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Burton, A and Eisenmann, J and Cowburn, I and Lloyd, R and Till, K (2021) Developing motor competency in youths: Perceptions and practices of Strength and Conditioning coaches. *Journal of Sports Sciences*, 39 (23). pp. 2649-2657. ISSN 0264-0414 DOI: <https://doi.org/10.1080/02640414.2021.1949189>

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To cite this article: Alan M. Burton, Joey C. Eisenmann, Ian Cowburn, Rhodri S. Lloyd & Kevin Till (2021) Developing motor competency in youths: Perceptions and practices of strength and conditioning coaches, Journal of Sports Sciences, 39:23, 2649-2657, DOI: [10.1080/02640414.2021.1949189](https://doi.org/10.1080/02640414.2021.1949189)

To link to this article: <https://doi.org/10.1080/02640414.2021.1949189>



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## Developing motor competency in youths: Perceptions and practices of strength and conditioning coaches

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### ABSTRACT

Motor competency is integral to the long-term athletic development of youths. Strength and conditioning (S&C) coaches are recommended to deliver motor competency interventions, yet no studies have investigated their perceptions and practices for developing motor competency in youths. Sixty-seven male, and 4 female S&C coaches completed an initial and follow up questionnaire using a 5-point Likert scale, rating 1] the importance of developing competence, and 2] how frequently they developed competence across 90 motor competencies. Over 55% of S&C coaches reported a broad range of “important” (69/90) and “frequently developed” (48/90) motor competencies. The most important motor competency was “deceleration” ( $4.9 \pm 0.3$ ), whilst “hip hinge (bilateral)” was the most practised ( $4.4 \pm 0.5$ ). S&C coaches targeted upper body pushing and pulling competencies more than their perceived importance, whilst agility (e.g., turning) competencies were targeted less than their importance. Further analysis showed S&C coaches who delivered 3–4 sessions per week targeted 15–18% more competencies compared to  $\leq 2$  sessions per week. Overall, these findings have strong implications for youth motor competency development including the reflection of important vs. practised competencies, coach education programmes, and consideration for how S&C coaches should seek to optimise motor competency development within youths.

### ARTICLE HISTORY

Accepted 25 June 2021



### KEYWORDS

Long-term athletic development; fundamental movement skills; foundational movement skills; athletic motor skill competencies


### Introduction

A central focus of Long-Term Athletic Development is to habitually develop athleticism within youths (Lloyd et al., 2016). The term “youths” represents both children until the onset of puberty (generally aged 11 for girls and aged 13 for boys), and adolescents following the onset of puberty (generally aged between 12–18 for girls, and aged 14–18 years for boys) (Lloyd et al., 2015b; Towlson et al., 2020). Motor competency is an important component of athleticism for youths, and refers to one’s ability to perform goal-directed tasks which require controlled and coordinated movement of the human body (Cattuzzo et al., 2016; Hulteen et al., 2018; Robinson et al., 2015). Whitehead (2010) suggests motor competency is multi-dimensional, consisting of simple (e.g., balance, coordination and flexibility), combined (e.g., agility requiring flexibility, balance and coordination) and complex (e.g., hand-eye coordination, needing orientation in space) movement capacities, which are all inter-related. Previous theory indicates that motor competency develops sequentially during early childhood, where stability skills (e.g., balance) develop prior to locomotive skills (e.g., running), followed by object control skills (e.g., catching) (Gallahue et al., 2012).

Across childhood, motor competency, physical fitness and perceived competence are suggested to interact to induce positive (i.e., increased physical activity and healthy weight status) or negative (i.e., decreased physical activity and unhealthy weight status) trajectories (Stodden et al., 2008). Various reviews support these trends, and highlight that motor competency is positively associated with physical activity level (Holfelder & Schott, 2014; Lloyd et al., 2015a), musculoskeletal strength and endurance, cardiorespiratory endurance, and inversely associated with weight status throughout childhood (Cattuzzo et al., 2016; Lubans et al., 2010). Accordingly, limited motor competency foundations could be linked to a “proficiency barrier” (Seefeldt, 1980), whereby reduced competency during childhood transpires to reduced motor competency, physical activity levels and physical fitness in adolescents and adulthood (Stodden et al., 2009). Indeed, children with enhanced motor competency maintain their physical activity levels into adolescence (Barnett et al., 2009; Robinson et al., 2015). Conversely, less competent children show reduced fitness throughout their development (Hands & Larkin, 2006; Robinson et al., 2015; Schott et al., 2007). Therefore, developing and maintaining motor competency throughout childhood and adolescence is a priority to enhance health, reduce injury risk, reduce obesity, increase

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This article has been republished with minor changes. These changes do not impact the academic content of the article.

 Supplemental data for this article can be accessed online <https://doi.org/10.1080/02640414.2021.1949189>.

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athleticism, increase confidence and competence, and enhance physical activity (Cattuzzo et al., 2016; Hardy et al., 2012; Lloyd et al., 2015b; Robinson et al., 2015; Telama et al., 2005).

Recent recommendations state that planned and structured interventions are vital to develop motor competency across long-term athletic development (Lloyd et al., 2016), as practice, feedback and instruction are likely to facilitate positive motor competency outcomes (Clark & Metcalfe, 2002; Gallahue & Ozmun, 2006). Hence, various methods, ideas and approaches (e.g., fundamental movement skills [FMS] (Barnett et al., 2009); foundational movement skills (Hulsteen et al., 2018); athletic motor skill competencies [AMSC] (Lloyd et al., 2015a) have been proposed to assist practitioners design and implement interventions to develop athleticism within youths. Indeed, structured Strength and Conditioning (S&C) interventions have shown to improve motor competency in youths (Behringer et al., 2011; Pullen et al., 2020). However, whilst this research has demonstrated positive improvements, no studies have investigated the perceived importance and the practices of S&C coaches that are responsible for developing motor competency in youths. Such insights could help foster the sharing of best practice, enhance long-term athletic development pathways, and inform future coach development and research (Jones et al., 2017; Wells & Langdown, 2020) to help overcome diminishing motor competency levels within youths (Dobbs et al., 2020; Parsonage et al., 2014). Therefore, the purpose of this study was to evaluate and compare the perceptions (i.e., importance) and practices (i.e., frequency of developing competencies) of S&C coaches responsible for developing motor competency within youths.

## Methods

### Study design

For this study, a web-based questionnaire approach was adopted. Contrary to other approaches (e.g., face-to-face/telephone interviews, postal questionnaires), web-based questionnaires are simple to use, inexpensive, time efficient and minimise data entry errors (Sebo et al., 2017). Additionally, web-based questionnaires can be distributed internationally to enhance participant reach (Jones et al., 2008). Therefore, the initial and follow up questionnaires were distributed online to S&C coaches responsible for developing motor competency in elite (e.g., talent development) and non-elite (e.g., school) youth environments. The questionnaires were developed and administered using Qualtrics™ software (Qualtrics, Provo, USA) between April and June 2020.

### Participants

Initially, potential participants were invited to participate and given access to the questionnaires through professional networks (e.g., LinkedIn), and publicly available emails, as per the methods of similar studies (e.g., Robertson et al., 2017). To increase potential reach, details of the study and the link to participate were circulated on social media (e.g., Twitter). To participate, S&C coaches required 1) a minimum of

3 years' experience in youth environments (e.g., schools, sports clubs, and talent development pathways involving children and adolescents aged 18 or younger) based upon Drury et al. (2021); and 2) accreditation from a relevant governing body (e.g., United Kingdom Strength and Conditioning Association, National Strength and Conditioning Association, Australian Strength and Conditioning Association, British Association of Sport and Exercise Sciences) and/or a relevant post graduate qualification (e.g., MSc). Such details are synonymous with the minimum knowledge and experience requirements for entry level youth S&C coaching positions.

In total, 71 youth S&C coaches ( $n = 67$  male;  $n = 4$  female; experience =  $8.2 \pm 4.9$  years; range = 3–26 years), from 13 countries, completed both questionnaires. Respondents stated their primary affiliation ( $n = 41$  team sports;  $n = 8$  individual sports;  $n = 19$  school/multi-sports;  $n = 3$  academia) and facilitated S&C programmes for several sports including: Athletics ( $n = 1$ ), Baseball ( $n = 1$ ), Basketball ( $n = 1$ ), Cricket ( $n = 2$ ), Freestyle snow sports ( $n = 1$ ), Gaelic Athletic Association (GAA) hurling ( $n = 1$ ), Gymnastics ( $n = 2$ ), Ice hockey ( $n = 1$ ), Judo ( $n = 1$ ), Multiple sports ( $n = 19$ ), Netball ( $n = 1$ ), Rowing/Kayaking ( $n = 1$ ), Rugby (union and league;  $n = 20$ ), Soccer ( $n = 17$ ), Short track speed skating ( $n = 1$ ) and Swimming ( $n = 1$ ). This study was conducted with formal ethical approval with participants providing consent.

### Identifying and defining motor competencies

Before designing the initial questionnaire, the 1<sup>st</sup> author, who is MSc qualified and has knowledge and experience in youth S&C, identified and defined a list of motor competencies. This list consisted of 58 competencies, which were based on literature relating to FMS (Giblin et al., 2014), foundational movement skills (Hulsteen et al., 2018; Tompsett et al., 2014) and AMSC (Lloyd et al., 2015a). The defined motor competencies were presented to the 5<sup>th</sup> author, who is a professor of youth athletic development, for examination and critique. Based the 5<sup>th</sup> author's feedback, 19 definitions were edited and a further 18 competencies were defined and included. The revised list was reviewed again, and then confirmed via discussions between the 1<sup>st</sup> and 5<sup>th</sup> authors. In total, 76 motor competencies were identified and defined during this process (Supplementary Table 1), and presented to participants during section 2 of the initial questionnaire.

Within the initial questionnaire, participants provided suggested additions or changes to the initial list presented. Similar to other S&C practice research (e.g., Gee et al., 2011; Jones et al., 2017), these open-ended responses were analysed via content analysis, (Elo & Kyngäs, 2008) to identify and report common patterns within the data (i.e., suggested additional competencies and/or edits to definitions). The process involved identifying key phrases within responses that represented a motor competency, for example, "I would add movement patterns related to crawling", "I would also find it essential to develop crawling derivatives", and "I would also suggest crawling" were identified as "crawling". Such phrases were compared to the initial list presented, and any

equivalent phrases were discounted. The 1<sup>st</sup> author then reviewed the phrases that were truly different from those presented in the initial list, to identify and define additional motor competencies. The defined list of additional competencies were then reviewed and confirmed via discussions between the 1<sup>st</sup> and 5<sup>th</sup> authors to enhance the validity of the follow up questionnaire. This process identified and defined 14 additional motor competencies, which were presented to participants in the follow up questionnaire.

### Procedures

The initial questionnaire consisted of three sections. Section 1 requested demographic information relating to the participants primary affiliation, number of years' experience in youth S&C, and the age ranges of their athletes/individuals. The 76 defined motor competencies were presented to S&C coaches in section 2 of the initial questionnaire. Participants were first asked to rate the importance of developing competence in each movement in youth populations on a 5-point scale (1] "not important", 2] "little importance", 3] "somewhat important", 4] "important", 5] "very important") (Croasmun & Ostrom, 2011; Fernandes & Randall, 1991). After rating all 76 competencies, an open-ended question asked participants if any edits were required, based on the initial list presented (e.g., highlight a competency that was not originally included; suggest edits to the definitions presented).

Section 3 of the initial questionnaire required participants to state their frequency of S&C delivery (i.e., "monthly", "fortnightly", "weekly", "2 x per week", "3 x per week", "4 x per week" or "> 4 x per week") and their average session duration (i.e., "0–30 mins", "31–45 mins", "46 mins – 59 mins", "1–1.5 hours" or "> 1.5 hours"). Following this, participants rated how frequently they developed each motor competency based on their contact time with their youths on a 5-point Likert-scale (1] "never", 2] "rarely", 3] "sometimes", 4] "often", 5] "always").

The follow up questionnaire was developed, based on the open-ended responses (14 additions: Supplementary Table 2) from section 2 of the initial questionnaire. Participants were required to rate the importance of, and how frequently they targeted each additional motor competency. In total, S&C coaches rated their perceived importance and coaching practices of 90 motor competencies.

### Data analysis

Likert-scale responses were reported as means and standard deviations and percentage of total responses. Likert-scale responses were categorised as either "important" ("important" + "very important") or "not important" ("not important" + "little importance") for perceptions, or "frequently developed" ("often" + "always") or "not frequently developed" ("never" + "rarely") for practices. To determine the magnitude of the percentages of total responses for each motor competency, qualitative terms were assigned as follows: Minority = <30%; approximately a third = ~ 30%; Approximately half = ~50%; Majority = 55–74%; Most = ≥75%; All = 100% of respondents, as per previous research (Ford et al., 2020; Starling & Lambert, 2018).

To analyse the influence of session frequency and duration on S&C coaches' practices, the percentage of motor

competencies reported as "frequently developed" (i.e., the percentage of competencies rated a 4 ["often"] or 5 ["always"]) was calculated for each participant. A linear mixed model then evaluated the influence of session frequency and duration on the number of competencies that S&C coaches frequently developed. Pairwise comparisons showed the magnitude of difference between groups with the F statistic, degrees of freedom, mean differences, p values reported. Effect sizes are reported as  $d \pm 90\%$  confidence intervals. Thresholds for effect sizes were set as follows: 0–0.19, trivial; 0.2–0.59, small; 0.6–1.19, moderate; > 1.2, large (Hopkins, 2000). Competencies were ranked by mean score to compare the differences between perceptions (i.e., importance) and practices (i.e., frequency of developing competence) for each motor competency.

## Results

### Perceived importance of developing motor competencies

Table 1 shows the 10 most, and 10 least important motor competencies reported by S&C coaches (see Supplementary Table 3 for a full overview of perceptions). Fifty-four (60%) of the 90 motor competencies were deemed important by most respondents (76–99%), with the majority (55–73%) highlighting a further 15 important motor competencies. The most important motor competencies consisted of "acceleration" (99%), "deceleration" (99%) and "hip hinge (bilateral)" (99%). The majority of S&C coaches rated "skating" (55%) and "Skiing" (62%) competencies as "not important", while approximately half (45–53%) of the participants rated "galloping", "vaulting" and "rowing machine" as "not important". Five other competencies were rated "not important" by approximately a third (31–36%) of S&C coaches.

**Table 1.** An overview of the 10 most, and 10 least important motor competencies to develop based on percentage of response frequency.

Movement	Not Important (% scoring a 1 or 2)	Important (% scoring a 4 or 5)
<b>Most important</b>		
Acceleration	0	99
Deceleration	0	99
Hip hinge (bilateral)	0	99
Sprinting	1	97
Turning	1	97
Landing (bilateral)	0	96
Landing (unilateral)	0	96
Cutting	0	94
Hip hinge (unilateral)	1	94
Jumping (Vertical)	0	94
<b>Least important</b>		
Hurdling	36	35
Cycling	31	32
Jogging	33	30
Cartwheel	32	28
Handstand	34	27
Galloping	45	25
Vaulting	51	17
Rowing machine	53	15
Skating	55	8
Skiing	62	3

\* Percentages do not add up to 100% due to rounding and excluding the percentage of response frequencies that did not fit the groupings for perceptions (i.e., excludes percentage of responses scoring a 3, "somewhat important").



**Table 2.** An overview of the 10 most, and 10 least frequently developed motor competencies based on percentage of response frequency.

Movement	Not frequently developed (% scoring a 1 or 2)	Frequently developed (% scoring a 4 or 5)
<b>Frequently developed</b>		
Hip hinge (bilateral)	0	96
Lunge (horizontal)	1	94
Squat (bilateral)	0	93
Upper body vertical pulling (unilateral/bilateral)	3	92
Jumping (Vertical)	1	90
Jumping (horizontal)	3	90
Upper body horizontal pushing (Unilateral/bilateral)	3	90
Hip hinge (unilateral)	1	89
Hip mobility	0	89
Upper body horizontal pulling (unilateral/bilateral)	3	89
<b>Not frequently developed</b>		
Climbing	83	8
Handstand	68	8
Vaulting	85	8
Rowing machine	70	8
Swimming	77	7
2 handed striking	85	7
1 handed striking	82	7
Cartwheel	70	7
Skating	92	7
Skiing	99	1

\* Percentages do not add up to 100% due to rounding and excluding the percentage of response frequencies that did not fit the groupings for practices (i.e., excludes percentage of responses scoring a 3, "sometimes").

### Youth strength and conditioning coach's session frequency and duration

Figure 1a and 1b show the participants reported session frequency and average session duration, respectively. The most common session frequency was "2 x per week" (n = 20, 28%), while "46–59 minutes" (n = 26; 37%) was the most common duration.

### Frequency of developing movement competencies with youths

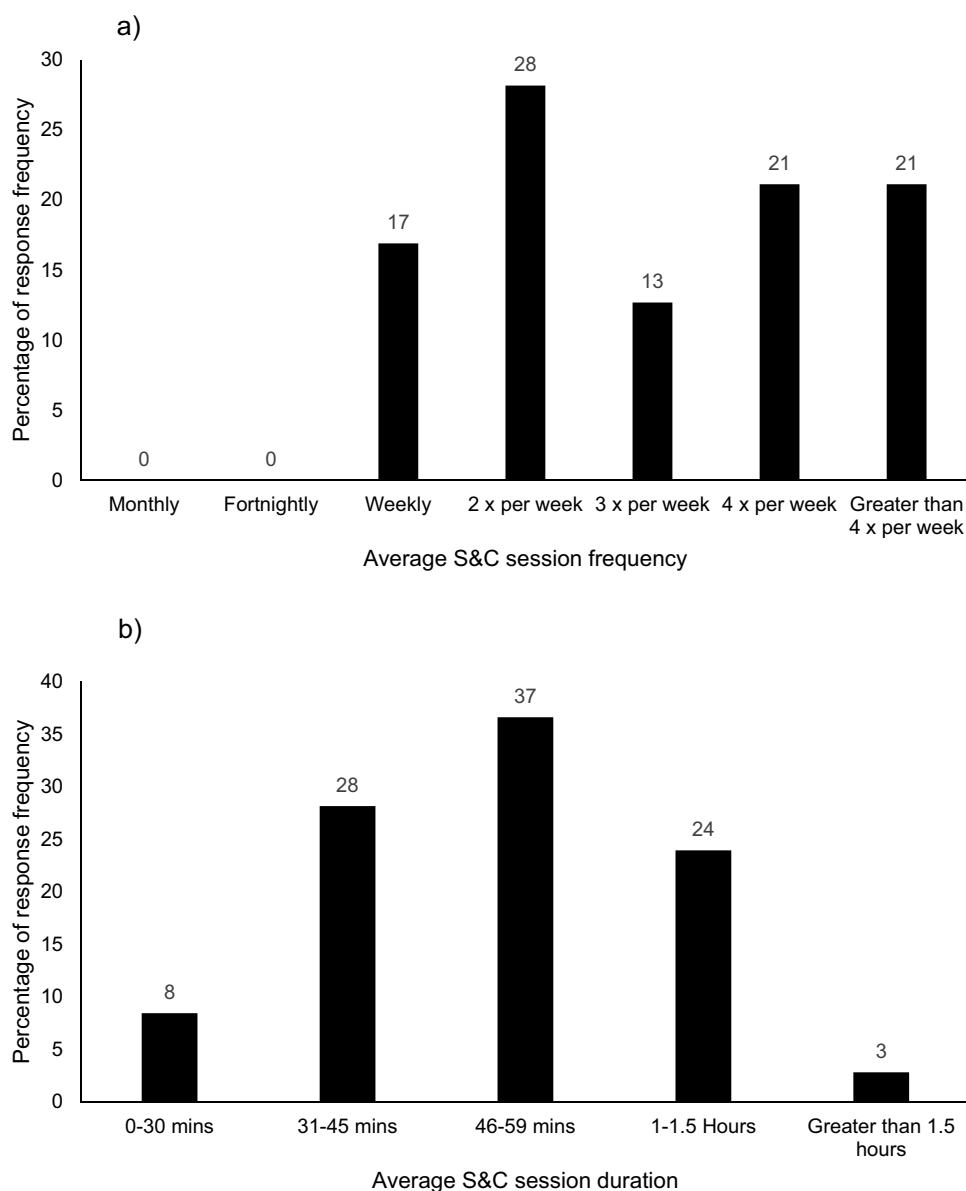
Table 2 shows the 10 most, and 10 least frequently developed motor competencies by S&C coaches (see supplementary Table 3 for full overview of practices). Most (76–96%) respondents indicated they "frequently developed" 24 motor competencies with their respective youths with the majority of coaches (55–73%) reporting they "frequently developed" a further 24 motor competencies. The most frequently developed competencies were "hip hinge (bilateral)" (96%), "lunge (horizontal)" (94%) and "squat (bilateral)" (93%). Most S&C coaches (82–99%) highlighted seven competencies that were "not frequently developed", while the majority (58–75%) highlighted a further 15 competencies that were "not frequently developed", within their programmes.

### Perceptions vs. practices

Table 3 illustrates the differences between S&C coaches' perceptions (i.e., importance) and practices (i.e., frequency of developing movement competencies) for motor competence development in youths (see supplementary table 4 for a full overview). The greatest differences in ranked mean scores between perceptions and practices were witnessed in "upper body horizontal pushing (unilateral/bilateral)" (importance rank = 36; frequency rank = 6; rank difference = ↑ 30), "upper body vertical pushing (unilateral/bilateral)" (importance rank = 32; frequency rank = 9; rank difference = ↑ 23), "reacceleration" (importance rank = 20; frequency rank = 50; rank difference = ↓ 30), and "turning" (importance rank = 7; frequency rank = 35; rank difference = ↓ 28). Five competencies did not change rank, with "skating" (importance rank = 89; frequency rank = 89) and "skiing" (importance rank = 90; frequency rank = 90) being rated the least important and least frequently developed motor competencies.

**Table 3.** Greatest mean score rank changes between perceived importance and coaching practices (i.e., frequency of developing motor competencies).

Movement	Perceived Importance of developing each motor competency			Frequency of developing each motor competency			Rank difference
	Mean	SD	Rank	Mean	SD	Rank	
<b>Greatest rank increase</b>							
Upper body horizontal pushing (Unilateral/bilateral)	4.30	0.74	36	4.30	0.72	6	↑ 30
Upper body vertical pushing (unilateral/bilateral)	4.32	0.71	32	4.27	0.81	9	↑ 23
Upper body horizontal pulling (unilateral/bilateral)	4.34	0.75	29	4.27	0.74	8	↑ 21
Knee hinge (unilateral/bilateral)	4.20	0.86	47	3.92	0.84	26	↑ 21
Anti-lateral flexion	3.80	0.82	62	3.55	0.94	42	↑ 20
Olympic lifting derivatives	3.44	0.94	74	3.35	1.06	54	↑ 20
Upper body vertical pulling (unilateral/bilateral)	4.41	0.69	22	4.31	0.71	4	↑ 18
Lateral flexion	3.44	0.92	73	3.13	1.07	58	↑ 15
Jumping (lateral)	4.21	0.77	45	3.85	0.77	31	↑ 14
Jumping (repeated)	4.24	0.75	40	3.90	0.76	27	↑ 13
<b>Greatest rank decrease</b>							
Reacceleration	4.48	0.69	20	3.48	0.95	50	↓ 30
Turning	4.65	0.59	7	3.72	0.97	35	↓ 28
Cutting	4.61	0.60	10	3.70	0.93	36	↓ 26
Change of Direction combinations	4.49	0.67	17	3.62	0.95	39	↓ 22
Deceleration	4.89	0.36	1	4.08	0.91	21	↓ 20
Balance (moving)	4.35	0.93	28	3.55	1.01	44	↓ 16
Landing (unilateral)	4.75	0.53	5	4.10	0.66	19	↓ 14
Kicking	4.00	1.07	56	2.42	1.33	70	↓ 14
Dribbling (hands)	3.59	1.17	68	1.96	1.07	82	↓ 14
Swimming	3.54	1.26	70	1.79	1.00	84	↓ 14



**Figure 1.** Percentage of response frequency relating to a) how frequently practitioners deliver S&C sessions to their athletes or individuals; and b) their average duration of S&C delivery.

### ***Influence of session frequency and average session duration on youth strength and conditioning coaches' motor competency practices***

A linear mixed model identified significant differences between session frequency and the percentage of motor competencies "frequently developed" ( $F_{(4,53)} = 3.23$ ,  $p = 0.019$ ). Specifically, S&C coaches delivering sessions "3 x per week" could develop a significantly greater percentage of motor competencies compared to those delivering sessions "weekly" (mean difference = 16.47%,  $p = 0.006$ ;  $d = 1.05 \pm 0.77$ ) or "2 x per week" (mean difference = 14.80%,  $p = 0.008$ ;  $d = 1.03 \pm 0.70$ ). Similarly, participants delivering sessions "4 x per week" could significantly develop more motor competencies than coaches delivering sessions "weekly" (mean difference = 17.73%;  $p = 0.002$ ;  $d = 1.00 \pm 0.68$ ) and twice weekly (mean difference = 16.06%;  $p = 0.002$ ;  $d = 0.93 \pm 0.59$ ). There were no significant differences

between delivering sessions weekly or twice per week, no significant differences between delivering three or four sessions per week, and no differences between delivering sessions "> 4 x per week" and all session frequencies. Average session duration had no effect on the percentage of motor competencies that S&C coaches "frequently developed" ( $F_{(4,53)} = 2.31$ ,  $p = 0.70$ ).

### ***Discussion***

The development of motor competency is important for health and performance (Lloyd et al., 2016) but limited research has evaluated the perceptions and practices of practitioners responsible for developing motor competency in youths. Therefore, this study aimed to evaluate and compare the perceptions and practices of youth S&C coaches. Findings

indicated that S&C coaches valued the importance of, and frequently developed, a broad range of motor competencies with their youths. However, differences were apparent between S&C coaches' perceptions and practices, with participants rating greater importance to linear speed and agility competencies (e.g., reacceleration, turning), whilst targeting more resistance training competencies (e.g., upper body pushing and pulling) in their coaching practices. Further, coaches who delivered 3 or 4 sessions per week targeted between 15–18% more motor competencies, compared to coaches who delivered 2 or less sessions per week.

Strength and conditioning coaches perceived it important to develop a broad range of motor competencies relating to speed (e.g., "acceleration"), resistance training (e.g., "hip hinge [bilateral]"), agility (e.g., "turning") and plyometrics (e.g., "jumping [vertical]") activities. However, common FMS (e.g., "galloping", "2-handed striking", "cartwheel") and foundational movement skills (e.g., "cycling", "swimming") were reported as the least important motor competencies to develop. Reporting lower importance to traditional FMS or foundational competencies may have implications for a youth's motor competency as they develop. For example, previous studies have identified that 51% of adolescent rugby union players lack proficient sprint mechanics (Parsonage et al., 2014), and young male cricketers lack squatting proficiency across all stages of maturity (Dobbs et al., 2020). Therefore, considering the findings of the present study, it is plausible that S&C coaches are overlooking the importance of developing FMS and foundational competencies, which could lead to reduced motor proficiency at latter stages of development.

Although S&C coaches may be overlooking FMS and foundational motor competencies, likely explanations exist. Firstly, it is unclear what coaches learn throughout their formal education (e.g., university) relating to motor competency development, because the curriculum contents of institutions are rarely published. Furthermore, it appears that national S&C accreditation curriculums focus on resistance training principles over motor competence development (e.g., National Strength and Conditioning Association, 2020; United Kingdom Strength and Conditioning Association, n.d.). If university curricula align with national accreditation curricula, it may be plausible that S&C coaches develop and express knowledge/skills related to resistance training over motor competency development in youths. If so, this may partially explain why coaches value the importance of resistance training competencies over FMS and foundational competencies. Second, perceived importance could be related to other coaches' practices within a multi-disciplinary team. For example, research involving a sports-based multi-disciplinary team suggests that operational monitoring (i.e., monitoring day to day processes), and reflections of observations could influence decision-making related to injury prevention (Tee & Rongen, 2020). Specifically, these observations may change the focus of subsequent training sessions. In the context of developing motor competency, it's plausible that if S&C coaches observe another coach frequently focusing on certain competencies (e.g., agility) within their sessions, the S&C coach may spend less time developing those competencies, thus identifying them as less important.

When ranking motor competencies in order from most to least important, the top five competencies were: "deceleration", "acceleration", "sprinting", "hip hinge (bilateral)" and "landing (bilateral)". This suggests coaches may value the importance of enhancing sports performance (Rumpf et al., 2012) and injury risk reduction (Rössler et al., 2014; Steib et al., 2017) within their programmes as these competencies align to existing research. However, when comparing perceptions to practices, the most important competencies (except "hip hinge [bilateral]") ranked lower (ranked difference: "deceleration", ↓ 20; "acceleration", ↓ 11, "sprinting", ↓ 13; "landing [bilateral]", ↓ 9) than some more recognised resistance training (e.g., frequency rank: "squat [bilateral]" = 2; "upper body vertical pulling [unilateral/bilateral]" = 4; "upper body horizontal pushing [unilateral/bilateral]" = 6) and plyometric competencies (e.g., frequency rank: "jumping [vertical]" = 5; "jumping [horizontal]" = 7). This indicates that coaches focused more on developing traditional resistance training competencies (especially within the upper body), that may not be as important as initially perceived, to prepare youth for the demands of sport (Lloyd et al., 2016). These findings therefore represent a potential disconnect between S&C coaches' perceptions and practices when developing motor competency in youths, which signifies that coaches don't target what they perceive is important. Such findings may be indicative of complex decision-making processes in S&C, which are influenced by various contextual factors including an organization's values, other individuals (e.g., players, other coaches, club officials, support staff, and parents), accepted practices and traditions, physical constraints (e.g., facilities), and resources (Till et al., 2019). For example, respondents in this study may target more resistance training competencies as their sessions (depending on facilities and resources) are more gym based. Nevertheless, a deeper understanding is required to fully understand why S&C coaches report a disconnect between perceptions and practices. Coaches should reflect on their practices to ensure these are appropriate for their athlete's/individual's needs.

The most commonly reported session frequency and duration was 2 sessions per week, lasting 46–59 minutes. Results showed that session frequency, but not duration, influenced the percentage of competencies "frequently developed" by S&C coaches. Respondents delivering 3 or 4 sessions per week "frequently developed" 15–18% more competencies than those who delivered sessions twice weekly or less. These findings could be explained by coaching efficacy theory, which suggests a coaches' perceived ability could influence their behaviours (Bandura, 1977; Bandura, 1986; Feltz et al., 1999). For example, respondents in the present study stated they frequently developed "hip hinge (bilateral)" (mean response =  $4.45 \pm 0.58$ ), "squat (bilateral)" (mean response =  $4.39 \pm 0.62$ ) and "jumping (vertical)" (mean response =  $4.30 \pm 0.68$ ) competencies, over "sprinting" (mean response =  $4.18 \pm 0.92$ ). Although (in adults) specific sprinting methods are the ideal method to enhance sprint performance (Rumpf et al., 2016), combined plyometric and resistance training interventions can improve speed in adolescent males ( $ES = -1.33 \pm 0.47$ ; percentage change =  $-5.79 \pm 2.54\%$ ) (Rumpf et al., 2012). Consequently, coaches delivering fewer sessions may focus on competencies which they are more confident at coaching (e.g., resistance



training and plyometric competencies), regardless of what constitutes “ideal practice”. Furthermore, coaches with a greater session frequency may have more flexibility enabling them to experiment, build confidence, and expand the repertoire of motor competencies which they frequently develop. Therefore, S&C coaches should seek other opportunities outside of scheduled sessions, to target a broader range of motor competencies.

To maximise opportunities to develop a broader range of motor competencies within sessions, S&C coaches may focus on various transferable competencies rather than individual skills. Here, the AMSC approach could be appropriate as most athletic tasks typically involve numerous AMSC combinations (e.g., rapid change of direction efforts during tennis requires lower limb force production/load attenuation, along with core bracing/antirotation). Developing strength and coordination is essential for motor competency because all forms of movement require some degree of force production and absorption (Lloyd et al., 2019; Radnor et al., 2020). Therefore, coaches should develop quality and function within each AMSC, using varying levels of session structure depending on the coaching environment and maturity stage of youths (Radnor et al., 2020).

Outside of S&C sessions, the concept of “microdosing” could maximise the number of competencies developed across long-term athletic development. Microdosing, involves frequently performing exercises at a low volume, but high frequency (Read et al., 2020). In relation to motor competency, microdosing could occur as frequently as a coaches programme allows, providing stimulus to various competencies that are important, but less frequently developed (Read et al., 2020). However, during the circumpubertal period of adolescence, some youths may be susceptible to adolescent awkwardness (i.e., a temporary reduction in sensorimotor function; (Quatman-Yates et al., 2012)). Therefore S&C coaches should longitudinally track motor competence, using technique and outcome based assessments (Hulsteen, Barnett et al., 2020; Hulsteen, True et al., 2020), and regularly review their interventions to facilitate the individualised development of important but un-targeted competencies (Lloyd et al., 2016). To facilitate microdosing of less targeted competencies, coaches could utilise the RAMPAGE (i.e., raise, activate, mobilise, prepare, activity, games, evaluate) coaching session framework (Till et al., 2020). Specifically, the “RAMP” element represents a structured warm-up, where coaches could target various locomotive, object control, strength, stability, mobility, plyometric and speed competencies (Till et al., 2020). Within sessions, coaches can then use the “activity”, “games” and “evaluate” sections to frequently target AMSC and sport specific skills, whilst continually reflecting on practices (Till et al., 2020).

Although this is the first study to examine the perceptions and practices of S&C coaches responsible for developing motor competency in youths, it is not without limitations. Firstly, it is not possible to fully explain participants responses to each motor competency. Other studies examining the perceptions and practices of professional golfers (Wells & Langdown, 2020) and elite Rugby Union S&C coaches (Jones et al., 2017) included deeper qualitative processes, and therefore added clarity to

their findings. Thus, utilising qualitative methods (e.g., more open ended questions or focus groups) in the present study could have provided additional context to explain quantitative scores (Robertson et al., 2017). Nevertheless, this study provides coaches with practical recommendations to increase the repertoire of motor competencies which are developed within their long-term athletic development programmes. Secondly, this study investigated S&C coaches perceived importance and coaching practices related to the youths that they coach. This approach therefore does not consider how S&C coaches’ perceptions and practices may change depending on the different stages of biological maturity. This is an important consideration as coaching practices should differ depending on biological and psychosocial maturity (Lloyd & Oliver, 2012; Lloyd et al., 2015b). Yet, this study provides a comprehensive examination of how S&C coaches perceptions differ to coaching practices, which has implications for future coach development. Thirdly, it is clear that a very low number of female S&C coaches were involved in this study, and may represent a gender gap within the industry. Indeed, this limits the ability to compare perceptions and practices between male and female S&C coaches, which could provide intriguing findings. However, this is an interesting future research direction in a relatively new and novel research topic.

## Conclusion

This study evaluates and compares the perceptions and practices of S&C coaches responsible for developing motor competency in youths. Coaches perceive it important to develop a broad range of competencies (e.g., speed, resistance training, agility, plyometrics) which is replicated in their coaching practice delivery. Findings reflect a preference towards developing resistance training competencies (e.g., ranked mean scores for developing upper body motor competencies were 18–30 places higher than perceived importance), to prepare youths for sport and more intensive S&C programmes at following stages in their training careers. This suggests coaches should reflect on their practices to ensure they are delivering competencies related to their athletes/individual’s needs. Session frequency but not session duration significantly influenced the number of motor competencies developed by coaches, with those who delivered 3–4 sessions per week developing 15%–18% more competencies than those who delivered sessions twice weekly or less. This suggests that coaches with less contact time should seek additional opportunities (outside of scheduled sessions) to target motor competencies which receive less focus. Other practitioners responsible for developing motor competency in youths can use the extensive list of movements provided to evaluate their own coaching strategies. Additionally, coaches and researchers can design motor competency interventions considering the large range of competencies presented. Future research should evaluate how youth S&C coaches’ perceptions and practices change depending on maturity status, and should involve deeper qualitative approaches to provide greater context to this important area for enhancing performance and health in youths.

## Practical applications

There are several practical applications related to the results of this study. Firstly, findings suggest that S&C coaches should reflect on their coaching practices, to ensure that targeted competencies reflect their athletes/individual's needs. This should involve evaluating important competencies relating to their youths' stage of development, comparing these competencies to those frequently developed, and identifying how to develop competencies that require more focus within their programmes. Additionally, S&C coaches with reduced session frequency should seek other opportunities to develop more motor competencies in their programmes. Here, a two-fold approach could be used by 1] utilising the AMSC approach to develop motor competency within S&C sessions (Radnor et al., 2020), and 2] micro-dosing other important competencies outside of S&C sessions as part of a motor competency focused warmup (e.g., RAMPAGE; Till et al., 2020).

## Acknowledgments

The authors would like to thank all the participants involved throughout this study.

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