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Differences in self-regulatory skills among talented athletes: The significance of competitive level and type of sport

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Abstract
Research has shown that talented athletes outscore their mainstream peers on the basis of self-regulation. Although valuable, this does not tell us more about the distinction between good athletes and the best, which is a prerequisite in talent development. Therefore, we examined the self-regulatory skills of 222 male and female talented athletes aged 12–16 years as a function of competitive sport level (junior international or junior national athletes) and type of sport (individual or team sports). Multivariate analyses of covariance in combination with a discriminant function analysis revealed that ''reflection'' distinguishes between athletes at the highest levels of excellence. Furthermore, athletes playing individual sports had higher scores on ''planning'' and ''effort'' than team sport athletes, highlighting the importance of differences between types of sport. In conclusion, we emphasize the importance of reflection as a self-regulatory skill. Reflection facilitates the development of sport-specific characteristics, which may vary by type of sport. This means that an advanced sense of reflection may help talented athletes to acquire desirable characteristics during their ''talent'' years to ultimately reach adult elite levels of competition.

Keywords: *Metacognition, motivation, expert youth athletes, individual/team sports, talent development*

Introduction

Self-regulation is thought to be one of the key elements of successful learning (e.g. Clark & Ste-Marie, 2007; Van de Wiel, Szegedi, & Weggeman, 2004; Zimmerman, 2002a) as well as sport performance. Expert athletes distinguish themselves from their non-expert peers by their superior self-regulatory skills (e.g. Anshel & Porter, 1996; Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002). Furthermore, self-regulation has been related to effective time management, which may be especially relevant during the ''talent'' years (12–18 years in most sports), as this period is characterized by significant investments of time in training to progress in sport in combination with an academic career (Brettschneider, 1999; Zimmerman & Martinez-Pons, 1986).

Even though a developmental paradox exists with respect to self-regulation (i.e. non-experts are associated with less knowledge and self-regulation, whereas the use of self-regulatory skills is related to increased knowledge and expertise; Pintrich & Zusho, 2002), it has been proposed that involvement in high-level sports may aid the development of self-regulatory skills. Self-regulatory literature suggests that before one can be self-regulated one must be ''other-regulated''. This means that self-regulatory skills are developed by instructions and feedback provided by others, such as coaches and teachers, which is largely the case in sports (Pintrich & Zusho, 2002). Furthermore, athletes involved in high-level sports are familiar with the need to be goal-directed and self-conscious to continuously improve their performances (Van de Wiel et al., 2004; Williams, Donovan, & Dodge, 2000).These characteristics are closely related to self-regulatory skills.

Self-regulation is the extent to which learners exert control over their own learning to master a specific task and to improve (Zimmerman, 1989, 2006). Self-regulated learners plan their performance in advance, monitor whether they are still on track during performance, and evaluate their performance outcomes afterwards. During these planning, monitoring, and evaluation cycles, self-regulated learners reflect constantly on their learning process, which enables them to use prior knowledge and strategies for future actions (Ertmer & Newby, 1996; Zimmerman, 2006). Besides knowing what aspects to improve, self-regulated learners must also be willing

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to engage in effective forms of self-regulation (i.e. they must be willing to put sustained effort in their performances) and they must believe that they have the potential to execute actions successfully (i.e. self-efficacy; Bandura, 1997; Ericsson, Krampe, & Tesch-Römer, 1993; Zimmerman, 2006).

For the purpose of this study, we adopted Zimmerman's (1986, 2006) definition in which self-regulation is the extent to which talented athletes are metacognitively, motivationally, and behaviourally proactive participants in their own learning process (Pintrich, 2000; Zimmerman, 1986, 2006). *Metacognition* is the awareness of, and knowledge about, one's own thinking and consists of planning, self-monitoring, evaluation, and reflection (Ertmer & Newby, 1996; Herl et al., 1999; Hong & O'Neil, 2001; Pintrich, 2000; Zimmerman, 1990, 2002b). *Motivation* refers to the degree to which learners are self-efficiously, autonomously, and intrinsically driven to attain their goals and consists of effort and self-efficacy (Hong & O'Neil Jr., 2001; Zimmerman, 1990).

Although the value of self-regulation in sports has been recognized in distinguishing experts from non-experts (e.g. Anshel & Porter, 1996; Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002), it does not help us to distinguish between good athletes and the best athletes. In the field of talent development, however, knowledge about what distinguishes the good from the best is essential. However, when all athletes are considered experts, any difference between them is not as clear as when they are compared with their less athletic counterparts. The few studies that have focused on psychological differences between athletes with "high" or "very high" competitive standard have reported minor differences (e.g. Elferink-Gemser, Visscher, & Lemmink, 2008; Elferink-Gemser, Visscher, Lemmink, & Mulder, 2007; Kannekens, Elferink-Gemser, & Visscher, 2009; Meyers, Bourgeois, LeUnes, & Murray; 1999; Orlick & Partington, 1988).

As various studies have indicated that differences in psychological skills exist between athletes playing individual sports (e.g. swimmers and judokas) and those playing team sports (e.g. field hockey and volleyball; Anshel, 1995; Helsen, Starkes, & Hodges, 1998; Highlen & Bennet, 1983), we also focused our investigation on possible differences between types of sports. Previous research has suggested that self-regulation is particularly relevant in individual sports in which the surroundings remain relatively stable during performance (Anshel, 1995; Elferink-Gemser et al., 2008; Highlen & Bennet, 1983), and in which many hours are spent in training and competition. According to Ericsson (1996, 2003; Ericsson et al., 1993), it takes at least 10,000 h of deliberate training, often over 10 years or more, to achieve expert performance (e.g. 8000–10,000 h in wrestling and figure skating; Starkes, Deakin, Allard, Hodges, & Hayes, 1996). In contrast, studies of team sport athletes have reported much less time in training to achieve expert status (e.g. 3000–4000 h in ice hockey, field hockey, netball, basketball, and soccer; Baker, Coté, & Abernethy, 2003; Helsen et al., 1998; Soberlak & Coté, 2003; Starkes, 2000). In addition, differences between athletes may also occur as a consequence of their age and gender. Older students tend to be more self-regulative than younger students (Al-Hilawani, 2003; Pintrich & Zusho, 2002; Zimmerman & Martinez-Pons, 1990). With respect to gender, there is inconsistency between studies (Anshel & Porter, 1996; De Jager & Reezigt, 1996; Zimmerman & Martinez-Pons, 1990).

The roles of the metacognitive and motivational skills of talented athletes, competing at the highest competitive levels in their age category, remain unclear. Therefore, the aim of the present study was to assess possible differences in self-regulatory skills within a group of highly talented athletes competing in either individual or team sports. Based on the above findings, we proposed that differences would be minor when comparing talented athletes at the highest levels of excellence (i.e. junior international or junior national level). Nevertheless, insight into the self-regulatory skills of these athletes may help them to develop desirable characteristics to achieve expert status.

Methods

Participants

A total of 222 male ($n = 110$) and female ($n = 112$) talented athletes aged 12–16 years, attending 21 schools in the Netherlands, participated in this study. All athletes were classified by the type of sport they competed in (i.e. individual sports, $n = 113$; or team sports, $n = 109$) and by their competitive standard (i.e. junior international level, $n = 78$; or junior national level, $n = 144$). Furthermore, all athletes attended classes at the pre-vocational [preparatory training for the International Standard Classification of Education (ISCED) levels 4 and 5] or pre-university level (preparatory training for ISCED level 6; Inspectie van het Onderwijs, 2008; UNESCO, 1997). Of the total population, 26.1% attended classes at a pre-vocational academic level and 73.9% attended pre-university classes.

Of the 113 athletes competing in individual sports, 47 competed at junior international level (22 males and 25 females; mean age 14.3 years, $s = 1.1$). This means that in addition to their national commitments, they also trained and competed for the

Netherlands internationally. Of these 47 athletes, 16 were gymnasts, 4 judokas, 10 speed skaters, 4 swimmers, and 13 tennis players. The other 66 athletes competed at junior national level (37 males and 29 females; mean age 14.0 years, $s = 1.1$) and included 5 gymnasts, 14 judokas, 19 speed skaters, 8 swimmers, and 20 tennis players.

Of the 109 athletes playing team sports, 31 competed at junior international level (14 males and 17 females; mean age 14.8 years, $s = 1.1$). This means that in addition to their involvement in national competitions, they also trained and competed to represent the Netherlands in international competition. Of these 31 athletes, 13 played baseball, 8 basketball, 3 field hockey, 3 handball, and 4 volleyball. The other 78 athletes competed at junior national level (37 males and 41 females; mean age 14.1 years, $s = 1.0$), 5 athletes of whom played baseball, 23 basketball, 9 field hockey, 24 handball, and 17 volleyball. All team sports in the present study are referred to as ''interactive sports'', in that the teams' performance outcomes are dependent on a combination of all individual players' performances (Landers & Lüschen, 2007). Table I shows the athletes' general characteristics.

Instrument

To obtain demographic details for the participants and to assess their involvement in sports as well as their self-regulatory skills, all participants completed a questionnaire specially compiled for this study.

General questions. In the general part of our inventory, participants provided their personal details (e.g. date of birth, gender, academic level) as well as the following sport-related data: sport competed in, number of training sessions per week, and number of training hours per week.

Self-regulation items. The six self-regulatory skills were assessed using the subscales of various existing questionnaires (see below). These subscales were translated in accordance with the procedures described by Pelletier and colleagues (1995). First, two native speakers of Dutch proficient in English translated the original English subscales into Dutch, which were translated back into English by two other bilingual individuals who had no knowledge of the original subscales. The resultant translations were evaluated by all translators and their supervisor (Professor in Human Movement Sciences), which resulted in some minor modifications. Some additional but also minor modifications were made after we had tested the intelligibility of the questionnaire in a small sample of 11- to 14-year-olds, the youngest age band in our target group.

With respect to the reliability and validity of the questionnaire, we performed a confirmatory factor analysis with the data of 1201 adolescents aged 11–17 years. The factor analysis showed satisfactory results for an adjusted six-factor model, which also supported the construct validity of the instrument. Presenting the details of the factor analysis is beyond the scope of this study. However, we did calculate the internal consistency (Cronbach's alpha) for each group in the present study. Cronbach's alpha ranged from 0.74 for ''self-monitoring'' to 0.88 for ''effort'', which is considered acceptably high and in line with values reported in the original studies (i.e. range from 0.72 for ''evaluation'' and ''reflection'' to 0.85 for ''self-efficacy''; Herl et al., 1999; Hong & O'Neil, 2001; Howard, McGee, Sia, & Hong, 2000; Peltier, Hay, & Drago, 2006).

Planning, self-monitoring, effort, and self-efficacy. The first three subscales were originally formulated by Hong and O'Neil Jr. (2001) and Herl et al. (1999). The ''planning'' scale gauges the respondent's awareness of the demands of a task before its execution. The ''self-monitoring'' scale evaluates the awareness the respondent has of his or her actions during task execution, while the ''effort'' scale measures the respondent's willingness to apply himself or herself to attain the set goal. Self-efficacy (i.e. how the respondent judges his or her capabilities

Table I. General characteristics related to age, number of training sessions per week, total number of training hours per week (mean $\pm$ *s*), and academic level (mean $\pm$%) as a function of competitive level and type of sport.

	International			National		
	Individual (n=47)	Team (n=31)	Total (n=78)	Individual (n=66)	Team (n=78)	Total (n=144)
Age (years)	14.3 ± 1.1^a	14.8 ± 1.1^a	14.5 ± 1.1^a	14.0 ± 1.1^b	14.1 ± 1.0^b	14.0 ± 1.1^b
Training ($n \cdot \text{week}^{-1}$)	7.19 ± 2.53^a	5.35 ± 1.47^b	6.46 ± 2.34^c	5.71 ± 1.70^d	5.26 ± 1.47^d	5.46 ± 1.59^d
Training ($\text{h} \cdot \text{week}^{-1}$)	19.24 ± 11.14^a	11.79 ± 4.66^b	16.28 ± 9.80^c	11.20 ± 4.47^d	9.68 ± 3.12^e	10.38 ± 3.86^f
Academic level	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Pre-vocational	10 $(21.3)^a$	6 $(19.4)^a$	16 $(20.5)^a$	20 $(30.3)^a$	22 $(28.2)^a$	42 $(29.2)^a$
Pre-university	37 $(78.7)^a$	25 $(80.6)^a$	62 $(79.5)^a$	46 $(69.7)^a$	56 $(71.8)^a$	102 $(70.8)^a$

Note: Within each row, means with the same superscript are not significantly different from each other at the 0.05 level.

to organize and execute the required actions) was assessed using the Generalized Self-Efficacy Scale (Hong & O'Neil Jr., 2001; Schwarzer, 1993; Wegner, Schwarzer, & Jerusalem, 1993). All scales consisted of 7–12 items and participants needed to rate each item on a 4-point Likert type scale ranging from ''almost never'' to ''almost always''. High scores on these subscales indicate a high level of metacognition in general task situations.

Evaluation. The 8-item Inventory of Metacognitive Self-Regulation (IMSR; Howard et al., 2000) was included to examine evaluation skills (i.e. the ability to assess both the processes employed and the end product after task completion). Participants responded to each item on a 5-point Likert-type scale ranging from ''never'' to ''always''. A high score on the ''evaluation'' scale indicates that the respondent often evaluates his or her performance.

Reflection. The five items of the Reflective Learning Continuum (RLC; Peltier et al., 2006) were selected to measure reflection (i.e. the extent to which respondents are able to appraise what they have learned and to adapt their past knowledge and experiences to improve themselves). Items are rated on a 5-point Likert-type scale ranging from ''strongly agree'' to ''strongly disagree''. Accordingly, low scores on the RLC indicate a high level of reflection, but we reversed the scores for our analyses. Thus, in the results, high scores on this subscale indicate a high level of reflection.

Procedures

All athletes, schools, and the athletes' parents were informed of the study's procedures, after which they provided their informed consent to participate. As all participants were attending schools with special provisions (e.g. flexibility in school timetable) within the regular Dutch education system, they completed the questionnaire in a classroom setting during their regular school activities. Test leaders were present and the assessment occurred within the competitive season (i.e. March–May). The procedures were in accordance with the standards of the local medical ethics committee of the University of Groningen, University Medical Center Groningen.

Data analyses

Analysis of the data was conducted using SPSS 14.0. For all six subscales of self-regulation (i.e. planning, self-monitoring, evaluation, reflection, effort, and self-efficacy), descriptives were presented according to competitive level (international vs. national level) and type of sport (individual vs. team sports). To interpret the scores, effect sizes (d) between competitive levels and types of sport were calculated. Effect sizes around 0.20 are considered small, around 0.50 moderate, and around 0.80 large (Cohen, 1988).

A multivariate analysis of covariance (MANCOVA) was used for analysis of the data. The scores on the six self-regulatory subscales served as the dependent variables and competitive level and type of sport as the independent variables. As self-regulatory skills may vary by age, gender, and academic level, these characteristics were considered as covariates. Where appropriate, univariate analyses of covariance (ANCOVA) for each of the six aspects of self-regulation separately, with competitive level and type of sport as factors, were conducted as follow-up tests. Again, age, gender and academic level served as covariates.

A stepwise discriminant function analysis in which competitive level was the dependent variable was conducted to assess whether self-regulation could predict membership of the internationally competing or nationally competing groups. For all tests of significance, the Bonferroni method was used to correct for multiple testing and an alpha level of 0.05 was adopted.

Results

Mean scores and standard deviations on the six subscales of self-regulation by competitive level and type of sport and the corresponding effect sizes are presented in Table II.

The MANCOVA revealed significant differences for competitive level ($F_{6,210} = 2.224$; $P < 0.05$) and type of sport ($F_{6,210} = 2.236$; $P < 0.05$). No significant interaction was found between competitive level and type of sport ($F_{6,210} = 1.043$; $P > 0.05$). The covariates, age, gender, and were also not significant (all $P > 0.05$).

The ANCOVA showed that, regardless of competitive level, athletes playing individual sports outscored their peers playing team sports on ''planning'' ($F_{1,215} = 5.387$; $P < 0.05$) and ''effort'' ($F_{1,215} = 5.715$; $P < 0.05$). No significant differences were found for ''self-monitoring'', ''evaluation'', ''reflection'', and ''self-efficacy'' (all $P > 0.05$). The effect sizes ranged from small for ''self-monitoring'' ($d = 0.24$), ''evaluation'' ($d = 0.00$), ''reflection'' ($d = -0.10$), and ''self-efficacy'' ($d = 0.16$) to small-to-moderate on ''planning'' ($d = 0.32$) and ''effort'' ($d = 0.29$).

With respect to competitive level, the results of the ANCOVA showed that, regardless of type of sport, athletes competing internationally had significantly higher scores on ''reflection'' ($F_{1,215} = 7.395$; $P < 0.05$) than athletes competing nationally. No significant differences were observed for the other five self-regulatory skills (all $P > 0.05$). Effect sizes

were moderate for ''reflection'' and small on the other aspects of self-regulation (Table II).

The MANCOVA was followed up by a stepwise discriminant function analysis to ascertain the nature of these results and their predictive value. This analysis showed that only ''reflection'' (Wilks' $\lambda = 0.960$; $F_{1,220} = 9.124$; $P < 0.05$) can discriminate successfully between athletes competing internationally and those competing nationally. The average squared canonical correlation was 0.200, which indicates that, knowing the scores on ''reflection'', the percent variance accounted for is 20%.

Comparisons between the predicted group classifications and the actual group classifications can be made on the basis of the results of the discriminant function analysis. Table III shows that when competing internationally or nationally is predicted from ''reflection'', 58.1% of athletes are classified correctly.

Discussion

The purpose of this study was to examine the self-regulatory skills of 12- to 16-year-old talented athletes as a function of their competitive level (junior international or junior national level) and type of sport (individual or team sports). Our results indicate that talented athletes competing at junior international level outscore their junior national peers on ''reflection'' and that this attribute is the only self-regulatory skill that successfully distinguishes athletes competing internationally from those competing nationally (Table III). This finding extends previous research reporting that experts are more likely to self-reflect during athletic practice sessions than non-experts (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002).

The discriminant function analysis revealed that 58% of athletes were correctly classified, which means that classifying talented athletes on the basis of ''reflection'' adds 8% to classification based on chance (50%). We assume that this 8% is relevant, as we compared athletes towards the expert end of the learning continuum where differences appear minor. We are also aware that the 8% is based on a difference in mean score between the two study groups of 0.3 on a 5-point Likert scale. This appears minimal, but the practical meaning may be quite relevant.

When international athletes are compared with their national peers on ''reflection'', the standard deviations and range in scores (Table II) of the internationals show less variation. All internationals

Table II. Mean scores, standard deviations (mean $\pm$ *s*), ranges and effect sizes (*d*) on all self-regulation subscales according to competitive level and type of sport.

	International competitive level					National competitive level			
	Individual (n=47)	*d*	Team (n=31)	Total (n=78)	*d*	Total (n=144)	Individual (n=66)	*d*	Team (n=78)
Planning	2.92 ± 0.51^a 2.00–3.89	$0.47^{\#}$	2.67 ± 0.55^b 1.67–3.89	2.82 ± 0.54^c 1.67–3.89	0.27^+	2.68 ± 0.49^c 1.56–3.78	2.74 ± 0.48^a 1.78–3.78	0.18^+	2.64 ± 0.50^b 1.56–3.78
Self-monitoring	2.91 ± 0.44^a 2.13–3.63	$0.41^{\#}$	2.72 ± 0.48^a 2.00–3.75	2.83 ± 0.46^a 2.00–3.75	0.26^+	2.71 ± 0.46^a 1.38–3.88	2.73 ± 0.51^a 1.38–3.88	0.06^+	2.70 ± 0.42^a 1.63–3.50
Evaluation	3.60 ± 0.50^a 2.75–5.00	-0.06^+	3.63 ± 0.51^a 2.63–5.00	3.61 ± 0.50^a 2.63–5.00	0.24^+	3.49 ± 0.49^a 2.00–5.00	3.49 ± 0.49^a 2.00–4.75	0.00^+	3.50 ± 0.50^a 2.25–5.00
Reflection	4.14 ± 0.54^a 2.40–5.00	$-0.22^{+\#}$	4.25 ± 0.45^a 3.40–5.00	4.18 ± 0.51^a 2.40–5.00	$0.44^{\#}$	3.90 ± 0.74^b 1.20–5.00	3.84 ± 0.86^b 1.20–5.00	-0.12^+	3.95 ± 0.63^b 1.40–5.00
Effort	3.18 ± 0.55^a 2.00–4.00	$0.50^{\#}$	2.91 ± 0.52^b 2.11–3.78	3.07 ± 0.55^c 2.00–4.00	0.04^+	3.05 ± 0.55^c 1.67–4.00	3.11 ± 0.55^a 1.67–4.00	0.22^+	3.00 ± 0.54^b 1.78–4.00
Self-efficacy	3.10 ± 0.42^a 2.18–3.91	$0.50^{\#}$	2.87 ± 0.49^a 1.64–3.73	3.01 ± 0.46^a 1.64–3.91	0.23^+	2.91 ± 0.40^a 1.73–4.00	2.89 ± 0.43^a 1.73–4.00	-0.10^+	2.93 ± 0.37^a 2.18–3.91

Note: $d = \sim 0.20$ (small$^+$), $d = \sim 0.50$ (moderate$^{\#}$), $d = \sim 0.80$ (large^) (Cohen, 1988).
Within each row, means with the same superscript are not significantly different from each other at the 0.05 level.

Table III. Classification of the stepwise discriminant function analysis (n and %)[a].

		Predicted group membership		
	Competitive level	International	National	Total
Original	International	n=47 (60.3%)	n=31 (39.7%)	n=78 (100%)
	National	n=62 (43.1%)	n=82 (56.9%)	n=144 (100%)

[a]58.1% of original groupings correctly classified.

possess an average-to-high extent of ''reflection'', as their lowest scores refer to the middle category (neutral) on the continuum of the Likert-scale (strongly agree–strongly disagree), whereas the scores of the nationals vary widely (i.e. between the lowest category and the highest category). In other words, to perform at international level, at least average amounts of ''reflection'' are essential. This is consistent with research stressing the importance of reflection in expert learning (Ertmer & Newby, 1996). Reflection helps the learner to comprehend knowledge and skills that have been acquired and to apply them in various situations (Peltier et al., 2006). Within the sports context, reflection facilitates the development of sport-specific characteristics that are important to realize one's full potential.

Although it has been proposed that involvement in high-level sports may aid the development of self-regulatory skills, circularity still exists in the role of reflection at the highest levels of excellence (i.e. at junior international and junior national levels). Are international athletes competing at the highest level as a consequence of their well-developed sense of reflection, or are their highly reflective skills a result of their international expertise? Based on our data, we are unable to answer this question. In fact, our research population may be the middle of what the paradox is like. More specifically, the junior internationals are already experts in their age category, as they outperform their nationally competing peers in sporting terms as well as reflectively. However, to achieve senior international status, they still have to improve and reflection can assist to develop the required sport-specific characteristics efficiently (Ertmer & Newby, 1996). We therefore recommend using a longitudinal design to assess the development of self-regulatory skills in future studies.

Even though ''reflection'' was the only attribute that reached significance, the means of the other self-regulatory aspects were also higher for the athletes competing internationally. As anticipated, effort serves as the only exception. In this study, all athletes had relatively high average scores for ''effort'', surpassing 3.0 on a 4-point Likert scale. This is in line with Ericsson's deliberate practice theory (Ericsson, 2003; Ericsson et al., 1993). To reach senior international as well as senior national level, athletes need to invest many hours in training (at least 10,000 h over 10 years or more).

Not only may well-developed self-regulatory skills facilitate learning efficiency in sports, it may also help to combine the large time investments in sports with other activities such as academic study (Eccles & Feltovich, 2008). Regarding the academic achievements of the athletes, our results are consistent with previous research, suggesting an association between the level at which young athletes compete in sports and the level at which they study, namely that talented athletes frequently attend schools with pre-university academic level (Table I; Jonker, Elferink-Gemser, & Visscher, 2009; Zimmerman & Martinez-Pons, 1986). This trend continues towards the higher competitive sport levels, since the percentage of internationals attending pre-university classes tends to be higher than that of nationals (approximately 80% vs. 71%; Table I).

Regarding type of sport, athletes competing in individual sports had higher scores for ''planning'' and ''effort''. Based on these findings, we propose that athletes from different types of sport differ most on the self-regulatory skills that are strongly related to the sport-specific characteristics needed to perform well. More specifically, the environment in most individual sports remains relatively stable during training and competition, which makes it amenable to the use of planning strategies (Highlen & Bennet, 1983). In most team sports, however, skills are executed in a constantly changing environment, which makes the use of planning strategies less applicable (Elferink-Gemser et al., 2008; Highlen & Bennet, 1983). In addition, differences in self-regulatory skills between athletes from different types of sport tend to become more evident at international level (see effect sizes in Table II).

That athletes playing individual sports are more effortful than their peers playing team sports can also be explained by sport-specific characteristics. Athletes competing in individual sports tend to spent more time in effortful and sustained training (Helsen et al., 1998; Starkes, 2000; Table I). However, effort is not only expressed by the number of hours spent on training, but is also reliant on differences in the processes required for high-level achievement. As a consequence of the individual character, athletes competing in individual sports are more affected by their own performance and less dependent on others for their performance outcomes (Elferink-Gemser et al., 2008; Régnier, Salmela, & Russell, 1993). Moreover, studies in individual sports have found a consistent correlation between level of excellence and the amount of solitary training (Ericsson, 2003). In interactive team sports, in contrast, athletes constantly have to act and react to behaviours of teammates and opponents. In addition, their personal achievements are less evident as they depend on a combination of various mini performances that contribute to the overall team performance valued by trainers and coaches (Elferink-Gemser et al., 2008; Kannekens et al., 2009; Landers & Lüschen, 2007; Régnier et al., 1993).

This study does have some limitations. As is common in self-regulatory studies, we used a self-report questionnaire that is generally sensitive to social desirable answers (Ericsson et al., 1993;

Young & Starkes, 2006). Furthermore, this study involved several different sports. One might argue that it is relatively easier to become an international in one sport (e.g. bowling) than in another sport (e.g. tennis) simply due to differences in the number of athletes playing the sport. However, this phenomenon is considered of secondary relevance, as all the sports included were popular sports in the Netherlands (i.e. top-20 sports, except baseball), accounting for more than 35% of Dutch athletes (NOC*NSF, 2008). Another issue is the heterogeneity within the group of internationals, as it may well be the case that internationals differ in the number of minutes that they are active during competition. Nevertheless, the distinction between athletes competing internationally or nationally is considered relevant as all internationals train and compete to represent the Netherlands in addition to their commitments at national level, whereas the nationals do not. To further unravel the mystery of expertise, we recommend assessing the self-regulatory skills of athletes who are most successful in sports (e.g. by winning medals at the highest competitive level). However, the numbers of athletes competing at this level is limited.

In conclusion, our results show that athletes competing in individual sports outperform their team sport peers on ''planning'' and ''effort'' at the highest levels of junior competition and that athletes competing internationally can be distinguished from athletes playing nationally on the basis of their reflective skills. Athletes competing internationally reflect more on their learning process and on past performances, which implies that they learn more efficiently than their national peers. It is not clear, however, whether they are junior internationals as a consequence of their well-developed sense of reflection, or whether their highly reflective skill is a result of their international expertise. Nonetheless, learning efficiently by means of reflection may be considered a key process in the development of junior international athletes and may help in achieving senior international status.

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