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Translation and validation of an extended German-language version of the Perceived Locus of Causality Questionnaire (PLOCQ-G) in a sample of physical education students

Introduction

Although the importance of physical activity on individuals' health and well-being is well-documented (e.g., Fox, Boutcher, Faulkner, & Biddle, 2000; Penedo & Dahn, 2005), an increasing number of epidemiological studies have reported decreases in physical activity levels during early adolescence (Dumith, Gigante, Domingues, & Kohl, 2011; Finne, Bucksch, Lampert, & Kolip, 2011; Sallis, 2000). Globally, only 15% of girls and 22% of boys in the 11–17 age group meet the World Health Organization (WHO) recommendations for daily physical activity (Guthold, Stevens, Riley, & Bull, 2020). This trend parallels a lack in fun and enjoyment in compulsory physical education (PE) classes (Digelidis & Papaioannou, 1999). Such declines are alarming, given that enjoyment and fun, as well as other positive experiences in PE, predict physical activity participation during leisure time

(Bagøien, Halvari, & Nesheim, 2010; Chatzisarantis, Hagger, Culverhouse, & Biddle, 2003; Hagger, Barkoukis, Chatzisarantis, Wang, & Baranowski, 2005; McDavid, Cox, & McDonough, 2014; Ntoumanis, 2001). In order to prevent further declines in physical activity levels in adolescents and young adults, it therefore seems worthwhile to investigate students' underlying motivational orientations toward compulsory PE. Obtaining deeper insights into the reasons why students engage or fail to engage in PE helps to develop tailored intervention strategies to adjust PE curriculums according to students' desires and expectations and to promote more self-determined motivation in PE contexts (Teixeira, Monteiro, Carraça, & Palmeira, 2018). As no German measurement instrument yet exists, the aims of the present study are to translate and validate a German language version of the Perceived Locus of Causality Questionnaire (PLOCQ; Goudas, Biddle, & Fox, 1994), a questionnaire that assesses different forms of behavioural regulations in the PE context based on Self-Determination Theory (SDT; Deci & Ryan, 1985, 2000).

Deci and Ryan's SDT (1985, 2000) offers a suitable theoretical framework for investigating students' underlying reasons for PE participation. The theory consists of six mini-theories, one of which focuses on different types of behavioural regulations, namely organismic integration theory (OIT). One aspect of the theory that appears appealing is its multidimensional nature of motivation, which facilitates a refined examination of the reasons why people engage or fail to engage in intended behaviour, such as taking part in PE. According to OIT, there are different forms of behavioural regulations that reflect qualitatively different ways in which a behaviour can be regulated. These forms lie on a continuum of self-determination, ranging from completely non-self-determined to fully self-determined regulation. From left to right on the continuum, the order is as follows: *Amotivation*, a non-regulation, describes a state in which people do not know why they engage in certain behaviours and act without having the intention to achieve an outcome (Deci & Ryan, 2004). In the PE context, amotivated students participate without having the aim to learn something new (Gerber, 2016). *External regulation* represents the

Declaration of submission

The work described has not been published previously (except in the form of an abstract) and it is not under consideration for publication elsewhere.

lowest form of self-determined motivation and refers to behavioural engagement characterised by avoiding punishment or obtaining rewards (Deci & Ryan, 1985). In the PE context, students may participate because PE is compulsory at their school and they are afraid of getting bad grades (Gerber, 2016). *Introjected regulation* describes behavioural engagement based on the avoidance of feelings of guilt and shame or the acquisition of pride and praise (Ntoumanis, Barkoukis, & Thøgersen-Ntoumani, 2009). Students participate in PE to avoid feeling bad if they did not. *Identified regulation* describes behavioural engagement based on personal meaningfulness and value found in a given behaviour (Deci & Ryan, 2000). In PE classes, students who are identified regulated participate because they find some personal meaning in PE, such as an improved health status they obtain as a result of regular PE participation (Gerber, 2016). *Integrated regulation* is characterised by the acceptance of the importance of a behaviour and the alignment of this importance with other aspects of the self (Deci & Ryan, 2000). Students who are integrated regulated may take part in PE because they see it is a part of who they are. *Intrinsic motivation* is the highest internalised form of behavioural regulation and reflects behavioural engagement based on pleasure, enjoyment, and innermost interest (Deci & Ryan, 2000). Students who are intrinsically motivated may participate in PE out of pure interest and enjoyment (Deci & Ryan, 2000; Gerber, 2016). According to OIT, people have a natural tendency to transform and convert societal rules and norms into more personally meaningful values and behavioural regulations in order to form a unified and coherent sense of self. In cases where this so-called internalisation process functions successfully, people take in and identify with the importance of a behaviour, accept it as their own, and will sustain it over time. In cases where the internalisation is forestalled, behaviour will only partially be internalised or remain external after all (Deci & Ryan, 2000).

In the PE context, as well as in the physical activity, exercise, and sport context, the continuum of self-determi-

nation has been investigated in relation to different correlates to obtain deeper insights into how these regulations express themselves. For instance, goal orientations (Nicholls, 1989) have been frequently reported correlates of behavioural regulations in the PE literature (Ferrer-Caja & Weiss, 2000; Goudas et al., 1994; Standage, Duda, & Ntoumanis, 2003). Also, Deci and Ryan (2000) pointed out that there is an undisputed connection between goal theory and SDT with regard to the learning environment. Cognitive correlates, such as goal orientations (e.g., task and ego orientations), can influence peoples' behaviour in certain situations (Nicholls, 1989). *Task orientation* describes the tendency to acquire knowledge and skills and perform one's best. If they are task-oriented, individuals tend to perceive their competence as self-referenced (e.g., when task-oriented, students may experience personal improvement in certain tasks of PE class). In contrast, *ego orientation* prevails when people tend to be preoccupied with their abilities and regard personal demonstrations of superior competence as essential to their success. Ego-oriented individuals are likely to evaluate their competence via comparison with others (e.g., ego-oriented students want to demonstrate superiority in comparison with their peers; Castillo et al., 2010; Nicholls, 1989). Strong positive correlations have been reported between task orientation and intrinsic motivation in high school students in PE settings (Dorobantu & Biddle, 1997; Vlachopoulos & Biddle, 1996), while small negative associations have been found for ego orientation and intrinsic motivation in a similar target group (Ferrer-Caja & Weiss, 2000).

Additional important correlates in relation with PE participation include enjoyment, perceived competence, perceived choice, and pressure (assessed by the intrinsic motivation inventory [IMI]; Deci & Ryan, 2003; McAuley, Duncan, & Tammen, 1989) and represent essential factors in PE participation for all age groups (Pannekoek, Piek, & Hagger, 2014). While the more autonomous forms of behavioural regulation have consistently been found to be associated

with correlates like interest (Goudas et al., 1994) and teachers' perceptions of persistence and effort (Standage, Duda, & Ntoumanis, 2006), amotivation has exhibited positive associations with effort to avoid attendance and low involvement in PE contexts (Ntoumanis, Pensgaard, Martin, & Pipe, 2004).

Although several instruments have been developed and validated in specific languages to measure behavioural regulations in PE contexts, it is still likely that these instruments may not accurately assess what is intended after being translated and adopted to new cultures and contexts (Teixeira et al., 2018). Despite cross-validation procedures and SDT's principles of universality, little attention has been paid to the validity of the scores of one of the most commonly used SDT-based measurement instruments regarding students' motivation in PE, the PLOCQ (Goudas et al., 1994; Lonsdale, Sabiston, Taylor, & Ntoumanis, 2011). Goudas et al. (1994) initially developed this instrument by adopting the Self-Regulation Questionnaire created by Ryan and Connell (1989). The initial scale consisted of the following factors: external regulation, introjected regulation, identified regulation, and intrinsic motivation; it was then extended by a factor assessing amotivation (derived from the Academic Motivation Scale; Vallerand et al., 1992) to expand the spectrum of the self-determination continuum. Each factor consisted of four items. Previous research on psychometric evaluations of the PLOCQ has demonstrated support for the reliability and validity of these five factors (Lonsdale et al., 2011; Ntoumanis, 2005; Standage, Duda, & Ntoumanis, 2005; Taylor & Ntoumanis, 2007; Teixeira et al., 2018), with some inconclusive findings found for introjected regulation (i.e., alpha values lower than 0.70; Murcia, Coll, & Garzón, 2009; Ntoumanis, 2005) and difficulties in the distinction between amotivation and external regulation as well as identified regulation and intrinsic motivation (Teixeira et al., 2018).

Although the PLOCQ has been an extremely useful instrument for assessing behavioural regulations in the PE context, it does have limitations. Despite

the fact that the PLOCQ has been extended by an additional factor assessing amotivation, a measure of integrated regulation, however, is still missing in the current version of the PLOCQ, as it is also missing in other commonly used instruments to assess behavioural regulations (e.g., Behavioural Regulation in Exercise Questionnaire; Mullan, Markland, & Ingledew, 1997; Behavioural Regulation in Exercise Questionnaire-2; Markland & Tobin, 2004), presumably because it mirrors a multifaceted latent variable that is challenging to assess with few specific items (Pelletier & Sarrazin, 2007) and is difficult to distinguish from identified regulation.

However, by omitting a measure of integrated regulation, a complete operationalisation of motivational constructs as specified by OIT is precluded. Furthermore, research in the PE context supports the role of integrated regulation in predicting physical activity participation (Ferriz, González-Cutre, & Sicilia, 2015), which is particularly important as PE should prepare and motivate students to take on an active lifestyle outside of the school environment. Moreover, given PE's compulsory characteristic at German schools, integrated regulation might be the most self-determined regulation (of extrinsic motivation) we are able to detect (i.e., students might not report enjoyment and fun in PE contexts because it is compulsory). Lastly, research in the exercise context across various samples also points to integrated regulation being a predictor of exercise uptake, maintenance (e.g., Edmunds, Ntoumanis, & Duda, 2006; Wasserkampf, Kleinert, & Chermette, 2018; Wilson & Rodgers, 2004), and exercise duration (Duncan, Hall, & Wilson, 2010), pointing to the importance of an assessment of integrated regulation particularly with respect to long-term behavioural sustainment. Thus far, however, modifications of existing measures in the PE and exercise domain that include a measure of integrated regulation have not resulted in definitive measures of the construct (McLachlan, Spray, & Hagger, 2011) due to limited details regarding item generation and/or validation procedures as well as con-

cerns about conforming to a simplex-like structure (D'Angelo, Reid, & Pelletier, 2007; Li, 1999; Wilson & Rodgers, 2004). As such, there is a strong need to develop valid and reliable measures of integrated regulation.

Furthermore, to our knowledge, no German version of the PLOCQ currently exists. Consequently, the aims of this study were to (1) translate the PLOCQ into the German language and extend the questionnaire by including the factor integrated regulation and to (2) evaluate the psychometric properties of the questionnaire (i.e., item analysis, analysis of factor structure, analysis of reliability, and construct validity testing). In terms of construct validity, based on the theoretical and empirical background mentioned above, moderate positive associations are expected to be found between the more autonomous forms of regulations (especially intrinsic motivation) and task orientation in addition to small negative associations between the more autonomous forms of regulations (especially intrinsic motivation) and ego orientation. Furthermore, positive associations are expected to be found between the autonomous forms of regulations (especially intrinsic motivation) and enjoyment/interest, perceived competence, and perceived choice as well as negative associations between the autonomous forms of regulations (especially intrinsic motivation) and pressure.

Step 1: translation and extension of the Perceived Locus of Causality Questionnaire (PLOCQ)

As indicated above, the aim of step 1 was to create a German version of the PLOCQ (Goudas et al., 1994) with the additional factor of integrated regulation, given that the original PLOCQ does not include an integrated regulation factor.

Method

The PLOCQ (Goudas et al., 1994) was translated using a back-translation technique (Banville, Desrosiers, & Genet-Volet, 2000). First, the original English versions of the instruction, item stem,

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Abstract

The aims of this study were to translate and validate an extended German-language version of the Perceived Locus of Causality Questionnaire (PLOCQ), a questionnaire that assesses behavioural regulations in the physical education (PE) context. Items assessing integrated regulation were added given that the original PLOCQ omits this factor. The sample consisted of 223 students from different German secondary schools. Psychometric analyses provided support for the six factors and 24-item model. Inter-correlations among the factors predominantly mirrored a simplex-like structure, except for the correlations between introjected and identified regulation and integrated regulation and its adjacent forms of regulation. Construct validity was demonstrated with positive correlations between the autonomous forms of regulation on the one hand and task orientation, perceived competence, and enjoyment on the other. Overall, this study showed that the PLOCQ-G with six factors and 24 items has good psychometric properties and can be used to assess behavioural regulations in German PE students.

Keywords

Self-Determination Theory · Behavioural regulations · Psychometric properties · Measurement instrument · Integrated regulation

scale, and individual items were translated into the German language independently by three experts in (exercise) motivation psychology to ensure that the translations were designed in the way they were intended. Subsequently, for the instruction, item stem, scale, and each individual item, the three translations were compared, with the experts agreeing upon a final version. With regard to the items, in case more than one accept-

able translation for a given item was revealed, all acceptable item versions were retained. Consequently, for some items, two versions exist (double items). Second, the accepted translations were back-translated by a native English speaker. Third, the original and back-translated versions of the instruction, item stem, scale, and items were compared. Differences between both versions resulted in additional adjustments to the initial translation. Overall, debate about the adjustments among the experts resulted in minor changes. Items assessing integrated regulation were derived from the German version of the Behavioural Regulation in Sports Questionnaire (BRSQ; Kleinert & Pels, 2013; Lonsdale, Hodge, & Rose, 2008). In previous studies, these items revealed an excellent internal consistency ($\alpha = 0.93$; Kleinert & Pels, 2013; $\alpha = 0.90$; Kleinert et al., 2017). Because the questionnaire was developed for the sports context in general, the wording of the items was slightly adjusted to the PE context. The final version was given to a potential recipient of the questionnaire (i.e., a student in grade 7) to acquire specific information regarding any difficulties in their understanding of the wording of the questionnaire.

Results

A first version of the PLOCQ-G was developed, containing 30 items resulting in six factors (amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation). Some items per factor revealed more than one acceptable translation: amotivation and identified regulation each contain four items (as proposed in the original PLOCQ version; Goudas et al., 1994); introjected and intrinsic motivation comprise five; while external regulation and integrated regulation each contain six items due to the use and inclusion of double items. Identified regulation and amotivation (four items each) have the same distribution of items as the original questionnaire from Goudas and colleagues. The pretest regarding the student's understanding of the wording confirmed an overall good understanding and plausibility.

Step 2: evaluation of psychometric properties

In step 2, item analysis, analysis of the factor structure, analysis of reliability, and construct validity testing of the PLOCQ-G were conducted. The purpose of these analyses was to determine the psychometric item statistics, the reliability of the factors, the factor validity, and the construct validity of the questionnaire. In order to analyse the construct validity, the behavioural regulation factors were related to the factors of task and ego orientation as well as to their antecedents (perceived competence, perceived choice) and the outcomes (enjoyment, pressure) of intrinsic motivation.

Method

Participants

The sample consisted of 223 students ($n = 111$ girls, $n = 108$ boys) aged between 13 and 20 years ($M = 15.70$ years, $SD = 1.48$) from different German secondary schools in North-Rhine Westphalia (NRW). Students were recruited from grammar schools, comprehensive schools, and special schools. Grade levels ranged from grade 8 to 13. Grade 10 was the most represented grade in this sample. The majority of the students (68%) participated in three PE classes per week ($M = 2.98$, $SD = 0.06$).

Measures

Behavioural regulations in PE. To assess behavioural regulations in PE, the extended German version of the PLOCQ (Goudas et al., 1994), containing the double items, was used (step 1). Following the stem 'I participate in this physical education class...', the questionnaire's 30 items were partitioned into six factors, with four to six items for each factor: *amotivation* (four items, e.g., '... but I really don't know why'), *external regulation* (six items, e.g., '... because I'll get into trouble if I don't'), *introjected regulation* (five items, e.g., '... because I want the teacher to think I'm a good student'), *identified regulation* (four items, e.g., '... because I want to learn sport skills'), *integrated regulation* (six items, e.g., '... because PE

is a part of me'), and *intrinsic motivation* (five items, e.g., '... because PE is fun') with a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) (Appendix A).

Task and ego orientations in sports.

Task and ego orientations in sports were operationalised by the German version (Rethorst & Wehrmann, 1998) of the Task and Ego Orientation in Sports Questionnaire (TEOSQ; Duda, 1992). The questionnaire asks participants to think of situations in which they personally feel successful in sports. Following the stem 'I feel most successful, when ...', the 13-item scale assesses *task orientation* by means of seven items (e.g., '... I learn a new skill by trying hard'; $\alpha = 0.86$) and *ego orientation* by means of six items (e.g., '... the others can't do as well as me'; $\alpha = 0.89$). Responses are given on a five-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree).

Intrinsic motivation. Intrinsic motivation was assessed with the German version of the short scale of intrinsic motivation (Wilde, Bätz, Kovaleva, & Urhahne, 2009; original version 'Intrinsic Motivation Inventory' (IMI); Deci & Ryan, 2003), which measures participants' perceived motivation related to a target activity. The scale gives detailed information about positive and negative predictors of intrinsic motivation based on the basic psychological needs for autonomy and competence (Deci & Ryan, 2000). The scale is made up of 12 items and is partitioned into four factors, measuring *enjoyment* (three items, e.g., 'I enjoyed the activity in PE very much'; $\alpha = 0.89$), *perceived competence* (three items, e.g., 'I am satisfied with my performance in PE'; $\alpha = 0.87$), *perceived choice* (three items, e.g., 'I believe I had some choice about doing the activity in PE'; $\alpha = 0.80$), and *pressure* (three items, e.g., 'I felt very tense while doing the activity in PE'; $\alpha = 0.78$) with three items per factor. The five-point Likert scale ranges from 0 (strongly disagree) to 4 (strongly agree).

Procedure

First, several educational directors from secondary schools in NRW were con-

tacted to request their collaboration within the current project. Based on the agreement of the directors, PE teachers were informed about the study's purpose via e-mail and, if necessary, via telephone for further information. Afterwards, the PE teachers asked their students if they were willing to take part in this research project. Questionnaires were to be answered at the end of the PE lesson, with completion taking about eight minutes. The questionnaires were returned to the study administration via the PE teachers. The Ethics Committee of the university approved the study following the principles of the Declaration of Helsinki. Students provided their signed informed consent prior to participation.

Data analysis

Prior to the actual data analysis, data were checked for multivariate outliers according to the guidelines of Tabachnick and Fidell (2014). No multivariate outliers had to be removed from the data set. The data analyses first involved analysis of the descriptive statistics (*M*, *SD*, *Min*, *Max*) and item discrimination (i.e., the correlation of an item with the mean value of the remaining items; Bühner, 2021) for all items (including the double items; see step 1, translation) using IBM SPSS 25 (IBM, Armonk, NY, USA). With respect to the double items, in accordance with the recommendations of Bühner (2021), the item discrimination and item difficulty were used as criteria for the selection of the final items. In the case of several basically fitting items, items contributing to a broad range of item difficulties for the respective factor were selected (Bühner, 2021). After the reduction in the number of items, the item discrimination and item homogeneity (i.e., the items of a factor measuring the same characteristics as the overall factor; Bühner, 2021) for the final items were analysed. Subsequently, confirmatory factor analysis (CFA) using IBM SPSS AMOS 25 was conducted to test the six-factor structure of the PLOCQ-G. In addition to the assumed six-factor structure, a total of four five-factor models were tested, where (I) integrated regulation and identified regulation and (II) integrated regulation and intrinsic motivation were combined,

with both combinations taking place once with eight items and once with four items. In preparation of the CFA, a covariance matrix was generated. Next, the reliability (internal consistency) was analysed. Finally, to evaluate the construct validity, Pearson correlational analyses were conducted between the six behavioural regulation forms on the one hand and task orientation and ego orientation on the other as well as between the behavioural regulation forms on the one hand and enjoyment, perceived competence, perceived choice, and pressure on the other.

Results

Item analysis

Descriptive statistics. The descriptive statistics for each item are shown in [Table 1](#). For all items, the whole range of response options (1 to 7) was utilised. Of the items that were part of the final questionnaire, most of the mean item values were below the midpoint of the scale (4), except for item 8 (external regulation), items 13 to 16 (identified regulation), and items 21 to 24 (intrinsic motivation), which were above the midpoint of the scale. While the lowest mean value was assessed for item 2 (amotivation; $M = 1.80$, $SD = 1.50$), the highest was assessed for intrinsic motivation ($M = 5.37$, $SD = 1.82$). The standard deviations for all mean item values were high.

Specific psychometric item properties.

The psychometric item properties are shown in [Table 1](#). The *item difficulties* were low, medium, and high for each of the factors, as indicated by the aforementioned mean values. The *item discrimination* varied between $r_{id} = 0.45$ and $r_{id} = 0.87$. None of the items were under the recommended discrimination minimum of $r_{id} = 0.30$ (Bühner, 2011). The *item homogeneity* was between $H = 0.51$ ($SD = 0.08$) and $H = 0.76$ ($SD = 0.05$). These values indicate that the factors were moderately to highly homogeneous.

Analysis of factor structure

Model fit. A confirmatory factor analysis of the PLOCQ-G ([Fig. 1](#)) was

conducted to test whether the data adequately fit the factor structure of the original version plus the extension of the factor integrated regulation. According to Hu and Bentler's (1999) and Arbuckle's (2007) guidelines, the confirmatory factor analysis for the six-factor PLOCQ-G demonstrated acceptable fit values: ($\chi^2(237) = 441.38$, $p < 0.001$, $CMIN/DF = 1.86$, $CFI = 0.93$, $TLI = 0.92$, $SRMR = 0.09$, $RMSEA = 0.07$, 90% CI 0.061–0.081). The five-factor models achieved lower fit values (Appendix B) than the OIT-proposed six-factor model (integrated regulation as a separate factor). Therefore, these models were not considered any further.

Factor loadings. The factor loadings were satisfactory ([Fig. 1](#)). More specifically, the factor loadings were acceptable (i.e., $\lambda > 0.60$) to good, except for the items of introjected regulation: item 12 ($\lambda = 0.55$) and item 9 ($\lambda = 0.59$) showed rather low factor loadings, while item 10 ($\lambda = 0.96$) and item 11 ($\lambda = 0.91$) showed high factor loadings.

Inter-correlations. The inter-correlations among the six factors predominantly mirrored a simplex-like structure: Positive correlations were found between adjacent types of regulations (e.g., intrinsic motivation and integrated regulation) and negative or weaker correlations were found for non-adjacent regulation types (e.g., intrinsic motivation and amotivation). Contradictory to the simplex-like structure, weak (positive) correlations were found for introjected and identified regulation as well as for integrated regulation and its adjacent forms of regulation (intrinsic motivation, identified regulation). Contrary to the assumption, a higher correlation was also found for intrinsic motivation and identified regulation ([Fig. 1](#)).

Analysis of reliability

The results of the analysis of the *internal consistency* revealed good to excellent Cronbach alpha values between $\alpha = 0.81$ (external regulation) and $\alpha = 0.93$ (integrated regulation). Given that essential tau-equivalence was violated (as indicated by unequal factor loadings),

Table 1 Descriptive item statistics, psychometric item properties and factor reliability of the PLOCQ-G (Perceived Locus of Causality Questionnaire–German version)

Item number	M	SD	r_{id} (all)	r_{id} (final)	$H(SD)$ (final)	α (final)	ω (final)
1 (AM)	1.95	1.64	0.70	0.70	0.60 (0.05)	0.86	0.86
2 (AM)	1.80	1.50	0.74	0.74			
3 (AM)	2.05	1.68	0.65	0.65			
4 (AM)	2.06	1.69	0.71	0.71			
5 (ER)	2.50	2.14	0.57	0.56	0.51 (0.08)	0.81	0.81
6 (ER)	3.71	2.20	0.77	0.72			
^a 6 double (ER)	3.79	2.30	0.79	–			
7 (ER)	2.45	2.09	0.61	0.60			
8 (ER)	4.20	2.32	0.77	0.62	0.51 (0.19)	0.81	0.83
^a 8 double (ER)	3.92	2.37	0.81	–			
9 (IJ)	3.87	2.20	0.42	0.45			
10 (IJ)	2.52	2.03	0.77	0.80			
11 (IJ)	2.76	2.16	0.75	0.77	0.58 (0.06)	0.85	0.85
12 (IJ)	3.12	2.13	0.68	0.50			
^a 12 double (IJ)	3.19	2.15	0.68	–			
13 (ID)	4.89	1.89	0.73	0.73			
14 (ID)	4.99	1.92	0.69	0.69	0.76 (0.05)	0.93	0.93
15 (ID)	5.09	1.84	0.71	0.71			
16 (ID)	4.50	1.93	0.62	0.62			
17 (IG)	3.82	2.08	0.79	0.76			
18 (IG)	3.31	2.15	0.91	0.86	0.65 (0.06)	0.88	0.88
^a 18 double (IG)	3.53	2.35	0.86	–			
19 (IG)	2.82	1.95	0.87	0.87			
20 (IG)	2.98	1.93	0.86	0.82			
^a 20 double (IG)	2.75	1.83	0.83	–	0.65 (0.06)	0.88	0.88
21 (IM)	5.37	1.82	0.68	0.69			
22 (IM)	5.05	1.88	0.84	0.78			
^a 22 double (IM)	4.72	1.90	0.83	–			
23 (IM)	4.24	1.97	0.74	0.74			
24 (IM)	4.82	1.90	0.81	0.76			

M Mean and item difficulty, SD Standard deviation, **double** double item, in case more than one acceptable translation for a given item was revealed, r_{id} (all) = item discrimination when all items are retained, r_{id} (final) = item discrimination of the finally retained items (without double items), $H(SD)$ (final) = item homogeneity of the final factors (without double items), α (final) = Cronbach alpha factor reliability of the final factors (without double items), ω (final) = McDonald's omega factor reliability of the final factors (without double items), **AM** Amotivation, **ER** External Regulation, **IJ** Introjected Regulation, **ID** Identified Regulation, **IG** Integrated Regulation, **IM** Intrinsic Motivation
^aItems 6 double (ER), 8 double (ER), 12 double (IJ), 18 double (IG), 20 double (IG), 22 double (IM) are not retained in the final questionnaire

McDonald's omega was also calculated (Trizano-Hermosilla & Alvarado, 2016). The results were exactly the same as for Cronbach's alpha, except for introjected regulation ($\omega = 0.83$; $\alpha = 0.81$), confirming the internal consistency.

Analysis of construct validity

Table 2 displays the correlations between the behavioural regulations and task and ego orientation as well as between the behavioural regulation forms

and enjoyment, perceived competence, perceived choice, and pressure. In terms of task and ego orientation, the more autonomous forms of regulations showed positive correlations with task orientation, with the highest positive correlation found for intrinsic motivation and task orientation ($r = 0.71$, $p < 0.001$). Furthermore, weak positive correlations were found for identified regulation and ego orientation ($r = 0.16$, $p = 0.021$) as well as for integrated regulation and ego orien-

tation ($r = 0.24$, $p < 0.001$). No significant correlations were found for intrinsic motivation and ego orientation. The more controlled regulation forms showed negative or weak positive correlations with task orientation, with the highest negative correlation found for task orientation and amotivation ($r = -0.40$, $p < 0.001$) in addition to negative or weak (not significant) positive correlations with ego orientation.

Weak positive correlations were found between the more autonomous regulation forms and enjoyment, perceived competence, and perceived choice. The highest positive correlation was found between intrinsic motivation and enjoyment ($r = 0.36$, $p < 0.001$). Furthermore, negative correlations between the more autonomous regulation forms and pressure were revealed, with the highest negative correlation found for intrinsic motivation and pressure ($r = -0.14$, $p = 0.040$). The more controlled regulation forms showed negative or weak positive correlations with enjoyment, perceived competence, and perceived choice. The highest negative correlation was found for amotivation and enjoyment ($r = -0.34$, $p < 0.001$). Meanwhile, positive correlations were revealed between pressure and the more controlled regulation forms. The highest positive correlation was found for extrinsic regulation and pressure ($r = 0.23$, $p = 0.001$).

Discussion

In order to prevent further declines in physical activity levels in adolescents and young adults, it seems worthwhile to investigate students' underlying motivational orientations towards compulsory PE. Obtaining deeper insights into the reasons why students engage or fail to engage in PE helps to develop tailored intervention strategies to adjust PE curriculums according to students' desires and expectations and promote more self-determined motivation in PE contexts (Teixeira et al., 2018). As no German measurement instrument yet exists, the aims of this manuscript were to (1) translate the PLOCQ into the German language and extend the questionnaire by including the factor integrated regula-

Fig. 1 Confirmatory factor analysis of the PLOCQ-G (Perceived Locus of Causality Questionnaire–German version) based on $n = 223$ students (six factors, 24 items)

tion and to (2) evaluate the psychometric properties of the questionnaire. The main findings suggest that the PLOCQ-G with six factors is a reliable and valid measurement instrument for assessing behavioural regulations in German PE classes.

With regard to the translation of the PLOCQ into the German language and the extension of the factor integrated regulation, no major issues were detected. The pretesting of the questionnaire revealed the student's good understanding of the items. The minor adjustments

made to the integrated regulation items (i.e., to ensure they fit the PE context) were also unproblematic, as shown by the factor's good psychometric properties, as further discussed below.

With regard to the evaluation of the psychometric properties of the questionnaire, the results indicated that the PLOCQ-G is reliable and valid for assessing behavioural regulations in German PE classes. In the following section, the item analysis, factor structure (model fit, factor loadings, inter-correlations),

reliability, and construct validity of the PLOCQ-G will be discussed.

With regard to the item analysis and descriptive statistics, the whole range of response options (1 to 7) was used across items. The mean values found for the six regulation factors followed a descending order, beginning with intrinsic motivation and ending with amotivation, except for identified regulation, which showed higher mean values compared to integrated regulation; this is in accordance with previous research (Cid et al., 2018; Ferriz et al., 2015; Wilson, Rodgers,

Table 2 Correlation coefficients (*r*) of the six PLOCQ-G (Perceived Locus of Causality Questionnaire–German version) factors with the additional correlates task and ego orientation and enjoyment, perceived competence, perceived choice and pressure

Factor	1	2	3	4	5	6	7	8	9	10	11	12
1. Amotivation	–	–	–	–	–	–	–	–	–	–	–	–
2. External	0.48**	–	–	–	–	–	–	–	–	–	–	–
3. Introjected	–0.01	0.38**	–	–	–	–	–	–	–	–	–	–
4. Identified	–0.44**	–0.19	0.21**	–	–	–	–	–	–	–	–	–
5. Integrated	–0.36**	–0.27	0.15*	0.59**	–	–	–	–	–	–	–	–
6. Intrinsic	–0.55**	–0.31**	0.13	0.71**	0.57**	–	–	–	–	–	–	–
7. Task orientation	–0.40**	–0.17*	0.12	0.56**	0.47**	0.71**	–	–	–	–	–	–
8. Ego orientation	–0.09	0.07	0.09	0.16*	0.24**	0.12	0.16*	–	–	–	–	–
9. Enjoyment	–0.34**	–0.18**	0.13	0.14*	0.17*	0.36**	0.30**	0.04	–	–	–	–
10. Perceived competence	–0.15*	–0.09	0.06	0.21**	0.27**	0.26**	0.17*	0.28**	0.52**	–	–	–
11. Perceived choice	–0.19**	–0.10	0.06	0.05	0.22**	0.16*	0.12	0.17*	0.43**	0.42**	–	–
12. Pressure	0.22**	0.23**	0.12	–0.02	–0.09	–0.14*	–0.07	–0.09	–0.23**	–0.26**	–0.05	–

* $p < 0.05$, ** $p < 0.01$

Loitz, & Scime, 2006). The analysis of specific psychometric item properties showed satisfactory results (e.g., item difficulties, item discrimination, and item homogeneity).

In terms of the factor structure, the results showed acceptable model fit values for the extended six-factor and 24-item model, which is in line with Goudas et al. (1994). However, a few inconsistencies regarding the factor loadings of introjected regulation were obtained, with two items showing factor loadings slightly lower than the recommended minimum of $\lambda = 0.60$: item 9 ($\lambda = 0.59$; ‘... because I want the teacher to think I’m a good student’) and item 12 ($\lambda = 0.55$; ‘... because it bothers me when I don’t’). In order to explain these values, it might be worthwhile to look closer at the meaning of item 9, as the item’s orientation appears to differ compared to the other introjected regulation items. Typically, introjected regulation is assessed through avoidance-oriented items, such as in item 10, 11, and 12, in which students engage in PE to avoid negative consequences (e.g., Item 10: ‘... because I would feel guilty if I didn’t’). Item 9, in contrast, appears to be unique, as both avoidance and approach orientations (i.e., engaging in PE to receive praise from the PE teacher) could co-exist. Whether item 9 is ultimately perceived as approach- or avoidance-oriented depends, nonetheless, on how the student understands and interprets that item,

which in turn affects the factor loading of item 9. As such, the lower scores found for item 9 could thus be attributed to an imbalance in the orientations (i.e., avoidance vs. approach) underlying the introjected regulation items.

With respect to the lower factor loading found for item 12 (‘... because it bothers me when I don’t’), it should be emphasised that the phrasing ‘bother’ is relatively uncommon in the assessment of introjected regulation when compared to the common scales assessing behavioural regulations. Typically, introjected regulation is captured by shame, guilt, and anxiety (Deci & Ryan, 1985). The slightly lower value found for the factor loading of item 12 might thus be attributed to item-specific variances (i.e., different interpretations due to the uncommon wording of the item). Apart from these issues surrounding items 9 and 12, we would like to emphasise that the Cronbach alpha value for the factor introjected regulation is nonetheless acceptable.

With regard to the inter-correlations among the PLOCQ-G, the results revealed that the single factors supported the simplex-like structure underlying the self-determination continuum, but with few exceptions. First, while stronger correlations were identified for adjacent and weaker correlations were detected for nonadjacent regulations (i.e., according to a quasi-simplex structure), weak (positive) correlations were found for introjected and identified regulation as

well as for integrated regulation and its adjacent forms of regulation (intrinsic motivation, identified regulation). In comparison to the aforementioned weak positive correlations, a higher correlation was found for intrinsic motivation and identified regulation. Although the positive correlation found for introjected and identified regulation as well as the higher correlation found for intrinsic motivation and identified regulation are contradictory to OIT’s simplex-like structure, these findings are not new, with similar patterns having been reported in the literature. For example, numerous studies have reported positive relations between introjected and identified regulation across different contexts (Ng et al., 2012; Pelletier et al., 1995; Wilson, Rodgers, Fraser, & Murray, 2004). Furthermore, although correlations between identified and intrinsic motivation were found to be high in the current study, similar high results were found for intrinsic and identified regulation ($r = 0.99$, $p < 0.001$) in the Spanish PLOCQ scale (also in a PE context; Ferriz et al., 2015). In addition, studies that excluded measures of integrated regulation in the PE context have also reported high correlations for the aforementioned regulations that are even higher than those found in the current study (Murcia et al., 2009; Teixeira et al., 2018). Lastly, even in the sport context, similar results have been reported (Cid et al., 2018; Wilson et al., 2006). Despite

this, we would like to emphasise that the results pertaining to integrated regulation need to be interpreted with caution, as the quasi-simplex structure is not confirmed by the present data. In sum, and based on the present results, the inclusion of the factor integrated regulation seems to be a worthwhile extension of the PLOCQ; however, it has some limitations that should be addressed in future studies in order to improve the integrated regulation factor.

The analysis of reliability (internal consistency) revealed Cronbach alpha values between $\alpha=0.81$ (e.g., external regulation, introjected regulation) and $\alpha=0.93$ (e.g., integrated regulation), both of which are classified as “good” to “excellent” Cronbach alpha values (Hair, Black, & Babin, 2014), this particularly, when scales are composed of a few items only (Cronbach, 1951). Contrary to previous research, which commonly obtained relatively low reliability scores for introjected regulation (Goudas et al., 1994; Murcia et al., 2009; Ntoumanis, 2005; Standage et al., 2005), the Cronbach alpha value for introjected regulation in the present study was above the recommended minimum value of $\alpha=0.70$ (Hair et al., 2014). Also McDonald’s omega values confirmed the internal consistency.

Lastly, analyses of the construct validity showed widely expected results, as most correlations were in accordance with what was expected (e.g., a correlation between intrinsic motivation and task orientation), with only some correlations not as hypothesised (e.g., an unexpected correlation between integrated regulation and ego orientation; e.g., a weak correlation between intrinsic motivation and enjoyment). The unexpected positive correlations between ego orientation and the more autonomous regulation forms could be attributed to a perceived competence that even ego-oriented students feel during PE lessons. Consistently, previous research has shown that ego orientations might be positively related to intrinsic motivation in students who feel competent in PE (Goudas et al., 1994). Furthermore, the weak correlations between the factors of the PLOCQ-G and the intrinsic motiva-

tion factors of the short scale of intrinsic motivation could be attributed to the measurement instruments and specifically to the instructions of the scales. While the instructions of the short scale of intrinsic motivation refers to the PE lesson students participated in (situational motivation), the instructions of the PLOCQ-G refers to PE classes in general (contextual motivation) (Vallerand, 2001). Future studies are warranted to re-examine the PLOCQ-G’s construct validity with additional convergent (e.g., behavioural regulation in sport/exercise) and divergent (e.g., basic psychological needs; Deci, Ryan, & Williams, 1996) constructs to obtain even clearer results.

Limitations and future research

Although the present study attempted to close a research gap (i.e., the nonexistence of a measurement that assesses the full behavioural regulation spectrum in the German language), several limitations need to be addressed with respect to: (1) the integrated regulation factor, (2) the sample, (3) the instrument’s generalizability, and (4) the context of reference.

First, although the results of the factor integrated regulation indicated satisfactory internal consistencies, some concerns regarding its inter-correlations and mean values were detected. These theoretically contradictory findings might be attributable to the wording of the integrated regulation items, which presumably were more difficult to understand for the target group, as the items mirror the key concepts of the factor, including alignment with one’s core values, which requires a reflection of one’s sense of self. Additionally, as integrated regulation is characterised by the acceptance of the importance of a behaviour and the alignment of this importance with other aspects of the self (Deci & Ryan, 2000), not only might the wording have been challenging for the target group but also an inability to reflect on one’s sense of self and core values (Lonsdale et al., 2008). To overcome these assessment issues, future studies that additionally include integrated regulation indicators, such as positive corre-

lations between a given behaviour (e.g., PE) and a self-report of valuing and enjoying that given behaviour, are warranted along with those that apply an interactive approach, such as an interview with clarifying explanations (Lonsdale et al., 2008; Pelletier & Sarrazin, 2007), to help students better understand this type of regulation. Lastly, given that the pretesting was undertaken by one student only, future studies are encouraged to extend their pretesting procedures to include more participants. Secondly, with respect to the sample, it was not controlled for the level of PE course in which the participants took part, that is, whether it was a higher level course or a general PE course. Differences in the PE course levels most likely affected how the students responded to behavioural regulation-related questions, with students from higher level courses potentially scoring higher on the more autonomous regulation items when compared to the students who participated in general PE courses. Future studies are therefore encouraged to distinguish between different PE course levels. Thirdly, with regard to the instrument’s generalisability, we cannot yet declare whether the PLOCQ-G can be used in different age groups (e.g., lower and higher grades). Future studies are encouraged to test for measurement invariances, as age group-specific motivation-related information is crucial when curricula are being adjusted according to students’ desires and needs. Fourthly, given that the instructions for the questionnaires used varied with respect to the context (i.e., PE in general vs. a PE class just completed), future research should focus on the same context when assessing motivation-related constructs, also with regard to more robust construct validity results. Lastly, we would like to draw the readers’ attention to the most recent debates on the structure and conceptualisation of motivation as defined in SDT. While the present findings are grounded in a multidimensional approach to motivation (i.e., conceptually distinct types of regulations), Howard, Gagné, and Morin (2020) argued that these qualitatively distinct types of regulations are also tied together along a single continuum of self-determination,

reflecting the degree of self-determination in a global dimension (i.e., unidimensional). Given that the research to date typically refers to either one or the other (i.e., either a multi- or unidimensional approach), but rarely both, one half of the theory is often ignored (Howard et al., 2020). Future research is encouraged to integrate both assumptions in order to best conceptualise motivation as defined in SDT.

Conclusion

Overall, the aims of this study were to (1) translate the PLOCQ into the German language and to extend the questionnaire by including the factor integrated regulation and to (2) evaluate the psychometric properties of the questionnaire. Despite some limitations concerning the factor integrated regulation, the present study provides an instrument that allows for assessing the entire behavioural regulation spectrum (including integrated regulation) in the German PE context. For the time being, we recommend researchers who believe that an assessment of the factor integrated regulation is worthwhile, to assess it, but to interpret the results with caution. With the validation of the PLOCQ-G, it is now possible to help PE teachers gain insights into the reasons why their students engage in PE and support them in designing their PE lessons according to their students' needs.

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Declarations

Conflict of interest. J. Wolf, J. Kleinert, F. Pels and A. Vogelsang declare that they have no competing interests.

For this article no studies with human participants or animals were performed by any of the authors. All studies performed were in accordance with the ethical standards indicated in each case.

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Appendix A

Table A.1 German version of the Perceived Locus of Causality Questionnaire (PLOCQ-G)**Ich nehme am Sportunterricht teil, ...**

1. aber ich weiß wirklich nicht warum. [AM, item 1]
2. aber ich weiß nicht warum wir Sportunterricht haben sollten. [AM, item 2]
3. aber ich habe wirklich das Gefühl meine Zeit im Sportunterricht zu verschwenden. [AM, item 3]
4. aber ich weiß nicht, was mir der Sportunterricht bringen soll. [AM, item 4]
5. weil ich Ärger kriege, wenn ich es nicht tue. [ER, item 5]
6. weil es das ist, was ich tun soll. [ER, item 6]
- ^aweil es von mir erwartet wird. [ER, item 6 *double*]
7. damit der Lehrer/die Lehrerin mich nicht anschreit. [ER, item 7]
8. weil es so vorgeschrieben ist. [ER, item 8]
- ^aweil es die Regel ist. [ER, item 8 *double*]
9. weil ich will, dass der Lehrer/die Lehrerin denkt, dass ich ein guter Schüler/eine gute Schülerin bin. [IJ, item 9]
10. weil ich mich schuldig fühlen würde, wenn ich es nicht täte. [IJ, item 10]
11. weil ich mich schlecht fühlen würde, wenn ich es nicht täte. [IJ, item 11]
12. weil es mich ärgert, wenn ich es nicht tue. [IJ, item 12]
- ^aweil ich mich ärgere, wenn ich es nicht tue. [IJ, item 12 *double*]
13. weil ich sportliche Fähigkeiten lernen möchte. [ID, item 13]
14. weil es mir wichtig ist, gut im Sportunterricht zu sein. [ID, item 14]
15. weil ich mich im Sportunterricht verbessern will. [ID, item 15]
16. weil ich Fähigkeiten lernen kann, die ich auch in anderen Bereichen meines Lebens nutzen könnte. [ID, item 16]
17. weil es eine Möglichkeit ist, einfach ich selbst zu sein. [IG, item 17]
18. weil der Sportunterricht ein Teil von mir ist. [IG, item 18]
- ^aweil er ein Teil von mir ist. [IG, item 18 *double*]
19. weil das, was ich im Sportunterricht tue, ausdrückt, wer ich bin. [IG, item 19]
20. weil er mir ermöglicht, in Einklang mit meinen Werten zu leben. [IG, item 20]
- ^aweil der Sportunterricht mir ermöglicht, in Einklang mit meinen Werten zu leben [IG, item 20 *double*]
21. weil Sportunterricht Spaß macht. [IM, item 21]
22. weil ich gerne neue Fähigkeiten lerne. [IM, item 22]
- ^aweil ich es genieße neue Fähigkeiten zu lernen. [IM, item 22 *double*]
23. weil Sportunterricht spannend ist. [IM, item 23]
24. weil es mir Freude macht, neue Fähigkeiten zu lernen. [IM, item 24]

German translation of the Perceived Locus of Causality Questionnaire (PLOCQ) by Goudas et al. (1994). Items assessing integrated regulation (items IG 17–20) were derived from the German version of the Behavioural Regulation in Sports Questionnaire (BRSQ; Kleinert & Pels, 2013; Lonsdale et al., 2008)

AM Amotivation, **ER** External Regulation, **IJ** Introjected Regulation, **ID** Identified Regulation, **IG** Integrated Regulation, **IM** Intrinsic Motivation

^aItem 6 double (ER), 8 double (ER), 12 double (IJ), 18 double (IG), 20 double (IG), and 22 double (IM) are not retained in the final questionnaire

Appendix B

Table B.1 Fit indices for the final six-factor model and the alternative five-factor models

Factors	Model	χ^2	Df	p	CMIN/df	CFI	TLI	RMSEA	SRMR	90% CI
6	1) Final PLOCQ-G	441,384	237	< 0.001	1.862	0.927	0.915	0.071	0.0870	0.061–0.081
5	5) Combined IG & IM (8 Items)	715,407	242	< 0.001	2.956	0.831	0.808	0.107	0.1025	0.098–0.116
	6) Combines IG & IM (4 Items)	398,667	160	< 0.001	2.492	0.884	0.862	0.094	0.0929	0.082–0.105
	7) Combined IG & ID (8 Items)	654,27	242	< 0.001	2.704	0.852	0.832	0.100	0.1056	0.091–0.109
	8) Combines IG & ID (4 Items)	394,645	160	< 0.001	2.467	0.887	0.866	0.093	0.1056	0.081–0.104

The combined models each contain two factors with either 8 items (all final items of both factors) or 4 items (for each factor, two items with the best factor loadings)

ID Identified Regulation, *IG* Integrated Regulation, *IM* Intrinsic Motivation

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