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Michael Braksiek
Department of Sports Science, University of Vechta, Vechta, Germany

Pre-service physical education teachers' attitudes toward inclusive physical education

Subject specificity and measurement invariance

Introduction

Since German ratification of the United Nations Convention on the Rights of Persons with Disabilities in 2009, students with special educational needs (SENs) have the right to be educated in mainstream schools and regular classrooms (Powell, Edelstein, & Blanck, 2016). In the course of that fundamental change in the school system, many questions have arisen regarding the implementation of inclusive education in every school subject. Inclusive education is about providing an optimal learning environment for every student and reducing learning barriers (Forlin, 2012; Tiemann, 2018). In addition to contextual factors and conditions, teachers influence the extent to which their classrooms are inclusive through their teaching practices (Florian & Spratt, 2013). Therefore, appropriate training is crucial for successful implementation of inclusive education programs (Erhorn, Moeller, & Langer, 2020; Forlin & Chambers, 2011). Although teachers prior to receiving their teacher certification (pre-service teachers) need to develop skills for implementing inclusive practices, they also should develop the willingness and intention to implement these inclusive practices in their teaching. This intention is considered as an essential condition for the actual implementation of such practices (Sheeran & Webb, 2016; Yan & Sin, 2014). According to the theory of planned behavior (TPB; Fishbein & Ajzen, 2010), attitude plays an important role in shaping one's intention to behave in a certain way. In many recent studies, focus has been on the attitudes of teachers and pre-service teachers toward inclusive education in general (Forlin, Earle, Loreman, & Sharma, 2011; MacFarlane & Woolfson, 2013; Schwab, 2018; Sharma, Shaukat, & Furlonger, 2015) as well as toward inclusive physical education (PE) specifically (Hutzler, Meier, Reuker, & Zitomer, 2019; Lautenbach & Antoniewicz, 2018; Rischke, Heim, & Gröben, 2017).

According to the TPB, the measured attitude should have the same context as the predicted intention and behavior for optimal power of prediction (Fishbein & Ajzen, 2010). Therefore, in the context of inclusive education, focus should be on subject-specific attitudes, as school subjects represent a specific context for specific inclusive teaching practices. Especially inclusive PE represents a context in which the need for specific inclusive practices is obvious. For example, the unique teaching environment (e.g., gymnasium, swimming pool) leads to higher relevance of the students' bodies and motor abilities than in other subjects. This implies that certain SENs must be given more (i.e., physical disabilities) and others less attention (i.e., learning disabilities) than in other subjects (Rischke & Braksiek, 2019).

A positive attitude toward inclusive PE is one stated goal of physical teacher education (PETE) for inclusion (Erhorn et al., 2020), but there is a lack of research regarding the attitude of pre-service PE teachers in Germany and especially the assessment of that attitude. There are some instruments to assess the attitude of in- and pre-service PE teachers validated in English and other languages (e.g., Folsom Meek & Rizzo, 2002; Hutzler, Zach, & Gafni, 2005; Kudlacek, Valkova, Sherrill, Myers, & French, 2002; for an overview: Braksiek, Gröben, Heim, & Rischke, 2018), but only two validated instruments are available in German, one each for in-service and pre-service PE teachers:

Based on qualitative interviews, Meier, Ruin, and Leineweber (2017) developed the HainSL/ATIPE[1] instrument to assess pre-service PE teachers' attitudes toward inclusive PE. Based on sociologically oriented pedagogical approaches the instrument focuses on two core aspects of inclusive PE: body and performance (Meier & Ruin, 2019). According to the authors, pre-service PE teachers can perceive these aspects in a wide (i.e., holistic) or narrow (i.e., norm-oriented) manner, which correspond with the two factors of the instrument. The ATIPE is based on a broad concept of diversity and therefore does not explicitly focus on PE with students with SEN. In their validation study, Meier et al. (2017) conducted contrast-group analyses between students of

[1] In German: Instrument zur Erfassung von Haltungen zu inklusivem Sportunterricht bei (angehenden) Lehrkräften. In English: Attitude Towards Inclusive Physical Education scale (ATIPE). For the validation of the English version, see Meier and Ruin (2019).

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sport science, students of PE (pre-service PE teachers) and students of other subjects (pre-service teachers). Results indicated higher values on the *narrow*- and lower values on the *wide*-factor for the pre-service PE teachers compared to the pre-service teachers but lower values on the *narrow*-factor for the pre-service PE teachers compared to the students of sport science.

Rischke et al. (2017) developed the EZI-Sport/S-AIPE[2] to assess the attitude of in-service PE teachers toward inclusive PE. The items of the scale were developed on the basis of qualitative interviews and a scale to assess teachers' general attitudes toward inclusive education (Kunz, Luder, & Moretti, 2010). The S-AIPE is based on a narrow concept of inclusive education (i.e., focus on SENs and disabilities) and measures PE teachers' attitudes toward inclusive PE with one factor. Data of the validation study showed a positive effect of teaching conditions for (inclusive) PE (e.g., accessibility of sports areas and materials), amount of work experience and private experience with people with disabilities on the PE teachers' attitudes (Braksiek, Gröben, Rischke, & Heim, 2019). Although the S-AIPE was not validated for pre-service teachers, Friedrich, Gräfe, Pögl, and Scheid (2017) used the S-AIPE to assess pre-service PE teachers' attitudes toward inclusive PE in an intervention study. They found a positive effect of a seminar about inclusive PE during one semester on pre-service PE teachers' attitudes toward inclusive PE in comparison to a control group.

Other studies in the context of PETE for inclusion investigated pre-service PE teachers' attitudes toward inclusive education in general, using scales that do not focus on inclusive PE as certain subject (e.g., Lautenbach & Antoniewicz, 2018; Weber, 2018). In contrast to most studies in the field, Lautenbach and Antoniewicz (2018) investigated pre-service PE teachers' *implicit* attitudes besides *explicit* attitudes. Whereas explicit attitudes are generally measured using scales, implicit attitudes can be measured using a Single-Target Implicit Association Test (ST-IAT; Bluemke & Friese, 2008). Using this test, Lautenbach and Antoniewicz (2018) showed ambivalent but marginally positive implicit attitudes toward inclusion in a sample of pre-service PE teachers. Weber (2018) showed that there is a difference in pre-service PE teachers' attitudes toward inclusive education in general depending on their degree program. For example, pre-service PE teachers who studied PE and special education had more positive attitudes toward inclusive education than pre-service PE teachers who studied PE and other subjects (Weber, 2018).

Summarizing, there is currently no instrument available to assess pre- and in-service PE teachers' attitudes toward inclusive PE that has been validated in both groups. However, such an instrument is a prerequisite to compare this attitude and potential influence factors between these groups as well as to investigate the development of this attitude over time. These comparisons would help to better understand the effects of various factors in different states of professionalization in teaching inclusive PE and PETE for inclusion. Against this backdrop, the role of the subject-specificity of PE regarding attitude measurement in the context of inclusive education has to be taken into consideration as well. Therefore, the relation of a subject-specific attitude toward inclusive PE to general attitudes regarding inclusive education should be investigated (1) to ensure valid measurements and (2) to investigate differences regarding these attitude dimensions and their influence factors.

Moreover, regarding PETE for inclusion, nothing is known about differences in attitudes toward inclusive PE across different degree programs in German PETE. As most of the degree programs in German teacher education depend on the type of school in which the pre-service teachers are planning to teach, results of these comparisons can be compared to investigations with in-service teachers in certain type of schools. This would lead to a better understanding of the effect of different types of schools on the attitude of in-service PE teachers toward inclusive PE, which has been found in recent studies (e.g., Thomas & Leineweber, 2018). However, as traditions and cultures of inclusive education differ across school types—especially in Germany (Powell et al., 2016)—pre-service teachers' beliefs about inclusive education, and inclusive PE as well, may differ significantly. For example, these beliefs may correlate with pre-service teachers' choice of future school and, accordingly, with their choice of degree program. Moreover, their beliefs may be shaped by the content, topics, and experiences in a certain degree program. These potentially different beliefs about inclusive PE could lead to measurement invariances when using an attitude scale to compare attitudes between groups with different beliefs about inclusive PE. The measurement invariances would consequently lead to inappropriate and imprecise comparison of composite scale means among these groups (Chen, 2008). In terms of the TPB, attitude measurement by Likert-type scales is called "belief-based measure" (Fishbein & Ajzen, 2010, p. 85). Every item of a scale addresses a certain belief about an attitude object (i.e., inclusive PE), which is evaluated by the respondents. A valid belief-based measure of attitudes toward inclusive PE requires that items of the scale address the same beliefs about inclusive PE of every person. For different groups of persons (i.e., pre-service PE teachers in different degree programs), this can be tested investigating the measurement invariance of a scale (Chen, 2008). However, the issue of measurement invariance regarding attitude measurement in the context of PETE for inclusion has not been studied so far.

This study addresses these desiderata in two steps. First, this study investigates the factorial and convergent validity of the S-AIPE in a sample of pre-service PE teachers by setting it in relation to scales that measure attitudes toward inclusive education in general. Second, the measurement invariance of the S-AIPE among different degree programs of the pre-service PE teachers as well as

[2] In German: Skala zur Erfassung der Einstellung zu inklusivem Sportunterricht. In English: Scale to assess PE teachers' attitudes toward inclusive PE (S-AIPE) (Braksiek, Gröben, Rischke, & Heim, 2019).

differences in the assessed attitude depending on the pre-service PE teachers' degree programs are investigated using the alignment method, a new approach for multigroup CFAs (Asparouhov & Muthén, 2014; Byrne & van de Vijve, 2017).

Methods

Participants

The 362 undergraduate pre-service PE teachers ($M_{age} = 22.13$, $SD = 2.93$, female = 53.89%, $M_{semester} = 4.08$, $SD = 2.69$) who took part in this study were studying PE and at least one other subject at a university in North-Rhine Westphalia, Germany. At the time of data collection, most pre-service teachers in Germany were required to complete both a bachelor degree and a master degree within about five years[3]. Afterwards, they were required to complete a practical induction phase of 18–24 months. The sample consisted of pre-service teachers who were in the process of completing their bachelor degree. The pre-service teachers surveyed were studying in one of four degree programs. The programs prepare pre-service teachers for work in (1) primary schools ($n = 54$, 14.9%), (2) secondary and comprehensive schools ($n = 111$, 30.66%), and (3) advanced secondary and comprehensive schools ($n = 151$, 41.71%). The fourth program also prepares pre-service teachers for work in primary schools but offers integrated teacher training for special and inclusive education ((4) ISIE; $n = 46$, 12.71%). It offers several courses and lectures about the field of special and inclusive education. This degree program leads to a double qualification, which technically allows graduates to teach at regular and special schools (Lütje-Klose, Miller, & Ziegler, 2014). However, in line with the government's new goal of making all education inclusive, the aim of this program is to prepare teachers for an inclusive education system and to enable them to teach at regular inclusive schools.

Assessment instruments

To assess the pre-service PE teachers' attitudes toward inclusive PE, the S-AIPE was used (Braksiek et al., 2019; Rischke et al., 2017; ◘ **Table 1**). The scale has five Likert-items ranging from 1 (strongly disagree) to 6 (strongly agree) to which the pre-service PE teachers had to respond. One of these items is reversed to optimize coverage of the construct and minimize disruption of nonsubstantive response behavior (Weijters & Baumgartner, 2012). To assess dimensions of a general attitude toward inclusive education, two short scales from the KIESEL[4] questionnaire were used (Bosse & Spörer, 2014). One of the scales measures the attitude toward the arrangement of inclusive education (AA, e.g., "Teaching children with and without disabilities together can meet the needs of all children by using appropriate methods."[5]) and the other one measures the attitude toward the effects of inclusive education (AE, e.g., "Inclusion of students with disabilities in mainstream classrooms can be beneficial for students without disabilities."[5]). Both scales consist of four Likert-items ranging from 1 (strongly disagree) to 6 (strongly agree). Both scales provide good internal consistency reliability ($\alpha_{AA} = 0.77$, $\alpha_{AE} = 0.74$) as well as factorial validity (i.e., good model fit in a confirmatory factor analysis) in a sample of German pre-service teachers (Bosse & Spörer, 2014). Furthermore, Gorges, Grumbach, Micheel, and Neumann (2020) showed the convergent validity of both scales in a sample of German pre- and in-service teachers applying correlation analyses with scales measuring comparable attitude dimensions as well as self-efficacy beliefs toward inclusive education.

[3] In some federal states, all or certain degree programs in teacher education are completed with a state examination (e.g., Saxony, Bavaria, and Hesse).

[4] German abbreviation for short scales for assessing teachers' attitudes and self-efficacies toward inclusive education.

[5] Free, not validated translations.

Abstract

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M. Braksiek

Pre-service physical education teachers' attitudes toward inclusive physical education. Subject specificity and measurement invariance

Abstract

A teacher's positive attitude is an important factor for successful inclusive physical education (PE). PE teachers' attitudes are shaped during PE teacher education (PETE) programs. Thus, a valid instrument is needed not only for assessing pre-service PE teachers' attitudes toward inclusive PE but also for evaluating the effect of PETE programs in general and the effect of specific parts of such programs (e.g., seminars) on the development of those attitudes. Regarding the measurement of this attitude, little is known about how a subject-specific attitude toward inclusive education is related to general attitudes toward inclusive education. In this study 362 pre-service PE teachers' attitudes toward inclusive education in general and inclusive PE were assessed using two general attitude scales and one PE-specific attitude scale. By conducting confirmatory factor analyses (CFAs), the factorial and convergent validity of the PE-specific scale was investigated. Results showed that the scale measures attitude toward inclusive PE adequately and that this attitude is related to general attitudes toward inclusive education. In addition, the measurement invariance of the scale among different degree programs of the pre-service PE teachers as well as group differences in the assessed attitude depending on the degree programs were investigated using multigroup CFA. The results support the use of the scale in the context of PETE for inclusion, but also point to general difficulties regarding attitude measurement in the context inclusive of (physical) education.

Keywords

Scale development · Teacher education · Degree program · Subject-specificity

Table 1 Items of the S-AIPE

1	Der gemeinsame Sportunterricht ist eine berufliche Bereicherung. *(Inclusive PE is a professional enrichment for me.)*
2	Ich lehne es ab, einen Sportunterricht zu erteilen, an dem Lernende mit und ohne Behinderung gemeinsam teilnehmen. *(I refuse to conduct PE lessons in which learners with disabilities and learners without disabilities participate together.)*
3	Ich begreife die Heterogenität in einem Sportunterricht, an dem Lernende mit und ohne Behinderung gemeinsam teilnehmen, als Chance. *(I see heterogeneity in a PE lesson in which learners with disabilities and learners without disabilities participate together as an opportunity.)*
4	Ich befürworte die Idee des gemeinsamen Sportunterrichts. *(I support the idea of inclusive PE.)*
5	Der Sportunterricht ist ein geeignetes Fach, um die Idee der Inklusion umzusetzen. *(PE is a suitable subject for implementing the idea of inclusion.)*

S-AIPE Scale to Assess PE Teachers' Attitudes Toward Inclusive Physical Education (PE)

Table 2 Fit Indices of the confirmatory factor analyses (CFA)

	CFI	TLI	RMSEA	90% RMSEA CI	*p*-close	SRMR	χ^2/df	*p*
AE	0.984	0.952	0.060	0.000; 0.135	0.309	0.019	4.626/2	0.0989
S-AIPE	0.990	0.980	0.047	0.000; 0.096	0.468	0.020	8.985/5	0.1096
CFA 1	0.943	0.930	0.062	0.048; 0.074	0.074	0.043	128.703/54	< 0.00001
CFA 2	0.972	0.965	0.044	0.027; 0.059	0.740	0.036	89.151/53	0.0014
CFA 3	0.976	0.968	0.042	0.024; 0.057	0.795	0.035	82.761/51	0.0032

AE attitude toward the effects of inclusive education, *S-AIPE* attitude toward inclusive PE scale, *CFI* comparative fit index, *TLI* Tucker Lewis Index, *RMSEA* Root Mean Square Error of Approximation, *CI* confidence interval, *pclose* probability of close fit, *df* degrees of freedom

Statistical methods

Data were prepared and descriptive statistics were calculated using SPSS 25 (IBM Corp., 2017). Statistical analyses were conducted using Mplus 7.4 (Muthén & Muthén, 2017). The convergent and factorial validity of the S-AIPE was examined conducting CFAs (Byrne, 2013).

To determine the differences and measurement invariance between the groups of pre-service PE teachers regarding their attitudes toward inclusive PE, the new alignment approach (Asparouhov & Muthén, 2014; Byrne & van de Vijve, 2017) was used[6]. As this approach has not been widely used in sports science, it is briefly explained and justified according to Marsh et al. (2018) as follows: To test for measurement invariance between more than two groups is cumbersome and requires multiple testing. Furthermore, correction of partial invariance in several groups takes additional effort and leads to complications regarding the latent mean comparison. If different parameters must be chosen for the free estimation when comparing more than two groups, the latent mean of a group may differ depending on the comparison. With the alignment method for multiple group CFA, in one step group-specific means can be estimated and compared without requiring full invariance. The alignment method "seeks an optimal measurement invariance pattern based on a simplicity function that is similar to the rotation criteria used with exploratory factor analysis" (Marsh et al., 2018). Therefore, the alignment approach tests for *approximate* measurement invariance and allows for a few noninvariant parameters when comparing latent means (Asparouhov & Muthén, 2014). These noninvariant parameters are identified in every group[7]. Within the alignment method, analysis can be performed using the free or the fixed alignment method (Asparouhov & Muthén, 2014). In the free alignment method, all factor means are estimated; in the fixed method, the factor mean of the group with the smallest absolute factor mean is set at zero. Mplus (Muthén & Muthén, 2017) recommends the optimal choice according to the data and the model being tested (Byrne & van de Vijve, 2017). In this study, Mplus suggested the fixed alignment method, as the model would have been poorly identified using the free alignment method.

For all these analyses, the following configurations and cut-off values were chosen: The full information maximum likelihood algorithm was used to estimate missing values because they were completely missing at random (Little's test: $\chi^2(474) = 505.133$, $p = 0.156$; Enders & Bandalos, 2001). For the estimation of model parameters, a robust maximum likelihood estimator (MLR) with robust standard error and corrected chi-square (χ^2) value was used to avoid consequences of nonnormal data (e.g., imprecise estimates) (Maydeu-Olivares, 2017). For model comparisons χ^2 difference tests were conducted. Due to the MLR estimator Satorra–Bentler scaled χ^2 was used for these tests (Satorra & Bentler, 2001). The general model fit was evaluated according to common conventions: Root Mean Square Error of Approximation (RMSEA) ≤ 0.08 and Standardized Root Mean Square Residual (SRMR) ≤ 0.10, Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) ≥ 0.95, a lower limit of RMSEA confidence interval close to 0 and an upper limit of ≤ 0.08 as well as a nonsignificant test for the closeness of fit (Hooper, Coughlan, & Mullen, 2008; Marsh, Hau, & Wen, 2004).

[6] For another recent study in the field of educational assessment, see Fischer, Praetorius, and Klieme (2019).

[7] A brief but precise description of the alignment procedure is given by Flake and McCoach (2018, p. 59): "After the group-specific measurement models are estimated, invariance testing is conducted on all of the parameters. Taking one parameter at a time, two groups' parameter estimates are compared. If these estimates are not statistically significantly different from one another, they become connected. These comparisons are made again and again, across the groups' parameter estimates to create an invariant set, and then each parameter is tested against the mean of the invariant set".

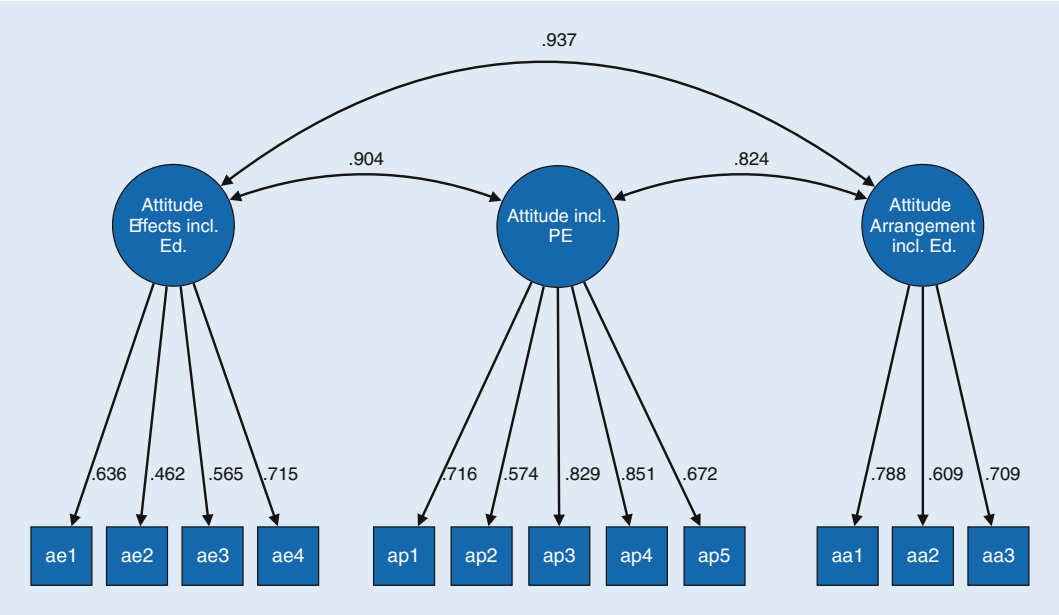

Fig. 1 ◀ Three-factor model of the confirmatory factor analyses. All paths are significant with $p < 0.0001$. *Attitude Effects incl. Ed.* attitude toward effects of inclusive education. *Attitude incl. PE* attitude toward inclusive physical education. *Attitude Arrangement incl. Ed.* attitude toward the arrangement of inclusive education

Results

Factorial and convergent validity

The results of the CFAs, which were conducted to investigate the factorial and convergent validity of the scales, are shown in **Table 2**.

The model fit for the AE scale and the S-AIPE was very good. Due to the poor model fit of the AA scale (CFI = 0.848, RMSEA = 0.233, SRMR = 0.059), the item with the lowest factor loading ($\lambda = 0.483$) and highest residual variance ($\sigma_e^2 = 0.766$) was removed. The resultant scale had only three indicators left, so no global or incremental model fit could be investigated. However, the local model fit was good, and internal consistency was good as well ($\alpha = 0.737$, $\omega = 0.749$).

To investigate the relationship between the dimensions of attitude, several CFAs were conducted (**Table 2**): First, all items were set to load on one factor. Second, a model with two factors was estimated including one factor for the attitude toward inclusive PE (measured by the S-AIPE) and one factor representing an attitude toward inclusive education in general (measured by both, the AA and the AE scale). Third, a three-factor model (**Fig. 1**) with every scale representing a separate factor was tested (i.e., attitude toward inclusive PE, attitude toward the arrangement of inclusive education and attitude toward the effects of inclusive education). The model fits of all models were very good. However, Satorra-Bentler scaled χ^2 tests showed that the three-factor model as well as the two-factor model fitted significantly better than the one-factor model ($\chi^2(3) = 35.583$, $p < 0.001$; $\chi^2(1) = 47.412$; $p < 0.001$). The three-factor model and the two-factor model fitted equally well ($\chi^2(2) = 5.180$, $p = 0.075$). Due to the descriptively better fit indices, the three-factor model was considered further (**Fig. 1**). The model indicated significant correlations among the dimensions of attitude (AE with AA: $r = 0.937$, $p < 0.0001$; S-AIPE with AA: $r = 0.824$, $p < 0.0001$; S-AIPE with AE: $r = 0.904$, $p < 0.0001$). Additional Wald tests showed that both correlations were significantly different from 1, indicating at least minimal discriminant validity (Rönkkö & Cho, 2020; S-AIPE with AA: $\chi^2(1) = 24.085$, $p < 0.001$; S-AIPE with AE: $\chi^2(1) = 8.297$, $p = 0.004$). In summary, the analyses revealed that the attitude toward inclusive PE can be measured as unidimensional construct using the S-AIPE.

Measurement invariance and group differences

To determine the measurement invariance of the S-AIPE as well as differences between the attitudes of the pre-service PE teachers depending on their degree program, a multigroup CFA was conducted using the alignment method.

The test of approximate measurement invariance showed only two noninvariant parameters concerning the second item on the S-AIPE. The pairwise comparisons identified the intercept and the loading of the second item in the group of the pre-service PE teachers for primary school with ISIE as noninvariant. Hence, there were only 20% noninvariant parameters on the scale. This is under the limit specified by Asparouhov and Muthén (2014) above which the results should be interpreted cautiously. Therefore, a valid comparison of the latent factor means was possible. The invariance indices for the intercepts and loadings (**Table 3**) can be interpreted as measures for invariance. Each value "indicates the variation of these parameters across groups […] that can be explained by variation in the factor means and variances across groups" (Byrne & van de Vijve, 2017, p. 547). Therefore, the values can range between 0 and 1. Values close to 0 indicate a low degree of invariance and values close to 1 indicate a high degree of invariance (Asparouhov & Muthén, 2014). Both values of the second item underpin the found noninvariance of these parameters. Although the invariance index for the loading of the third item was small, the parameter

Table 3 Invariance indices for the intercepts and loadings of the S-AIPE items

	Invariance index for intercepts	Invariance index for loadings
AIPE 1	0.974	0.453
AIPE 2	0.710	0.251
AIPE 3	0.987	0.116
AIPE 4	0.959	0.672
AIPE 5	0.982	0.961

S-AIPE Scale to Assess PE Teachers' Attitudes Toward Inclusive Physical Education

was invariant across all groups. Taken together, the S-AIPE was not completely approximate invariant across the groups, but a valid comparison of the latent factor means is statistically possible and justified.

To investigate differences in the attitude of the pre-service PE teachers depending on their degree program, latent factor means were compared, using the fixed alignment method. For this comparison, the group of pre-service PE teachers for advanced secondary and comprehensive schools was set as the reference group as this group had the smallest factor mean (Asparouhov & Muthén, 2014). As a result, precise *p*-values could be computed from comparisons with this group only (**Fig. 2**): There were significant differences to the pre-service PE teachers for secondary and comprehensive schools ($M = 0.366$, $z = 2.693$, $p = 0.007$) and for primary schools with ISIE ($M = 0.730$, $z = 4.788$, $p < 0.0001$). There also were significant differences ($p < 0.05$) between the latent factor mean of the pre-service PE teachers for primary schools with ISIE ($M = 0.730$) and the pre-service PE teachers for secondary and comprehensive school ($M = 0.366$) and pre-service PE teachers for primary schools ($M = 0.312$). In summary, the pre-service PE teachers for primary schools with ISIE had the highest factor mean on the S-AIPE of all the groups of pre-service PE teachers. The pre-service PE teachers for advanced secondary and comprehensive schools had the lowest factor mean of the S-AIPE of all the groups except for the group of pre-service PE teachers for primary schools.

Discussion

The aim of this study was to examine the factorial and convergent validity as well as the measurement invariance of the S-AIPE in a sample of pre-service PE teachers. In addition, differences in the attitudes of the pre-service PE teachers depending on their degree program were investigated. Particularly, testing for convergent validity should explore the relationship of an attitude toward inclusive PE and two dimensions of subject-unspecific attitudes.

The S-AIPE provided good factorial and convergent validity in the group of pre-service PE teachers. This means it is the first scale for assessing pre- and in-service PE teachers' attitudes toward inclusive PE that has been validated using state-of-the-art methods in both groups. It was also shown that the attitude toward inclusive PE, measured by the S-AIPE, is related to the attitude toward effects and toward the arrangement of inclusive education in general. These relationships can be explained, since these general attitude dimensions are not subject-specific: The attitudes toward inclusive education in general (i.e., its effects and arrangement) are based, among other things, on experiences and expectations regarding both (or more) subjects that the pre-service PE were studying. Thus, these general attitudes are also based on experiences and expectations regarding *inclusive PE*. In addition, these results are largely in line with those of the study conducted by Braksiek et al. (2019), who used the S-AIPE in a sample of in-service PE teachers. They also used two subject-unspecific scales to assess the teachers' attitudes toward inclusive education (i.e., attitude toward school support and social integration in inclusive education, Kunz et al., 2010). Using exploratory and confirmatory factor analyses they were also able to differentiate empirically among the three dimensions. They also found significant, but smaller correlations between the dimensions (S-AIPE with attitude toward school support: 0.781; S-AIPE with attitude toward social integration: 0.638). Strikingly, in both studies, the correlations with factors that measure attitudes toward *educational achievements* in inclusive education (i.e., toward school support and effects of inclusive education) are stronger than the correlations with factors that measure attitudes toward *social aspects* of inclusive education (i.e., attitude toward social integration and arrangement of inclusive education). Thus, the attitude toward inclusive PE, measured by the S-AIPE, seem to be based more on evaluations of inclusive PE regarding educational achievements rather than regarding social aspects of inclusive PE. This is not surprising, since educational achievements are the main goal of school education (Ditton, 2000). Therefore, this aspect seems to be a more important reference point for the evaluation of inclusive PE than social aspects for both, in- and pre-service PE teachers. Nevertheless, the S-AIPE does not measure these dimensions explicitly. Measuring these attitude dimensions explicitly would enable to better predict certain behaviors. According to the theory of planned behavior (Fishbein & Ajzen, 2010), attitude will determine intention and behavior the better the closer the attitude is related to the behavior and its context. The attitude toward educational achievements and social aspects in inclusive PE address different behavioral categories that include certain inclusive practices. Some inclusive practices aim more on educational achievements (e.g., differentiated, and individualized instructions) and others more on social aspects (e.g., encouraging a positive classroom environment) (Lindner & Schwab, 2020). Accordingly, attitudes toward these aspects should predict behavioral intentions to perform inclusive practices supporting these aspects (e.g., Knauder & Koschmieder, 2019). Therefore, corresponding subscales should be developed in future studies to explicitly measure the attitude toward educational

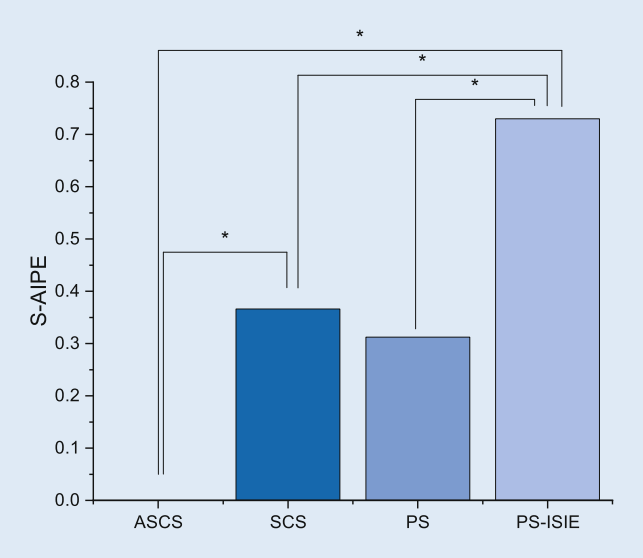

Fig. 2 ◀ Differences in latent factor means depending on the degree program. * $p < 0.05$. *S-AIPE* Scale to Assess PE (physical education) Teachers' Attitudes Toward Inclusive PE, *ASCS* advanced secondary and comprehensive school, *SCS* secondary and comprehensive school, *PS* primary school, *PS-ISIE* primary school with ISIE (integrated training for special and inclusive education)

achievement and social aspects in inclusive PE.

The investigation of the measurement invariance of the S-AIPE indicated that it can be used as an instrument to evaluate PETE programs as it provides good validity and approximate scalar invariance across degree programs, except for the group of pre-service teachers in the degree program for primary school with ISIE. In this group, both invariant parameters were found, but this did not affect the comparison between the groups. The loading of the third item of the S-AIPE was not significantly invariant, but its invariance index was low. According to Byrne and van de Vijve (2017), one explanation for this could be that this low degree of invariance is associated with the smallest group in the sample (i.e., pre-service PE teachers with ISIE) for which significance is not as easy to achieve. The noninvariant loading and intercept of the second item showed that its wording influenced the understanding of the content and the item difficulty (Chen, 2008; Sass, 2011). As the item was the reversed one (*I refuse to give PE classes in which learners with disabilities and learners without disabilities participate together*), the item was perceived as too difficult by members of this group. This result is hard to interpret, as it could be a result of a selection effect, a socialization effect or both. While pre-service teachers might choose this degree program because of their strong affirmative consent regarding inclusive education, the courses and lectures in this degree program might have influenced the understanding and evaluation of inclusive education in a positive way as well. However, this issue of belief-based attitude measures should be taken into account in future research on teacher education for inclusion in general and on PETE for inclusion, specifically.

The differences in attitudes found between the pre-service PE teachers in different degree programs revealed that the group of pre-service PE teachers in the degree program with ISIE had a significantly more positive attitude than the other groups. This result is comparable to other studies, which investigated pre-service teachers' attitudes toward inclusive education in general (e.g., Kraska & Boyle, 2014; Moser, Kuhl, Redlich, & Schäfer, 2014). In addition, the results are in line with Weber's (2018) investigation of pre-service PE teachers who investigated their attitudes toward inclusive education in general. Her results indicated a difference between the attitudes of pre-service PE teachers in a degree program for secondary and comprehensive schools and the attitudes of pre-service PE teachers in a degree program for advanced secondary and comprehensive schools. Furthermore, the pre-service PE teachers who additionally studied special education had more positive attitudes toward inclusive education in general than pre-service PE teachers for primary schools. The present study expands these results, as the pre-service PE teachers with ISIE had the most positive attitudes as well, but in this study, the subject-specific attitude toward inclusive PE was assessed. Therefore, PETE programs with additional teacher training for special and inclusive education seem to influence pre-service PE teachers' attitudes toward inclusive education in general and inclusive PE, specifically. As both investigations were cross-sectional, these results can be either a socialization effect (i.e., positive effect of teacher training for inclusive [physical] education) or a selection effect (i.e., students with a positive attitude toward inclusive education tend to study a degree program for special education). Interpreted optimistically, the significantly lowest attitude of the pre-service PE teachers for advanced secondary and comprehensive schools in this study should be a selection effect. Advanced secondary schools in Germany offer the highest level of academic programs and are at the top of a hierarchical school system. They do not have a tradition or culture of inclusive education (Powell, 2015) and tend to have a limited number of children with SENs (Hollenbach-Biele & Klemm, 2020). Therefore, pre-service teachers who chose this type of school to be their future workplace are not expected to have a comparatively positive attitude toward inclusive education. But consequently, longitudinal studies should be conducted to gain clearer insights into the causal effects regarding the degree programs. Nevertheless, the differences in attitude found between the pre-service PE teachers in different degree programs were interpretable and in line with other studies. Therefore, these results indicated the measurement sensitivity of the S-AIPE, but this should be further investigated in studies evaluating PETE programs for inclusion.

However, besides the discussed findings, this study has general limitations. The surveyed pre-service PE teachers only came from one university. While this should not affect the results of the validation, the results concerning the analyses of the measurement invariance

and the sensitivity are limited to the degree programs under investigation. In addition, some of the subsamples according to the degree programs were small. Especially the size of the group of pre-service PE teachers with ISIE possibly limited the statistical power of the analyses of measurement invariance. Moreover, the whole sample only consists of pre-service PE teachers in bachelor's degree programs. Future studies should investigate the attitudes toward inclusive PE of pre-service PE teachers in master's degree programs as well. In Germany, most of these degree programs include longer school practica (internships), which could influence the pre-service PE teachers' attitudes toward inclusive education. Concerning the validation of the S-AIPE in this study, one scale for the investigation of the convergent validity had to be adapted by removing one item (i.e., scale to measure the attitude toward the arrangement of inclusive education). Therefore, the construct validity of the scale was not optimal, but still adequate. As the removed item was the only negatively worded item, it seems to represent a method factor in the analyzed sample (DiStefano & Motl, 2006). This issue should be kept in mind in further studies using this scale.>

Conclusion

Ostensibly, this study is the first in which the subject-specificity of pre-service teachers' attitudes toward inclusive education, in this case pre-service physical education (PE) teachers' attitudes toward inclusive PE, was investigated using the S-AIPE (Scale to Assess PE Teachers' Attitudes Toward Inclusive PE). The factorial and convergent validity of the S-AIPE as well as the approximate measurement invariance and sensitivity were established in a sample of pre-service PE teachers. Thus, the S-AIPE can be used as valid instrument for evaluating parts of PE teacher education programs. Furthermore, results of this study imply that research on attitudes toward inclusive education may focus both theoretically and empirically on subject-specific dimensions of attitudes (e.g., Penney, Jeanes, O'Connor, & Alfrey, 2018). Nevertheless, the relevance of various types of special educational needs or certain inclusive practices for successful inclusive education in PE should be considered in further research and scale construction to gain a more differentiated understanding of the subject-specificity of PE in the context of inclusive education. In addition, the results also indicate that the measurement invariance of scales for measuring attitudes toward inclusive (physical) education should be investigated more frequently.

Corresponding address

Michael Braksiek
Department of Sports Science, University of Vechta
Vechta, Germany
michael.braksiek@uni-vechta.de

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Declarations

Conflict of interest. M. Braksiek declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

All procedures performed in studies involving human participants or on human tissue were in accordance with the ethical standards of the institutional and/or national research committee and with the 1975 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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