Ger J Exerc Sport Res
https://doi.org/10.1007/s12662-023-00921-7
Received: 28 February 2023
Accepted: 1 November 2023

Maike Niehues[1,2] · Jeffrey Sallen[1,2,3] · Erin Gerlach[1,2]

[1] Institute of Human Movement Science, University of Hamburg, Hamburg, Germany
[2] Educational Sciences, Faculty of Human Sciences, University of Potsdam, Potsdam, Germany
[3] Faculty of Sport Science, Leipzig University, Leipzig, Germany

Student–Athletes' Academic and Athletic Motivation Scale (SAAMS) for adolescents in secondary school: development, evaluation, and psychometric properties

Supplementary Information

The online version of this article (https://doi.org/10.1007/s12662-023-00921-7) contains supplementary material, which is available to authorised users.

Introduction

Various countries and institutions have identified the necessity to support students who pursue an athletic career in order to guide them in simultaneously coping with the athletic and academic challenges in their daily life. The combination of the athletic and academic career is known as a dual career (DC; Stambulova, Engström, Franck, Linner, & Lindahl, 2015). Considering the DC from a holistic perspective, student–athletes face developmental tasks in other life domains in addition to their academic and athletic careers (Ryba, Stambulova, Selänne, Aunola, & Nurmi, 2017; Wylleman, Reints, & De Knop, 2013). Hence, student–athletes need guidance in their DCs (Sallen & Gerlach, 2020). The EU guidelines highlighted that the academic career must be equally supported in order to continue with the DC (EU Expert Group, 2012). This equal support concurrently demands a balanced motivation between the two life domains. In the past, research concerning DCs has often focused on student–athletes in higher education (Aquilina & Henry, 2010; Gaston-Gayles, 2004; Lupo et al., 2015). Thus, DC research among student–athletes in adolescent elite sport needs to be enhanced.

Motivation is one of the most prominent aspects in DC research (Guidotti, Cortis, & Capranica, 2015) as researchers have identified motivation as one of the key aspects in facilitating a successful DC. Previous research on DC motivation involved a variety of theoretical approaches (Clancy, Herring, MacIntyre, & Campbell, 2016; Guidotti et al., 2015). Although self-determination theory has been extensively referred to in academic and athletic contexts (Vallerand, Pelletier, Briere, & Senecal, 1992; Pelletier et al., 1995), Kröhler and Berti (2014) found that the self-determination theory is unsuitable for measuring motivation among elite athletes since they do not differentiate between the gradations of intrinsic, integrated, identified, introjected, and external motivation, but perceive only two extremes. Moreover, an athletic career demonstrates a voluntary pathway that presents a more internally motivated stimulus in comparison to the obligatory academic career.

The dominant theoretical approach of DC motivation, when academic and athletic motivation is measured simultaneously, is the expectancy–value framework (EVF) by Eccles and colleagues (1993). The EVF is illustrated in the electronic supplement (Fig. S1). Wigfield and Eccles (2000) proposed two main dimensions in their framework. One dimension is called "expectancy," which contains the short-term and present sub-dimension *ability beliefs* as well as the long-term sub-dimension *expectations* for the future. The other dimension is known as "task values" and constitutes the sub-dimensions *attainment value* (importance), *intrinsic value* (interest), *utility value* (usefulness), and *cost* (Wigfield & Eccles, 2000). Gaston-Gayles (2004) as well as Aunola et al. (2018) are the only researchers having measured DC motivation among student–athletes by using this framework. The US-American Student–Athletes Motivation Toward Sports and Academics Questionnaire (SAMSAQ, Gaston-Gayles, 2004) developed for athletes in higher education has been adapted to various cultural contexts such as Europe, Asia, and South America (Lupo et al., 2015;

The authors Maike Niehues and Jeffrey Sallen are principal investigators, corresponding authors and share co-first authorship.

Published online: 13 December 2023

Park & Lee, 2015; Quinaud et al., 2021), but it relies on a mixture of diverse motivation theories including EVF, self-efficacy, and attribution theory. Aunola et al. (2018) only explore task values and, thus, only consider one part of the EVF. Hence, an instrument that measures DC motivation based on one theoretical framework is lacking.

Moreover, no instrument exists that measures DC motivation among student–athletes in secondary school. Park and Lee (2015) as well as Stambulova and Wylleman (2019) specifically request an instrument that investigates academic and athletic motivation among younger student–athletes. Niehues and colleagues (2021) have shown that a translated and adapted version of the SAMSAQ is inappropriate for adolescent student–athletes. Therefore, a new DC motivation measurement instrument needs to be developed. This instrument is urgently needed as there is a noticeable research gap for the target group of adolescent student–athletes regarding DC motivation based on a lack of appropriate DC motivation measurement instruments for student–athletes in school.

In terms of construct validity, previous research has used constructs including passion, identity, and chronic stress that have been shown to be empirically related to motivation. For instance, passion and motivation are theoretical constructs with a substantial overlap of their contents. Empirical studies show that a high motivation quality (intrinsic, autonomous, learning goal, and task orientation) is related to a high expression of non-obsessive passion (Chamorro, Torregrosa, Sánchez, García Calvo, & León, 2016; Fredricks, Alfeld, & Eccles, 2010; Moeller, 2013). Furthermore, the identification with the academic and athletic role has been associated with academic and athletic motivation (Fernandes, Moreira, & Goncalves, 2019; Love & Rufer, 2021; Steele, van Rens, & Ashley, 2020). Eccles (2009, p. 81) even mentioned, "that the motivational aspects of identity and identity formation processes […] are directly related to [the] sociocultural expectancy-value model of motivated behavioral choices" indicating a positive relationship between identity and motivation. Lastly, the decrease or absence of motivation or motivation quality is often associated with burnout, dropout, and chronic stress. The current state of research supports this thesis of a negative relation between motivation and chronic stress in the academic and athletic context (Gustafsson, Madigan, & Lundkvist, 2018; Pascoe, Hetrick, & Parker, 2019; Sorkkila, Ryba, Selänne, & Aunola, 2018).

As suitable instruments to measure motivation in academic and athletic contexts among adolescent student–athletes are scarce, the present study (1) developed a scale that focuses on student–athletes' academic and athletic motivation in upper secondary school and (2) evaluated this scale by exploring the psychometric properties. The development and evaluation of this scale is needed for practical as well as research settings. Practical settings include DC counselling in selecting appropriate support measures and educational paths for student–athletes as well as psychological support in order to identify mental health problems and prevent chronic stress (Sallen, Hemming, & Richartz, 2018a). In DC research, instruments measuring DC motivation can be useful for exploring relationships between motivation, health, and performance indicators in the athletic and academic domains.

Methodology and results

The process of development and evaluation of the scale was divided into two parts. Part 1 presents the development and evaluation of the scale's initial version with sample 1 whereas part 2 focuses on the final version with sample 2. Generally, the methodological approach follows the standardised procedure put forth by Boateng et al. (2018). The three-phase guideline, which is subdivided into nine steps, will be addressed in the following sections. An illustration of these nine steps can be found in the electronic supplement (Fig. S2).

In general, the descriptive statistical analyses were conducted using SPSS (version 26.0, IBM Corp., Armonk, NY, USA). Exploratory (EFA) and confirmatory factor analyses (CFA) as well as correlation analyses were carried out using Mplus (version 8.4; Muthén & Muthén, Los Angeles, CA, USA). Latent variables were used for all correlation calculations. In Mplus, missing data were treated with full information maximum likelihood.

Part 1: Methodological procedure of the initial SAAMS version with sample 1

Phase 1: Item development of the SAAMS

In the first step, relevant domains were identified and items were generated. The self-report Student-Athletes' Academic and Athletic Motivation Scale (SAAMS) has been developed based on the EVF for student–athletes in secondary school. Four items were initially developed for each sub-dimension in the athletic and academic domain and phrased according to examples given in previous studies using this framework (Gaston-Gayles, 2004; Eccles & Wigfield, 1995; Flake, Barron, Hulleman, McCoach, & Welsh, 2015; Wigfield & Eccles, 2000). An exception to this phrasing were the items used for the ability beliefs. These items are identical to the self-concept items developed by Marsh (1990) and adapted by Brettschneider and Klimek (1998). All items were developed domain specifically in order to create item pairings (e.g., "It is important to me to deliver very good results in school" for the academic domain and "It is important to me to deliver very good results in sport" for the athletic domain). The item pairs were worded identically in order to ensure an equal understanding and comparability of the items. All items of the initial scale including an English translation can be found in the electronic supplement (Table S1).

The second step included the exploration of the content validity. Items belonging to the respective sub-dimensions were discussed between the authors who came to a mutual agreement regarding the selection and wording of the items.

Phase 2: Scale development

In order to pre-test the scale in step 3, field pre-testing was chosen in the scale development phase with the initial SAAMS

version. The initial scale was distributed to 346 student–athletes (sample 1) in four German secondary schools in three federal states between February 2020 and November 2021. Afterwards, this scale was analysed and revised resulting in the final SAAMS.

The completion of the scale was supervised by trained personnel. Computer-assisted personal interviewing (CAPI) was chosen as requested by the schools in order to reduce errors associated with data entry and to enable the data collection of a large sample size.

The fourth step included the survey administration and the organisation of the sample. All participants were active in high-performance sport. They (a) train in sports with the aim of improving their athletic performances, (b) participate in sport competitions, (c) are formally registered as a competitor at a local, regional, or national sport federation, and (d) have sport training and competition as one of their major activities or focus of personal interest (Araújo & Scharhag, 2016). Detailed sample descriptions are listed in **Table 1**.

In the fifth step, item reduction analysis was conducted. The initial SAAMS version was investigated for general fit of data by evaluating the mean values and standard deviations of the items, normal distribution, skewness, and kurtosis as well as item difficulty and inter-item correlations.

Step 6 included the extraction of factors for the scale development phase. The initial SAAMS with sample 1 was evaluated using EFA with varimax rotation. Separate EFAs were run for the academic and athletic domain.

Results of the EFA with the initial SAAMS version using sample 1

Factor loadings of separate EFAs without previously defined factors as well as the scree plot for the academic and athletic domain indicated that there should be either four or five factors for the academic and athletic motivation respectively. A six-factor model was initially assumed. However, an EFA run with four, five, and six factors demonstrated the best solution for a five-factor model as these factors can be defined content wise. These models as well as their model fits can be found in the electronic supplement (Tables S3–S6).

Part 2: Methodological procedure of the final SAAMS version with sample 2

Phase 1: Item development of the SAAMS

After the initial scale development phase, the instrument was revised based on results of the EFA. Some items were rejected due to weak factor loadings. These items were reworded in order to replace missing items. Adjustments between the SAAMS versions are displayed in Table S7 (see electronic supplement). In the final version, five items each measured athletic and academic expectation, six items each measured athletic and academic importance as well as interest, three items each measured athletic and academic usefulness, and eight items each measured athletic and academic costs. The items regarding the self-concept remained untouched in the revision process. The items of the final scales as well as an English translation can be found in the electronic supplement (Table S2).

Phase 2: Scale development

In the scale evaluation phase, the final SAAMS was completed by 497 student–athletes (sample 2) in three Austrian and nine German schools in one Austrian and five German federal states between March and July 2022. The initial and final SAAMS version were tested on separate samples. Detailed sample descriptions are listed in **Table 1**. Item reduction analysis was conducted by investigating the final SAAMS version for general fit of data.

Phase 3: Scale evaluation

For the seventh step, dimensionality and measurement invariance were tested for the final SAAMS with sample 2. The tests of dimensionality, also known as factorial validity, were conducted with CFA run for a five- and six-factor solution with the aim of finding the best fitting solution. The CFA for a five-factor solution was conducted based on the results of the EFA with the initial version. In order to replicate the six-factor structure of the EVF, a CFA with a six-factor solution was also run. A maximum likelihood parameter (MLR) estimator was chosen for the data analysis as it provides robust standard errors. Following the results of the CFA, items not loading on any factor (≤ 0.40) or loading on more than two factors (≤ 0.32) were removed ensuring that at least three items represent one factor, following the recommendations by Osborne (2014). Moreover, the selectivity, reliability, and the descriptive data were used in order to determine the items that had to be removed. Items were only

Abstract

Ger J Exerc Sport Res
https://doi.org/10.1007/s12662-023-00921-7
© The Author(s) 2023

M. Niehues · J. Sallen · E. Gerlach

Student–Athletes' Academic and Athletic Motivation Scale (SAAMS) for adolescents in secondary school: development, evaluation, and psychometric properties

Abstract

Previous dual-career (DC) research focused on measuring student–athletes' motivation in the academic and athletic contexts. Existing measurement instruments are insufficient for adolescent student–athletes and countries with independent education and sport systems. The Student–Athletes' Academic and Athletic Motivation Scale (SAAMS) was developed based on the expectancy–value framework (EVF) with its dimensions *ability beliefs, expectations, importance, interest, usefulness*, and *cost*. The development of the SAAMS followed three phases: (1) item development, (2) scale development, and (3) scale evaluation. The initial version was tested with 346 student–athletes (mean age = 17.3 years; females = 47.7%). A revision phase resulted in a final SAAMS tested with 497 student–athletes (mean age = 17.0 years; females = 42.9%). Exploratory and confirmatory factor analyses were conducted for the evaluation. Several models were tested with the best results for a six-factor model as assumed by the EVF. The SAAMS is suitable for an extensive range of research and practical applications.

Keywords

Dual career · Elite sport · Validation · Confirmatory factor analysis · Education

Table 1 Description of samples with student–athletes

	Total sample of the initial SAAMS ($N = 346$)	Total sample of the final SAAMS ($N = 497$)
Age (years)	*M (SD)*	*M (SD)*
	17.3 (1.4)	17.0 (1.0)
Gender	*n (%)*	*n (%)*
Male	180 (52.0)	282 (56.7)
Female	165 (47.7)	213 (42.9)
Elite squad level	*n (%)*	*n (%)*
A and B squad (international level)	19 (5.5)	31 (6.2)
C squad (national level)	2 (0.0)	100 (20.1)
D/C squad (regional level)	80 (23.1)	61 (12.3)
D squad (regional level)	39 (11.3)	126 (25.4)
Other squad level	116 (33.5)	45 (9.1)
No squad level	90 (26.0)	126 (25.4)
Groups of Olympic sport disciplines	*n (%)*	*n (%)*
Endurance sports[a]	101 (29.2)	80 (16.1)
Team sports/sports games[b]	117 (33.8)	246 (49.5)
Strength and speed–strength sports[c]	43 (12.4)	66 (13.3)
Combat sports[d]	54 (15.6)	31 (6.2)
Artistic composition sports[e]	6 (1.7)	14 (2.8)
Multidiscipline sports[f]	20 (5.8)	35 (7.0)
Others[g]	5 (1.4)	25 (5.1)

[a] e.g., canoeing, running, rowing, swimming
[b] e.g., handball, football, volleyball, water polo
[c] e.g., weightlifting, athletics (sprinting, jumping, throwing, shot put)
[d] e.g., judo, boxing, wrestling
[e] i.e., figure skating, cheerleading
[f] i.e., triathlon, decathlon, modern pentathlon
[g] i.e., equestrian, sport shooting

kept if item pairing for both domains was given. For the interpretation of the model results, Hooper et al. (2008) suggest thresholds of ≤ 0.05 for the standardised root mean square residual (SRMR), ≥ 0.95 for the comparative fit index (CFI), and ≤ 0.08 for the root mean square error of approximation (RMSEA). However, Hu and Bentler (1999) suggest that in complex cases the combination rules should be followed. These rules indicate good fits of models if the CFI is close to 0.95 in combination with the SRMR being close to 0.09 and the RMSEA > 0.05 in combination with the SRMR > 0.06.

In addition to the suggestions by Boateng et al. (2018) concerning the scale evaluation, a multigroup comparison was used in order to investigate whether the final SAAMS is able to equally depict academic and athletic motivation among male and female student–athletes (Brown, 2015). The model fits of the CFA were calculated separately for males and females and compared with the model fits of the configural, metric, and scalar models. The models were calculated in order to test for the best model based on the student–athletes' sex.

The eighth step included the test for reliability for the final SAAMS with sample 2. In order to assess the internal consistency of the SAAMS subdimensions, McDonald's ω was calculated for the six factors replicating the sub-dimensions (Hayes & Coutts, 2020).

Lastly, the final SAAMS with sample 2 had to be tested for validity. Pearson's correlation was used in order to test for convergent and criterion validity. For the convergent validity, the relation between motivation and passion as well as identity was determined. A positive correlation between the athletic motivation measured by the SAAMS and the non-obsessive athletic passion measured by the Com.pass Scale (Moeller, 2013; McDonald's ω = 0.95) was expected. Moreover, a positive correlation was expected between motivation and identity in the academic and athletic contexts. In order to measure student–athletes' identity, the Athletic Identity Measurement Scale (AIMS; Brewer, Van Raalte, & Linder, 1993; AIMS-D, Schmid & Seiler, 2003; McDonald's ω = 0.89) and the Student Identity Measurement Scale (SIMS; Engström, 2011; McDonald's ω = 0.79) were used. Criterion validity was examined by correlating motivation with excessive demands. The latter was measured with an adapted version of the sub-scale "excessive demands for work" in the Trier Inventory for Chronic Stress (TICS; Petrowski et al., 2018; Sallen, Hirschmann, & Herrmann, 2018b) for the academic (McDonald's ω = 0.88) and the athletic context (McDonald's ω = 0.92). Negative correlations between motivation and excessive demands were expected. Moreover, the criterion validity was verified by correlating the time spent for extracurricular school work and competitive training with academic and athletic motivation. For the time spent for training, the mean values of the training hours of student–athletes were used. These mean values were relativised in relation to the sport disciplines indicated in **Table 1**, since Brettschneider (1999) mentioned that the training hours of student–athletes are related to their sport discipline. As motivation is supposed to predict behaviour, a moderate positive correlation was expected.

Results regarding the final SAAMS version with sample 2

The CFAs run in step 7 demonstrated the best solution for a six-factor model. Three items were kept for each factor. All other items were identified as difficult due to their loadings, their selectivity, their descriptive data, as well as a simultaneous comparison between the academic and athletic motivation. The final six-factor

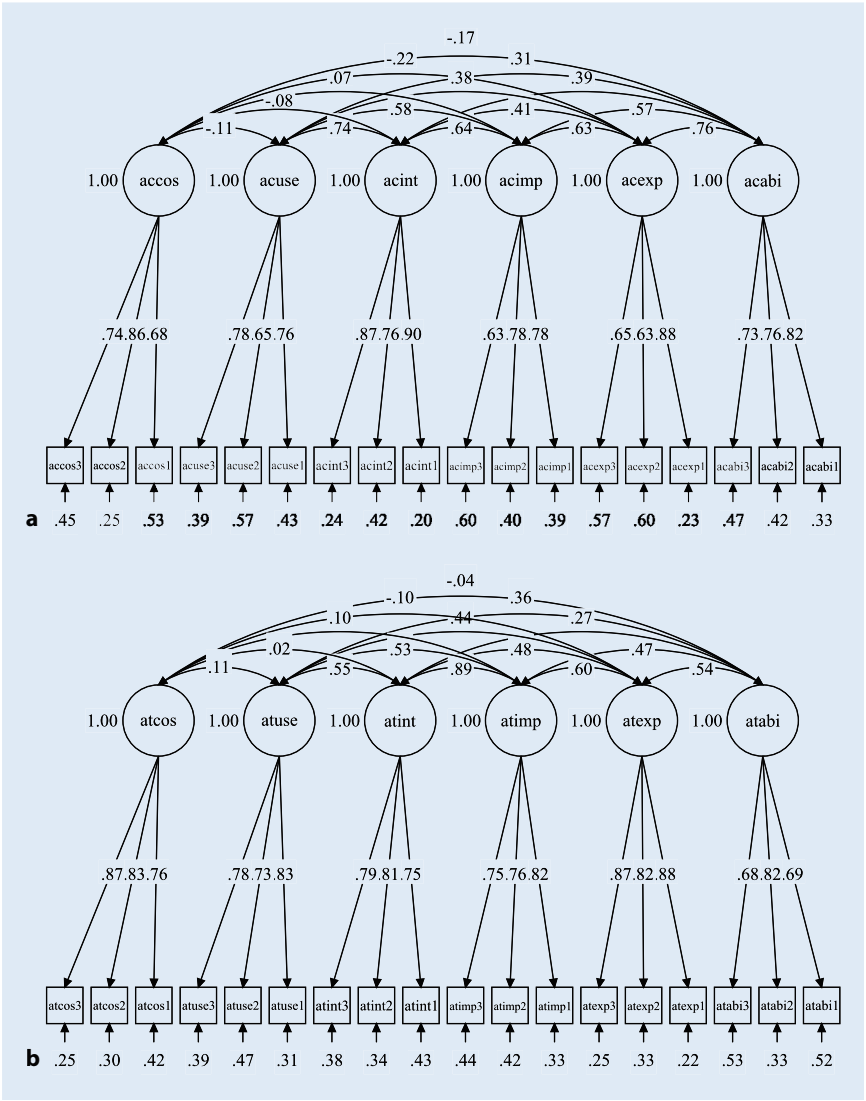


Fig. 1 ▲ Results of the confirmatory factor analysis regarding the final six-factor model for academic (**a**) and athletic (**b**) motivation

model is presented in **Fig. 1**. The five-factor models and their model fits can be found in the electronic supplement (Table S8, Figs. S3 and S4). Subsequently, the academic and athletic domain were summarised in new models (see **Fig. 2**). The model fits of all CFAs are listed in **Table 2**. The testing for measurement invariance resulted in a configural, metric, and scalar model. These model fits are included in **Table 2**.

The McDonald's ω values for all factors representing the sub-dimensions calculated in step 8 in order to test for reliability are displayed in **Fig. 2a**.

Finally, the results of the tests for validity, namely, the correlation analyses, are listed in **Table 3**.

Discussion

The present study aimed to develop a scale that measures academic and athletic motivation among adolescent student–athletes in upper secondary school. For this purpose, the newly developed SAAMS was evaluated following a standardised procedure by Boateng et al. (2018).

In step 6, an EFA with the initial SAAMS version resulted in a five-factor model although a six-factor model was expected in accordance with the EVF (Eccles et al., 1993). The factors replicate the sub-dimensions of the theoretical EVF. Particular problems arose with the item removal in the factors *importance* and *interest*. Moreover, difficulties with the loadings regarding the factor *cost* were identified. Despite these difficulties, the five factors can be interpreted in line with the EVF. Although separate sub-dimensions in the EVF, one factor of the initial SAAMS version constitutes the student–athletes' task values *importance* and *interest*. Previous research (Wigfield & Eccles, 2000) has highlighted that these two factors are closely related, even pointing out that there could be more task values such as happiness or freedom and that the value one places on a task might be influenced by the value that significant others such as parents, teachers, or coaches place on the task. Therefore, it is not surprising that the sub-dimensions *importance* and *interest* are represented by just one factor. Nevertheless, items were reworded and added in the revision process in order to explore further aspects of academic and athletic motivation with particular focus on the sub-dimensions *importance*, *interest*, and *cost*.

Although the EFA of the initial version resulted in a five-factor model, a six-factor model was attempted in the seventh step by testing for dimensionality in order to replicate the EVF. The separate CFAs for the academic and athletic motivation verified the attempted six-factor model as the factor loadings are over 0.60, indicating a fitting model. All model fits meet the thresholds by Hooper et al. (2008) when the models for academic and athletic motivation are calculated separately. In summary, the results of the separate CFAs suggest that a six-factor model is applicable for the final SAAMS. These six factors replicate the originally attempted sub-dimensions: *ability beliefs*, *expectation*, *importance*, *interest*, *usefulness*, and *cost*. Moreover, the six factors for the academic and athletic domain can be combined into one model with second-order factors as to explore motivation across various life domains. The two second-order factors include academic and athletic motivation which clearly indicate that student–athletes are able to differentiate between both domains. Moreover, a model with four second-order factors was calculated with regard to the four dimensions: academic and athletic expectancies as well

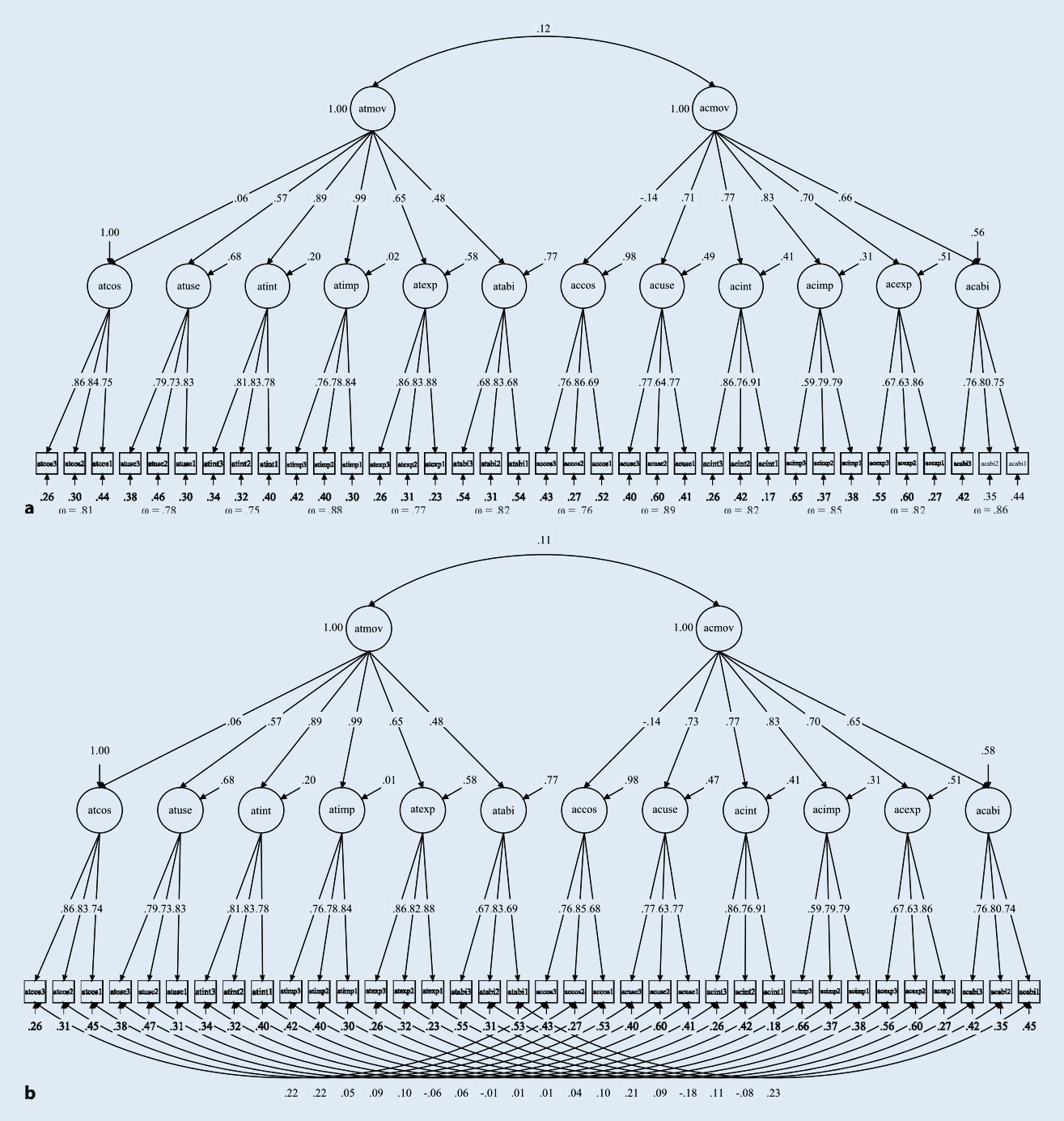


Fig. 2 ▲ Results of four models combing academic and athletic motivation. **a** Domain second-order model of the SAAMS with McDonald's ω for each sub-dimension. **b** Domain second-order model of the SAAMS including item-pairing correlations. **c** Dimension second-order model of the SAAMS. **d** Dimension second-order model of the SAAMS including item-pairing correlations

as academic and athletic task values. Although not all model fits of these second-order models meet the thresholds (Hooper et al., 2008), the combination rule by Hu and Bentler (1999) can be applied highlighting a fit for the model with four dimensions as second-order factors. In addition, the SAAMS was tested for measurement invariance by calculating configural, metric, and scalar models. The model fits of these three models as well as separate models for female and male student–athletes result in similar fits to the original model. Hence, the SAAMS is able to depict academic and athletic motivation between females and males equally.

In the iterative process of receiving the best CFA solution, several items had to be removed. Interestingly, all reverse-worded items were removed although

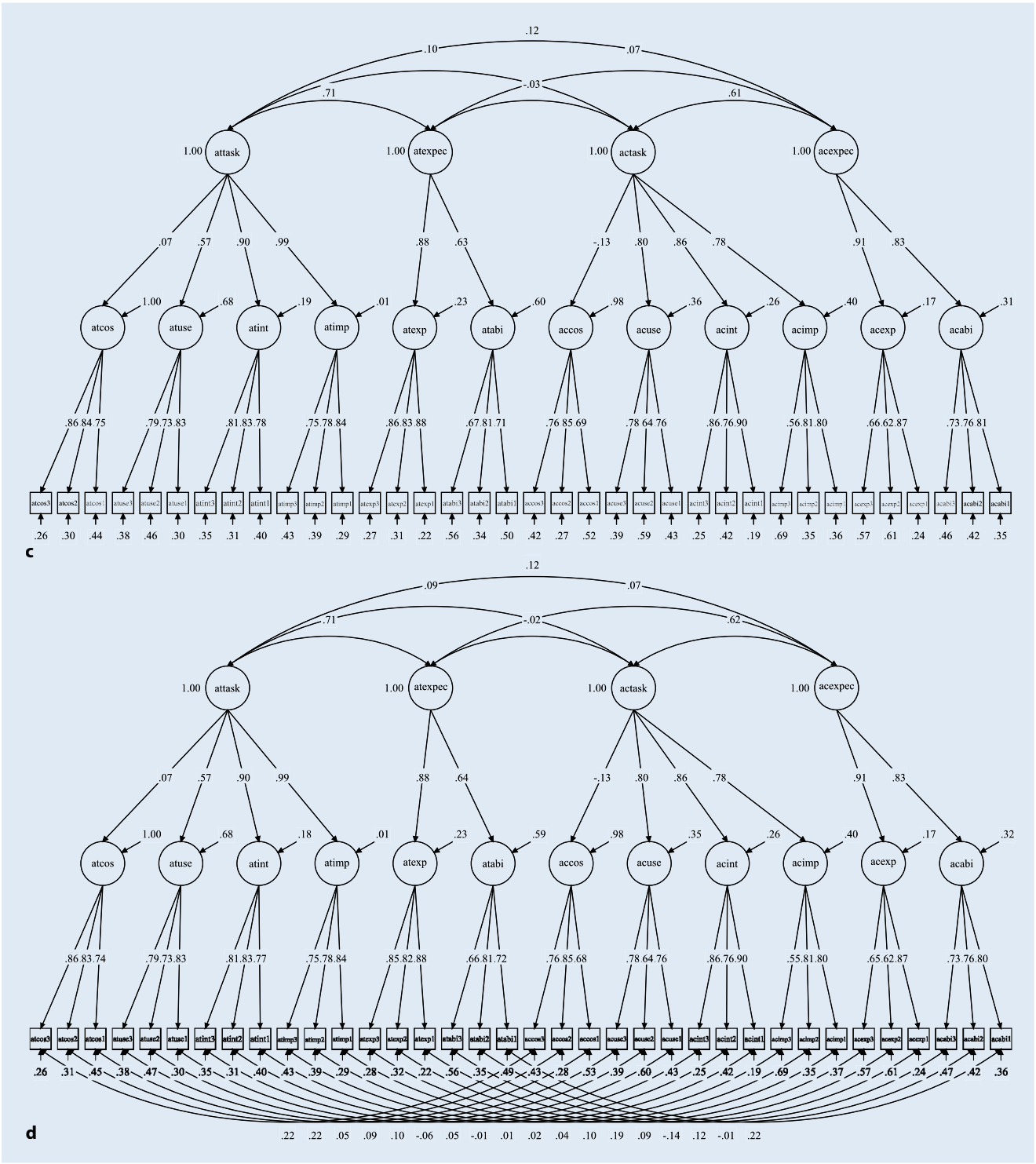


Fig. 2 ▲ (Fortsetzung)

these items aimed to prevent response bias. This removal of reverse-worded items is in line with recent findings that these items do not prevent response bias, but more significantly lead to confusion and inattention (Van Sonderen, Sanderman, & Coyne, 2013).

In step 8, reliability was tested. The McDonald's ω values indicate substantive internal consistency for all factors. This finding emphasises the appropriateness of the SAAMS for measuring academic and athletic motivation among student–athletes in secondary school.

The validity was tested in the last step. The findings regarding the correlations for the convergent and criterion validity are in line with previous assumptions, since positive relationships were found between identity and motivation as well as passion and motivation. In con-

Table 2 Model fits of the six-factor model for the domains of academic and athletic motivation as well as the combined SAAMS model using confirmatory factor analysis for the final SAAMS ($N = 497$)

	CFI	RMSEA	SRMR	χ^2	*df*	*p*
Separate models						
Academic motivation	0.933	0.069	0.047	386.9	120	< 0.001
Athletic motivation	0.962	0.054	0.039	282.6	120	< 0.001
Combined models						
Domain second-order SAAMS	0.892	0.053	0.072	1383.2	581	< 0.001
Domain second-order SAAMS with correlations	0.898	0.052	0.070	1321.4	563	< 0.001
Dimension second-order SAAMS	0.910	0.048	0.066	1245.8	576	< 0.001
Dimension second-order SAAMS with correlations	0.916	0.048	0.065	1187.2	558	< 0.001
Measurement invariance models for sex						
Female student–athletes ($n = 213$)	0.903	0.055	0.054	876.0	528	< 0.001
Male student–athletes ($n = 282$)	0.903	0.054	0.053	959.3	528	< 0.001
Configural model	0.903	0.055	0.054	1837.7	1056	< 0.001
Metric model	0.904	0.054	0.056	1848.8	1080	< 0.001
Scalar model	0.901	0.054	0.057	1897.1	1104	< 0.001

SAAMS Student–athletes' Academic and Athletic Motivation Scale, *df* degrees of freedom, *CFI* comparative fit index, *RMSEA* root mean square error of approximation, *SRMR* standardised root mean square residual

Table 3 Pearson's correlations for academic and athletic motivation as well as academic and athletic identity, excessive demands, athletic passion, and time spent for school work/training ($N = 497$)

	Academic motivation	Athletic motivation
Academic motivation	–	0.14*
Athletic motivation	0.14*	–
Academic context		
Academic identity	0.41**	0.05
Academic excessive demands	–0.63**	–0.06
Time spent for extracurricular school work	0.13**	0.05
Athletic context		
Athletic identity	–0.18**	0.34**
Athletic excessive demands	0.07	–0.22**
Athletic passion	0.24**	0.53**
Time spent for competitive training	0.07	0.12**

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

trast, negative correlations were found between motivation and excessive demands. It is interesting that the impact of the excessive demands seems to be higher for school than for sport. This finding, however, is not surprising as student–athletes are committed to sports voluntarily whereas school is compulsory. Positive, although weak, correlations were found between the time spent for extracurricular school work and academic motivation as well as the time spent for competitive training and athletic motivation. Hence, the correlations indicate a good convergent and criterion validity of the SAAMS.

In general, the results indicate that the SAAMS is appropriate for measuring adolescent student–athletes' academic and athletic motivation. The final SAAMS depicts the theoretical six-dimension model on the empirical level. Moreover, the SAAMS contributes to the discourse of DC research as the scale emphasises the importance of conducting research with student–athletes in secondary schools. In comparison to other instruments measuring DC motivation (Gaston-Gayles, 2004; Aunola et al., 2018), one can argue that the SAAMS is the only instrument that is based on a single theoretical underpinning and yields better statistical results.

The strength of the present study can be found in the novel approach of combining academic and athletic motivation in one scale in order to fully depict DC motivation. Although domain-specific instruments are still disputed, Heckhausen and Heckhause (2018) emphasised that life-domain-specific instruments measuring motivation provide substantial benefits. The SAAMS constitutes such a domain-specific instrument as the scale differentiates between the academic and athletic life context. Moreover, the SAAMS is the first scale constructed specifically for adolescent student–athletes in upper secondary school. In addition, the SAAMS seems to be independent of the specific location and type of sport school as well as the region and educational system, as the SAAMS was conducted in German and Austrian federal states. However, further studies need to investigate the adequacy of the SAAMS for measuring academic and athletic motivation in diverse cultural and educational contexts.

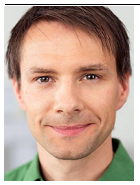
Besides the strength of the study, limitations should be considered. In terms of the method, most steps of the procedure suggested by Boateng et al. (2018) have been followed. However, some minimal deviations can be found. In step 3, the pre-testing of the items was conducted with a large sample rather than a small group in several rounds. Furthermore, as the study aimed to have equal scales for academic and athletic motivation, some items had to be deleted or kept during the EFAs in order to achieve equity, which might have led to a quality reduction in the initial SAAMS. Nevertheless, the CFAs show approval of the final solution with six factors. In order to test for the discriminant validity of the results of the CFAs, further examinations of the SAAMS have to be conducted. Moreover, the SAAMS has not yet been used in a longitudinal study. Future studies should evaluate the scale longitudinally with re-test reliability. Lastly, the items were worded with the aim of being culturally unspecific. This unspecificity seems to be true for the two German-speaking countries involved. However, the cultural specificity needs to be explored further, possibly in multicultural teams.

Conclusion

Previous research regarding DC motivation focused on student–athletes in higher education (Fernandes et al., 2019; Gaston-Gayles, 2004; Lupo et al., 2015; Park & Lee, 2015). The newly developed SAAMS contributes to the discourse of DC motivation research by focusing on adolescent student–athletes in upper secondary school. In light of the EVF, this scale is able to depict adolescent student–athletes' academic and athletic motivation. Based on existing findings, an extensive range of research and practical applications can be suggested for the SAAMS. As the athletic performance is not the only indicator for the participation in DC support services and since motivational aspects should additionally be considered, the SAAMS can possibly be used for talent identification and selection when making decisions about the access to and provision of support services. Another possible practical field of application for this scale is the usage by practitioners such as teachers, coaches, and DC counsellors in order to individually guide student–athletes through a successful DC. Moreover, the SAAMS can potentially be used in practical and research settings by documenting the longitudinal development of student–athletes' academic and athletic motivation. Further applications in research contexts include the description and prediction of DCs with regard to motivation. For example, optimal motivation profiles for a successful DC can be identified using the SAAMS by investigating student–athletes' motivation with regard to academic and athletic achievements, health, burnout, etc.

Corresponding address

Maike Niehues
Institute of Human Movement Science, University of Hamburg
Hamburg, Germany
maike.niehues@uni-hamburg.de



Jeffrey Sallen
Institute of Human Movement Science, University of Hamburg
Hamburg, Germany
jeffrey.sallen@uni-hamburg.de

Acknowledgements. We would like to thank Prof. Dr. Christopher Heim (Goethe University Frankfurt, Germany), Prof. Dr. Sebastian Ruin (University of Graz, Austria), and Dr. Hagen Wulff (University of Leipzig, Germany) for their support in arranging the contacts at the elite sport schools. Moreover, we would like to thank Christian Andresen, Jan Christmann, Benjamin Corts, Christoph Lahousen, Dominic Ullrich, and Lara Wille for their support in acquiring the participants for the study.

Author Contribution. All authors were responsible for the study conception and design. J. Sallen acted as initiator and supervisor of the study, organised sample 1 and led the data acquisition for the first study part (scale development phase). M. Niehues organised sample 2 and led the data acquisition for the second study part (scale evaluation phase), took lead in developing the SAAMS and in writing the manuscript. All authors made substantial contributions to the data analysis and interpretation. The manuscript was developed, revised, and approved for publication by all authors.

Funding. Open Access funding enabled and organized by Projekt DEAL.

Declarations

Conflict of interest. M. Niehues, J. Sallen and E. Gerlach declare that they have no competing interests.

The study was approved by local school authorities and the ethics committees of the University of Hamburg (approval number: 2022_036; Germany) and the University of Potsdam (approval number: 37/2021; Germany). All research procedures were in line with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

References

Aquilina, D., & Henry, I. (2010). Elite athletes and university education in Europe: A review of policy and practice in higher education in the European Union member states. *International Journal of Sport Policy and Politics*, *2*(1), 25–47. https://doi.org/10.1080/19406941003634024.

Araújo, C. G. S., & Scharhag, J. (2016). Athlete: a working definition for medical and health sciences research. *Scandinavian Journal of Medicine & Science in Sports*, *26*(1), 4–7. https://doi.org/10.1111/sms.12632.

Aunola, K., Selänne, A., Selänne, H., & Ryba, T. V. (2018). The role of adolescent athletes' task value patterns in their educational and athletic career aspirations. *Learning and Individual Differences*, *63*, 34–43.

Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quinonez, H. R., & Young, S. L. (2018). Best practices for developing and validating scales for health, social, and behavioral research: A primer. *Frontiers in Public Health*, *6*, Article 149. https://doi.org/10.3389/fpubh.2018.00149.

Brettschneider, W.-D. (1999). Risks and opportunities: Adolescents in top-level sport—Growing up with the pressures of school and training. *European Physical Education Review*, *5*(2), 121–133.

Brettschneider, W.-D., & Klimek, G. (1998). *Sportbetonte Schulen. Ein Königsweg zur Förderung sportlicher Talente? [Sport Schools. An Ideal Solution to Promote Athletic Talent?]*. Meyer & Meyer.

Brewer, B. W., Van Raalte, J. L., & Linder, D. E. (1993). Athletic identity: Hercules' muscles or Achilles heel? *International Journal of Sport Psychology*, *24*(2), 237–254.

Brown, T. A. (2015). *Confirmatory factor analysis*. Guilford.

Chamorro, J. L., Torregrosa, M., Sánchez, O. D., García Calvo, T., & León, B. (2016). Future achievements, passion and motivation in the transition from junior-to-senior sport in Spanish young elite soccer players. *The Spanish Journal of Psychology*, *19*, e69. https://doi.org/10.1017/sjp.2016.71.

Clancy, R. B., Herring, M. P., MacIntyre, T. E., & Campbell, M. J. (2016). A review of competitive sport motivation research. *Psychology of Sport and Exercise*, *27*, 232–242.

Eccles, J. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychologist*, *44*(2), 78–89.

Eccles, J. S., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin*, *21*(3), 215–225.

Eccles, J. S., Wigfield, A., Harold, R. D., & Blumenfeld, P. (1993). Age and gender differences in children's self- and task perceptions during elementary school. *Child Development*, *64*(3), 830–847.

Engström, C. (2011). *Dual career for student-athletes: A longitudinal study of adaptation during the first six months at the sport gymnasium in Sweden*.

Lund University, Department of Psychology. Master's Thesis

EU Expert Group "Education and Training in Sport", Sport Unit of the Directorate-General for Education and Culture of the European Commission. (2012). EU guidelines on dual careers of athletes. Recommended policy actions in support of dual careers in high-performance sport. http://ec.europa.eu/assets/eac/sport/library/documents/dual-career-guidelines-final_en.pdf

Fernandes, A., Moreira, L., & Goncalves, C. (2019). Student-athletes identity and motivation towards dual career: The context matters. *Kinesiologia Slovenica*, *25*(2), 15–29.

Flake, J. K., Barron, K. E., Hulleman, C., McCoach, B. D., & Welsh, M. E. (2015). Measuring cost: the forgotten component of expectancy-value theory. *Contemporary Educational Psychology*, *41*, 232–244. https://doi.org/10.1016/j.cedpsych.2015.03.002.

Fredricks, J. A., Alfeld, C., & Eccles, J. S. (2010). Developing and fostering passions in academic and nonacademic domains. *Gifted Child Quarterly*, *54*(1), 18–30. https://doi.org/10.1177/0016986209352683.

Gaston-Gayles, J. L. (2004). Examining academic and athletic motivation among student athletes at a Division I university. *Journal of College Student Development*, *45*(1), 75–83.

Guidotti, F., Cortis, C., & Capranica, L. (2015). Dual career of European student-athletes: a systematic literature review. *Kinesiologia Slovenica*, *21*(3), 5–20.

Gustafsson, H., Madigan, D. J., & Lundkvist, E. (2018). Burnout in athletes. In R. Fuchs & M. Gerber (Eds.), *Handbuch Stressregulation und Sport* (pp. 489–504). Springer. https://doi.org/10.1007/978-3-662-49322-9_24.

Hayes, A. F., & Coutts, J. J. (2020). Use Omega rather than Cronbach's Alpha for estimating reliability. *But … Communication Methods and Measures*, *14*(1), 1–24. https://doi.org/10.1080/19312458.2020.1718629.

Heckhausen, J., & Heckhause, H. (2018). *Motivation and action* (3rd edn.). Springer.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modelling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods*, *6*(1), 53–60.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Kröhler, A., & Berti, S. (2014). Anwendung der sport- und bewegungsbezogenen Selbstkonkordanz auf den Leistungssport [Implementation of the sport and movement related self-concordance for elite sport]. *Zeitschrift für Sportpsychologie*, *21*(3), 119–126.

Love, S. M., & Rufer, L. S. (2021). Am I a student or an athlete? An examination of motivation and identity in DIII student-athletes. *Journal of Issues in Intercollegiate Athletics*, *14*, 67–94.

Lupo, C., Guidotti, F., Goncalves, C. E., Moreira, L., Topic, M. D., Bellardini, H., Tonkonogi, M., Colin, A., & Capranica, L. (2015). Motivation towards dual career of European student-athletes. *European Journal of Sport Science*, *15*(2), 151–169. https://doi.org/10.1080/17461391.2014.940557.

Marsh, H. W. (1990). *Self-Description Questionnaire (SDQ) II: A theoretical and empirical basis for the measurement of multiple dimensions of adolescent self-concept. An interim test manual and a research monograph*. The Psychological Corporation.

Moeller, J. (2013). *Passion as concept of the psychology of motivation. Conceptualization, assessment, inter-individual variability and long-term stability*. University of Erfurt, Faculty of Educational Sciences. Doctoral Dissertation

Niehues, M., Gerlach, E., & Sallen, J. (2021). Measuring dual career motivation among German student-athletes using the Student Athletes' Motivation Toward Sports and Academics Questionnaire. *German Journal of Exercise and Sport Research*, *51*, 378–383. https://doi.org/10.1007/s12662-021-00723-9.

Osborne, J. W. (2014). *Best practices in exploratory factor analysis*. CreateSpace Independent Publishing Platform.

Park, S., & Lee, M. (2015). Validation of the student athletes' motivation towards sports and academics questionnaire to Korean student-athletes. *Journal of Exercise Rehabilitation*, *11*(4), 220–227. https://doi.org/10.12965/jer.150202.

Pascoe, M., Hetrick, S. E., & Parker, A. G. (2019). The impact of stress on students in secondary school and higher education. *International Journal of Adolescence and Youth*, *25*(1), 104–112. https://doi.org/10.1080/02673843.2019.1596823.

Pelletier, L. G., Fortier, M. S., Vallerand, R. J., Tuson, K. M., Briere, N. M., & Blais, M. R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports. The Sport Motivation Scale (SMS). *Journal of Sport & Exercise Psychology*, *17*, 35–53.

Petrowski, K., Kliem, S., Sadler, M., Meuret, A. E., Ritz, T., & Brähler, E. (2018). Factor structure and psychometric properties of the English version of the Trier Inventory for Chronic Stress (TICS-E). *BMC Medical Research Methodology*, *18*, 18. https://doi.org/10.1186/s12874-018-0471-4.

Quinaud, R. T., Gonçlaves, C. E., Possamai, K., Morais, C. Z., Capranica, L., & Carvalho, H. M. (2021). Validity and usefulness of the student-athletes' toward sport and academics questionnaire: a Bayesian multilevel approach. *PeerJ*, *9*, e11863. https://doi.org/10.7717/peerj.11863.

Ryba, T. V., Stambulova, N. B., Selänne, H., Aunola, K., & Nurmi, J.-E. (2017). "Sport has always been first for me" but "all my free time is spent doing homework": Dual career styles in late adolescence. *Psychology of Sport and Exercise*, *33*, 131–140.

Sallen, J., & Gerlach, E. (2020). Förderung Dualer Karrieren im Leistungssport [Promotion of dual careers in pre-elite sports]. In C. Breuer, C. Joisten & W. Schmidt (Eds.), *Vierter Deutscher Kinder- und Jugendsportbericht* (pp. 249–276). Schorndorf: Hofmann.

Sallen, J., Hemming, K., & Richartz, A. (2018a). Facilitating dual careers by improving resistance to chronic stress: effects of an intervention programme for elite student athletes. *European Journal of Sport Science*, *18*(1), 112–122. https://doi.org/10.1080/17461391.2017.1407363.

Sallen, J., Hirschmann, F., & Herrmann, C. (2018b). Evaluation and adaption of the Trier Inventory for Chronic Stress (TICS) for assessment in competitive sports. *Frontiers in Psychology*, *9*, 308. https://doi.org/10.3389/fpsyg.2018.00308.

Schmid, J., & Seiler, R. (2003). Identität im Hochleistungssport. Überprüfung einer deutschsprachigen Adaptation der Athletic Identity Measurement Scale (AIMS-D) [Identity in elite sport. Evaluation of a German adaptation of the Athletic Identity Measurement Scale]. *Diagnostica*, *49*(4), 176–183. https://doi.org/10.1026//0012-1924.49.4.176.

Sorkkila, M., Ryba, T. V., Selänne, H., & Aunola, K. (2018). Development of school and sport burnout in adolescent student-athletes: a longitudinal mixed-methods study. *Journal of Research on Adolescence*, *30*(S1), 115–133. https://doi.org/10.1111/jora.12453.

Stambulova, N. B., & Wylleman, P. (2019). Psychology of athletes' dual careers: a state-of-the-art critical review of the European discourse. *Psychology of Sport & Exercise*, *42*, 74–88.

Stambulova, N. B., Engström, C., Franck, A., Linner, L., & Lindahl, K. (2015). Searching for an optimal balance: Dual career experience of Swedish adolescent athletes. *Psychology of Sport and Exercise*, *21*, 4–14.

Steele, A. R., van Rens, F., & Ashley, R. (2020). A systematic literature review on the academic and athletic identities of student-athletes. *Journal of Intercollegiate Sport*, *13*(1), 69–92.

Vallerand, R. J., Pelletier, L., Briere, N. M., & Senecal, C. (1992). The academic motivation scale: a measure of intrinsic, extrinsic, and amotivation in education. *Educational and Psychological Measurement*, *52*, 1003–1017.

Van Sonderen, E., Sanderman, R., & Coyne, J. C. (2013). Ineffectiveness of reverse wording of questionnaire items: Let's learn from cows in the rain. *PloS One*, *8*(7), e68967. https://doi.org/10.1371/annotation/af78b324-7b44-4f89-b932-e851fe04a8e5.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, *25*, 68–81.

Wylleman, P., Reints, A., & De Knop, P. (2013). A developmental and holistic perspective on athletic career development. In P. Sotiaradou & V. De Bosscher (Eds.), *Managing high performance sport* (pp. 159–182). Routledge.