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Validation of a dutch measure for implicit theories of ability in sport (CNAAQ-2-NL)

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Our goal was to validate the Conceptions of the Nature of Athletic Abilities Questionnaire (CNAAQ-2) in a Dutch context. We conducted three studies to examine its psychometric qualities. In Study 1 we performed exploratory factor analyses on two samples (N = 400, and N = 341), which supported a solution of four factors labeled entity-stable, entity-gift, incremental-learning, and incremental-improvement. A confirmatory factor analysis showed an acceptable fit of a four-plus-two higher-order factor model, with entity and incremental as higher-order factors. To further improve the psychometric properties, 25 items were added, and in Study 2 we merged three samples that were then randomly split in two halves. A principal component analysis of the first half of the data (N = 255) led to a selection of 21 items (the CNAAQ-2-NL), which was verified in a confirmatory factor analysis of the second half of the data (N = 255). The fit of a model with four lower-order factors (entity-stable, entity-gift, incremental-learning, and incremental-improvement) was acceptable, as was the fit of a four-plus-two higher-order factor model, with entity and incremental as higher-order factors. In Study 3 (N = 322) we administered the CNAAQ-2-NL along with other measures, at two points in time three weeks apart. Test-retest reliability was good, and convergent validity was supported by relations with Dweck's measures of implicit theories of intelligence and sport abilities. Criterion-related validity was supported by relations with achievement goals. We conclude that the factor structure of the CNAAQ-2-NL was according to theory, and that validity was sufficiently supported. However, our findings also suggest that the role of implicit theories may be different in sport than in the context of intelligence and needs further investigation.

KEY WORDS: Implicit theories, entity beliefs, incremental beliefs, achievement goals, CNAAQ-2, Dutch.

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People differ in their beliefs about the malleability of human abilities. Some believe that abilities are innate and largely fixed, while others believe that abilities can be developed. According to Dweck (1999), the first implicit theory of ability is labeled an entity view and the second is labeled an incremental view. In the context of cognitive activities (e.g., in school), entity and incremental views relate to motivation, goals, affect, and behavior (Mueller & Dweck, 1998). In the context of sport and physical activities, these views relate to achievement goals (Vella et al., 2016; Weltevreden et al., 2018), self-determined motivation (Biddle et al., 2003; Moreno-Murcia et al., 2014), amotivation (Biddle et al., 2003), enjoyment (Biddle et al, 2003), self-handicapping (Chen et al., 2008; Ommundsen, 2001b), competence (Wang & Liu, 2007), attributions, and anxiety (Gardner et al., 2015).

To measure implicit theories of ability in sport, Biddle and colleagues (2003) revised Sarrazin et al.'s (1996) Conceptions of the Nature of Athletic Ability Questionnaire (CNAAQ) and named it the CNAAQ-2. Some studies have provided initial support for the reliability and validity of the CNAAQ-2 (Moreno-Murcia et al., 2013; Wang et al., 2005). However, as its psychometric properties varied across these studies, further validation of this instrument is needed. Furthermore, an early cross-cultural study (Wang et al., 2005) showed that the CNAAQ-2 yielded different results in English and Singaporean samples. Therefore, as to promote cross-cultural comparisons of research findings with this instrument, more research in different cultural contexts is highly needed.

Our first aim is to develop a Dutch version of the CNAAQ-2 and examine its psychometric properties. A second aim of this study is to test the dimensionality of the CNAAQ-2 and to investigate the validity of the scales and subscales. Moreover, to enhance the validity and generalizability of the CNAAQ-2 we test it among experienced athletes, which extends prior research that predominantly examined implicit theories of school children in the context of physical education classes (e.g., Biddle et al., 2003; De Oliveira Durão et al., 2010; Moreno-Murcia et al., 2013).

Our research comprises three studies. In Study 1, we develop a Dutch version of the CNAAQ-2 and investigate its construct validity and reliability in two samples. In Study 2, we further develop the Dutch CNAAQ-2 (i.e., the CNAAQ-2-NL) by generating additional items and cross-validating this measure in a third sample. In Study 3, we investigate the test-retest reliability of the improved CNAAQ-2-NL, as well as its convergent and criterion-related validity. All studies were approved by the Ethical Review Board of the University of Amsterdam. All participants provided their written consent for the use of their data.

Implicit Theories

Implicit theories were introduced to explain why children react differently to setbacks. Some children show a helpless response pattern, characterized by a sense of failure, negative self-cognitions, task avoidance, loss of self-confidence, negative affect, and performance decrements (Dweck, 1999). Other children show a mastery response pattern, marked by a combination of task-related self-instructions, heightened effort, and the absence of negative cognitions (Dweck & Leggett, 1988). These different response patterns were theorized to originate from children's beliefs about the malleability of intelligence and to reflect their achievement goals. The literature on achievement goals (e.g., Elliot & McGregor, 2001) distinguishes between performance goals, expressing the desire to demonstrate superior ability compared to others, and mastery goals, expressing the desire to learn, develop, and improve.

To account for the emergence of these goals and response patterns, Dweck and Leggett (1988) proposed two frames of reference: an entity view and an incremental view. An entity view reflects the belief that intelligence is a fixed and innate ability that cannot be changed. People with an entity view perceive performance situations as a moment where their abilities are compared to those of others, which elicits concerns about not being smart enough, worries about the outcome of the comparison, fear of failure, and avoidant behavior. Consequently, an entity view leads to the pursuit of performance goals and a helpless pattern, especially after failure is encountered. An incremental view reflects the idea that intelligence is malleable and can be developed through practice, learning, and effort. People with an incremental view tend to view performance situations as self-assessments that can inform them about their current level of ability and possible areas for improvement, which leads to mastery goals and a mastery reaction pattern.

Implicit Theories in Sport

Implicit theories can not only refer to intelligence but also to other abilities such as sports ability. Given that implicit theories are domain specific (Burnette et al., 2013; Dweck et al., 1995), a separate stream of research has focused on implicit theories in the sports domain. Specifically, implicit theories on sports ability were found to relate to achievement goals in sport (e.g., Vella et al., 2016; Wang et al., 2009). Furthermore, Spray et al. (2006) provided support for the causality of this relation. They showed that students who were manipulated with an entity view on golf ability were more likely to adopt performance goals than students who were manipulated with an incremental view on this ability. Also, 'entity' students were less likely to adopt mastery goals after failure than 'incremental' students.

Although the relations between implicit theories and achievement goals in sports were supported, they were not as convincing as in studies about intelligence. Therefore, to better capture the nature of athletic abilities, Sarrazin and colleagues (1996) developed a questionnaire in French called the Conceptions of the Nature of Athletic Abilities Questionnaire (CNAAQ), which consists of 21 items in six subscales, representing three dichotomies. Using this new questionnaire, they found relations between implicit theories and achievement goals that were better in line with the theory (Dweck & Leggett, 1988).

However, the factorial structure of the French CNAAQ (Sarrazin et al., 1996) was not always confirmed in other languages. Different numbers of factors were found, and some items showed cross-loadings or loaded on factors they did not belong to (e.g., Ommundsen, 2001a, 2001b). This led to a revision of the CNAAQ into an English version, the CNAAQ-2 (Biddle et al., 2003), consisting of four subscales with three items each. Biddle et al. (2003) estimated a measurement model with four first-order factors reflecting that sport ability is (1) *stable* over time, (2) a *gift*, (3) the product of *learning*, and (4) open for *improvement*, and two higher-order factors (entity and incremental). A four-factor model provided a better fit to the data, but the four-plus-two factor model was chosen because this model was considered more parsimonious. The four-plus-two factor structure was supported in subsequent studies with different samples, as well as the hypothesized relations with achievement goals, amotivation, and enjoyment (Biddle et al., 2003).

The factor structure of the CNAAQ-2 has been investigated in several languages. These studies provided support for a four-plus-two factor model (Moreno-Murcia et al., 2013; Stenling et al., 2014; Wang et al., 2009), a four-factor model (Moreno-Murcia et al., 2014; Stevenson and Lochbaum, 2008; Wang & Liu, 2007; Wang et al., 2005), or a two-factor model (Chen et al., 2008; De Oliveira Durão et al., 2010). Despite this variation in supported models, all studies found a distinction between entity and incremental beliefs.

Study 1: Translation and Initial Validation of the CNAAQ-2

In this study, we developed a Dutch version of the CNAAQ-2 using translation-back translation procedures and explored the four-factor structure, which is the theoretical basis of the original CNAAQ-2 (Biddle et al., 2003). Because research has provided evidence for different models (a four-plus-two factor model, a four-factor model, and a two-factor model), we compared these models to find the best fit. Most studies investigating implicit theories in sports have recruited school children as respondents (e.g., Biddle et al., 2003; Ommundsen, 2001a, 2001b), which limits the generalizability of results to experienced athletes. Therefore, we recruited participants who had practiced their sport for a number of years. These experienced athletes may respond differently to the CNAAQ-2 items than school children who think of sports in general or as physical education.

Method

Participants

Because our aim was to develop an instrument that is valid and reliable for all levels of sport participation and across many different sports, we recruited two samples for Study 1 consisting of respondents who were actively involved in a variety of sports at different competitive levels.

Sample 1. The first sample ($N = 400$; 165 female; 230 male; 5 did not report their gender; $M_{age} = 20.2$; $SD = 1.96$) was collected among students at a college for higher professional education for sports teachers ($n = 80$), and for management and entrepreneurship in sports ($n = 320$). Paper and pencil questionnaires were administered during class hours. All participants actively practiced sports on a daily basis, for an average of 6.3 hours per week ($SD = 3.7$). Soccer players formed the largest group ($n = 133$; 33.3%), followed by field hockey ($n = 32$; 8.0%), tennis ($n = 23$; 5.8%), and running ($n = 19$; 4.8%). Fifty participants (12.5%) practiced their sport on a recreational level and 333 (83.3%) on a competitive level, of which 24 took part in international competition (17 participants, 4.3%, did not report their participation level). On average, participants had been practicing their sport for 10.4 years ($SD = 4.6$).

Sample 2. The second sample ($N = 341$; 114 female, 216 male, 8 did not report their gender; $M_{age} = 21.9$ years; $SD = 10.6$) consisted of athletes from a variety of sports. Paper and pencil questionnaires were filled out at the sports facility. Soccer players formed the largest group ($n = 101$, 31.9%), followed by tennis ($n = 42$, 13.1%) and fitness ($n = 36$, 11.4%). One hundred twenty-two participants (35.8%) participated in sport on a recreational level and 218 (63.9%) on a competitive level, of which 22 took part in international competition (one participant did not report the level of sport participation).

Measures

Implicit theories of ability. After the first author had translated the CNAAQ-2 (Biddle et al., 2003) into Dutch, it was translated back into English by a researcher fluent in both English and Dutch. This procedure did not show any meaningful differences. Like the English version, the Dutch CNAAQ-2 consisted of twelve items that are expected to belong to four subscales, containing three items each: Stable (e.g., “You have a certain level of ability in sport and you cannot really do much to change that level.”), Gift (e.g., “You need to have certain ‘gifts’ to be good at sports.”), Learning (e.g., “To be successful in sport you need to learn techniques and skills, and practice them regularly.”), and Improvement (e.g., “In sport, if you work hard at it, you will *always* get better.”). Answers were provided using a Likert scale, ranging from 1 (*completely disagree*) to 5 (*completely agree*).

Results

To examine the factor structure, we performed a principal component analysis in both samples. We used oblimin rotation because the entity and incremental scales, as well as their four subscales, are expected to correlate. In both samples, the scree plot suggested retaining three factors, but the Kaiser criterion suggested four factors, explaining 59.47% and 58.86% of the variance, respectively. We chose a four-factor solution, based on the Kaiser criterion and on the distribution of items over factors, which clearly followed the underlying theory.

Average factor loadings per subscale (for Sample 1 and Sample 2 respectively) were .68 and .64, for the stable scale, .81 and .77 for the gift scale, -.70 and .61 for the learning scale, and .80 and .84 for the improvement scale. All primary loadings were above the .32 criterion, and all cross-loadings were below (cf. Tabachnick & Fidell, 2012), except for one item in Sample 2. This item belongs to the stable scale but had a higher, but negative, loading on the scale for learning (.32 vs. -.43), which is understandable, since these two scales represent opposing ideas (the idea that ability for sport can, or cannot, be developed).

In addition to the exploratory factor analysis, we performed confirmatory factor analyses (CFA’s) on the data of both samples. Based on Biddle et al. (2003), we fitted a model with four first-order factors (gift, stable, learning and improvement), and two higher-order factors (entity and incremental). This model was not identified, which we solved by constraining the factor loadings of the latent first order factors on their respective higher-order latent factors to be equal (cf. Porath et al., 2012). The fit of the four-plus-two model in Sample 1 was acceptable, but not very good (χ^2 = 130.10, *df* = 51, χ^2/*df*-ratio = 2.55, RMSEA = .06, NNFI = .89). The fit of this model in Sample 2 also was acceptable but not good (χ^2 = 106.08, *df* = 51, χ^2/*df*-ratio = 2.08, RMSEA = .05, NNFI = .91; the fit criteria are derived from Schermelleh-Engel et al., 2003).

All factor loadings in the CFA were significant in both samples (*t*-values ranging from 3.78 to 12.52, all *p*-values < .01). For Sample 1 and Sample 2, respectively, the average loadings were .34 and .38 for the stable scale, .69 and .68 for the gift scale, .37 and .31 for the learning scale, and .75 and .76 for the improvement scale. Although these values are acceptable, the average loadings for the stable and learning subscales are below the recommended minimum of .70 (Hair et al., 2019). The loadings of the primary latent factors on the higher order latent factors were all significant (*t*-values ranging from 2.83 to 5.19, all *p*-values < .01).

Based on the factor loadings we calculated the composite reliability (CR) and average variance extracted (AVE) for the four subscales, and for the entity and incremental scales. For CR a value of .70 is recommended and for AVE a minimum value of .50 is recommended (Hair et al., 2019). Table 1 presents these parameters and shows that most values in our study were below the recommended cutoffs. McDonald’s omegas (McNeish, 2018; for Sample 1 and 2 respectively) were .73 and .70 for the stable scale, .86 and .81 for the gift scale, .75 and .65 for the learning scale, and .84 and .88 for the improvement scale.

TABLE I
Descriptive Statistics and Intercorrelations of the Scales of the CNAAQ-2 in Study 1 (Samples 1 and 2)

	Sample 1					Sample 2										
CNAAQ-2 subscale	M	SD	ω	CR	AVE	*M*	*SD*	ω	CR	AVE	1.	2.	3.	4.	5.	6.
1. Entity total	2.72	0.48	.71	.51	.23	2.66	0.51	.56	.56	.24		.07	.61**	.86**	.09	.03
2. Incremental total	3.71	0.54	.71	.61	.29	3.90	0.53	.71	.61	.29	-.05		-.13**	.17**	.61**	.88**
3. Stable	1.97	0.50	.73	.28	.12	1.97	0.54	.70	.34	.16	.59**	-.09		.12*	-.12*	-.09
4. Gift	3.47	0.77	.86	.71	.45	3.36	0.82	.81	.72	.46	.84**	.00	.07		.19**	.10
5. Learning	4.15	0.53	.75	.33	.16	4.17	0.50	.64	.25	.10	.14**	.61**	-.11	.25**		.15**
6. Improvement	3.27	0.87	.84	.80	.57	3.63	0.85	.88	.81	.58	-.14**	.89**	-.05	-.13*	.19**	

Note. *Correlations in the upper diagonal are from Sample 1 (N = 400). Correlations in the lower diagonal are from Sample 2 (N = 341). CR = Composite reliability, AVE = Average Variance Extracted. Entity total = the average of the stable scale and the gift scale. Incremental total = the average of the learning scale and the improvement scale. Omegas for the Entity total scale and the Incremental total scale are calculated using the factor loadings from the principal component analysis with oblimin rotation, and a forced two-factor solution. Omegas for the subscales are calculated using the factor loadings from the principal component analysis with oblimin rotation that resulted in a four factor solution, based on a combination of eigenvalues and the scree plot. Composite reliability for the total scales is based on the confirmatory factor analysis with two factors, composite reliability for the subscales is based on the confirmatory factor analysis fitting a 4+2 factor model.*

$^{*}p < .05$, *two-tailed* $^{**}p < .01$, *two-tailed.*

Descriptives and correlations of the four subscales as well as the entity and incremental scales are also in Table 1. The correlation between the entity and incremental scales was close to zero (Sample 1: $r = .07$, $p = .17$; Sample 2: $r = -.05$, $p = .34$). The stable and gift scales did not correlate very strongly with each other (Sample 1: $r = .12$, $p = .01$; Sample 2: $r = .07$, $p = .20$), indicating that they are two separate aspects of the entity view. The learning and improvement scales did not correlate strongly either (Sample 1: $r = .15$, $p = .002$; Sample 2: $r = .19$, $p < .001$), indicating that they are two separate aspects of the incremental view. The low correlations of subscales with the opposing views' total scores support the theoretical proposition that the constructs are related but different. However, interpretation of these correlations is hampered by low values of some of the psychometric properties.

Conclusion

The results of the factor analyses provided support for the factor structure of the Dutch version of the CNAAQ-2. Items theoretically belonging together loaded on the same factor, and the dimensionality was clearly reflected in the pattern of correlations between scales. McDonald's omega reliabilities were also satisfactory. However, the model fit of the CFA in the two samples was acceptable, but not good; and it revealed a number of low item loadings, and low average loadings for the stable and learning subscales. Finally, most values of CR and AVE were lower than the advised minimum for these variables. Based on these results we concluded that the scale could be improved further.

A first explanation for the low factor loadings could be that the items were unclear to respondents. The exact translation of English items into Dutch may have caused expressions that are less common in Dutch. A second explanation could be that items in the stable and learning scales may not represent one single underlying idea or that the underlying idea was not clear enough to the respondents. The central idea of the stable scale is that, even if you try, it is hard to change how good you are in a sport. Because most people believe that one can improve sport performance through practice, this idea may be counterintuitive, which may have caused irregular responses. This is supported by the fact that the average score on this subscale was the lowest of the four in both our samples, indicating that respondents agreed the least with these items.

The learning subscale also did not perform well enough. The central idea of this scale is that to reach a high level in sport, it is necessary to practice and learn. Possibly, respondents found this idea so evident that they thought there was a deeper meaning behind the items. For example, the item with the lowest factor loading was: 'You need to learn and work hard to be good at sport'. Indeed, this subscale had the highest average score of the four subscales in both samples, indicating most respondents endorsed this viewpoint.

Because of the low reliabilities for the stable and learning subscales, we decided to adjust some items and generate additional ones. This revised Dutch version of the CNAAQ-2 (i.e., the CNAAQ-2-NL) was tested in Study 2.

Study 2: Development of the CNAAQ-2-NL

We improved the Study 1 items and generated a number of additional items, which we administered to three samples: soccer players, dancers, and competitive swimmers. We decided to collect data in these three distinct sports domains to examine whether the CNAAQ-2-NL would be applicable in a broad range of contexts. The three samples were combined into one dataset and this set was split in two random halves. Based on an exploratory factor analysis on the first half, we selected a set of items. This selection was then cross-validated with the second half of the data file, using CFA.

Further Instrument Development

Based on the scale descriptions in prior articles (Biddle et al., 2003; Sarrazin et al., 1996), we generated additional items that capture the central idea of the subscales (cf. Cortina et al., 2020). The central idea of the stable scale is that the level of ability that people have cannot be changed much and limits the performance level they can achieve. The central idea of the gift subscale is that innate talent is necessary to become successful in a sport. The central idea of the learning subscale is that learning and practicing are the way to keep improving in a sport. The central idea of the improvement scale is that people can always improve their skill level in a sport if they work on it, and that there is no limit to the performance level they can achieve.

As a first step, we re-evaluated the content of the twelve existing items. Where necessary, we slightly rephrased items to align them with the description of the scale they belonged to or to formulate them in more common and contemporary Dutch. Then, we formulated 105 new items based on literature about implicit theories of ability and the conceptualization of the scales (Biddle et al., 2003; Dweck, 1999; Sarrazin et al., 1996). Examples of newly formulated items are: 'Everyone has a maximum level in a sport, after which they cannot improve further' (Stable), 'If you want to reach the top in a sport, you need to have enough talent for it.' (Gift), 'To become good at a sport, you have to keep working on your technique and skills.' (Learning), 'You can always improve yourself in your sport if you are willing to practice hard for it.' (Improvement).

Finally, the first two authors selected the best 25 items out of the item pool of 105 items, based on the following criteria (Hinkin, 1998; Hofstee, 1999): (1) include both indicative and counter-indicative items, (2) avoid conceptual overlap between scales, (3) avoid statements formulated as a denial/negation (e.g., 'You do not need talent to …'), (4) avoid double-barreled statements (e.g., 'To stay motivated, and win medals you have to…'), (5) avoid intensifiers (e.g., sometimes, many), (6) vary the wording of items, (7) avoid statements that will likely evoke the same response in all respondents.

Adding these 25 items to the original twelve resulted in a 37-item questionnaire. In the revised version, the stable scale comprised eight items, the gift scale nine items, the learning scale eleven items, and the improvement scale nine items. Answers were provided using a Likert scale, ranging from 1 (*completely disagree*) to 5 (*completely agree*).

Method

Participants

We collected data from three subsamples. The first consisted of junior soccer players from two soccer academies, who filled out the paper and pencil questionnaires at their sports facility (n = 211; all boys; M_{age} = 14.7; SD = 2.8). The second subsample consisted of dancers, recruited through dancing schools and summer camps for young dancers (n = 154; 24 boys, 130 girls; M_{age} = 15.1; SD = 3.5). The dancers were invited to participate through an email that contained a link to the online questionnaire. The third subsample consisted of swimmers (n = 145; 74 boys, 71 girls; M_{age} = 18.1; SD = 3.6), who filled out the paper and pencil questionnaires before or after practice at their sports facility. The combined sample (N = 510; 309 boys, 201 girls; M_{age} = 15.8; SD = 3.5) was split in two random halves to create two data sets with a mix of participants from different domains. Following the procedure outlined in Gerbing and Hamilton (1996), we conducted an EFA on the first part of the sample (n = 255; 164 boys, 91 girls; M_{age} = 15.9, SD = 3.2; 114 soccer players, 64 dancers, and 77 swimmers) to select the best items. Then, we performed a CFA on the second part of the sample (n = 255; 145 boys, 110 girls; M_{age} = 15.8, SD = 3.8; 97 soccer players, 90 dancers, and 68 swimmers) to cross-validate the item selection.

Results

Exploratory Factor Analysis

We performed a principal component analysis with oblimin rotation because factors were expected to correlate. Ten factors had an eigenvalue above 1 and the scree plot suggested either a two-, or four-factor solution, explaining 33.61% or 44.06% of the variance, respectively. A two-factor solution was chosen because it reflected the entity and incremental distinction and we could then select the highest loading items of each of the four subscales.

We selected items based on a factor loading above .32 and a cross-loading below .32 (Tabachnick & Fidell, 2012). Moreover, items of the original CNAAQ-2 were preferred over newly formulated items. We selected 21 items, that is, the six highest loading items of the stable scale (ω = .61) and the five highest loading items of the gift scale (ω = .80), the learning scale (ω = .81), and the improvement scale (ω = .80). The full items are displayed in Appendix 1. For the stable scale we selected six items for reasons of reliability, to include Item 3 that was part of the original CNAAQ-2, and to keep Item 21 that had one of the highest factor loadings. Selecting six items for this scale resulted in a reliability of .61 for the stable scale which is acceptable but below the threshold of .70. Table 2 shows the factor loadings and reliabilities after rotation and the item selection.

Confirmatory Factor Analysis

We performed a CFA on the second part of the combined Sample 3. We compared three models. Model 1, with two first order factors (entity and incremental), was based on Dweck's (1999) model of implicit theories of ability. Model 2, with four first-order factors (gift, stable, learning and improvement), is the model closest to the theoretical foundation of the CNAAQ (Sarrazin et al., 1999). Model 3, with four first-order factors, and two higher-order factors, was based on the work by Biddle et al. (2003) that led to the revision of the CNAAQ into the CNAAQ-2.

Model 3 was unidentified, which we solved by constraining the first two factor loadings of the indicators to be equal for every first order factor, as well as constraining the factor loadings of the latent factors on their respective higher-order latent factors to be equal. This procedure reduces the number of paths to be estimated which resulted in the model being identified (Porath et al., 2012). Based on modification indices, the residual variances of some items were allowed to covary (Model 1 and 2: Items 1 and 9, 3 and 8, and 10 and 13; Model 3: Items 1 and 9, 3 and 8, and 18 and 19). All items originated from the same subscales except for Items 18 and 19.

Model 1 (two first-order factors) did not fit the data well (χ^2 = 371.85, *df* = 184, χ^2/df-ratio = 2.02, RMSEA = .07, NNFI = .89, AIC = 479.28). Model 2 (four first-order factors) fitted the data well (χ^2 = 277.33, *df* = 180, χ^2/df-ratio = 1.54, RMSEA = .05, NNFI = .94, AIC = 372.62) as did Model 3 (four

TABLE II

Factor Loadings of the Principal Component Analysis and MacDonald's Omegas in Study 2 (First Half of Sample 3) plus Composite Reliability and Average Variance Extracted (Second Half of Sample 3).

Scale	Item#	Factor 1	Factor 2	Scale	Item#	Factor 1	Factor 2
Ent-Gif	30	.19	.71[Ent]	Inc-Lea	15	.73[Inc]	.16
Ent-Gif	11	.22	.69[Ent]	Inc-Lea	19	.73[Inc]	
Ent-Gif	4	.24	.68[Ent]	Inc-Imp	20	.72[Inc]	
Ent-Gif	7	.12	.63[Ent]	Inc-Imp	32	.72[Inc]	
Ent-Gif	26		.62[Ent]	Inc-Lea	23	.66[Inc]	
Ent-Gif	14		.61	Inc-Imp	9	.65[Inc]	
Ent-Gif	22	.11	.57	Inc-Imp	16	.64[Inc]	
Ent-Sta	13		.53[Ent]	Inc-Lea	5	.64[Inc]	.16
Ent-Gif	33 (R)	-.16	.51	Inc-Lea	8	.61[Inc]	.14
Ent-Sta	17	-.31	.49[Ent]	Inc-Lea	2	.61	.10
Ent-Sta	21	-.39	.48[Ent]	Inc-Imp	24	.59[Inc]	-.13
Ent-Sta	1		.43[Ent]	Inc-Lea	36	.58	
Ent-Sta	25	-.10	.41[Ent]	Inc-Lea	34	.58	
Ent-Sta	3	-.20	.39[Ent]	Inc-Imp	6	.49	
Ent-Sta	29	-.39	.32	Inc-Imp	12	.49	
Ent-Sta	10	-.31	.28	Inc-Imp	35 (R)	.37	-.29
Ent-Gif	18	-.14	.20	Inc-Lea	27	.35	.12
				Inc-Lea	37 (R)	.32	-.25
				Inc-Imp	28 (R)	.27	-.43
				Inc-Lea	31 (R)	.25	

	Sample 2 Part 1 Omega	Sample 2 Part 2 CR	Sample 2 Part 2 AVE
All selected entity items (with superscript Ent, k = 11)	.83	.74	.23
All selected incremental items (with superscript Inc, k = 10)	.89	.64	.16
Entity-stable items (k = 6)	.61	.70	.32
Entity-gift items (k = 5)	.80	.66	.25
Incremental-learning items (k = 5)	.81	.51	.18
Incremental-improvement items (k = 5)	.80	.51	.17

Note. N = 255 in both samples. Results of a principal component analysis with forced two factor solution and oblimin rotation. Entity items and incremental items were analyzed together but are presented as separate sets for clarity. Selected items are marked with a superscript. Factor loadings below .100 have been omitted. Ent-Sta = Entity Stable; Ent-Gif = Entity Gift; Inc-Lea = Incremental Learning; Inc-Imp = Incremental Improvement; CR = Composite reliability; AVE = Average variance extracted.

first-order plus two higher-order factors; χ^2 = 298.29, *df* = 187, χ^2/df-ratio = 1.60, RMSEA = .05, NNFI =.93, AIC = 379.39). The AIC was in favor of Model 2, but because of the small difference in fit between Model 2 and 3, we concluded that both models were tenable and that the four factors (stable, gift, learning, and improvement) as well as the two higher-order factors (entity and incremental) were all valid indicators of underlying latent variables.

In both models, all factor loadings were significant (*t*-values ranging from 4.32 to 7.46, all *p*'s < .01) as well as the loadings of the primary latent factors on the higher order latent factors (*t*-values -6.02 and 6.60 respectively, both *p*-values < .01). Average standardized factor loadings (for Model 2 and Model 3, respectively) per subscale were .49 and .49, for the stable scale, .56 and .56 for the gift scale, .41 and .42 for the learning scale, and .42 and .41 for the improvement scale.

Conclusion

In Study 2, we developed new items and analyzed the total item pool with a principal component analysis resulting in the 21-item CNAAQ-2-NL. We tested the dimensionality of the CNAAQ-2-NL using CFA. A two-factor model did not fit the data well, but both the four-factor model and the four-plus-two factor model showed an acceptable fit, comparable to the fit reported in earlier studies (Biddle et al., 2003; Moreno-Murcia et al., 2013).

Study 3: Validity of the CNAAQ-2-NL

As a final step we investigated the test-retest reliability of the CNAAQ-2-NL, its convergent validity, and the criterion-related validity for achievement goals.

Test-Retest Reliability

To assess the stability of the CNAAQ-2-NL, we administered it twice with a three-week interval. The correlation between these scores is an indicator of the test-retest reliability (Furr, 2011). The test-retest interval in our study was three weeks, which is too long for participants to remember their scores, and too short to expect their implicit theories to have changed. To control for error variance, testing situations were equal on both occasions in terms of the presence or absence of other people, time of day, and location.

Relations with other measures of implicit theories

To assess the convergent validity, we examined relations between the CNAAQ-2-NL and three conceptually related measures: (a) a different measure of implicit theories in sport, (b) a measure of implicit theories of intelligence, and (c) a question about the relative importance of talent and hard work for success in sport. As a different measure of implicit theories in sport, we adapted the items developed by Dweck (1999) to measure implicit theories of intelligence, to apply to sport. This resulted in a Dweck-sport-entity scale and a Dweck-sport-incremental scale. We expected a positive relationship between the (a) entity-total scale, (b) entity-stable scale, and (c) entity-gift scale of the CNAAQ-2-NL and the Dweck-sport entity scale, and a positive relationship between the (d) incremental-total scale, (e) incremental-learning scale, and (f) incremental-improvement scale of the CNAAQ-2-NL and the Dweck-sport incremental scale (*Hypothesis 1a-f*).

We also examined the relation between the CNAAQ-2-NL and implicit theories of intelligence, as measured by the Dweck-intelligence-entity scale and the Dweck-intelligence incremental scale (Dweck, 1999). Although studies show that people hold different views about the malleability of abilities in different domains (Dweck et al., 1995), there is also overlap between domains, which suggests that some people generally are more entity oriented and others are generally more incremental oriented (Wang et al., 2018). Therefore, we expected to find the same pattern of relations between the CNAAQ-2-NL and implicit theories of intelligence as between the CNAAQ-2-NL and implicit theories in sport, but we expected the relations with beliefs about intelligence to be weaker than those about sport. Specifically, we expected a positive relationship between the (a) entity-total scale, (b) entity-stable scale, and (c) entity-gift scale of the CNAAQ-2-NL and the Dweck-intelligence entity scale; and a positive relationship between the (d) incremental-total scale, (e) incremental-learning scale, and (f) incremental-improvement scale of the CNAAQ-2-NL and the Dweck-intelligence incremental scale (*Hypothesis 2a-f*).

To verify the CNAAQ-2 against a different type of measure of beliefs about the influence of talent and effort on success in sport, we asked participants how important they thought talent and hard work are for success (cf. Li et al., 2006). We expected positive relationships between the (a) entity-total scale, (b) entity-stable scale, and (c) entity-gift scale of the CNAAQ-2-NL and the importance assigned to talent for success in sport. Also, we expected positive relationships between the (d) incremental-total scale, (e) incremental-learning scale, and (f) incremental-improve scale of the CNAAQ-2-NL and the importance assigned to hard work for success in sport (*Hypothesis 3a-f*).

Relations between Implicit Theories and Achievement Goals

In accordance with extant theory (Dweck, 1999), we expected implicit theories to relate to achievement goals. To test these relationships, we used the 2 x 2 framework of achievement goals (Elliot & McGregor, 2001), which is composed of two dimensions: the mastery-performance dimension and the approach-avoidance dimension. The four achievement goals thus formed are performance-approach goals (I want to be better than others), performance-avoidance goals (I do not want to be worse than others), mastery-approach goals (I want to learn and develop myself), and mastery-avoidance goals (I want to avoid missing out on chances to learn and develop myself). The literature on implicit theories of ability (e.g. Burnette et al., 2013; Dweck, 1999) predicts that the entity view, with its focus on fixed innate abilities, will lead to performance goals (both approach and avoidance). The incremental view, with its focus on learning and development, will lead to mastery goals (both approach and avoidance; Biddle et al., 2003; Dweck & Leggett, 1988). In sum, we expected positive relationships between the (a) entity-total scale, (b) entity-stable scale, and (c) entity-gift scale of the CNAAQ-2-NL and performance-approach goals, and positive relationships between the (d) entity-total scale, (e) entity-stable scale, and (f) entity-gift scale of the CNAAQ-2-NL and performance-avoidance goals (*Hypothesis 4a-f*). Furthermore, we expected positive relationships between the (a) incremental-total scale, (b) incremental-learning scale, and (c) incremental-improve scale of the CNAAQ-2-NL and mastery-approach goals; and between the (d) incremental-total scale, (e) incremental-learning scale, and (f) incremental-improve scale of the CNAAQ-2-NL and mastery-avoidance goals (*Hypothesis 5a-f*).

Method

Procedure

Data were collected from psychology students at a Dutch university. These students participated in two group-wise, computerized sessions with a three-week interval. In the first session respondents answered questions about demographics and filled out the CNAAQ-2-NL (first time), the Dweck implicit theories in sport scale, and answered the question about the importance of talent and hard work for success in sport. In the second session respondents filled out the CNAAQ-2-NL (second time), the achievement goal questionnaire, and the Dweck implicit theories of intelligence scale.

Participants

A total of 363 psychology students participated for course credit (N_{total} = 363; n_{t1} = 341; n_{t2} = 318). After each test session we asked if participants had answered the questions seriously (1 = not seriously at all; 5 = very seriously). Respondents who indicated they had not seriously answered the questions in one or both of the sessions, were removed (i.e., n = 41). All variables were screened for outliers, but none were removed based on the outlier analyses.

This resulted in a final sample of N = 322 (M_{age} = 20.2, SD = 3.2; 99 males, 211 females, 2 respondents identified as 'other', 10 gender values were missing). At the time of testing 189 respondents regularly practiced a sport and 115 did not at the moment but had practiced a sport in the past (18 missing values; sports most practiced were fitness, n = 58, 18.0%; soccer, n = 23, 7.1%; and running, n = 22, 6.8%). Most respondents (n = 286) had practiced sports between the ages of 12 and 18. The most popular sports were soccer (n = 52, 16.1%), hockey (n = 45, 14.0%), and various types of dancing combined (n = 41, 12.7%). Ninety-four respondents (30.9%) had participated in sport on a recreational level and 210 (63.5%) had participated in sport on a competitive level.

Measures

Implicit theories of ability were measured at T1 and 2. We used the 21-item CNAAQ-2-NL that was developed and tested in Study 2 which includes four subscales: the entity-stable scale (6 items; ω_{t1} = .60, ω_{t2} = .69), entity-gift scale (5 items; ω_{t1} = .88, ω_{t2} = .86), incremental-learning scale (5 items; ω_{t1} = .91, ω_{t2} = .81), and incremental-improvement scale (5 items ; ω_{t1} = .94, ω_{t2} = .89). A higher order entity-total scale (ω_{t1} = .77, ω_{t2} = .82) was calculated as the average of the entity-stable scale and the entity-gift scale, and a higher order incremental-total scale (ω_{t1} = .85, ω_{t2} = .89) was calculated as the average of the incremental-learning and the incremental-improvement scales. Answers were provided using a Likert response format, ranging from 1 (*completely disagree*) to 5 (*completely agree*).

We performed separate CFA's on the data from T1 and T2. Modification indices suggested that some items shared error variance. To attain a better fit, the residual variances of some items were allowed to covary (T1: Items 1 and 9, 3 and 8, 6 and 17, 11 and 17, 12 and 15; T2: Items 1 and 9, 1 and 18, 3 and 8, 10 and 13, 12 and 15). Except for Items 6 and 17, all connected items belonged to the same subscale.

The fit of the 4 + 2 factor model on T1 was good (χ^2 = 332.34, df = 181, χ^2/df-ratio = 1.84; RMSEA = .05; NNFI = .94; CFI = .95) and on T2 it was acceptable (χ^2 = 360.03, df = 181, χ^2/df-ratio = 1.99; RMSEA = .06; NNFI = .93; CFI = .94; fit criteria from Schermelleh-Engel et al., 2003).

Dweck implicit theories in sport scale was administered on T1. We adapted six items that are regularly used in studies of implicit theories of intelligence (Dweck, 1999) to the sport context. Three items measured entity beliefs (e.g., "You have certain qualities in sport, and you really can't do much to change that."; ω = .75) and three items measured incremental beliefs (e.g., "No matter who you are, you can always become much better in a sport."; ω = .84). Answers were provided on a Likert scale from 1 (*completely disagree*) to 6 (*completely agree*).

Dweck implicit theories of intelligence scale was administered at T2. Participants responded to the six original items that measure implicit theories of intelligence (Dweck, 1999). Three items measured entity beliefs (e.g., "You have a certain amount of intelligence, and you really can't do much to change it."; ω = .90) and three items measured incremental beliefs (e.g., "No matter who you are, you can change your intelligence a lot."; ω = .85). Answers were provided on a Likert scale from 1 (*completely disagree*) to 6 (*completely agree*).

Importance of talent and hard work was measured at T1. We asked participants to indicate the importance of hard work and talent for success in sport by using two sliders ranging from 0% to 100%. The question was: "We would like to know how important you think hard work and talent are for success in sport. Can you give your answer by distributing 100% using the two sliders below?" The first slider was labeled "Extent to which success in sport is determined by talent". The second slider was labeled "Extent to which success in sport in determined by hard work and practice". The sliders were connected such that the answer was only accepted when it added up to 100%. This procedure has been shown to be a valid way to assess people's beliefs about the importance of talent in sport (Li et al., 2006).

Achievement goals were measured at T2 with the revised Achievement Goal Questionnaire (AGQ-R; Elliot & Murayama, 2008), which was translated to Dutch and adapted to be used in a sport context. This questionnaire is composed of 12 items in four subscales of three items each: performance approach (e.g., "I try to do well compared to other athletes"; ω = .84), performance avoidance (e.g., "I try to avoid performing worse than other athletes"; ω = .89), mastery approach (e.g., "My goal is to learn as much as possible in my sport"; ω = .80), and mastery avoidance (e.g., "My goal in my sport is to avoid learning less than I could learn"; ω = .76). Answers were provided on a 5-point Likert scale ranging from 1 (*completely disagree*) to 5 (*completely agree*). When respondents did not practice a sport at the moment, they were asked to think back to when they were practicing a sport.

Results

Descriptive statistics, correlations, and McDonald's omegas are presented in Table 3. Important to note is that similar to previous studies (Biddle et al., 2003; Wang et al., 2009) there is a negative correlation between entity-total and incremental-total, r_{t1} = -.17, r_{t2} = -.35, both p-values < .001.

Test-Retest Reliability

Test-retest reliabilities were: Entity-total, r = .73; incremental-total, r = .58; entity-stable, r =.70; entity-gift, r = .64; incremental-learning, r = .47; incremental-improve, r = .59 (all p-values < .001). All test-retest reliabilities were large, except for incremental-learning, which was medium in size (Cohen, 1992).

Relations with Other Measures of Implicit Theories

The hypothesized relations between the CNAAQ-2-NL scales and the Dweck implicit theories in sport scales were examined at both time points. There were significant medium to strong relations of the entity-total, entity-stable, and entity-gift scales with the Dweck sport-entity scale, and of the incremental-total, incremental-learning, and incremental-improvement scales with the Dweck sport-incremental scale (all r-values > .29, all p-values < .001; Hypotheses 1a-f supported).

TABLE III
Descriptive Statistics, Pearson Correlations and McDonald's Omega Reliabilities in Study 3

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender[a]	0.33	0.48	-												
2. Age	20.22	3.16	.12*	-											
3. Hours train now	3.25	4.19	.19**	.03	-										
4. Hours train youth	8.38	7.12	.15**	.12*	.30**	-									
5. Level	2.91	1.08	.10	.14*	.24**	.55**	-								
6. Perf app	3.32	0.90	.14*	.08	.27**	.24**	.28**	.84							
7. Perf avoid	3.27	1.01	.03	.00	.19**	.09	.10	.64**	.89						
8. Mast app	3.57	0.81	.11	.10	.26**	.16**	.20**	.36**	.27**	.80					
9. Mast avoid	3.05	0.73	.06	.06	.15*	.14*	.19**	.33**	.24**	.62**	.76				
10. Entity-total t1	2.79	0.61	.09	.03	.10	.17**	.14*	.12*	.01	-.01	-.05	.77			
11. Incremental-total t1	4.25	0.48	-.02	-.03	.12*	.22**	.14*	.15*	.08	.27**	.18**	-.17**	.85		
12. Ent-Stable t1	2.66	0.63	.10	.05	.05	.08	.03	.02	-.06	-.06	-.08	.81**	-.22**	.60	
13. Ent-Gift t1	2.97	0.81	.03	.01	.10	.19**	.19**	.18**	.06	.01	-.01	.85**	-.06	.41**	.88
14. Inc-Learning t1	4.42	0.47	-.04	-.08	.09	.14*	.10	.07	.03	.16**	.11	.02	.79**	-.03	.05
15. Inc-Improve t1	4.08	0.66	.00	.01	.11	.22**	.13*	.17**	.09	.28**	.18**	-.26**	.90**	-.30**	-.13*
16. Dweck sport Ent	3.02	0.85	-.13*	.02	.02	.12*	.09	.09	.02	-.07	-.06	.61**	-.20**	.45**	.60**
17. Dweck sport Inc	4.45	0.81	.05	-.01	.16**	.16**	.11	.11	.07	.25**	.23**	-.40**	.56**	-.38**	-.26**
18. % Talent	35.13	14.85	.04	.13*	.10	.12*	.10	.18**	.10	.03	-.03	.48**	-.22**	.35**	.48**
19. % Hard work	64.87	14.85	-.04	-.13*	-.10	-.12*	-.10	-.18**	-.10	-.03	.03	-.48**	.22**	-.35**	-.48**
20. Entity-total t2	2.87	0.66	.07	.04	.07	.11	.05	.12*	.04	-.07	-.07	.73**	-.19**	.62**	.65**
21. Incremental-total t2	4.22	0.52	.01	-.07	.06	.02	.00	.12*	.05	.29**	.23**	-.31**	.58**	-.35**	-.17**
22. Ent-Stable t2	2.74	0.68	.07	.05	.07	.10	.05	.03	.00	-.09	-.06	.66**	-.24**	.70**	.47**
23. Ent-Gift t2	3.03	0.85	.02	.03	.04	.07	.03	.14*	.03	-.02	-.04	.58**	-.07	.37**	.64**
24. Inc-Learning t2	4.41	0.48	.00	-.09	.04	-.03	-.03	.06	-.01	.20**	.18**	-.16**	.49**	-.20**	-.05
25. Inc-Improve t2	4.02	0.70	.01	-.05	.05	.05	.03	.14*	.09	.30**	.22**	-.35**	.54**	-.39**	-.21**
26. Dweck intell Ent	3.49	1.03	.02	-.05	.05	-.03	.05	.12*	.03	-.03	-.11	.34**	-.12	.31**	.27**
27. Dweck intell Inc	3.58	0.94	-.08	-.01	-.02	.04	.01	-.04	-.04	.06	.12*	-.32**	.22**	-.31**	-.23**

Table III *(continued)*

	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1. Gender[a]														
2. Age														
3. Hours train now														
4. Hours train youth														
5. Level														
6. Perf app														
7. Perf avoid														
8. Mast app														
9. Mast avoid														
10. Entity-total t1														
11. Incremental-total t1														
12. Ent-Stable t1														
13. Ent-Gift t1														
14. Inc-Learning t1	.91													
15. Inc-Improve t1	.44**	.94												
16. Dweck sport Ent	-.09	-.23**	.75											
17. Dweck sport Inc	.29**	.61**	-.35**	.84										
18. % Talent	-.14*	-.23**	.43**	-.27**	-									
19. % Hard work	.14*	.23**	-.43**	.27**	-1.00**	-								
20. Entity-total t2	-.01	-.26**	.64**	-.35**	.54**	-.54**	.82							
21. Incremental-total t2	.40**	.57**	-.25**	.46**	-.25**	.25**	-.35**	.89						
22. Ent-Stable t2	-.06	-.30**	.56**	-.36**	.43**	-.43**	.82**	-.42**	.69					
23. Ent-Gift t2	.03	-.13*	.55**	-.22**	.48**	-.48**	.86**	-.15**	.44**	.86				
24. Inc-Learning t2	.47**	.38**	-.14*	.27**	-.16**	.16**	-.18**	.83**	-.23**	-.06	.85			
25. Inc-Improve t2	.28**	.59**	-.28**	.50**	-.27**	.27**	-.40**	.93**	-.47**	-.19**	.55**	.88		
26. Dweck intell Ent	-.03	-.15*	.30**	-.21**	.31**	-.31**	.36**	-.17**	.32**	.29**	-.07	-.21**	.90	
27. Dweck intell Inc	.08	.25**	-.21**	.35**	-.22**	.22**	-.28**	.30**	-.29**	-.15**	.16**	.34**	-.69**	.85

Note. N varies between 264 and 312 due to incidental missing values. Pearson correlations are presented. Numbers on the diagonal are McDonald's omega's. Perf app = performance-approach goals. Perf avoid = performance-avoidance goals. Mast app = mastery-approach goals. Mast avoid = mastery-avoidance goals. Ent = entity. Inc = incremental. [a]Categories include 0 = female; 1 = male. $^{*}p < .05$, two-tailed $^{**}p < .01$, two-tailed

The hypothesized relations between the CNAAQ-2-NL scales and the Dweck implicit theories of intelligence scales were also examined at both time points. There were significant small to medium-sized relations of the entity-total, entity-stable, and entity-gift scales with the Dweck intelligence-entity scale, and of the incremental-total and incremental-improvement scales with the Dweck intelligence-incremental scale (all r-values > .22 all p-values < .001; Hypotheses 2a-d, and Hypothesis 2f supported). The correlation between the incremental-learning scale and the Dweck intelligence-incremental scale was only significant at the second time point (r_{t1} = .08, p = .17, r_{t2} = .16, p = .01; Hypothesis 2e partly supported).

The hypothesized relations between the CNAAQ-2-NL scales and the importance assigned to talent and hard work for success were examined at both time points. There were significant, medium-sized relations of the entity-total, entity-stable, and entity-gift scales with the importance assigned to talent (all r-values > .35, all p-values < .001; Hypotheses 3a-c supported). There were significant, small to medium-sized relations of the incremental-total, incremental-learning, and incremental-improve scales with the importance assigned to hard work (all r-values > .14, all p-values < .02; Hypotheses 3d-f supported).

Relationships with Achievement Goals

The hypothesized relations between the CNAAQ-2-NL scales and achievement goals were examined at two time points. The CNAAQ-2-NL was administered at T1 and T2, but the achievement goal questionnaire was only administered at T2. Therefore, relations between CNAAQ-2-NL scores at T1, and the achievement goal scores collected at T2 give an indication of the predictive criterion-related validity, while the relations between the CNAAQ-2-NL scores at T2, and the achievement goals (also collected at T2) give an indication of the concurrent criterion-related validity.

There were significant, but small relations between the entity-total scale (at T1 and 2), and performance-approach goals (r_{t1} = .12, p = .047, r_{t2} = .12, p = .047; Hypothesis 4a supported). There were no significant relations between the entity-stable scale and performance-approach goals at either time point (both r-values < .04, both p-values > .05; Hypothesis 4b not supported), but there were significant, but small relations between the entity-gift scale and performance-approach goals at both time points (r_{t1} = .18, p < .001, r_{t2} = .14, p = .020; Hypothesis 4c supported).

There were no significant relations between the entity-total, entity-stable, or entity-gift scales and performance-avoidance goals at either time point (all r-values < .06, all p-values > .05; Hypotheses 4d-f not supported).

There were significant, small to medium-sized relations between the incremental-total, incremental-learning, and incremental-improve scales and mastery-approach goals at both time points (all r-values > .16, all p-values < .01; Hypotheses 5a-c supported).

There were significant relations between the incremental-total scale at T1 and T2, and mastery-avoidance goals ($r_{t1} = .18, p <. 001, r_{t2} = .23, p < .001$). The relation between the incremental-learning scale and mastery-avoidance goals was not significant at T1 ($r_{t1} = .11, p = .08$), but it was significant at T2 ($r_{t2} = .18, p = .003$). The incremental-improvement scale correlated significantly with mastery-avoidance goals at both time points ($r_{t1} = .18, p =. 004, r_{t2} = .22, p < .001$). Although one correlation did not reach significance, we nevertheless conclude that Hypotheses 5d-f were largely supported.

Conclusion

Our third study provided additional support for the fit of a 4 + 2 model of the CNAAQ-2-NL and showed that McDonald's omega reliabilities and test-retest reliabilities were generally good. The hypothesized relations with other measures of implicit theories were supported, as well as the hypothesized relations with the importance assigned to talent and effort for success. Hypotheses about relations between implicit theories and achievement goals were also largely supported, although the relationships were mostly small in size.

General Discussion

The main goal of the studies reported in this paper was to validate the CNAAQ-2 in a Dutch context. Our first study confirmed the factor structure but the reliability of the entity-stable- and incremental-learning subscales was unsatisfactory. It is possible that the literal translation did not capture identical ideas in both languages or that the central ideas of the stable and learning scales were not clear enough to respondents after translating them to another language and culture.

Therefore, we revised the original items and added 25 items. The total item set was administered to 550 athletes from three sports in Study 2. Based on an exploratory factor analysis of the data, using half of the sample, we selected 21 items (i.e., the CNAAQ-2-NL) based on several decision rules (see the Results section of Study 2 for an extensive discussion of the selection process). This item selection was tested with a confirmatory factor analysis, using the data of the second half of the sample. Two models showed adequate fit to the data: a model with four first-order factors and a four-plus-two higher-order factor-model. Because the model with four-plus-two factors offers more opportunity to investigate the beliefs athletes hold, we decided to examine this model further.

In Study 3 we found additional support for the factor structure and test-retest reliability of the CNAAQ-2-NL. Convergent validity was supported through relations with Dweck's measures of implicit theories of ability in sport and about intelligence. Concurrent and predictive validities of the CNAAQ-2-NL were supported through relations with achievement goals that were in line with previous studies (Biddle et al., 2003; Wang et al, 2009) and theory (Dweck, 1999).

Relations between Implicit Theories and Achievement Goals

In Study 3, we found support for the hypothesized relations between incremental-learning and incremental-improvement beliefs on the one hand and mastery-approach and mastery-avoidance goals on the other hand. However, the findings for entity beliefs and performance goals were more mixed. Specifically, we found no relations between entity-stable beliefs and performance-approach goals or performance-avoidance goals. We did find relations between entity-gift beliefs and performance-approach goals, but not between entity-gift beliefs and performance-avoidance goals. These weaker relations between entity beliefs and performance goals are in line with other studies in the sports domain, which also reported weaker relations between entity beliefs and performance goals than between incremental beliefs and mastery goals (e.g., Stenling, et al., 2014; Stevenson & Lochbaum, 2008; Wang & Liu, 2007; Wang et al., 2009). A similar pattern also appeared in a meta-analysis of implicit theories in sport (Vella et al., 2016). Theoretically, this could mean that the effects of entity beliefs about sport abilities and intelligence, respectively, differ. The belief that talent is important in sport seems to have less influence on setting performance goals in sports than the belief that intelligence is fixed has on setting performance goal in academic settings. In other words, context (sports, schools) matters when considering the relationship between entity beliefs and setting performance goals based on entity beliefs.

Despite the lower correlations between some entity beliefs and performance goals in sport, the pattern of relationships between implicit theories and achievement goals in this study is generally consistent with theoretical predictions and previous empirical work (Biddle et al., 2003; Vella et al., 2016). We conclude that the findings of this study largely support the construct validity of the CNAAQ-2-NL.

Comparison of Implicit Theories in Sport and Implicit Theories about Intelligence

An interesting finding is that in all our samples we found small to medium correlations between the entity-total and incremental-total scales, which are smaller than the large negative correlations that were found in studies about implicit theories of intelligence (e.g., Hong et al. [1999] discuss the unpublished study by Levy and Dweck [1997] that reports correlations of $r = -.81$ to $r = -.85$, and Levy et al. [1998] present correlations ranging from $r = -.69$ tot $r = -.86$). Low correlations between entity and incremental beliefs in the sports domain were also found in previous studies with the CNAAQ-2 (e.g., Biddle et al, 2003; Stenling et al., 2014; Stevenson & Lochbaum, 2008). These findings and those of studies about implicit theories of intelligence suggest that entity- and incremental beliefs about sport abilities are related but independent constructs, while entity- and incremental beliefs about intelligence are the endpoints of a continuum (e.g., Burnette et al., 2013). Theoretically, this means that context (sports, intelligence) matters for the dimensionality of implicit theories.

Furthermore, in Study 3, we found that people held stronger entity beliefs and weaker incremental beliefs about intelligence than about sport, $t(263) = 6.70$, $p < .001$, $t(263) = 14.10$, $p < .001$, respectively. This suggests that people have different beliefs about the malleability of intelligence as compared to abilities for sport, such that they view intelligence as less malleable than sports abilities. This may imply that findings on implicit theories from the academic domain may not apply to sports. In addition, because beliefs about effort and achievement differ between European and North-American and East-Asian cultures (Eisenberger, 1998; Hatono, 1998), also the cultural context should be considered. For example, the sometimes weak psychometric properties of the CNAAQ and CNAAQ-2 in other languages may partly result from different beliefs about achievement across nations.

Strengths, Limitations, and Future Research

A strength of the first two studies is that we have recruited a large number of athletes in different sports. This way, we have developed an instrument that researchers and practitioners in sport psychology can use with competitive athletes. A second strength is that our third study allowed us to do a test-retest analysis in a controlled environment, and to administer additional measures, which is often difficult to accomplish in sports practice.

A limitation is that we had to add items to the CNAAQ-2-NL which has made it a 21-item questionnaire instead of the original 12 items. If researchers want to use a shorter form, one option might be to include only the entity-gift and the incremental-improvement scales.

With this paper we have taken an important step in the development of the CNAAQ-2 in a Dutch context, but we agree with Furr (2011) that "validity is a matter of degree, it is not all-or-none." (p. 53). Further support for the validity of the CNAAQ-2 can be found by studying the variables in Study 3 in samples of athletes from different cultures worldwide. Another valuable step in future research would be to investigate the measurement invariance of the CNAAQ-2 across different cultures, performance levels (recreational vs. elite), and genders.

Conclusion

The study of implicit theories of ability in sport builds on theory and research on implicit theories about intelligence. Because sport and academic settings have much in common, the effects of implicit theories were expected to be similar across domains. Although the pioneering study by Sarrazin et al. (1996) was generally replicated, our study and other ones also revealed some different results. In particular, our research suggests that the entity-incremental divide is stronger for intelligence than for sport. Future research about implicit theories of ability in sport could further explore the tenability of this suggestion, preferably in different cultural contexts. We hope that the Dutch version of the CNAAQ-2 will be a starting point for this endeavor.

APPENDIX 1
Items of the CNAAQ-2-NL (in Dutch)

Below are the original Dutch items of the CNAAQ-2-NL as well as their English translations.

CNAAQ-2-NL

Zou je willen aangeven in hoeverre je het met de uitspraken eens bent? Het gaat om jouw eigen mening, dus er zijn geen goede of foute antwoorden. Omcirkel het nummer dat je mening het beste weergeeft. (1 = helemaal oneens, 2 = oneens, 3 = geen mening, 4 = eens, 5 = helemaal mee eens)

1. Je hebt een bepaalde hoeveelheid talent voor sport en je kunt er weinig aan doen om dat te veranderen.
2. Zelfs als je je best doet kom je niet verder dan je persoonlijke grens in een sport.
3. Je hebt talent nodig om goed te worden in een sport.
4. Je moet hard trainen en altijd blijven leren om goed te worden in een sport.
5. Om goed te worden in een sport moet je bij je geboorte de kwaliteiten hebben meegekregen die belangrijk zijn voor die sport.
6. Als je goed wil worden in een sport moet je steeds door nieuwe ontwikkelingsfases, waarin je dingen leert en je je lichaam verder traint.
7. Hoe goed je bent in sport, zal altijd verbeteren als je eraan werkt.
8. Om goed te worden in een sport moet je talent hebben.
9. Hoeveel talent je hebt voor een sport ligt vast.
10. Om goed te worden in een sport moet je alsmaar blijven werken aan je techniek en vaardigheden.
11. Zelfs de beste sporters kunnen nog beter worden door de juiste training.
12. Iedereen heeft een maximaal haalbaar niveau in een sport, waarna je niet meer beter wordt.
13. Om goed te worden in een sport moet je alsmaar blijven oefenen en bijleren.
14. Je kan jezelf altijd verbeteren in je sport, als je daar maar hard voor wil trainen.
15. Als je je persoonlijke top bereikt in een sport dan wordt je niet meer beter, ook al blijf je trainen.
16. Hard werken is het allerbelangrijkste als je goed wil worden in een sport.
17. Inzet zal altijd zorgen voor vooruitgang in sport.

18. In sommige sporten ben je wel goed en in andere niet, daar kun je niets aan veranderen.
19. Aangeboren eigenschappen bepalen of je goed wordt in een sport.
20. Als je de top wil bereiken in een sport moet je daar genoeg talent voor hebben.
21. Ook al ben je heel goed, je kunt altijd nog beter worden door hard te trainen.

CNAAQ-2-NL (English translation of the Dutch items)

Can you please indicate how much you agree with the statements below? This is a matter of your own opinion, so there are no right or wrong answers. Circle the number that best represents what you think. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

1. You have a certain amount of talent for a sport, and there is little you can do to change it.
2. Even if you try your best, you will not surpass your personal limit in a sport.
3. You need talent to become good at a sport.
4. You have to train hard and keep learning all the time to become good at a sport.
5. To become good at a sport you must have been given the qualities that are important for that sport at birth.
6. If you want to become good at a sport, you have to keep going through new developmental stages all the time, where you learn new things, and train your body further.
7. How good you are at a sport will always improve if you work at it.
8. To become good at a sport you must have talent.
9. How much talent you have for a sport is fixed.
10. To become good at a sport you have to keep working on your technique and skills.
11. Even the best athletes can become better through the right training.
12. Everyone has a maximum level in a sport, after which they cannot improve further.
13. To become good at a sport you have to keep practicing and learning.
14. You can always improve in your sport, as long as you are willing to practice hard for it.
15. When you reach your personal top in a sport, you will not improve further, even if you keep training.

16. Hard work is the most important thing if you want to become good at a sport.
17. Effort will always lead to progress in a sport.
18. You are good at some sports and not at other sports, that is something you cannot change.
19. Innate qualities determine whether you become good at a sport.
20. If you want to reach the top in a sport, you need to have enough talent for it.
21. Even if you are very good, you can always get better by training hard.

Entity-Stable: 1, 2, 9, 12, 15, 18
Entity-Gift: 3, 5, 8 19, 20
Incremental-Learning: 4, 6, 10, 13, 16
Incremental-Improvement: 7, 11, 14, 17, 21
Items 1-8 are taken from the English version of the CNAAQ-2 (Biddle et al., 2003).

REFERENCES

Biddle. S. J., Wang. C. J., Chatzisarantis. N. L., & Spray. C. M. (2003). Motivation for physical activity in young people: Entity and incremental beliefs about athletic ability. *Journal of Sports Science, 21*(12), 973-989. https://doi.org/10.1080/02640410310001641377

Burnette, J. L., O'Boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mindsets matter: A meta-analytical review of implicit theories and self-regulation. *Psychological Bulletin, 139*(3), 655-701. https://doi.org/10.1037/a0029531

Chen, L. H., Chen, M. Y., Lin, M. S., Kee, Y. H., Kuo, C. F., & Shui, S. H. (2008). Implicit theory of athletic ability and self-handicapping in college students. *Psychological Reports*, *103*(2), 476-484. https://doi.org/10.2466%2Fpr0.103.2.476-484

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155-159. https://doi.org/10.1037/0033-2909.112.1.155

Cortina, J. M., Sheng, Z., Keener, S. K., Keeler, K. R., Grubb, L. K., Schmitt, N., Tonidandel, S., Summerville, K. M., Heggestad, E. D., & Banks, G. C. (2020). From alpha to omega and beyond! A look at the past, present, and (possible) future of psychometric soundness in the Journal of Applied Psychology. *Journal of Applied Psychology*, *105*(12), 1351- 1382. http://dx.doi.org/10.1037/apl0000815

De Oliveira Durão, L. M., Moreira, J. M., Calvo, T. G., Cervelló, E., & Rubio, K. (2010). Propriedades psicométricas da versão portuguesa do Conceptions of the Nature of Athletic Ability Questionnaire-2 (cnaaq-2): Estudo da estrutura fatorial e validade de construto. *Revista Brasileira de Psicologia do Esporte*, *3*(2), 102-116.

Dweck, C.S. (1999). *Self-theories: Their role in motivation, personality, and development.* Psychology Press.

Dweck, C. S., Chiu, C. Y., & Hong, Y. Y. (1995). Implicit theories and their role in judgments and reactions: A world from two perspectives. *Psychological Inquiry*, *6*(4), 267-285. https://doi.org/10.1207/s15327965pli0604_1

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*(2), 256-273. https://doi.org/10.1037/0033-295X.95.2.256

Eisenberger, R. (1998). Achievement: The importance of industriousness. *Behavioral and Brain Sciences*, *21*(3), 412-413. https://doi.org/10.1017/S0140525X98281234

Elliot, A.J., & McGregor, H. A. (2001). A 2 × 2 achievement goal framework. *Journal of Personality and Social Psychology*, *80*(3), 501-519. https://doi.org/10.1037/0022-3514.80.3.501

Furr, M. (2011). *Scale construction and psychometrics for social and personality psychology*. SAGE Publications Ltd.

Gardner, L. A., Vella, S. A., & Magee, C. A. (2015). The relationship between implicit beliefs, anxiety, and attributional style in high-level soccer players. *Journal of Applied Sport Psychology*, *27*(4), 398-411. https://doi.org/10.1080/10413200.2015.1019681, EMEA.

Gerbing, D. W., & Hamilton, J. G. (1996). Viability of exploratory factor analysis as a precursor to confirmatory factor analysis. *Structural Equation Modeling*, *3*(1), 62-72. doi.org/10.1080/10705519609540030

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis (8th edition)*, Cengage Learning

Hatano, G. (1998). Might we adopt the learning-related account instead of the talent account?. *Behavioral and Brain Sciences*, *21*(3), 416-417. https://doi.org/10.1017/S0140525X98331234

Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods, 1*(1), 104-121. https://doi.org/10.1177%2F109442819800100106

Hofstee, W. K. B. (1999). *Principes van beoordeling [Principles of assessment]*. Swets & Zeitlinger.

Hong, Y. Y., Chiu, C. Y., Dweck, C. S., Lin, D. M. S., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of Personality and Social Psychology*, *77*(3), 588-599. https://doi.org/10.1037/0022-3514.77.3.588

Levy, S. R., Stroessner, S. J., & Dweck, C. S. (1998). Stereotype formation and endorsement: The role of implicit theories. *Journal of Personality and Social Psychology*, *74*(6), 1421-1436. https://doi.org/10.1037/0022-3514.74.6.1421

Li, W., Lee, A. M., & Solmon, M. A. (2006). Gender differences in beliefs about the influence of ability and effort in sport and physical activity. *Sex Roles*, *54*(1), 147-156. https://doi.org/10.1007/s11199-006-8876-7

McNeish, D. (2018). Thanks coefficient alpha, we'll take it from here. *Psychological Methods*, *23*(3), 412-433. http://dx.doi.org/10.1037/met0000144

Moreno-Murcia, J. A., Cervelló-Gimeno, E. M., Martínez-Galindo, M. C., & Moreno, R. (2013). Validación de la Escala de Creencias Implícitas de habilidad (CNAAQ-2) al contexto español. Diferencias según la práctica físico-deportiva. *RICYDE. Revista Internacional de Ciencias del Deporte*, *32*(9), 100-113. https://doi.org/10.5232/ricyde2013.03201

Moreno-Murcia, J. A., Gimeno, E. C., Galindo, C. M., Hernández, E. H., & Buñuel, P. S. L. (2014). Conceptions of ability and self-determined motivation in young Spanish athletes. *Psicologia: Reflexão e Crítica*, *27*(3), 515-521. https://doi.org/10.1590/1678-7153.201427312

Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology*, *75*(1), 33-52. https://doi.org/10.1037/0022-3514.75.1.33

Ommundsen, Y. (2001a). Pupils' affective responses in physical education classes: the association of implicit theories of the nature of ability and achievement goals. *European Physical Education Review*, *7*(3), 219-242. https://doi.org/10.1177%2F1356336X010073001

Ommundsen, Y. (2001b). Self-handicapping strategies in physical education classes: The influence of implicit theories of the nature of ability and achievement goal orientations. *Psychology of Sport and Exercise*, *2*(3), 139-156. https://doi.org/10.1016/S1469-0292(00)00019-4

Porath, C., Spreitzer, G., Gibson, C., & Garnett, F. G. (2012). Thriving at work: Toward its measurement, construct validation, and theoretical refinement. *Journal of Organizational Behavior*, *33*(2), 250-275. https://doi.org/10.1002/job.756

Sarrazin, P., Biddle, S., Famose, J. P., Cury, F., Fox, K., & Durand, M. (1996). Goal orientations and conceptions of the nature of sport ability in children: A social cognitive approach. *British Journal of Social Psychology, 35*(3), 399-414. https://doi.org/10.1111/j.2044-8309.1996.tb01104.x

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online*, *8*(2), 23-74.

Spray, C. M., Wang, C. K., Biddle, S. J., Chatzisarantis, N. L., & Warburton, V. E. (2006). An experimental test of self-theories of ability in youth sport. *Psychology of Sport and Exercise*, *7*(3), 255-267. https://doi.org/10.1016/j.psychsport.2005.05.001

Stenling, A., Hassmén, P., & Holmström, S. (2014). Implicit beliefs of ability, approach-avoidance goals and cognitive anxiety among team sport athletes. *European Journal of Sport Science*, *14*(7), 720-729. https://doi.org/10.1080/17461391.2014.901419

Stevenson, S. J., & Lochbaum, M. R. (2008). Understanding exercise motivation: examining the revised social-cognitive model of achievement motivation. *Journal of Sport Behavior*, *31*(4), 389-412.

Tabachnick, B. G., & Fidell, L. S. (2012). *Using multivariate statistics (6th edition).* Pearson.

Vella, S. A., Braithewaite, R. E., Gardner, L. A., & Spray, C. M. (2016). A systematic review and meta-analysis of implicit theory research in sport, physical activity, and physical education. *International Review of Sport and Exercise Psychology*, *9*(1), 191-214. https://doi.org/10.1080/1750984X.2016.1160418

Wang, C. J., & Liu, W. C. (2007). Promoting enjoyment in girls' physical education: The impact of goals, beliefs, and self-determination. *European Physical Education Review*, *13*(2), 145-164. https://doi.org/10.1177%2F1356336X07076875

Wang, C. K. J., Liu, W. C., Biddle, S. J., & Spray, C. M. (2005). Cross-cultural validation of the Conceptions of the Nature of Athletic Ability Questionnaire Version 2. *Personality and Individual Differences*, *38*(6), 1245-1256. https://doi.org/10.1016/j.paid.2004.08.007

Wang, J. C., Liu, W. C., Lochbaum, M. R., & Stevenson, S. J. (2009). Sport ability beliefs, 2 x 2 achievement goals, and intrinsic motivation: The moderating role of perceived competence in sport and exercise. *Research Quarterly for Exercise and Sport*, 80(2), 303-312. https://doi.org/10.1080/02701367.2009.10599565

Wang, C. K. J., Tan, L., & Dairianathan, E. I. (2018). Achievement goals, implicit theories, and intrinsic motivation: A test of domain specificity across music, visual art, and sports. *Journal of Research in Music Education*, *66*(3), 320-337. https://doi.org/10.1177%2F0022429418784563

Weltevreden, G.M., Van Hooft, E.A.J., & Van Vianen, A.E.M. (2018). Parental behavior and adolescent's achievement goals in sport. *Psychology of Sport & Exercise, 39,* 122-131. https://doi.org/10.1016/j.psychsport.2018.08.004

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