

1 Promoting schoolchildren's self-esteem in physical education: Testing the  
2 effectiveness of a five-month teacher training

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4 Postprint

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21 To cite this article

22 Rubeli, B., Oswald, E., Conzelmann, A., Schmid, J., Valkanover, S. & Schmidt, M. (2020).  
23 Promoting schoolchildren's self-esteem in physical education: Testing the effectiveness  
24 of a five-month teacher training. *Physical Education and Sport Pedagogy*, 1-15.

25 <https://doi.org/10.1080/17408989.2020.1712348>

27

**Abstract**

28 **Background:** Schoolchildren's personality development is considered a central goal of  
29 physical education (PE) globally (Bailey, 2006). With regard to the close relationship between  
30 psychological well-being and global self-esteem over the life course (Trzesniewski et al.,  
31 2006), the promotion of positive self-esteem is an issue of particular significance. According  
32 to the "exercise and self-esteem model" (EXSEM; Sonstroem & Morgan, 1989; Sonstroem,  
33 Harlow, & Josephs, 1994), enhanced perceived sports competence leads to positive self-  
34 esteem development. Past research revealed that PE taught with an individualized teacher  
35 frame of reference (iTFR; Lüdtke et al., 2005) and a reflexive teaching style is associated with  
36 positive effects on different facets of children's perceived sports competence (Schmidt,  
37 Valkanover, Roebbers, & Conzelmann, 2013). However, it remains an open question whether  
38 this teaching style has the potential to promote positive self-esteem development.

39 **Purpose:** The present study investigated whether a five-month teacher training, aimed to  
40 enhance the teachers' iTFR and their reflexive teaching style in PE, has a positive effect on  
41 students' perceived sports competence and their global self-esteem. To analyse the  
42 implementation quality, changes in students' perceived iTFR and perceived reflexive teaching  
43 style were investigated.

44 **Method:** A total of 21 teachers were assigned to either an intervention group ( $n = 13$ ),  
45 receiving the five-month teacher training, or a control group ( $n = 8$ ) consisting of regular  
46 teaching without teacher training. The teacher training encompassed five three-hour  
47 consecutive sessions (15 hours in total) during which the teachers acquired theoretical and  
48 practical knowledge about the promotion of competence perceptions in PE with a reflexive  
49 teaching style and an iTFR. Between the sessions, the teachers were instructed to implement  
50 an iTFR and a reflexive teaching style into their own PE classes. To evaluate the effects of the  
51 teacher training, their students' ( $N = 315$ , 53.7% girls,  $M_{\text{age}} = 13.2$  y,  $SD_{\text{age}} = 1.3$  y) perceived  
52 teaching style (iTFR and reflexive teaching), perceived sports competence and global self-

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53 esteem were measured with paper-pencil questionnaires at three measurement points (pre,  
54 post and follow-up).

55 **Findings:** Linear mixed effect models showed that students of the intervention group reported  
56 an increase in their teachers' reflexive teaching style, but there were no changes with regard  
57 to iTFR. With regard to students' perceived sports competence and global self-esteem, there  
58 were significant interaction effects between time and group over a period of eight months  
59 (from pre-test to follow-up), indicating positive effects on these self-concept dimensions due  
60 to the teacher training.

61 **Conclusion:** In summary, the present study indicates that a long-term teacher training (5  
62 months) supports PE teachers to implement specific teaching styles with the aim to promote  
63 students' self-concept development. Furthermore, the findings lead to the assumption that a  
64 more pronounced iTFR in combination with an enhanced reflexive teaching style has the  
65 potential to positively influence schoolchildren's perceived sports competence and global  
66 self-esteem over a long-term period. The findings of the present study are valuable for PE  
67 teachers and for people working in the field of teacher education.

68 *Keywords:* self-worth, physical self-concept, individual teacher frame of reference, self-  
69 reflexion, teacher education

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**Introduction**

Global self-esteem, defined as overall feelings of self-worth (Harter, 2012), is consistently viewed as an important personality characteristic being closely linked to well-being throughout the life course (Trzesniewski et al., 2006). Individuals with high levels of global self-esteem are generally more satisfied with their lives (Moksnes & Espnes, 2013; Sowislo & Orth, 2013). Conversely, low global self-esteem is associated with various negative outcomes, such as increased substance abuse (Fisher, Zapolski, Sheehan, & Barnes-Najor, 2017) and delinquent behaviour (Farrington, Gaffney, & Ttofi, 2017). In view of empirical studies indicating a decline in self-esteem from childhood through adolescence (Robins & Trzesniewski, 2005; Schaffhauser, Allemand, & Schwarz, 2017), the development of positive global self-esteem in adolescence is regarded as a crucial developmental task and an important aim of PE (Bailey, 2006).

The general assumption that physical activity enhances children’s self-esteem is well recognised, with meta-analyses revealing a weak to moderate relationship (e.g. Ahn & Fedewa, 2011; Ekeland, Heian, & Hagen, 2005; Liu et al., 2015). However, based on the theory of a hierarchical structured self-concept (Shavelson et al., 1976), and according to the “exercise and self-esteem model” EXSEM (Sonstroem & Morgan, 1989; Sonstroem et al., 1994), physical activity does not affect global self-esteem directly, but indirectly mediated by perceived sports competence, encompassing competence perceptions in sports and games (Estevan & Barnett, 2018). The EXSEM describes the mechanism as a bottom-up process by which physical activity initially promotes physical self-efficacy, thus leading to an increase in perceived sports competence, and ultimately influencing global self-esteem. The mediational role of perceived sports competence has been reported for children (Slutzky & Simpkins, 2009), adolescents (Wagnsson, Lindwall, & Gustafsson, 2014) and adults (Fox, 2000; Levy & Ebbeck, 2005). Considering this, the specific promotion of perceived sports competence is considered an important factor in terms of self-esteem promotion in PE (Harter, 2012).

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96            Specific teaching styles are supposed to enhance schoolchildren's sense of competence  
97 (Edmunds, Ntoumanis, & Duda, 2008). According to Sedikides and Skowronski (1995),  
98 people derive knowledge about themselves from self-reflection, social comparison and  
99 reflected appraisal. Self-reflection means that individuals draw inferences about themselves  
100 by observing their own behaviour and abilities (Sedikides & Skowronski, 1995). With a  
101 reflexive teaching style, including methods such as documenting performance, asking  
102 questions that encourage self-reflections and providing opportunities for self-observation, the  
103 integration of individual competence perceptions into one's self-concept can be fostered  
104 (Magnaguagno et al., 2016; Schmidt et al., 2013). To evaluate one's abilities, individuals are  
105 assumed to compare their own ability with that of significant others (e.g. classmates) and use  
106 this social reference as a baseline for their self-evaluations (Sedikides & Skowronski, 1995).  
107 If students in PE compare their sports competence to that of more able students, a "negative  
108 social comparison effect" occurs (Chanal, Marsh, Sarrazin, & Bois, 2005; Margas, Fontayne,  
109 & Brunel, 2006). An individualized teacher frame of reference (iTFR; Lüdtke et al., 2005) is  
110 believed to counteract such "negative social comparison effects" and enhance students' self-  
111 perceptions (Lüdtke et al., 2005). Teachers with an iTFR prefer an individual instead of a  
112 social reference standard to evaluate students' performances (Rheinberg, 1980). Hence,  
113 teachers with an iTFR give positive feedback if students display intraindividual  
114 improvements, even if the students are underperforming (Lüdtke & Köller, 2002; Lüdtke et  
115 al., 2005). Hence, it is believed that an iTFR is linked to reflected appraisal (Sedikides &  
116 Skowronski, 1995), especially for underperforming students. It is therefore hypothesized that  
117 a reflexive teaching style and an iTFR trigger the three primary sources of self-knowledge;  
118 self-reflection, social comparison and reflected appraisal (Sedikides & Skowronski, 1995).  
119 This subsequently results in perceptions of competence and the fostering of positive global  
120 self-esteem.

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121 Two short-term interventions studies had already shown that PE taught with a reflexive  
122 teaching style and an iTFR promotes specific self-concept dimensions. Schmidt et al. (2013)  
123 investigated the effect of a 10-week PE-intervention on fifth-graders' self-concept. Teachers  
124 completed a half-day training programme instructing them in the basic principles, aims and  
125 purposes of the intervention programme and demonstrating the specific contents with teaching  
126 materials. Afterwards, the teachers were allocated to carry out both an endurance and a  
127 strength training programme in PE taught with a reflexive teaching style and an iTFR. After  
128 10 weeks, this specific intervention led to beneficial effects on self-concept of endurance and  
129 strength, whereas normal PE lessons (without intervention) had no effect (Schmidt et al.,  
130 2013). Whereas Schmidt et al. (2013) investigated effects on two facets of the self-concept,  
131 endurance and strength, Oswald, Schmidt, Valkanover and Conzelmann (2013) investigated  
132 the effect of such a kind of PE on perceived sports competence. Students who received this  
133 specific kind of PE over a period of 20 weeks displayed a more positive development of  
134 perceived sports competence compared to a control group (Oswald, Schmidt, Valkanover, &  
135 Conzelmann, 2013). The authors of both studies explained the absence of an effect on more  
136 global facets of the self-concept by referring to the relatively short intervention period. Based  
137 on the assumption that changes in global self-esteem are caused by previous changes in  
138 specific dimensions or facets (Harter, 2012; Shavelson et al., 1976), it has been argued that  
139 changes in global self-esteem need a number of competence perceptions on lower self-  
140 concept levels (e.g. perceived sports competence), which is likely to take longer than 10  
141 weeks to achieve (O'Mara, Marsh, Craven, & Debus, 2006; Reddon, Meyre, & Cairney,  
142 2017). In sum, there is evidence for the positive effects of iTFR and reflexive teaching style in  
143 PE on specific facets of the physical self-concept (e.g. sports competence, endurance,  
144 strength), but it is not clear whether such a kind of PE also enhances global self-esteem over a  
145 long-term period.

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146           Teacher trainings are considered an effective tool to sustainably support an iTFR and  
147 reflexive teaching style, however, the nature and quality of teacher trainings in PE received  
148 only limited attention in past research. According to Kyriakides, Creemers and Antoniou  
149 (2009), teaching behaviour and the quality of teaching is closely linked to student outcomes.  
150 Therefore, it is assumed that teachers need to implement an iTFR and a reflexive teaching  
151 style of high quality to achieve the intended effects on students' self-esteem. Teacher  
152 trainings help teachers acquire specific knowledge, ideas and methodological skills (Kealey,  
153 Peterson, Gaul, & Dinh, 2000). Magnaguagno et al. (2016) showed the importance of teacher  
154 trainings with regard to implementation quality of a reflexive teaching style. Teachers who  
155 received didactic materials and additional coaching during a 13-week PE-based intervention  
156 outperformed teachers who received only didactic materials. Although there is no specific  
157 literature about teacher trainings to promote an iTFR, the systematic review by Lander et al.  
158 (2017) focusing on characteristics of teacher trainings in school-based PE to improve  
159 fundamental movement skills and physical activity provides additional insights into relevant  
160 aspects of effective teacher trainings. According to Lander et al. (2017), teacher trainings are  
161 effective if the training programmes: (1) last more than one day, (2) are framed by a theory or  
162 model, (3) provide comprehensive subject and pedagogy content, (4) provide follow-up or  
163 ongoing support to the teachers, and (5) consider teacher satisfaction and fidelity. Thus, long-  
164 term teacher trainings, which consider these aspects, are believed to sustainably improve  
165 teacher's reflexive teaching style and iTFR in PE. This should promote individual competence  
166 perceptions what in turn might enhance students' global self-esteem.

167           The aim of the present study was to investigate long-term effects of a teacher training  
168 designed to promote an iTFR and reflexive teaching style in PE on primary schoolchildren's  
169 global self-esteem. Therefore, a longitudinal quasi-experimental study was conducted, with  
170 teachers in the intervention group participating in a five-month teacher training, and teachers  
171 in the control group receiving no training. Specifically, it is assumed that students from

172 teachers in the intervention group report an increase in iTFR and reflexive teaching style of  
173 their teacher. Consequently, the students in the intervention group are believed to display a  
174 more pronounced development of perceived sports competence and global self-esteem  
175 compared to the students in the control group.

## 176 **Method**

### 177 **Participants**

178 A total of 315 students and 21 PE teachers from 21 Swiss PE classes participated in this  
179 study. The teachers of the intervention group registered voluntarily to participate in the  
180 publicly announced teacher training. The announcement was made over the website of the  
181 Bernese University of Teacher Education. In addition, leaflets were handed out to increase the  
182 teachers' awareness of the training. The control group was acquired by contacting randomly  
183 selected PE teachers of fifth to ninth graders. The teacher sample consisted of 21 individuals  
184 ( $M_{\text{age}} = 37.6$  y,  $SD_{\text{age}} = 10.8$  y), with a higher proportion of women (57%) than men. This  
185 approximately matches the unequal gender distribution in primary and secondary school  
186 teachers in Switzerland. Their professional experience ranged from 0.5 to 28 years with a  
187 mean of  $M = 9.7$  years ( $SD = 8.0$ ). Thirteen teachers participated in the intervention group and  
188 eight teachers in the control group. The two groups did not differ with regard to sex ( $\chi^2 =$   
189  $0.27$ ,  $df = 1$ ,  $p = .604$ , Cramer's  $V = .11$ ), age ( $t(19) = -0.70$ ,  $p = .494$ ,  $d = 0.31$ ) and  
190 professional experience ( $t(19) = -0.49$ ,  $p = .628$ ,  $d = 0.22$ ). With regard to the sample of  
191 students ( $N = 315$ , 53.7% girls,  $M_{\text{age}} = 13.2$  y,  $SD_{\text{age}} = 1.3$  y), 200 individuals were part of the  
192 intervention group (62% girls,  $M_{\text{age}} = 13.2$ y,  $SD_{\text{age}} = 1.1$  y) and 115 of the control group (40%  
193 girls,  $M_{\text{age}} = 13.3$  y,  $SD_{\text{age}} = 1.5$  y). The two groups did not differ in terms of their age  
194 ( $t(195.53) = 0.57$ ,  $p = .570$ ,  $d = 0.07$ ) but with regard to gender ( $\chi^2 = 13.57$ ,  $df = 1$ ,  $p < .001$ ,  
195 Cramer's  $V = .21$ ).



196 **Measures**

197 **Reflexive Teaching Style.** The students' perceived teachers' reflexive teaching style  
198 was analysed using a scale developed by Magnaguagno et al. (2016). In a sample of early  
199 adolescents ( $M_{\text{age}} = 10.92$  y,  $SD_{\text{age}} = 0.64$  y), Cronbach's alpha was .73, indicating acceptable  
200 reliability (Magnaguagno et al., 2016). The scale consists of four items with one example of  
201 an item being: "*In physical education we are encouraged to think about our behaviour*". All  
202 items were rated on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly  
203 agree). High scores on this scale indicate that the students perceive pronounced reflexive  
204 teaching style in PE. The analysis of internal consistency revealed Cronbach's alpha of .69 for  
205 pre-test, .70 for post-test and .77 for follow-up-test in the present sample.

206 **Individualized Teacher Frame of Reference (iTFR).** In order to check whether  
207 students from the teachers in the intervention group reported an increase in iTFR compared to  
208 controls, the students' perceived iTFR was measured with the scale from Lüdtkke et al. (2005).  
209 Previous studies using this scale in a sample of adolescents reported a Cronbach's alpha  
210 above .70, indicating acceptable psychometric properties (see Lüdtkke et al., 2005; Oswald et  
211 al., 2013; Schmidt et al., 2013). The scale consists of four items with one example of an item  
212 being: "*If a student improves his/her achievement, the teacher praises him/her, even if he/she*  
213 *is below class average*". Students responded to each item on a scale ranging from 1 (strongly  
214 disagree) to 4 (strongly agree). High scores on this scale indicate that the teacher was  
215 perceived to have a pronounced iTFR. At pre-test, Cronbach's alpha was .84, at post-test .87  
216 and at follow-up-test .89.

217 **Perceived Sports Competence.** To measure perceived sports competence, a subscale  
218 from the German version (Braun, Martin, Alfermann, & Michel, 2018) of the short version of  
219 the Physical Self Description Questionnaire (PSDQ-S; Marsh, Martin, & Jackson, 2010) was  
220 used. Evidence of the reliability and validity of the PSDQ-S in a sample of early adolescents  
221 has been shown by Brown and Bonsaksen (2019). The subscale for perceived sports

222 competence consists of three positively worded items with one example of an item being: “*I*  
223 *am good at most sports*”. All items were rated on a 4-point Likert scale ranging from 1  
224 (strongly disagree) to 4 (strongly agree), since Freund, Tietjens, and Strauss (2013) have  
225 demonstrated better psychometric properties for the four response categories format in  
226 children and adolescents. High scores on this scale indicate that the students perceive  
227 themselves as competent in PE and sports. The analysis of internal consistency indicated a  
228 Cronbach’s alpha of .81 at pre-test, of .76 at post-test and of .81 at follow-up-test in the  
229 present sample.

230 **Global Self-Esteem.** Global self-esteem was measured with the corresponding subscale  
231 from the German version of the PSDQ-S (Braun et al., 2018). Out of the five items, two items  
232 are negatively worded, with one example of a positive item being: “*Most things I do, I do*  
233 *well*”. All items were rated on a 4-point Likert scale ranging from 1 (strongly disagree) to 4  
234 (strongly agree). High scores on this scale indicate that the students have a positive sense of  
235 overall self-worth. The analysis of internal consistency with regard to the present sample  
236 indicated Cronbach’s alpha of .74 at pre-test, .75 at post-test and .77 at follow-up-test.

### 237 **Procedure**

238 The study was carried out in cooperation with schools from the German speaking part of  
239 Switzerland. After receiving the permission of the participating school principals, the teachers  
240 were contacted for study enrolment. The legal guardians of all participants have signed an  
241 informed consent form approved by the Institutional Review Board. The researchers  
242 emphasised to the students that completing the questionnaire was voluntary, that they could  
243 discontinue at any time without any reason, and that all data would be treated confidentially.  
244 All students underwent the initial measurement and completed the questionnaires. Next, the  
245 teachers in the intervention group completed a five-month training designed for the  
246 development of practical teaching skills in individualized and reflexive teaching style. The  
247 participating teachers were instructed to implement an iTFR and a reflexive teaching style

248 into their own PE classes. The PE-teachers in the control group did not attend the training and  
249 were not instructed to adopt an iTFR and a reflexive teaching style. After finishing the  
250 training programme, all participants completed the questionnaires again and after three  
251 months, the measurement procedure was repeated again.

### 252 **Teacher Training (Intervention)**

253 The teacher training consisted of five three-hour consecutive sessions (15 hours in  
254 total), which took place over a period of five months (see table 1). In the first two sessions,  
255 the teachers acquired theoretical and empirical knowledge about the structure, the sources and  
256 the development of self-esteem, and how it can be promoted with a reflexive teaching style  
257 and an iTFR. The next three sessions focused on the application of an individualized and  
258 reflexive teaching style and the implementation in the participant's PE classes. Every session  
259 included interactive and practical sequences where the teachers analysed case studies,  
260 discussed their own experiences and applied the theory into practice<sup>1</sup>. Between the sessions  
261 over the period of five months, the teachers were instructed to implement an iTFR and a  
262 reflexive teaching style into their own PE classes.

263 [Insert Table 1 here]

### 264 **Statistical analyses**

265 All statistical analyses were completed using the software R (R Core Team, 2016).  
266 There was some loss of data because of incomplete questionnaires. However, the percentage  
267 of missing values did not exceed 2.9%, and the MCAR-Test (Little & Rubin, 2002) revealed  
268 that the missing values were missing completely at random ( $\chi^2 = 327.14$ ,  $df = 306$ ,  $p = .194$ ).  
269 Therefore, the full sample ( $N = 315$ ) was retained for all procedures. Initially, variables were  
270 screened for violations of statistical assumptions (e.g., normality, linearity). Because the data  
271 did not satisfy the assumption of normality and violating this assumption has undesirable  
272 effects on parameter estimates, their associated standard errors, confidence intervals and  $p$ -

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<sup>1</sup> Lesson plans and materials used in the teacher training can be obtained from the corresponding author.

273 values (Field & Wilcox, 2017), robust statistical methods were used. Yuen's (1974) robust *t*-  
274 tests using the `yuenbt()` function from the package "WRS2" (Mair & Wilcox, 2018) were  
275 conducted to compare differences between intervention and control group at baseline (20%  
276 trim and 2000 bootstrap iterations).

277 The hypotheses were tested with robust mixed effects modelling using the `rlmer()`  
278 function from the package "robustlmm" (Koller, 2016). Primary outcomes were assessed for  
279 the impact of group (control vs. intervention), time (baseline vs. post-test and baseline vs.  
280 follow-up) and their interaction. Additionally, gender (female vs. male) was included as a  
281 fixed effect, because the distribution of gender differed between control (40% girls) and  
282 intervention group (62% girls). The intercepts are allowed to vary by participants (random  
283 intercept model) and the clustered nature of the data (ICC values of 0.00 to 0.09) is taken into  
284 account by specifying the students as nested in classes. In robust linear mixed models, there is  
285 no *p*-value given (Koller, 2016). Therefore, instead of *p*-values, 95% Wald confidence  
286 intervals for the beta-coefficients was computed. Cohen's (1988) *d* according to the formula  
287 by Westfall, Kenny and Judd (2014) were used to determine effect sizes (Cohen's *d* = 0.20,  
288 0.50, 0.80).

## 289 Results

### 290 Preliminary Analyses

291 Table 2 shows descriptive statistics and the results of the preliminary analyses.  
292 Skewness values of -1.06 to 0.27 and kurtosis values of -0.63 to 2.19 revealed weak to high  
293 deviations from a normal distribution (Blanca, Arnau, López-Montiel, & Bendayan, 2013).  
294 Independent robust *t*-tests showed that the intervention and the control group differed at  
295 baseline in terms of iTFR ( $M = -0.35$ ,  $p < 0.001$ ,  $d = 0.35$ ) with higher means in the  
296 intervention group. There were no significant differences regarding the other dependent  
297 variables.

298 [Insert Table 2 here]

299 **Primary Analyses**300 *Effects on reflexive teaching style and iTFR*

301 Whether teachers in the intervention group implemented an iTFR and a reflexive  
302 teaching style in PE was tested by mixed effects models in which the students' perception of  
303 the iTFR and reflexive teaching style were treated as dependent variables. With regard to  
304 reflexive teaching style, there was a significant negative linear effect of time ( $\beta = -0.12$ , 95%  
305 CI [-0.23, -0.01],  $d = 0.18$ ) from baseline to post-test, suggesting a decline of perceived  
306 reflexive teaching style in the whole sample over the period of five months. There were no  
307 differences of means between the intervention and control group ( $\beta = 0.10$ , 95% CI [-0.06,  
308 0.27],  $d = 0.15$ ) but there was a significant interaction effect between time and group ( $\beta =$   
309  $0.18$ , 95% CI [0.03, 0.32],  $d = 0.26$ ) from pre- to post-test. Figure 1 shows that teachers in the  
310 intervention group increased reflexive teaching style, whereas the control group decreased  
311 during the teacher training and three months beyond the end of the training. From baseline to  
312 follow-up there was still a significant negative effect of time ( $\beta = -0.15$ , 95% CI [-0.23, -  
313 0.01],  $d = 0.23$ ). Again, there were no differences between the groups ( $\beta = 0.11$ , 95% CI [-  
314 0.06, 0.27],  $d = 0.16$ ), but a significant interaction effect between time and group ( $\beta = 0.26$ ,  
315 95% CI [0.11, 0.41],  $d = 0.40$ ), indicating that the positive effect of the training on perceived  
316 reflexive teaching style persisted over time.

317 In terms of perceived iTFR, there was no effect of time ( $\beta = -0.02$ , 95% CI [-0.12, 0.08],  
318  $d = 0.03$ ) but significant moderate effects of group ( $\beta = 0.22$ , 95% CI [0.07, 0.37],  $d = 0.36$ ),  
319 indicating higher perceptions of iTFR in favour of the intervention group (see figure 2).  
320 Furthermore, there was no significant interaction between time and group ( $\beta = -0.01$ , 95% CI  
321 [-0.21, 0.05],  $d = 0.13$ ). A similar pattern revealed the results from pre-test to follow-up with  
322 regard to the effect of time ( $\beta = -0.08$ , 95% CI [-0.19, 0.03],  $d = 0.13$ ), group ( $\beta = 0.22$ , 95%  
323 CI [0.03, 0.30],  $d = 0.36$ ) and the interaction ( $\beta = 0.00$ , 95% CI [-0.13, 0.14],  $d = 0.01$ ).  
324 Hence, the teacher training had neither immediate nor delayed effects on perceived iTFR.

325 However, students in the intervention group reported a more pronounced perception of iTFR,  
326 independently of the measurement time point.

327 [Insert Figure 1 here]

328 [Insert Figure 2 here]

329 *Effects on perceived sports competence and global self-esteem*

330 Next, it was explored whether there were effects of the teacher training on students'  
331 perceived sports competence and global self-esteem from baseline to post-test and from  
332 baseline to follow-up. With regard to changes in perceived sports competence from pre- to  
333 post-test, there was a significant negative effect of time ( $\beta = -0.10$ , 95% CI [-0.18, -0.02],  $d =$   
334 0.18), indicating an overall decline in the sample. There were no mean differences between  
335 the intervention and control groups ( $\beta = 0.00$ , 95% CI [-0.13, 0.13],  $d = 0.00$ ). There was no  
336 significant interaction effect from pre- to post-test ( $\beta = 0.08$ , 95% CI [-0.01, 0.18],  $d = 0.15$ ).  
337 Consequently, there is no beneficial treatment effect on perceived sports competence after the  
338 completion of the whole teacher training. From baseline to follow-up, the results with regard  
339 to the effects of time ( $\beta = -0.17$ , 95% CI [-0.25, -0.10],  $d = 0.31$ ) and group ( $\beta = 0.00$ , 95% CI  
340 [-0.14, 0.14],  $d = 0.00$ ) remained similar. In contrast to the results from baseline to post-test,  
341 there was a small but significant interaction effect from baseline to follow-up ( $\beta = 0.14$ , 95%  
342 CI [0.04, 0.24],  $d = 0.25$ ). Figure 3 shows that the decline in perceived sports competence is  
343 more pronounced in the control group compared to the intervention group.

344 With regard to changes in global self-esteem over the period from pre- to post-test, there  
345 were no significant effects of time ( $\beta = -0.04$ , 95% CI [-0.11, 0.03],  $d = 0.10$ ), group ( $\beta =$   
346 0.07, 95% CI [-0.02, 0.16],  $d = 0.19$ ), and no interaction between time and group ( $\beta = 0.06$ ,  
347 95% CI [-0.03, 0.15],  $d = 0.16$ ). The same pattern of results was evident from pre-test to  
348 follow-up with regard to the effects of time ( $\beta = -0.06$ , 95% CI [-0.13, 0.00],  $d = 0.16$ ) and  
349 group ( $\beta = 0.07$ , 95% CI [-0.03, 0.16],  $d = 0.17$ ). Again, in contrast to the results from  
350 baseline to post-test, there was a small significant interaction effect between time and group

351 ( $\beta = 0.10$ , 95% CI [0.02, 0.19],  $d = 0.27$ ) from baseline to follow-up. As can be seen in Figure  
352 4, there was a beneficial effect on global self-esteem in favour of the intervention group. The  
353 global self-esteem in the intervention group slightly improved over time, whereas the global  
354 self-esteem in the control group gradually declined.

355 [Insert Figure 3 here]

356 [Insert Figure 4 here]

### 357 **Discussion**

358 The aim of the current study was to evaluate whether a five-month teacher training  
359 enhances teachers' reflexive teaching style and iTFR in PE, consequently promoting students'  
360 perceived sports competence and global self-esteem. In summary, the results showed that the  
361 teacher training was effective in promoting the teachers' reflexive teaching style, but not their  
362 iTFR. With regard to students' perceived sports competence and global self-esteem, there  
363 were no beneficial treatment effects over a period of five months (from pre-test to post-test).  
364 However, over a period of eight months (from pre-test to follow-up), significant time x group  
365 interaction effects occurred.

366 The teacher training had a positive effect on teachers' reflexive teaching style, primarily  
367 indicated by significant time x group interaction effects from pre- to post-test and from pre-  
368 test to follow-up. However, since the interaction effects were evoked by decreases in the  
369 control group and small increases in the intervention group, the evidence for the effectivity is  
370 somewhat limited. Nevertheless, the significant increase in reflexive teaching style over a  
371 period of eight months in the intervention group (see table 2) indicates a positive influence of  
372 the teacher training on this variable. Magnaguagno et al. (2016) reported a similar pattern of  
373 results for the intervention group, which received didactic materials and coaching during the  
374 13-week intervention phase. Although the short-term training by Magnaguagno et al. (2016)  
375 achieved a similar effect from baseline to post-test, it should be noted that the effect of the  
376 long-term training from this study persisted after the training period of five months. Even

377 more, the larger effect size from pre-test to follow-up in the present study suggests a potential  
378 sleeper effect in which the impact of the teacher training grew larger over time. In contrast to  
379 our results, the effect from the short-term training by Magnaguagno et al. (2016) decreased  
380 from post-test to follow-up. This difference to Magnaguagno et al. (2016) indicates that an  
381 intensive teacher training outperforms short-term trainings with regard to sustainability of  
382 changes in teacher behaviour.

383 In terms of teachers' iTFR, in both groups the mean levels did not change over time,  
384 indicating no effect of the teacher training on the teaching style. Hence, this study could not  
385 replicate the results from previous short-term interventions (Oswald et al., 2013; Schmidt et  
386 al., 2013). In contrast to those studies, there were significant mean differences in favour of the  
387 intervention group at all measurement points, and the means of iTFR ranging from 3.27 to  
388 3.38 (max = 4) were relatively high compared to previous studies. The lacking treatment  
389 effect might be due to the voluntary registration for the training, which might have caused a  
390 ceiling effect. The teachers in the intervention group seemed to use a very pronounced iTFR  
391 already before taking part in the teacher training.

392 Although the descriptive statistics showed the expected pattern of results, there were no  
393 beneficial treatment effects on perceived sports competence and global self-esteem from pre-  
394 to post-test. Hence, past findings regarding perceived sports competence (Babic et al., 2014;  
395 Oswald et al., 2013; Schmidt et al., 2013) and global self-esteem (Ahn & Fedewa, 2011; Liu  
396 et al., 2015) could not be replicated. The indirect nature of the teacher training could help  
397 explain the relatively small effects on students' self-concept. O'Mara et al. (2006) showed  
398 that indirect self-concept treatments display minor effects compared to direct treatments.  
399 Furthermore, teachers in the intervention group decided on their own how often and how  
400 pronounced they wanted to implement an iTFR and reflexive teaching style. Therefore, it is  
401 comprehensible that previous short-term interventions (e.g. Oswald et al., 2013; Schmidt et  
402 al., 2013), which clearly specified what teachers in the intervention group had to do, displayed



403 larger effects. Another explanation for the absence of an immediate effect can be seen in the  
404 lacking effect on iTFR. The baseline difference in iTFR in favour of the intervention group  
405 made it more difficult to achieve the hypothesised additional effects.

406         Considering the timeframe from pre-test to follow-up (eight months), as expected the  
407 more individual oriented and reflexive taught PE in the intervention group was associated  
408 with positive effects on perceived sports competence and global self-esteem, indicated by  
409 significant interaction effects. Whereas perceived sports competence and global self-esteem in  
410 the intervention group remained stable, negative development trends occurred in the control  
411 group. Again, the decreases in the control group contributed to the significant interaction  
412 effects. However, previous work revealed that global self-esteem and physical self-concept  
413 decreases over the time from late childhood to adolescence (Robins & Trzesniewski, 2005;  
414 Schaffhauser et al., 2017). Hence, the observed decreases in the control group are in line with  
415 the negative development trends found in other studies. Therefore, the stability in the  
416 intervention group could be cautiously interpreted as a beneficial treatment effect. Whereas  
417 the present study found a positive effect of PE taught with pronounced iTFR and reflexive  
418 teaching style on global self-esteem, the studies investigating the same kind of PE on  
419 students' self-concept, found no effects of a 10-week (Schmidt et al., 2013) and 20-week  
420 (Oswald et al., 2013) intervention. According to the bottom-up model (Shavelson et al., 1976;  
421 Sonstroem et al., 1994), it is theorised that changes in global self-esteem need a number of  
422 competence perceptions on a low self-concept level. Therefore, it can be concluded that  
423 previously chosen 10 to 20 weeks of individualized and reflexive taught PE do not provide  
424 sufficient competence perceptions to affect global self-esteem, but eight months appear to be  
425 adequate. However, in view of the small effects in the present study, the effectivity should not  
426 be overestimated.

427         With regard to the aim of PE concerning the goal of personality development, the  
428 present study provides implications on what teachers in PE can do, and how they can be

429 supported to achieve this goal. For PE teachers and practitioners in the field of exercise  
430 psychology, the present findings illustrate the relevance of an iTFR and reflexive teaching  
431 style to promote global self-esteem development. If students consequently receive  
432 individualized PE accompanied by guided reflections on their improvements, not only  
433 perceived sports competence becomes more positive (Oswald et al., 2013) and realistic  
434 (Schmidt et al., 2013), but there are also benefits to the development of global self-esteem.  
435 However, a long-term implementation appears to be crucial to achieve positive effects on  
436 global self-esteem. Therefore, teachers need specific knowledge and skills, which can be  
437 provided by a teacher training. For people working in the field of teacher education, the  
438 present study shows that an intensive training helps to achieve sustainable changes in teaching  
439 style. Characteristics of the present teacher training and potential key factors for success in the  
440 present teacher training are the long duration (15 hours distributed over 5 months), the  
441 evidence based theoretical foundation, and the interactive and applied nature of the training  
442 (Lander et al., 2017).

443         Some limitations of the present study are worth noting as directions for future work.  
444 First, a well-known problem of quasi-experimental studies and a limitation of the current  
445 study is the non-randomized sample. Therefore, selection effects, evoked through the  
446 voluntary registration to the teacher training, could not be controlled. Hence, the  
447 generalizability of the results is somewhat limited. Second, whether the beneficial effects on  
448 self-concept in favour of the intervention group were caused through the more pronounced  
449 iTFR, the increase in reflexive teaching style or the interaction between iTFR and reflexive  
450 teaching style remains open. Because the teacher training did not affect iTFR, it is not clear  
451 whether the positive effects on self-concept were indeed caused through the teacher training.  
452 To get more insight into the psychological mechanisms behind self-esteem promotion in PE,  
453 future research should analyse in more detail how these didactic principles affect perceived  
454 competence and global self-esteem. Third, from an economic point of view, it was not

455 possible to get knowledge about the actual teaching. Therefore, the content of the PE lessons  
456 and the implementation frequency of an iTFR and reflexive teaching style were not  
457 controlled, which might have influenced the effects on students' perceived sports competence  
458 and self-esteem. Hence, more research into the processes and factors influencing the  
459 implementation quality and frequency with regard to successful self-esteem promotion is of  
460 great interest to optimize further efforts in teacher education.

461 In sum, the central findings of this study revealed that a five-month teacher training  
462 sustainably enhanced teachers' reflexive teaching style, which in turn, after a period of eight  
463 months, led to minor declines in perceived sports competence and global self-esteem.  
464 Considering the high relevance of global self-esteem with regard to psychological well-being  
465 (Trzesniewski et al., 2006), the small effect sizes reported in the present study are of  
466 considerable importance.

#### 467 **Acknowledgments**

468 This work was supported by the Federal Office of Sport (FOSPO) Magglingen, Switzerland.

#### 469 **Declaration of interest statement**

470 The authors declared no potential conflicts of interest with respect to the research, authorship,  
471 and/or publication of this article.

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Figures

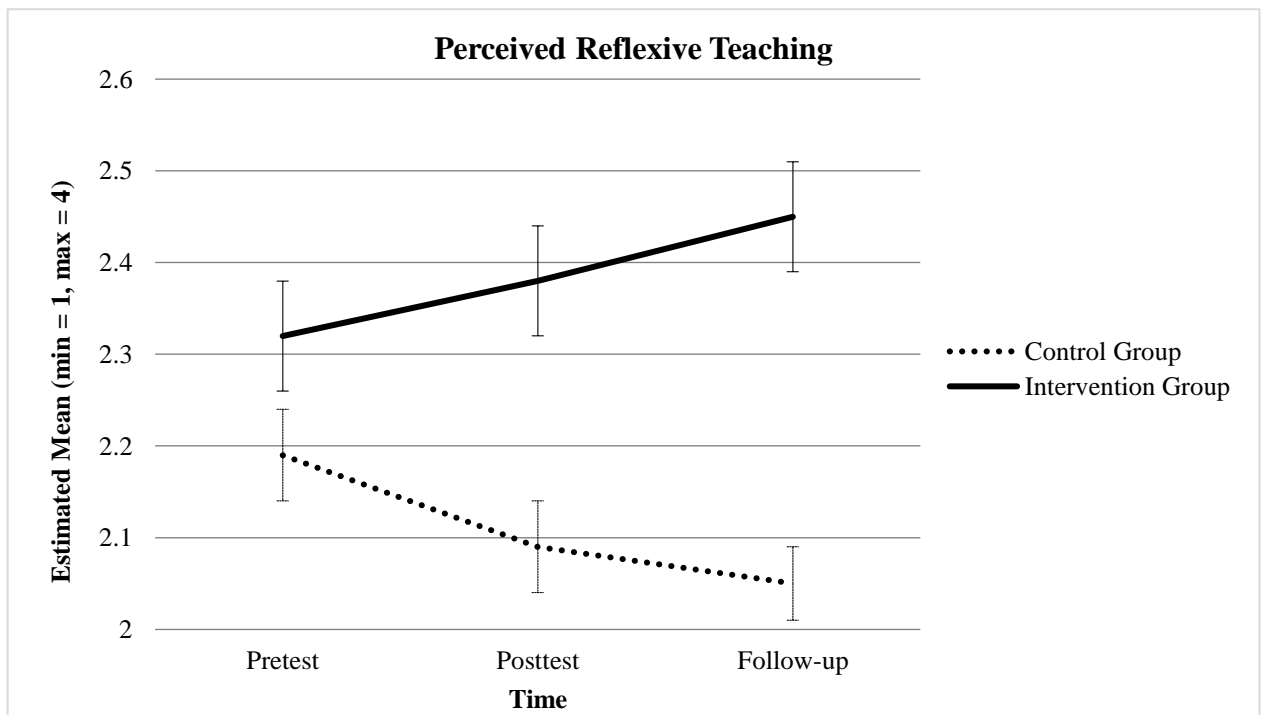


Figure 1. Means of reflexive teaching style for the intervention and control group. Error bars represent standard error of the means.

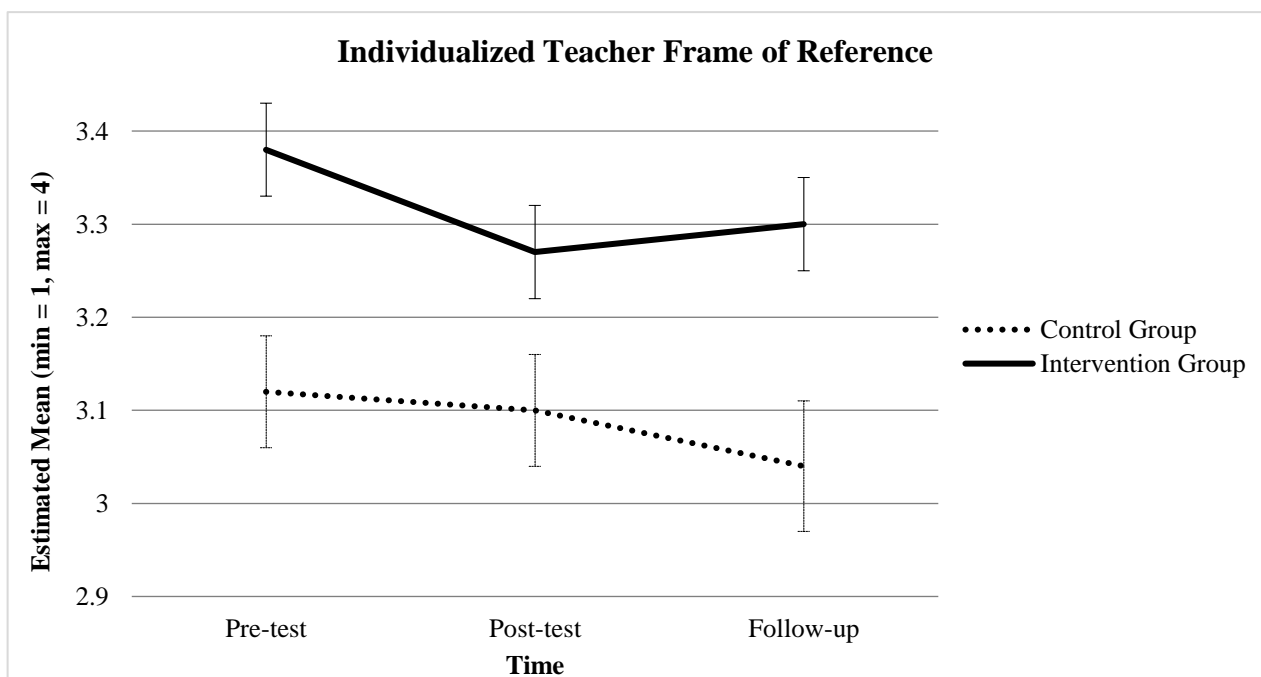


Figure 2. Means of iTFR for the intervention and control group. Error bars represent standard error of the means.

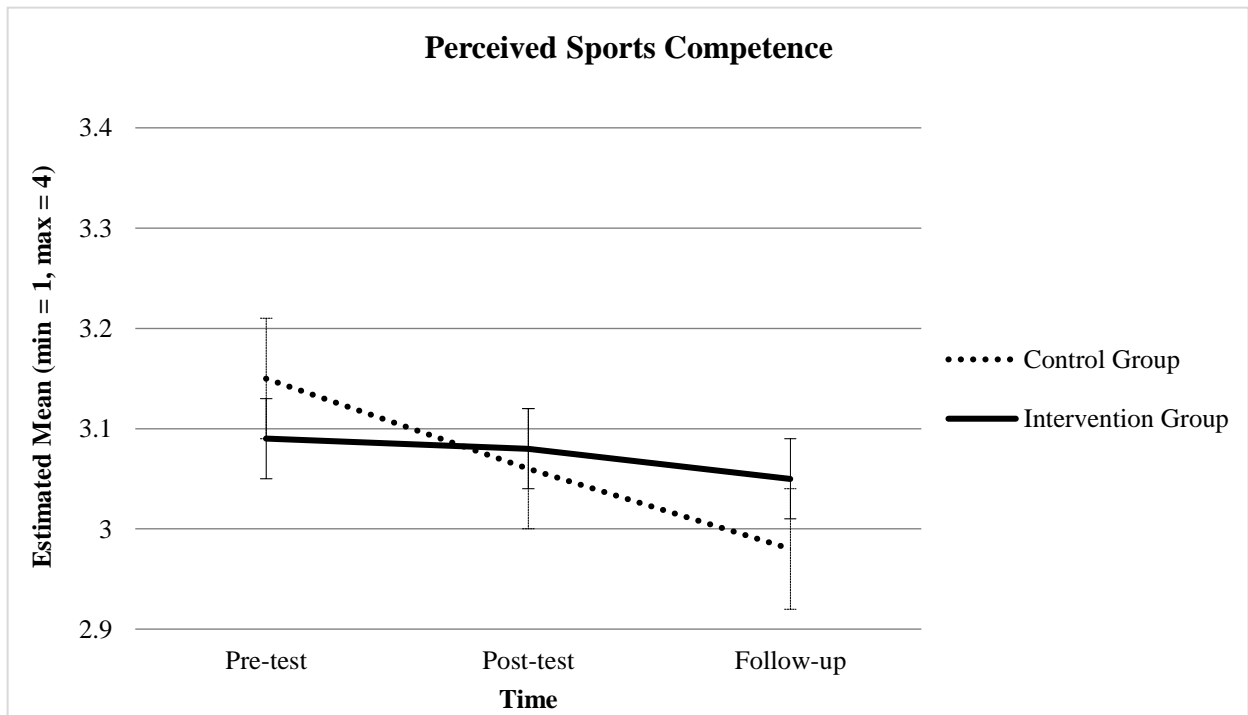


Figure 3. Means of perceived sports competence for the intervention and control group. Error bars represent standard error of the means.

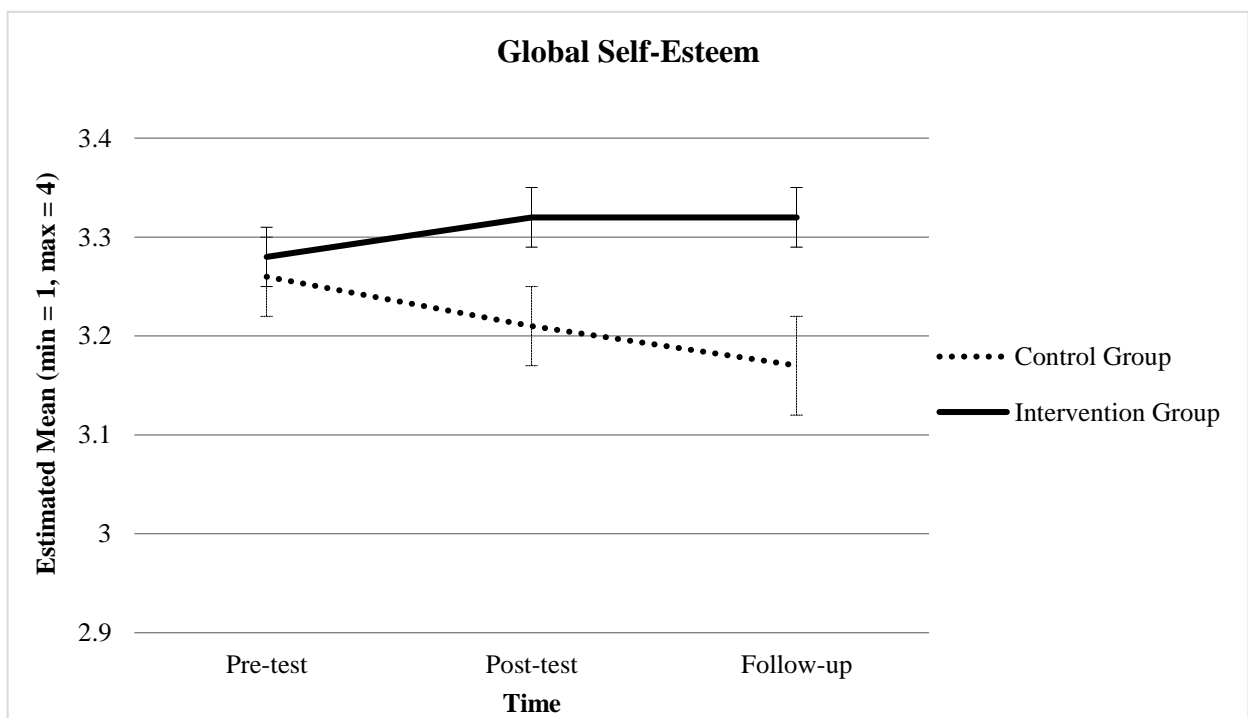


Figure 4. Means of global self-esteem for the intervention and control group. Error bars represent standard error of the means.

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### Tables

Table 1

*Content and Procedures of the Teacher Training*

Session	Content	Procedure
1	Introduction to the subject self-concept promotion in PE; Theory about structure and sources of self-concept in childhood and adolescence.	<ol style="list-style-type: none"> <li>1. Introduction with a practical example lesson (focus on ball games and acrobatics)</li> <li>2. Discussion of experiences made during the example lesson</li> <li>3. Presentation about the structure and sources of self-concept</li> <li>4. Discussion of participants experiences with regard to self-concept promotion in PE</li> </ol>
2	Theory about self-concept promotion with physical activity and exercise; Theory about teaching styles to enhance schoolchildren's sense of competence.	<ol style="list-style-type: none"> <li>1. Review of the first session and discussion of first experiences</li> <li>2. Presentation about teaching styles proposed to promote positive self-concept development (e.g. reflexive teaching style, individual teacher frame of reference)</li> <li>3. Transfer into practice with an example lesson (focus on dance)</li> </ol>
3	Theory about individual oriented feedback with transfer into practice; Planning lessons aimed to promote self-concept.	<ol style="list-style-type: none"> <li>1. Review of the past session and discussion of participants experiences</li> <li>2. Presentation about individual oriented feedback in PE</li> <li>3. Transfer into practice with an example (focus on coordination circuit)</li> <li>4. Preparation and discussion of participants own PE lessons</li> </ol>
4	Elaborate and develop further lessons with a focus on reflexive teaching and individualization.	<ol style="list-style-type: none"> <li>1. Review of the past session and discussion of participants experiences</li> <li>2. Conduction of two short practical examples (focus on endurance and game development)</li> <li>3. Preparation, elaboration and discussion of participants lessons</li> </ol>
5	Exchange of teaching materials between the participants; Discussion about factors related to a successful long-term implementation.	<ol style="list-style-type: none"> <li>1. Review of participants experiences</li> <li>2. Exchange of teaching materials</li> <li>3. Practical examples (focus on fighting games; participants lessons)</li> <li>4. Discussion about difficulties and barriers with regard to sustainable implementation</li> </ol>

*Note.* Every session lasted 3 hours (15 hours in total).

## PROMOTING SELF-ESTEEM IN PHYSICAL EDUCATION

Table 2

*Descriptive Statistics of Intervention and Control Groups*

	Control Group ( <i>n</i> = 115)					Intervention Group ( <i>n</i> = 200)				
	Pre-test	Post-test	Follow-up	Effect Sizes		Pre-test	Post-test	Follow-up	Effect Sizes	
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>d</i> <sub>T1→T2</sub>	<i>d</i> <sub>T1→T3</sub>	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>d</i> <sub>T1→T2</sub>	<i>d</i> <sub>T1→T3</sub>
<b>Teaching Style</b>										
Reflexive Teaching Style	2.20 (0.63)	2.09 (0.66)	2.05 (0.65)	-0.17	-0.23	2.32 (0.68)	2.38 (0.69)	2.45 (0.62)	0.09	0.20 <sup>a</sup>
Individualized TFR	3.12 (0.64)	3.10 (0.64)	3.04 (0.77)	-0.03	-0.11	3.38 (0.66)	3.27 (0.76)	3.30 (0.70)	-0.16	-0.12
<b>Self-Concept</b>										
Perceived Sports Competence	3.16 (0.65)	3.09 (0.59)	2.98 (0.59)	-0.11	-0.29 <sup>a</sup>	3.09 (0.60)	3.08 (0.52)	3.05 (0.58)	-0.02	-0.07
Global Self-Esteem	3.26 (0.46)	3.21 (0.49)	3.17 (0.51)	-0.11	-0.18	3.28 (0.43)	3.31 (0.38)	3.32 (0.39)	0.07	0.10

*Note.* All scales range from 1 to 4. Effect sizes were estimated using Cohen's *d*.  $d_{T1→T2}$  = effect size with respect to the difference between pre- and post-test;  $d_{T1→T3}$  = effect size with respect to the difference between pre-test and follow-up.

<sup>a</sup> The superscript denotes effect sizes the 95% confidence limits of which do not include 0.