Running head: PROMOTING SELF-ESTEEM IN PHYSICAL EDUCATION

1	Promoting schoolchildren's self-esteem in physical education: Testing the
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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, Roebers, & Conzelmann, 2013). However, it remains an open question whether 38 this teaching style has the potential to promote positive self-esteem development.

Purpose: The present study investigated whether a five-month teacher training, aimed to enhance the teachers' iTFR and their reflexive teaching style in PE, has a positive effect on students' perceived sports competence and their global self-esteem. To analyse the implementation quality, changes in students' perceived iTFR and perceived reflexive teaching 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 teacher training, their students' (N = 315, 53.7% girls, $M_{age} = 13.2$ y, $SD_{age} = 1.3$ y) perceived 51 52 teaching style (iTFR and reflexive teaching), perceived sports competence and global self-

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

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

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

70

Introduction

71 Global self-esteem, defined as overall feelings of self-worth (Harter, 2012), is 72 consistently viewed as an important personality characteristic being closely linked to well-73 being throughout the life course (Trzesniewski et al., 2006). Individuals with high levels of 74 global self-esteem are generally more satisfied with their lives (Moksnes & Espnes, 2013; 75 Sowislo & Orth, 2013). Conversely, low global self-esteem is associated with various 76 negative outcomes, such as increased substance abuse (Fisher, Zapolski, Sheehan, & Barnes-77 Najor, 2017) and delinquent behaviour (Farrington, Gaffney, & Ttofi, 2017). In view of 78 empirical studies indicating a decline in self-esteem from childhood through adolescence 79 (Robins & Trzesniewski, 2005; Schaffhauser, Allemand, & Schwarz, 2017), the development 80 of positive global self-esteem in adolescence is regarded as a crucial developmental task and 81 an important aim of PE (Bailey, 2006).

82 The general assumption that physical activity enhances children's self-esteem is well 83 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 84 85 theory of a hierarchical structured self-concept (Shavelson et al., 1976), and according to the 86 "exercise and self-esteem model" EXSEM (Sonstroem & Morgan, 1989; Sonstroem et al., 87 1994), physical activity does not affect global self-esteem directly, but indirectly mediated by 88 perceived sports competence, encompassing competence perceptions in sports and games 89 (Estevan & Barnett, 2018). The EXSEM describes the mechanism as a bottom-up process by 90 which physical activity initially promotes physical self-efficacy, thus leading to an increase in 91 perceived sports competence, and ultimately influencing global self-esteem. The mediational 92 role of perceived sports competence has been reported for children (Slutzky & Simpkins, 93 2009), adolescents (Wagnsson, Lindwall, & Gustafsson, 2014) and adults (Fox, 2000; Levy & 94 Ebbeck, 2005). Considering this, the specific promotion of perceived sports competence is 95 considered an important factor in terms of self-esteem promotion in PE (Harter, 2012).

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 believed to counteract such "negative social comparison effects" and enhance students' self-110 111 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.

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, & Conzelmann, 2013). The authors of both studies explained the absence of an effect on more 135 136 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.

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

teachers in the intervention group report an increase in iTFR and reflexive teaching style of their teacher. Consequently, the students in the intervention group are believed to display a more pronounced development of perceived sports competence and global self-esteem 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 $(M_{age} = 37.6 \text{ y}, SD_{age} = 10.8 \text{ y})$, 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 eight teachers in the control group. The two groups did not differ with regard to sex (χ^2 = 188 189 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, $M_{age} = 13.2$ y, $SD_{age} = 1.3$ y), 200 individuals were part of the 192 intervention group (62% girls, $M_{age} = 13.2y$, $SD_{age} = 1.1 y$) and 115 of the control group (40% girls, $M_{age} = 13.3$ y, $SD_{age} = 1.5$ y). The two groups did not differ in terms of their age 193 (t(195.53) = 0.57, p = .570, d = 0.07) but with regard to gender $(\chi^2 = 13.57, df = 1, p < .001, df = 1, p < .001)$ 194 195 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 ($M_{age} = 10.92$ y, $SD_{age} = 0.64$ y), Cronbachs 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 Lüdtke 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 Lüdke at 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.

Perceived Sports Competence. To measure perceived sports competence, a subscale from the German version (Braun, Martin, Alfermann, & Michel, 2018) of the short version of the Physical Self Description Questionnaire (PSDQ-S; Marsh, Martin, & Jackson, 2010) was used. Evidence of the reliability and validity of the PSDQ-S in a sample of early adolescents 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.

Global Self-Esteem. Global self-esteem was measured with the corresponding subscale from the German version of the PSDQ-S (Braun et al., 2018). Out of the five items, two items are negatively worded, with one example of a positive item being: "*Most things I do, I do well*". All items were rated on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). High scores on this scale indicate that the students have a positive sense of overall self-worth. The analysis of internal consistency with regard to the present sample 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

into their own PE classes. The PE-teachers in the control group did not attend the training and were not instructed to adopt an iTFR and a reflexive teaching style. After finishing the training programme, all participants completed the questionnaires again and after three 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 practice¹. 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 that the missing values were missing completely at random ($\chi^2 = 327.14$, df = 306, p = .194). 268 269 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-

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

values (Field & Wilcox, 2017), robust statistical methods were used. Yuen's (1974) robust *t*tests using the yuenbt() function from the package "WRS2" (Mair & Wilcox, 2018) were
conducted to compare differences between intervention and control group at baseline (20%
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 by Westfall, Kenny and Judd (2014) were used to determine effect sizes (Cohen's d = 0.20, 287 288 0.50, 0.80).

289

Results

290 Preliminary Analyses

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

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 ($\beta = -0.12, 95\%$ CI [-0.23, -0.01], d = 0.18) from baseline to post-test, suggesting a decline of perceived 305 306 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). Furthermore, there was no significant interaction between time and group ($\beta = -0.01$, 95% CI 320 321 [-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.

However, students in the intervention group reported a more pronounced perception of iTFR,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.

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

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356

357

Discussion

[Insert Figure 3 here]

[Insert Figure 4 here]

358 The aim of the current study was to evaluate whether a five-month teacher training enhances teachers' reflexive teaching style and iTFR in PE, consequently promoting students' 359 360 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.

With regard to the aim of PE concerning the goal of personality development, thepresent 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 competence and global self-esteem. Third, from an economic point of view, it was not 454

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.

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

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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.

Tables

Table 1

Content and Procedures of the Teacher Training

Session	Content	Procedure					
	Introduction to the subject self-	1. Introduction with a practical example lesson (focus on ball games and acrobatics)					
1	concept promotion in PE; Theory about structure and sources of self-concept in childhood and	2. Discussion of experiences made during the example lesson					
1		3. Presentation about the structure and sources of self-concept					
	adolescence.	4. Discussion of participants experiences with regard to self-concept promotion in PE					
	Theory about self-concept promotion with physical activity and exercise; Theory about teaching styles to enhance schoolchildren's sense of	1. Review of the first session and discussion of first experiences					
2		2. Presentation about teaching styles proposed to promote positive self-concept development (e.g. reflexive teaching style, individual teacher frame of reference)					
	competence.	3. Transfer into practice with an example lesson (focus on dance)					
	Theory shout individual oriented	1. Review of the past session and discussion of participants experiences					
2	feedback with transfer into practice; Planning lessons aimed to promote self-concept.	2. Presentation about individual oriented feedback in PE					
3		3. Transfer into practice with an example (focus on coordination circuit)					
		4. Preparation and discussion of participants own PE lessons					
	Elaborate and develop further	1. Review of the past session and discussion of participants experiences					
4	lessons with a focus on reflexive teaching and individualization.	2. Conduction of two short practical examples (focus on endurance and game development)					
		3. Preparation, elaboration and discussion of participants lessons					
	Exchange of teaching materials between the participants; Discussion about factors related	1. Review of participants experiences					
		2. Exchange of teaching materials					
5		3. Practical examples (focus on fighting games; participants lessons)					
	implementation.	4. Discussion about difficulties and barriers with regard to sustainable implementation					

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

Table 2

Descriptive Statistics of Intervention and Control Groups

	Control Group $(n = 115)$				Intervention Group $(n = 200)$					
	Pre-test	Post-test	Follow-up	Effect Sizes		Pre-test	Post-test	Follow-up	Effect S	izes
	M(SD)	M (SD)	M(SD)	$d_{\mathrm{T1} \rightarrow \mathrm{T2}}$	$d_{\mathrm{T1} \rightarrow \mathrm{T3}}$	M(SD)	M(SD)	M(SD)	$d_{\mathrm{T1} \rightarrow \mathrm{T2}}$	$d_{\mathrm{T1} \rightarrow \mathrm{T3}}$
Teaching Style										
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 ^a
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
Self-Concept										
Perceived Sports Competence	3.16 (0.65)	3.09 (0.59)	2.98 (0.59)	-0.11	-0.29 ^a	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*. $d_{T1 \rightarrow T2}$ = effect size with respect to the difference between pre- and post-test; $d_{T1 \rightarrow T3}$ = effect size with respect to the difference between pre-test and follow-up.

^a The superscript denotes effect sizes the 95% confidence limits of which do not include 0.