale for the decision to initiate BLS/CPR[a,b]					
([27], in adoption, distinct modifications)		M (SD)		r_{itc}	
Total internal consistency: $\alpha(t_0) = 0.896$ / $(t_1) = 0.913$		t_0	t_1	t_0	t_1
subdomain: psychological challenges (PSY)[c]				**$\alpha(t_0) = 0.813$ / $(t_1) = 0.848$[d]**	
I'm sure I can perform CPR even if...					
p1	...I'm afraid of causing harm to the person.	3.07 (1.46)	3.64 (1.39)	0.50	0.68
p2	...I feel sad about the emergency.	3.21 (1.66)	3.92 (1.30)	0.57	0.68
p3	...I feel overwhelmed by the sudden emergency situation.	2.94 (1.32)	3.55 (1.26)	0.62	0.64
p4	...It disgusts me to have contact to or touch the person.	3.12 (1.58)	3.40 (1.49)	0.62	0.63
p5	...I don't feel that strong.	3.25 (1.58)	3.69 (1.35)	0.71	0.65
subdomain: social challenges (SOC)[c]				**$\alpha(t_0) = 0.849$ / $(t_1) = 0.863$[e]**	
I'm sure I can perform CPR even if...					
s1	...my companions urge me to move on.	3.58 (1.64)	4.08 (1.34)	0.69	0.74
s2	...I am late for an appointment and friends are waiting for me.	3.87 (1.72)	4.33 (1.30)	0.66	0.73
s3	...no one around me offers to help me voluntarily.	3.52 (1.46)	3.84 (1.31)	0.68	0.66
s4	...other people just continue walking by or do nothing.	3.82 (1.46)	4.04 (1.29)	0.71	0.72
specific outcome expectancy scale for BLS/CPR behaviour[a,c]					
(own development)		M (SD)		r_{itc}	
		t_0	t_1	t_0	t_1
subdomain: positive value (PS)				**$\alpha(t_0) = 0.655$ / $(t_1) = 0.841$[f]**	
ps1	If I personally intervene in an observed cardiac arrest, then I can encourage other people to help. *[social]*	3,89 (1.16)	3.98 (1.17)	0.46	0.64
ps2	If I do chest compressions, I significantly contribute to the chances of survival. *[evaluative]*	4,03 (1.10)	4.21 (1.20)	0.39	0.67

ps3	If I cooperate with other bystanders, I may help the person who is affected better than acting alone. *[social]*	4,01 (1.25)	4.09 (1.26)	0.45	0.65
ps4	If I just wait for the emergency medical services, it'll be too late. *[evaluative]*	3,62 (1.17)	4.18 (1.18)	0.32	0.60
ps5	If I assign tasks to the others around me, then I save important time in helping. *[social]*	3,44 (1.46)	3.88 (1.46)	0.43	0.68
subdomain: negative value (NG)				**$\alpha(t_0) = 0.552$ / $(t_1) = 0.618$[g]**	
		t_0	t_1	t_0	t_1
ng1	If I resuscitate someone, I can cause even more severe injuries. *[evaluative]*	2.40 (1.42)	2.05 (1.60)	0.36	0.40
ng2	If I have to do CPR, it requires too much physical strength. *[evaluative]*	1.95 (1.36)	2.50 (1.52)	0.30	0.34
ng3	If I do mouth-to-mouth during a resuscitation, then I seriously risk an infection. *[evaluative]*	2.60 (1.37)	2.58 (1.33)	0.32	0.36
ng4	When I start a resuscitation, other people will start to question me for it. *[social]*	2.01 (1.39)	2.07 (1.50)	0.24	0.32
ng5	If I perform CPR to someone, there's a lot I can do wrong. *[evaluative]*	2.98 (1.35)	2.00 (1.44)	0.35	0.43

Abbreviations: α: Cronbachs alpha value; M: Mean value; SD: standard deviation; r_{itc}: corrected selectivity of the item.
Explanations:

[a] Item phrasing and response options were translated from the German questionnaire.
[b] Instruction: Now it's about evaluating how confident you feel in a situation where you have to resuscitate someone.
[c] Response options: 6-point rating-scale: 0-completely disagree – 5-fully agree
[d] $n(t_0) = 357$ / $n(t_1) = 362$
[e] $n(t_0) = 351$ / $n(t_1) = 354$
[f] $n(t_0) = 357$ / $n(t_1) = 359$
[g] $n(t_0) = 351$ / $n(t_1) = 352$

Table 2. Comparison of the model fit indices for the developed SET-BLS scales. The 4-factor model represents all four sub-dimensions of the self-efficacy scales (2 dimensions) and outcome expectancies (2 dimensions), whereas the model with two factors includes the complete scales. The one factorial analysis was applied as a control and items are not subdivided into any scales.

model fit[a,b]	**4-factor model**	**2-factor model**	**1-factor model**
X^2 (df)	256.660 (146)	349.739 (151)	448.134 (152)
p-value	< 0.001	< 0.001	< 0.001
X^2/df	1.758	2.316	2.948
CFI	0.93	0.86	0.80
TLI	0.91	0.85	0.77
RMSEA	**0.047**	**0.062**	**0.076**
p-value	0.686	0.004	<0.001
95%-CI	0.039-0.056	0.055-0.070	0.069-0.083
SRMR	**0.051**	**0.069**	**0.079**
rating	✓	×	×

[a] Estimation method: maximum likelihood estimation with robust standard errors (Huber-White) [MLR].
[b] n = 338.

Based on the developed four sub-dimensions of the two determinants "situational self-efficacy" and "specific outcome expectancies" of the SET-BLS scales, a factor analysis was conducted to confirm the anticipated theoretical structure. The 4-factorial design's fit indices were compared to (a) a 2-factorial model, which summarizes the scale sub-dimensions, and (b) a 1-factorial model, which does not distinguish between self-efficacy and outcome expectancy related items. The fit parameters are presented in Table 2. The four-factor model fit the data best, achieving a satisfactory model fit for root mean square of approximation = 0.047, p_{close} <0.05 and standardized root mean square residual = 0.051 [29]. Although the global chi-square test was significant (p <0.001), the test of difference (X^2/df) was within the cut-off values (1.76 < 2.50). Due to partial data inhomogeneity of variances and a relatively small sample size (n = 338) the significant chi-square test was rated of minor relevance for the model fit. The comparative fit index (0.93) was only slightly lower than recommended by Hu and Bentler [29]. The 4-factorial model was in total approved for further analysis.

213), the other participants equally were recruited from "Gesamtschule" and "Realschule" [3].

Seventyseven students (21.1%) previously participated in a first aid course and five participants reported that they performed CPR in the past (1.4%).

Statistics

Data was analysed with the Statistical package for the Social Sciences v.26 (SPSS 26). Demographics are given in proportions. SET scales were checked for reliability calculating Cronbach's alpha. To confirm scale structure, confirmatory factor analyses were conducted using the Lavaan2SPSS extension bundle with R 3.5.0. Covariances between the subscales were assumed and for cut-off criteria, Hu and Bentler (1999) were considered [29].

Differences between the baseline assessment (t_0) and final test (t_1) were calculated with paired t-test procedures. Differences between groups (e.g. gender) were assessed by calculating an independent t-test. Normal distribution was assumed in compliance with the central limit theorem (sample size per group

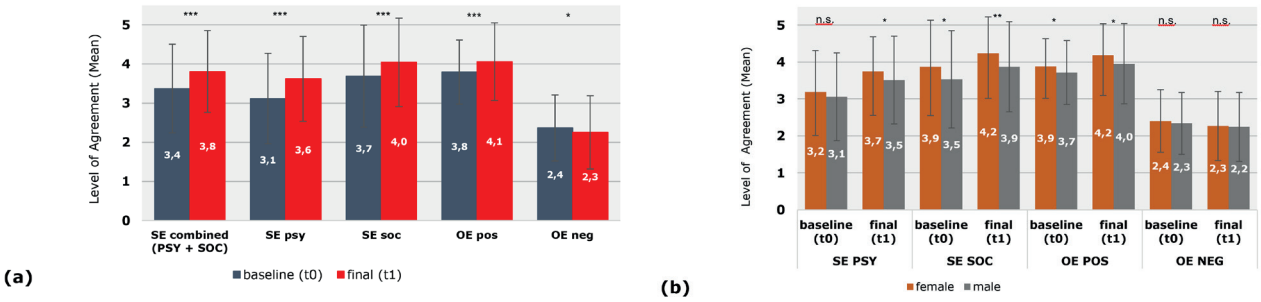

Figure 3. Comparisons over time (a) and between gender groups (b) for perceived self-efficacy and outcome experiences in BLS encouragement. (a) self-efficacy and outcome expectancy: combined self-efficacy (PSY+SOC) and all subdimensions. (b) between-group-testing of self-efficacy and outcome expectancy subdimensions at t_1 and t_2. Error bars indicate standard deviation. N = 365; N_{male} = 193; N_{female} = 172. *: p ≤ 0.05; **: p ≤ 0.01; ***: p ≤ 0.001.

Sample

In total, the data of N=365 participants (mean age = 13.67 years, SD = 1.46; 47.1%) fit the inclusion criteria. 52.9% were female (n = 193) and 47.1% were male, with no other stated gender. Participants were recruited from five schools in the region of Ostwestfalen-Lippe in Germany, distributed from grades 6 to 10 (age range: 11-16 years) and from three school types. Of the participants, 23% were 11-12 years old, whereas 64.9% were in grades 8 or 9 (age 13-15) and 12.1% in grade 10 of a "Gymnasium". Students from a "Gymnasium" were represented with 58.4% (n = n > 30) and observed using box plots, Q-Q-diagrams and histograms. All unpaired comparisons were interpreted using the Welch output independent from Levene-statistics [30]. According to the hypotheses, in the case of multiple comparisons of dependent variables, Bonferroni-Holm corrections were applied.

P-values ≤ .05 were considered statistically significant and effect size according to Cohen [31] was estimated to be small (d ≥ 0.2), medium (d ≥ 0.5) and great (d ≥ 0.8). For unidirectional hypotheses, one-sided p-values were reported.

3 German secondary schools cover an age range from 10 to 16 years. "Realschule" provides a lower secondary education from grades 5 to 10 (16 years). "Gesamtschule" offers lower and upper secondary level, with different education paths. "Gymnasium" is focused on an in-depth general education (qualification for higher education access).

Results

General comparison of SET-BLS scales

Overall, self-reported values improved for self-efficacy and outcome expectancies. A combined BLS self-efficacy score (mean values of all SE psy + SE soc items) increased significantly from baseline to final assessment ($t(364) = -7{,}701$; $p < 0.001$; $d = 0.396$). In detail, psychological challenges (PSY) were reported to be mastered less self-efficacious than social ones (SOC) (cf. Figure 3a), but with a significant difference before and after the intervention in both domains. Self-efficacy, if social reasons were specified as obstacles, on average increased from 3.7±1.30 (t_0) to 4.0±1,13 (t_1) ($t(364) = -5.38$; $p < 0.001$; $d = 0.289$). Regarding psychological barriers, participants stated they were 'somewhat efficacious' to cope with at t_1 ($t(364) = -8{,}43$; $p < 0.001$; $d = 0.445$; Figure 3a).

Outcome expectancies significantly differed from t_0 to t_1. For specified positive outcomes (POS), there were significantly higher values after intervention ($M_{t1} = 4.1±0.99$ vs. $M_{t0} = 3.8±0.82$; $t(364) = -5.621$; $p < 0.001$; $d = 0.291$). On average, negative outcomes (NEG) were expected less after the intervention, compared to baseline ($t(364) = 2.284$; $p = 0.023$; $d = 0.127$). However, this effect was just minimal (< 0.2) but nevertheless indicated a 'trend of improvement'.

SET scales: association to gender groups

Over time, situational self-efficacy in participating students is promoted by BLS education independent of gender affiliation. For both time points and scale domains, girls had higher efficacy values. However, for girls (comparing t_0 vs. t_1: $t_{PSY}(171) = -7.127$; $p < 0.001$; $d = 0.530$; $t_{SOC}(171) = -4.226$; $p < 0.001$; $d = 0.320$) as well as for boys ($t_{PSY}(192) = -5.120$; $p < 0.001$; $d = 0.380$; $t_{SOC}(192) = -3.500$; $p < 0.001$; $d = 0.269$), we found significantly higher efficacy values at the final testing point (t_1) compared to baseline. Considering effect sizes, this difference is more meaningful for female participants (small to medium effect size). In general, both males and females felt more self-effective in dealing with social challenges than with psychological ones, which was revealed as a trend for pre and post interventional ratings (Figure 3b) and reflects the general analysis (Figure 3a). Consistent with the lower increase of self-efficacy in social challenges (SOC) from t_0 to t_1, effect sizes are relatively low ($d_{female} = 0.320$ and $d_{male} = 0.269$, respectively).

To explore whether there exist gender differences as potential learning obstacles, between-group-comparisons were calculated. As Figure 3b illustrates, gender-related significant differences were identified, excluding negative outcome expectancies.

After the BLS intervention gender disparities primarily persisted as observed at baseline (t_0) (Figure 3b). However, at t_1 females had higher self-efficacy scores than males in both domains ($t_{PSY}(365.12) = 2{,}092$; $p = 0.019$; $d = 0.219$ and $t_{SOC}(359.61) = 3.174$; $p = 0.002$; $d = 0.333$). The difference regarding psychological SE became significant after intervention, which was nonsignificant before ($t(361.85) = 1.107$; $p = 0{,}135$). Outcome expectancies at t_1 were significantly higher in the female group (in contrast to the male one) for positive ($t(357.46) = 2.235$; $p = 0.026$; $d = 0.234$) but not for expected negative outcomes ($t(357.83) = 0.220$; $p = 0.413$) – which corresponds with the baseline assessment (Figure 3b).

Content-based analysis of the SET-BLS scales

We conducted an item-based descriptive comparison of subdimensions and time points to give us an impression of relevant factors within the scales (Figure 4).

All self-efficacy items improved regarding the students' agreement after the intervention. Prior to the intervention, students felt least self-efficacious to cope with their own feelings of being overwhelmed by the situation (item 3, cf. Table 1, Figure 4). Afterwards the average agreement for this item indicates improvement to react to these feelings. In contrast, a sense of disgust when touching a foreign body or providing mouth-to-mouth resuscitation (item 4, Figure 4) seems to remain for students: The increase between t_0 and t_1 was low, indicating an eminent mental barrier. With respect to social challenges, self-efficacy had the lowest values at t_0 and t_1 when participants perceived helplessness, i.e. if no one else is willing to assist the aide (item 3).

All items which operationalize positive outcome experiences gain more agreement at t_1. However, this improvement was low. The most notable increase was observed when understanding the time-sensitiveness of the emergency (item 4, Figure 4) and the benefit of encouraging others during a situation requiring BLS-measures (item 5). Similarly, negative expectations remained relatively stable over time. Noteworthy, the expectation of not having enough physical strength to perform CPR increased after intervention (item 2). However, the fear of doing something wrong decreased from t_0 to t_1 by one scale unit (item 5; $M = 2.95±1.4$ vs. $2.02±1.4$).

Discussion

This is the first study that shows a positive impact of BLS training in schools on student self-efficacy and outcome expectancies. The findings provide new insight and implications to better understand the perception of competency in secondary school students. As self-efficacy and outcome expectancies are essential conditions of bystander activity, we needed an evaluative tool to address it and assess these beliefs in BLS training (see the questionnaire; Table 1).

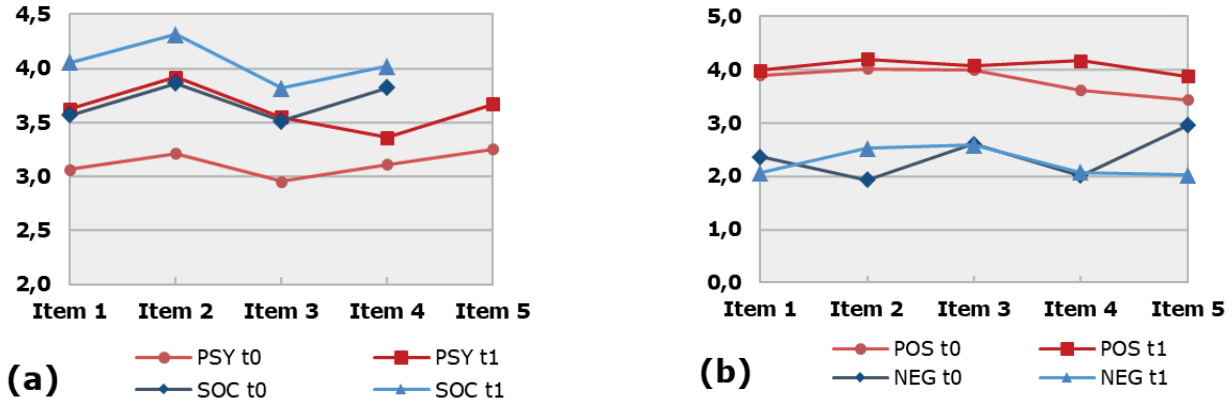

Figure 4. Item-based line-chart for the SET-BLS scale subdimensions. (a) self-efficacy at t_0/t_1; psychological dimension is red, social dimension blue. N = 359-365. (b) outcome expectancies at t_0/t_1. Positive consequences are red, negatives are blue. N = 359-364.

Students generally profit from BLS education of at least 90 minutes regarding their self-reported efficacy and outcome expectations. This intervention improves self-regulatory efficacy towards mental (psychological) and social obstacles (cf. H1, H2). Our results reveal self-efficacy barriers in identifying and approaching a cardiac arrest situation and they correspond with prior evaluations on BLS education reporting an increase in technical CPR competency or self-efficacy beliefs after BLS interventions already [32; 17]. Social obstacles were assessed as slightly less challenging by the participating students. This may be interpreted as a positive outcome of (parental) education and socialisation beforehand as well as the focus on partner work and the appeals to the importance of working together with others in our training. The effect of group dynamics, i.e. diffusion of responsibility [33] in young people may be relativized, thus enhancing decisiveness and assertiveness in such situations. However, items presenting negative role models (i.e. SE soc 3, 4; OE neg 4) changed little after intervention indicating that after a (single) sequence of lessons it is not sure, that participants now feel comfortable with handling others ignoring the situation or those who refrain from helping. These challenges remain serious concerns to (student) bystanders during first aid.

Our results indicate that mental (psychological) barriers are harder to deal with than social ones. As these concerns might be connected to either a remained uncertainty in first aid measures or long-time misconceptions, they probably are firmly anchored in human behaviour conceptions. Recent analyses showed that the fear of doing harm, acting wrongly or being accused, all influence the decision to help [25; 26]. The persistence of these fears might be a potential reason as to why we observed self-efficacy towards psychological challenges to be lower than towards social factors and why negative outcome experiences were relatively stable over time on a medium level. Although most students in this study did not perform mouth-to-mouth resuscitation, the fear of getting infected is similarly high after the training as it was before. This supports Kanstadt et al. [34], who report that 73% of study participants consent to an algorithm without ventilations. Of them, 46% stated the fear of catching an infection as reason [34]. Creating space and time to consider mental-emotional issues is recommended to improve behaviour after training [35].

In comparison to males, it is known that female students have a higher interest in human issues, first aid and medicine [36], higher achievements in self-regulatory efficacy [18] and also a higher motivation to learn and disseminate CPR skills [21]. Our results (cf. H3, H4) add similar evidence to these reports regarding higher BLS self-efficacy and positive outcome expectancy values of girls in this study: Female participants seem to be more open and feel more competent when deciding to help. In contrast Finke et al. [21] pointed out in their review on gender issues in BLS training that male students are more confident in performing CPR [21]. This male "performance efficacy" can be connected to the physical effort required to perform chest compressions which is regularly less achieved by girls [e.g. 37]. Generally, in our study self-reported sufficient strength is perceived more problematic after BLS lessons than before (see item 2 of the negative outcome expectancies). Since strength and quality of measures are interdependent, those reservations have to be adressed during the lessons. If so, students need alternative operating suggestions: That we observed a decrease in the fear to make mistakes and an improvement in the awareness of teamwork and communication is an important achievement for better efficacy.

This study has several limitations. The sample is restricted to a certain area in Germany with a medi-

um sample size, limiting its generalisation. For future research, more school types should be included with balanced proportions. The scale structure should be revalidated with a greater sample size. To analyse if age and intervention duration have an effect on the SET-BLS outcome, further comparative investigations should be conducted. Another limitation are the measured short-term effects of this study. It would be recommended in future research to also survey long-term effects by conducting a follow-up design.

Implications

This study first analysed students' BLS competency perception based on self-efficacy theory. BLS student training is effective in improving perceived capabilities and to restructure expected consequences to some extend. Based on our results, we recommend to: (a) continue step-wise approaches, focusing on compression-only concepts for young students to avoid establishing anxiety, (b) implement extra space and time to reflect on common self-efficacy barriers (cf. Table 1) and (c) recognize the different capabilities of male and female students, as males (in contrast to females) need more support to confidently approach an emergency rather than to treat it. We aim to both support students' theoretical knowledge and practical performance and include self-reported efficacy and outcome expectations into further research as well as in-course evaluations after a BLS training.

Acknowledgements

We would like to thank Vivienne Litzke for language editing and all participating schools and students.

This study was conducted within a project that has been financially supported by the 'Allgemeine Ortskrankenkasse' (AOK) Nordwest.

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Rico Dumcke, M.Ed. (corresponding author), Faculty of Biology, Biology Didactics, Bielefeld University
rico.dumcke@uni-bielefeld.de

Niels Rahe-Meyer, MD, MSc, PhD, Anesthesiology and Intensive Care Medicine , Franziskus Hospital Bielefeld
niels.rahe-meyer@franziskus.de

Claas Wegner, M.Ed., PhD, Faculty of Biology, Biology Didactics, Bielefeld University
claas.wegner@uni-bielefeld.de