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The art of the question: the structure of questions posed by youth soccer coaches during training

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Running head: STRUCTURE OF QUESTIONING IN FOOTBALL

**The Art of the Question: The structure of questions posed by youth soccer coaches
during training**

Keywords: Coaching; Coaching Pedagogy; Learning; Football; Questioning

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1 order thinking. In contrast, divergent questions are generally related to a game tactic or principle
2 and are asked when the team has stopped an activity. The rule models indicated there is a general
3 trend when considering the structure and profile of the type of question (i.e., convergent;
4 divergent) asked in the different training session activity types. During drills and small-sided
5 games, coaches asked convergent questions to the team, which were instructional in nature and
6 required lower level knowledge. For large games, the question was more targeted to the individual
7 while the activity was on-going, but still required lower level knowledge. Divergent questions
8 generally related to game tactics although only 7% of these questions asked players to problem
9 solve.

10 *Conclusion:* The results of the current study indicate that coaches are posing more questions
11 within a coaching session, compared to previous studies, possibly reflecting the emphasis placed
12 on questioning as an athlete learning strategy within the FFA National Curriculum. Association
13 rule models provided greater insights into the distinct ‘styles’ or profiles typically implemented by
14 coaches during specific types of activity. From a learning perspective, coaches should consider the
15 players needs and wants when determining which type of question best suits the situation and be
16 prepared to move between types of questions depending on player responses. Future research
17 should consider the perspectives of coaches and athletes to determine why questions were asked,
18 and how effective they were in reaching their intended purposes.

19

20 **Keywords:** Coaching; Coaching Pedagogy; Learning; Football; Questioning

21

1 Summary for practitioners

2 This study explored the structure and profile of questions used by 19 youth soccer coaches
3 (U12-U16 years teams) within the coaching environment to promote athlete learning. Analysis
4 found coaches asked on average 71 questions per session (0.88 questions per minute), with slightly
5 more closed questions (52%) than open questions (48%). When using closed questions during
6 drills and small-sided games, coaches asked lower order instruction questions to the team. When
7 posing an open question during small and large games, the coach generally asks the players to stop
8 where they are (freeze) and directs a tactical question to an individual player or the group. Open
9 questions were evenly split between lower order and higher order questions although only 2-3 of
10 these questions required players to problem solve. Coaches should consider players capabilities
11 when determining which type of question best suits the situation and be prepared to move between
12 cognitive levels depending on player responses.

1 approach to guide coaches on how to create learning environments to promote technical and
2 tactical athlete development. The National Curriculum (Football Federation Australia, 2013),
3 provides a philosophy on how the game should be played and guides youth coaches to structure
4 training sessions through a holistic approach to development, rather than trying to develop
5 individual components in isolation. To achieve this, the National Curriculum recommends that
6 coaches should create purposeful practice sessions, using the constraints-led approach and
7 manipulating task and environmental constraints provides opportunities for players to adapt to
8 various situations and explore solutions to problems within activities that are representative of
9 the sport context (Renshaw & Chow 2019). For example, activities are designed so players are
10 always perceiving-deciding-executing (one instructional skill-based activity followed by 2-3
11 game-based activities), coupled with quality feedback and questioning techniques. A key
12 element highlighted by the curriculum is for coaches to “Ask smart questions to develop player
13 understanding and enhance learning” (FFA curriculum, 2013; page 192). While this is a key
14 suggestion for coaches to employ, there is limited understanding about how coaches use
15 questioning techniques within a coaching session, and the type and structure of questions they
16 pose to athletes.

17 From a learning perspective, pedagogical researchers have found that questioning is an
18 effective instructional tool and pedagogical strategy to enhance learning outcomes in education
19 (Engin 2013; Walsh and Sattes 2016); medicine, (Adams 2015); and sport (Harvey and Light
20 2015; Kidman et al. 2001). Questioning techniques are critical for focusing attention to key
21 concepts, clarifying understanding (Engin 2013; Hill 2016; Tofade, Elsner, and Haines 2013),
22 memory recall (Caram and Davis 2005), stimulating high levels of thinking (Metzler 2000),
23 developing critical thinking (Shim and Walczak 2012), and problem-solving and decision-
24 making skills (Grehaigne et al. 2001; O’Connor, Wardak, Goodyear, Larkin, and Williams
25 2018). When players retrieve knowledge from their memory to answer a question this

1 reinforces the relevant cues and improves long-term retention of that information (Binks 2018;
2 Dirx, Kester, and Kirschner 2014). Therefore, coaches are encouraged to use questions,
3 prompts, and feedback to contextualise the athletes' learning by encouraging and guiding them
4 to identify and explore solutions to game-based problems), rather than merely telling them what
5 to do (O'Connor et al. 2020; Pill 2015, 2016).

6 While questioning is a key strategy for learning, coaches need to take into account the
7 capabilities of the athlete and the coaching situation, to ensure they are matching questions to
8 the athlete's needs (Long, Blankenburg, and Butani 2015). In the literature, questions are
9 commonly classified as either convergent or divergent. Convergent questions are closed in
10 nature, and offer few response options. They assume a single answer, or a narrow range of
11 'best' answers (Tofade et al. 2013). In contrast, divergent questions are more open in nature,
12 encouraging exploration of diverse perspectives, with multiple response, promoting deeper
13 thinking (O'Connor, Larkin, and Williams 2018; Partington and Cushion 2013; Partington et
14 al. 2014; Tofade et al. 2013). A further classification for questions can be based on the level of
15 cognitive processing required to answer the question. Questions which require lower levels of
16 cognitive processing, such as recall and comprehension, are classified as lower-order questions.
17 In contrast, questions which involve analysis, synthesis and evaluation to generate new
18 knowledge are classified as higher-order questions (Bloom, 1956; Metzler, 2000). While some
19 researchers highlight the benefit associated with asking higher order questions to promote
20 quality educational outcomes (Metzler, 2000; Chambers and Vickers 2006; Harvey, Cushion,
21 and Massa Gonzalez 2010; McNeill et al. 2008; Praxedes et al. 2016), it should be noted that
22 lower order questions also serve an important educational function to monitor understanding
23 and to establish and situate a common understanding for new information or problems (Myhill
24 and Dunkin, 2005). For example, recall questions can be used by coaches to focus athlete's
25 attention on actions or concepts which have previously been explored/learnt (Pearson and

1 Webb, 2008). Therefore, one effective questioning strategy is to start with convergent lower-
2 order questions and progress to divergent higher-order questions, by building from the recall
3 of facts to higher levels of thinking and problem solving (Caram and Davis, 2005; Engin, 2013).
4 Progressing from simple questions to more difficult ones that require reasoning helps students
5 develop cognitive abilities and critical thinking skills, through the formulation of, and
6 reflection on, ideas that are needed for personal sense-making, which players can then test
7 within the game-play environment (Cope et al. 2016; Light et al. 2014).

8 To understand how coaches use questioning within their sessions, researchers have
9 conducted observational studies of the coaching environment. Results have shown that during
10 a session coaches ask few questions to their athletes (between 2.29% and 7.83% of the session;
11 Potrac, Jones, and Armour 2002; Potrac, Jones, and Cushion 2007; Partington and Cushion
12 2013; Partington, Cushion, and Harvey 2014). In addition to this relatively low frequency of
13 questioning, it has also been found that coaches generally ask more convergent than divergent
14 questions. Cope and colleagues (2016) built on prior observational research by exploring
15 coaches' questioning practice and the discursive nature of questioning approaches. They
16 conducted conversational analysis of five youth soccer academy coaches' training sessions.
17 They found three underlying problematic themes: coaches wanting an immediate response
18 from players, the use of leading questions to elicit a desired response, and the monological
19 nature of coach/athlete interactions. The findings show coaches positioning themselves as
20 gatekeepers of knowledge, with athletes cast as passive learners. O'Connor, Larkin and
21 Williams (2017) found coaches asked more questions in their sessions (compared to earlier
22 studies) and were aware of the need to use questions aimed at developing athlete decision-
23 making skills.

24 Previous investigations have explored the use of questions within a coaching session in
25 relation to the type and frequency of questions asked (Cope et al. 2016; O'Connor et al. 2017;

1 Partington et al. 2014). While this provides some understanding of how coaches use questions
2 within a session, there is still limited exploration of the structure and context of questions asked
3 by coaches within the coaching environment. Determining the structure and taxonomy of coach
4 questioning strategies will provide insight in how they are used by coaches to potentially
5 promote athlete learning. Therefore, this study aims to extend the current knowledge of coach
6 questioning by exploring the structure and profile of questions used by youth soccer coaches,
7 who are guided by the FFA National Curriculum, during specific contexts/activities within the
8 coaching environment. This will provide a better understanding of the type of questions asked
9 during specific contexts/activities within the session and how they are used by coaches to
10 potentially promote athlete learning.

11 **Method**

12 **Participants**

13 Participants were selected for this study using a convenience-based sampling method,
14 whereby clubs competing in the New South Wales National Premier League Youth competition
15 (i.e., the highest level of youth participation) were contacted regarding participation. A total of
16 19 coaches who are currently coaching elite youth soccer teams (i.e., U12 – U16) and
17 implementing the FFA National Curriculum volunteered to participate in the study. Of the 19
18 participants, 10 were coaching teams within the Skill Acquisition Phase of the FFA National
19 Curriculum (i.e., U12 – U13), and nine participants were coaching within the Game Training
20 Phase (i.e., U14 – U16). All teams played in 11 v 11 competitive matches, apart from the five
21 Under 12 teams who play competitive 9 v 9 games. On average, coaches had been coaching
22 for 9.76 (SD = 5.67) years. All participants were qualified youth coaches, with one coach
23 holding a grassroots football certificate (i.e., Level 1), nine coaches had a Football Federation
24 Australia (FFA) / Asian Football Confederation (AFC) C license (i.e., Level 2), and nine had
25 an FFA/AFC B license (i.e., Level 3). Ethical approval was obtained from the lead institution's

1 research ethics committee with informed consent provided by the participants. In addition, the
2 parents and/or guardians of all the players within the teams provided informed consent prior to
3 data collection.

4 **Instruments**

5 **Questioning Profile System.** A questioning profile coding system was developed to
6 provide an understanding of how coaches use questioning in training sessions. The questioning
7 profiling system was an extension to the Coach Analysis Intervention System (CAIS) (Cushion
8 et al. 2012; Partington and Cushion 2013) used to measure coach behaviour. The questioning
9 profile coding system was used to provide a detailed profile of the questions asked by the
10 coaches during the coaching session. As indicated in Table 1, the coding system outlined the
11 type of questions (i.e., convergent; divergent) and the context in which they were asked (i.e.,
12 freeze in position; player huddle; activity ongoing). Further, information relating to who the
13 question was asked to (i.e., individual or team); what the question was about (i.e., instructional;
14 tactics/principles; technique; problem solving; general) and whether the question required
15 higher or lower order knowledge was also coded. To establish the content validity of the
16 questioning profile system, definitions and content were examined by leading learning
17 scientists and participants in two international coaching workshops. The questioning profile
18 coding system measured the frequency and structure of questioning used by coaches.

19 <<<INSERT TABLE 1 HERE>>>

20 **Procedures**

21 Participants were filmed on two separate occasions at their regular ground using a digital
22 video camera (Sony HDR PJ540E, Japan) in an elevated position to the side of the coaching
23 area. Participants were instructed to conduct a regular training session, with the research team
24 providing no additional information in relation to effective coaching/questioning strategies or
25 the specific aims of the project. During the sessions, participants wore a lapel microphone and

1 hip mounted radio transmitter (Sennheiser EW112P, Germany), which transmitted the audio
2 signal to a radio receiver connected to the camera (Sony HDR PJ540E, Japan). This process
3 ensured both voice and video data were captured simultaneously. Due to logistical reasons,
4 three participants were only filmed on the one occasion (Skill Acquisition, $n = 1$; Game
5 Training, $n = 2$), resulting in a total of 35 recorded sessions, with an average duration of 81.0
6 (SD = 11.9) minutes per session. In total, over 47 hours (47:15:51; Hr:min:sec) of coaching
7 footage was coded for analysis purposes.

8 Following the coaching sessions, the video footage was analysed using Dartfish 7
9 (Dartfish, France). The questioning profile coding system was used to provide a detailed profile
10 of the questions asked by the coaches during the coaching session. The frequency of each coded
11 event (i.e., type; context; who; what; knowledge; and activity) was recorded. One independent
12 and trained coder coded each session; with an intra-coder agreement of 96%, indicating a high
13 level of agreement (Nunnally 1978).

14 **Practice Activity.** To assess the structure of the questions used in different coaching
15 session activities, the soccer practice activity coding system developed by O'Connor, Larkin
16 and Williams (2017) was employed. Therefore, the analysis considered the structure of
17 questions within five soccer-specific activities: session introduction; individual activity; drills;
18 small sided games (i.e., 2 v 2 to 4 v 4); and large games (i.e., 5 v 5 or greater) (see Table 1).

19 **Data analysis**

20 Data were coded and quantified for each questioning profile descriptor. Descriptive
21 statistics (mean \pm standard error) were used to describe all coded information. A significant
22 alpha was set at 0.05, with effect size denoted as small ($r = 0.1 - 0.29$), medium ($r = 0.3 - 0.49$)
23 or large ($r = 0.5 - 1$) (Cohen 1992).

24 Association rule models were generated to determine the extent to which one
25 questioning profile descriptor (i.e., Question Type, Knowledge, Context, Who, What) occurred

1 in the presence of another. Association rules are algorithms which can identify underlying and
2 frequent non-linear patterns in a large dataset. The ‘*Arules*’ package was used to apply the
3 *Apriori* algorithm (Hahsler et al., 2019) to measure the levels of association between the five
4 types of questioning profile descriptor. Six separate models were constructed; one for each
5 session type (i.e., session introduction; individual activity; drill, small-sided game, large-sided
6 game) and one including All. For each model, a minimum support of 10% (i.e., any rules that
7 constituted less than 10% of total occurrences were not analysed) and confidence of 90% were
8 required in order for a rule to be constructed. All analyses were undertaken in the R computing
9 environment (version 3.6.1, Vienna, Austria).

10 **Results**

11 In total, 2495 questions were coded for the analysis. The descriptive statistics (i.e., mean;
12 standard deviation; minimum; maximum) from the questioning profile coding system are
13 presented in Table 2. In addition, the percentage of each coded descriptor is provided - relative
14 to the total number of questions asked per session. Descriptive statistics for the profile of
15 specific questions (i.e., divergent and convergent) are presented in Table 3. Table 4 shows the
16 distribution of time across different types of activities. It shows that the largest proportion of
17 coaching time was allocated to larger and small sided games.

18 <<<INSERT TABLE 2 HERE>>>

19 <<<INSERT TABLE 3 HERE>>>

20 <<<INSERT TABLE 4 HERE>>>

21 Results from each of the six rule models are reported below. For each model, two rules
22 are presented. These rules (a) meet each of the selection criteria reported for each model and
23 (b) have practical relevance from a coaching perspective. In combination, they illustrate the
24 utility of the analysis with respect to the aims of the study. To provide further context relating
25 to the rules, examples from the data are also presented.

1 Overall Session

2 A total of 2495 questions were asked during the whole session model. Among the most notable
 3 patterns was one captured by 'Rule 8', which consisted of: Type of
 4 Question=**Convergent/Closed Question** Context=Freeze Who=Team What=instructional 253
 5 ==> Knowledge=Lower Order 253 <confidence:(1)>. This rule indicates, with 100%
 6 confidence, for the 253 occasions when a convergent question is posed, that it is instructional,
 7 to the team, during a freeze and only requires lower order knowledge.

8 Rule 25. Context=Freeze What=Tactics/Principle Knowledge=Higher Order 392 ==> Type of
 9 Question=**Divergent/Open Questions** 380 <confidence:(0.97)>. This rule indicates, with 97%
 10 confidence, for 392 occasions when the coach asks the players to freeze, and asks a
 11 tactics/principle and higher order question, most of these are divergent questions (380
 12 instances).

13 Session Introduction

14 A total of 109 questions were asked in the session introduction model. Among the most notable
 15 was 'Rule 11' which consisted of: Type of Question=**Convergent/Closed Question**
 16 Who=Team Knowledge=Lower Order 39 ==> Context=Player Huddle 39 <confidence:(1)>.
 17 This rule indicates, with 100% confidence, for the 39 occasions when a lower order convergent
 18 question is posed to the team, it occurs in a player huddle.

19 At the start of the session, for the coach to determine the physical condition of the players (as
 20 this may influence the structure of the session), coaches would bring the players into a huddle,
 21 and ask convergent questions to the team related to the previous day's session or game (external
 22 to the coaches session; school game), for example, "How did you all go yesterday? Any
 23 injuries?" (Coach 7).

24 Rule 37. Type of Question=**Divergent/Open Questions** Who=Team What=Tactics/Principle
 25 23 ==> Context=Player Huddle 23 <confidence:(1)>. The rule indicates, with 100%

1 confidence, for the 23 occasions when the coach asks a divergent question to the team related
2 to tactics/principles, it occurs in a player huddle.

3 At the start of a session the coach would introduce the session aim and then clarify what the
4 players knew in relation to this aim, for example with the players in a huddle the coach would
5 ask a question such as “what do we know about running with the ball and protecting it?” (Coach
6 11) or “why do we want to have good first touch into space?” (Coach 19).

7 **Individual Activity**

8 A total of 57 questions were asked in the Individual Model. Of the 30 rules output, Rule 6
9 consisted of Type of Question=**Convergent/Closed Question** Who=Team What=instructional
10 28 ==> Knowledge=Lower Order 28 <confidence:(1)>. This rule indicates, with 100%
11 confidence, for the 28 occasions when a convergent question is posed to the team and is
12 instructional, it involved lower order thinking.

13 During an individual activity, such as the session warm-up, coaches would provide instruction
14 questions to the players such as, “Can we slow down the jog coming back please - it is too fast”
15 (Coach 10).

16 Due to the small number of divergent open questions asked (n = 9), no rules met the 10%
17 minimum support and therefore no rules were created.

18 **Drill**

19 A total of 622 questions were asked in the Drill model. Among the most salient rules, ‘Rule 9’
20 consisted of: Type of Question=**Convergent/Closed Question** Context=Freeze Who=Team
21 What=instructional 103 ==> Knowledge=Lower Order 103 <confidence:(1)>. This rule
22 indicates, with 100% confidence, for the 103 occasions when a convergent question is posed
23 to the team during a freeze and is instructional, it involves lower order thinking.

1 During an activity, the coach stops the drill and checks what the players were doing wrong.
 2 Following another demonstration, the coach then makes sure the players understand the task
 3 properly – “Everybody understand what we are doing then?” (Coach 17).

4 Rule 24. Context=Freeze What=Tactics/Principle Knowledge=Higher Order 101 ==> Type of
 5 Question=**Divergent/Open Questions** 98 <confidence:(0.97)>. The rule indicates, with 97%
 6 confidence, for 101 occasions when the coach asks a question during a freeze about
 7 tactics/principles of a higher order, the majority of the time it was a divergent question (98
 8 instances).

9 During a drill, the coach stops the activity and gets the players to freeze in position. They then
 10 ask a question related to the tactical principle they were highlighting in the activity – “If you
 11 come in to receive, can you hit Player 1? Why were you sitting so far away and what happened
 12 as soon as you came out here?” (Coach 5).

13 **Small sided Games**

14 The small-sided game Model included 872 questions. One notable example of the 30 rules
 15 output was Rule 8. Type of Question=**Convergent/Closed Question** Context=Freeze
 16 Who=Team 117 ==> Knowledge=Lower Order 115 <confidence:(0.98)>. This rule indicates,
 17 with 98% confidence, for the 117 occasions when a convergent question is posed to the team
 18 during a freeze, the majority of times it involved lower order knowledge (115 instances).

19 After briefly observing a small sided game, coaches will generally stop the activity and get the
 20 players to freeze in position and then ask convergent questions to the group in relation to the
 21 focus of the activity, for instance, “Do you understand the shape with how you will defend?
 22 One goes, one stays?” – (Coach 12) and “now can you see all the passing lanes you’ve got?”
 23 (Coach 2).

24 Rule 24. Type of Question=**Divergent/Open Questions** Who=individual or group but others
 25 are waiting What=Tactics/Principle 139 ==> Context=Freeze 131 <confidence:(0.94)>. The

1 rule indicates, with 94% confidence, for 139 occasions when the coach asks a divergent
 2 question about tactics/principles, to a player or group and the other players are waiting, this
 3 generally occurs in a freeze (131 instances).

4 During a small sided game, coaches generally have the players freeze in position and then ask
 5 questions to an individual player while the group waits for the response. For instance, “When
 6 XX has the ball and the defenders are like that, where could you go to receive the ball?” (Coach
 7 14); or “XX after you made that pass you looked to see where the reds were – where were
 8 they?” [player responds]; “and where did you go?” [player responds]; and where is there no
 9 one? [player responds] (Coach 1).

10 **Large Games**

11 For the large games, 835 questions were considered in the rule model. Rule 6 - Type of
 12 Question=**Convergent/Closed Question** Who=Individual Player other keep going 114 ==>
 13 Knowledge=Lower Order 114 <confidence:(1)>. This rule indicates, with 100% confidence,
 14 for the 114 occasions when a convergent question is posed to an individual player while the
 15 other players keep playing, it involves lower order thinking.

16 During a large sided game, coaches generally asked questions on the go, for instance, they
 17 would enter the playing area and speak to a player off the ball and ask them a question, such
 18 as “XX was your first touch into space??” (Coach 9) or “Can we create opportunities to get one
 19 of our players into midfield in control possession??” – (coach 16).

20 Rule 29. Type of Question=**Divergent/Open Questions** Who=individual or group but others
 21 are waiting What=Tactics/Principle 143 ==> Context=Freeze 132 <confidence:(0.92)>. The
 22 rule indicates, with 92% confidence, for 143 occasions when the coach asks a divergent
 23 question about tactics/principles, to a player or group and the other players are waiting, this
 24 mainly occurs in a freeze (132 instances).

1 During a large sided game, coaches generally asked tactical/principle divergent questions to an
2 individual player within a freeze situation. For example, “It was a 3v1, what led you to decide
3 to dribble out of that situation?” (Coach 17) or “XXX how are you helping your teammates
4 there?”; “what could you have done better here?” and “XXX where do you need to be” (Coach
5 11).

6 **Discussion**

7 Researchers have explored questioning in a sports coaching context in relation to
8 frequency of questions and athlete-coach interactions (Cope et al. 2016; Ford et al. 2010;
9 O’Connor et al. 2017; Partington and Cushion 2013; Partington et al. 2014). However, little is
10 known about the structure and taxonomy of coach questioning strategies. The results of the
11 current study highlight how youth soccer coaches, implementing the FFA National Curriculum,
12 have used questioning techniques within specific coaching contexts/activities to potentially
13 promote athlete learning. From a descriptive perspective, coaches asked on average 71
14 questions per session (0.88 questions per minute), with slightly more use of convergent (i.e.,
15 closed) questions (52.2%) than divergent (i.e., open) questions (47.8%). From a structural
16 perspective, generally coaches use convergent (i.e., closed) questions that are instructional and
17 involve lower order thinking. In contrast, divergent (i.e., open) questions are generally related
18 to a game tactic or principle and are asked when the team has stopped an activity. Ideally,
19 coaches should move between types of questions based on the needs of their athletes and the
20 nature of the situation. For example, coaches may start with questions of recall and
21 understanding and get players to build on this knowledge by progressing to asking players to
22 interpret cues, analyse the situation, develop solutions/actions and then evaluate their previous
23 decisions and actions in determining what worked and what didn’t. If players struggle to find
24 answers, then coaches can rephrase the question, provide players more time to respond, or let
25 them work together to come up with solutions (Hill 2016; Long et al 2015).

1 In comparison to previously published findings (Harvey et al., 2010; Partington and
2 Cushion 2013; Partington et al. 2014), the descriptive results from the current study would
3 suggest coaches pose more questions to their athletes within a coaching session. This
4 potentially reflects the emphasis placed on questioning as an athlete learning strategy within
5 the FFA National Curriculum. In addition, the current results indicate coaches ask a higher
6 proportion of divergent questions during a session than previously reported (Harvey et al. 2010;
7 Partington and Cushion 2013; Partington et al. 2014). However, it should be noted the large
8 SD (34 ± 25) recorded indicates considerable variation between coaches in their use of this
9 questioning technique. This finding could be due to several factors, including the confidence
10 of the coach to ask divergent questions, coach understanding of their athletes' needs and
11 capabilities (Long et al. 2015; Caram and Davis, 2005), or the belief that divergent questions
12 develop decision-making skills (O'Connor et al. 2017; O'Connor et al. 2018). While this was
13 not specifically an aim of the current paper, further research should consider elaborating on
14 this by asking coaches to recall why they have posed a certain question, and at that specific
15 time in the session.

16 From a model perspective, rule-based solutions are particularly useful when multiple
17 features exist in large datasets, as analytical approaches like this are able to help identify
18 meaningful patterns in situations where researchers are overwhelmed by the data and unable to
19 recognise such patterns without such an aide. They do so not only by identifying complex
20 interactions between features, but also identifying the frequency of these interactions within a
21 data set. In this paper, they have the benefit of describing questioning behaviour/profiles of
22 coaches during certain sections of a training session in enhanced detail. This can lead to greater
23 insights into the efficacy of such approaches, or to help better define the distinct 'styles' or
24 profiles typically implemented by a coach or in a particular activity. As access to more data
25 types continues to grow in these environments, the benefit of these analytical approaches over

1 human observations will only become more pronounced. The rule models indicated some clear
2 patterns when considering the structure and profile of the type of question (i.e., convergent;
3 divergent) asked in the different training session activity types. For convergent questions, the
4 rule based analysis indicated that across individual, drills and small-sided games, coaches
5 asked questions to the team, which were instructional in nature and required lower level
6 knowledge. This may be an example of a naïve form of constructivism whereby coaches' use
7 instructional questions and believe they are effective (as they are questioning rather than telling
8 them what to do), however, they may actually be limiting the players knowledge, as they are
9 not able to construct new knowledge (Cope and Cushion, 2020; Cushion, 2013). As such, the
10 'power' of learning is still with the coach who is making the decisions and determining the
11 subsequent player actions (i.e., how the game may be played – 3 touches etc...).

12 For large games, the convergent question was more targeted to the individual while the
13 activity was on-going, but still required lower level knowledge. While lower order questioning
14 requires only lower levels of cognition and positions the athletes as responders, a coach may
15 use this type of questioning to assess athlete understanding (i.e., “which passing option is best
16 from here, forward or backwards?”), recall of key cues (i.e., “when you see the defence step
17 up, what should you do?”), comprehending the activity (i.e., “does everyone understand what
18 we are doing in the activity then?”), and direct the athlete's attention toward specific aspects
19 of the game environment and potential outcomes (Raab and Johnson 2007). Further, the
20 responses players provide to questions posed may assist the coach in deciding when and how
21 to progress the activity or session (Mitchell, Oslin and Griffin 2006).

22 With respect to divergent questioning there is a greater focus on higher order thinking,
23 through the formulation and reflection of ideas. It also stimulates critical thinking and problem
24 solving which players can then test within the game-play environment (Chambers and Vickers
25 2006; Cope et al. 2016; McNeill et al. 2008; Partington and Cushion 2013; Praxedes et al.

1 2016). The divergent questioning rule models for each type of activity indicate coaches
2 generally ask the question to the whole group, with the question having an emphasis on a key
3 game tactic or principle. The potential benefit associated with divergent questions is they
4 promote deeper level thinking: stimulating the athletes to go beneath the surface appearance of
5 the problem (Kracl 2012). However, it should be noted that while divergent questions should
6 provide more opportunities for higher order thinking, in the current study, approximately 50%
7 of the divergent questions asked by coaches only required lower order thinking - that is,
8 questions which assess an individual's ability to recall and understand a single fact about the
9 sport-specific problem. Further evidence of this was that only 7% of divergent questions asked
10 players to problem solve. This potentially reduces athletes' opportunities to evaluate a situation
11 and formulate their next decision or action. This finding supports education-based research
12 which indicates that, despite evidence to suggest the benefit to learning from the use of
13 divergent higher-order questions, this is not reflected in practice, with teachers predominantly
14 using lower-order, recall questions (Jiang 2014; Tan 2007). However, using limited problem-
15 solving questions may reflect the capability of the athletes, within the specific context, to
16 respond to such questions. Asking unrealistically challenging questions may lead athletes to
17 lose self-confidence and becoming disengaged from the task (Long et al. 2015). Therefore, as
18 researchers highlight the relationship between the complexity/type of question posed and the
19 level of athlete thinking required for depth of learning (Chambers and Vickers 2006; Cope et
20 al. 2016; McNeill et al. 2008; Praxedes et al. 2016), coaches should consider when it is
21 appropriate to use higher order problem solving divergent questions to promote athlete
22 development.

23 While the results may suggest coaches are attempting to ask more questions to their
24 athletes in comparison to previous studies (Potrac et al. 2002; Potrac et al. 2007; Partington
25 and Cushion 2013; Partington et al. 2014), more attention needs to be paid to who they are

1 posing the question to. The results suggest the coaches predominately pose divergent questions
2 to the whole group. However, whole group questioning has been shown to be less effective for
3 athlete understanding compared to inductive questioning scaffolded for an individual or small
4 group (Cope et al. 2016; McNeill et al. 2008). A potential issue with posing whole group
5 questions is some athletes will not answer a question while others may dominate the responses.
6 This may be influenced by the confidence of the athlete in their ability to articulate their
7 thoughts. Coaches could address this issue by giving everyone time to think of an answer before
8 asking one or more players to share their answers. Further, coaches need to be aware of whether
9 the question relates to the whole team or specific athletes. If they believe the question is
10 important for the whole group, then they need to ensure everyone is fully engaged (i.e. all
11 athletes can hear and potentially respond). However, if the question is only relevant for one or
12 several players, they could consider whether questioning on the run is more effective. Harvey
13 and Light (2015) recommend the ‘debate of ideas’ as a strategy coaches can employ to achieve
14 greater athlete engagement and discussion during several ‘tactical time-outs’. Based on
15 Grehaigne, Richard and Griffin’s (2005) framework of four generic tactical questions, the
16 coach pre-plans the questions for small groups of players to discuss while the coach moves
17 from group to group listening and adding probing questions if required. The scaffolded
18 questions encourage players to reflect, analyse and debate amongst themselves, providing a
19 better understanding of each other’s perspectives (Harvey and Light 2015; Hill, 2016).
20 Therefore, while coaches may be encouraged to use questioning within the learning
21 environment to promote student/athlete learning (Butler 2005; Cope et al. 2016; Football
22 Federation Australia, 2013) there is still limited empirical evidence to demonstrate their
23 practical effectiveness as an athlete teaching and learning strategy.

24 While researchers promote the benefits associated with effective questioning techniques
25 (Chambers and Vickers 2006; Cope et al. 2016; McNeill et al. 2008; Praxedes et al. 2016),

1 when exploring questioning techniques and performance, interventions tend to couple
2 questioning techniques with other pedagogical tools, such as instruction or feedback
3 behaviours (Chambers and Vickers 2006; Garcia-Gonzalez, et al. 2014). The lack of studies
4 which have focused on questioning as a learning strategy within interventions impacts the
5 ability to establish causal relationships between teacher questioning and student learning
6 outcomes. While we acknowledge it would be challenging for researchers to develop
7 interventions to isolate questions as a pedagogical technique (e.g. ‘test’ questions providing
8 retrieval practice; Binks 2018 Dirkx et al. 2014), researchers should consider taking an
9 ecological research approach by examining the combination of learning environment,
10 questioning strategies, and learner preparation that makes for success.

11 This is one of the first studies to explore the nature and structure of coach questioning
12 within real coaching environments. Findings are limited by some aspects of the study design
13 and further research is needed to pursue some of the following matters more deeply. First, while
14 the data provides an overview of the number of questions asked during certain activities, the
15 time engaged in each kind of activity was not equal and therefore direct comparisons between
16 the number and type of questions asked during each kind of activity is not straightforward.
17 Future studies exploring the structure of coaches’ questions may control for the time invested
18 in certain activities to provide clear comparisons between the structures of questions within
19 these different practice activities. Second, the data collected provide a descriptive account of
20 the type of question, when it was asked and to whom. However, the data do not allow
21 exploration of why the question was asked - the specific purpose for the question. Further, we
22 acknowledge the lack of player voice in the study, which may also limit the understanding of
23 the outcome of the intended question. Future studies should consider the perspectives of
24 coaches and athletes to determine why questions were asked, and how effective they were in
25 reaching their intended purposes. Finally, the data collected does not consider the effect of the

1 questioning on the athletes performance. While questioning has been proposed as an effective
2 pedagogical tool (Harvey and Light 2015; Kidman et al. 2001; O'Connor et al. 2018), the
3 current findings do not indicate how the question may have effected athlete performance of a
4 skill, either positively or negatively. Future studies may consider implementing an intervention
5 program which measures the impact of a certain questioning technique or style and the potential
6 benefits they may have on athlete performance.

7 **Conclusion**

8 In summary, our findings show that youth soccer coaches use an array of questioning
9 types to potentially promote athlete learning. In comparison to previous research, coaches pose
10 more questions (Harvey et al., 2010; Partington and Cushion 2013; Partington et al. 2014), of
11 which a higher proportion are divergent questions (with these evenly split between lower order
12 and higher order questions), which possibly reflects the FFA National Curriculum's emphasis
13 on questioning as an athlete learning strategy. The rule models extends current knowledge by
14 revealing clear patterns when considering the structure and profile of questions, for example,
15 when divergent questions are asked during small-sided games and large games, the coach
16 generally asks the players to stop where they are (freeze) and directs a tactical question to an
17 individual player or the group. Convergent questions on the other hand, were predominantly
18 instructional, involving lower order thinking. While lower order questioning requires only
19 lower levels of cognition to assess athlete understanding, recall, comprehension, and direct
20 attention toward specific information, coaches should consider players capabilities when
21 determining which type of question best suits the situation and be prepared to move between
22 cognitive levels depending on player responses.

23 This research provides an understanding of current coach questioning practice, and by
24 knowing what we currently do we can modify practice to create better opportunities for athlete
25 learning. A key application for coaches is taking the time to specifically plan questions to

1 ensure they guide and promote particular athlete knowledge and behavioural actions (Pill,
2 2016). To achieve this coaches may consider scaffolding questions within the session to ensure
3 an appropriate sequence of questions addressing athlete learning needs while building towards
4 more complex understanding and applications (Pill, 2016). Overall, the findings from the study
5 provide an initial exploration of the type of questions asked by coaches within the coaching
6 environment, to provide insight in how they are used by to potentially promote athlete learning.
7 To develop further understanding, future research should consider coaches and athletes
8 perspectives to determine the purpose of questions asked and how effective they were in
9 reaching their intended purpose. Although the current study is unable to determine the explicit
10 impact of FFA's focus of questioning techniques to promote athlete learning, researchers may
11 now consider implementing intervention programs which examine how questioning techniques
12 impact athlete learning.

13

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- 1
2 Table 1.
3 *The category, sub-category, definitions, and associated examples of the questioning profile system.*

Category	Sub-Category	Definition
Type of Question	Convergent	Any question to player(s) that have a limited number of responses/options (i.e., yes/no; one word answers; closed questions). e.g., “Which is the best passing option from here, forward or back?” Which team has possession of the ball?”
	Divergent	Any question to player(s) that have a the potential for multiple responses/options (i.e., why questions; open ended questions) e.g., “What options do you have available for you in this situation?” “when do you think it might be a good option to close the player down?” what can you do to help the player in possession of the ball?”
Context	Freeze in Position	Coach stops the activity to talk to the players and the players remain in their current position during the activity. e.g., “stop and hold there...” “ok just stop in your position”
	Player Huddle	Coach stops the activity and gets the players to come together for a group discussion lead by either the coach or a player. e.g., “stop and bring it in...”
	Activity On-going	The coach has not stopped the activity, with the players still actively engaged in the activity e.g., players are actively participating in an activity
Who	Individual player; Others Continue Activity	A question is asked by the coach to an individual player while the rest of the team continue in the activity e.g., coach shadows a players during the activity and speaks to them while they are still playing the game

	Group; Others Continue Activity	A question is asked to more than one player, however the rest of the team continue to participate in the activity e.g., coach pulls a small group of players from the game and asks a question
	Individual or Group but Others are Waiting	A question is asked to one or more players, however the rest of the team are not actively participating in an activity and waiting for direction from the coach e.g., coach singles out one player to answer the question
	Team	A question is posed to the whole team e.g., coach asks a question to the team and anyone can respond
	Instructional	The question is about the specific activity the group are doing e.g., how many touches are we focussing on in this activity? ,
	Tactics/principles	The question is related to the tactics or principles of the game e.g., how can we slow the momentum of the game?
What	Technique	The question is related to the performance of a technical skill, such as a pass e.g., what determines the direction the ball will go?
	Problem-solving	The question relates players understanding what to do, when to do it and why e.g., How can you stop that player receiving the ball?
	General	A question not related to a sport-specific learning or performance e.g., "did anyone see John today?"; "did you watch the game last night?"
Knowledge	Higher order	Questions which require the player to comprehend the topic, situation or solution to a sport-specific problem

		e.g., how and when can we use this move in a game?
	Lower order	Questions which only assess players ability to recall a single fact about the sport-specific problem e.g., what went wrong then?
	Session Introduction	The introduction to the training session which is general and not related to a specific training session activity e.g., introducing the training sessions main content, discussing the previous game
	Individual	Activities during training whereby the player is working on skills by oneself. e.g., juggling, running a lap with the ball
	Drills	Activities during training whereby the player is performing predetermined actions or movements. There is a set sequence to the activity with minimal options available to the player. e.g., passing from cone to cone, dribbling around cones, sequence passing (i.e., players have to pass to a specific person next)
Activity	Small-Sided-Activities	Activities whereby players work in small teams of between 2 and 4 players in a game or activity situation. e.g., 4 v 3 end zone game, 2 v 2 possession activity
	Larger Activities	Activities during training where players work in teams of 5 or more players in a game or activity situation. e.g., 8 v 8 large size game, 5 v 7 offence v defence
	Transitions	Periods of time where the players are moving (or transitioning) between activities or inactivity periods e.g., players moving back into position following a player huddle or drink break

1 Table 2.

2 *Descriptive statistics of the coded questions asked during a youth soccer coaching session.*

Category	Sub-Category	Mean	SD	Minimum	Maximum	Percentage of Total Questions
Type	Convergent	37.20	12.04	15	62	52.18
	Divergent	34.09	25.41	1	98	47.82
Context	Huddle	13.94	9.03	0	38	19.55
	Activity Ongoing	18.66	12.21	1	43	26.17
	Freeze	38.69	19.25	2	99	54.27
Who	Team	36.91	15.70	9	74	51.78
	Individual or group but others are waiting	19.20	14.15	2	74	26.93
	Group - others keep going	4.57	7.13	0	32	6.41
	Individual - others keep going	10.60	8.23	1	35	14.87
What	Technique	4.26	5.18	0	28	5.97
	Instructional	20.94	9.84	5	45	29.38
	General Questions	4.60	3.73	0	13	6.45
	Tactics/principles	38.86	24.38	1	104	54.51
	Problem Solving	2.63	3.49	0	18	3.69
Knowledge	Lower order	53.89	17.81	17	88	75.59
	Higher order	17.40	13.36	0	50	24.41
Practice Activity	Session Introduction	3.11	4.45	0	16	4.37
	Individual	1.63	3.88	0	19	2.28
	Drills	17.77	16.86	0	79	24.93
	Small-Sided Games	24.91	22.81	0	85	34.95
	Large Games	23.86	20.44	0	67	33.47

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4 Table 3.

5 *The percentage of divergent (M = 34.09) and convergent (M = 37.20) questions relative to the specific coded sub-category.*

		Divergent Questions (Mean = 34.09)			Convergent Questions (Mean = 37.20)		
		Mean	SD	%	Mean	SD	%
Context	Huddle	6.40	6.34	18.79	7.54	4.40	20.26
	Activity Ongoing	5.11	7.24	15.02	13.54	8.95	36.38
	Freeze	22.54	17.50	66.19	16.14	7.71	43.36
Who	Team	16.71	13.21	49.07	20.20	8.73	54.26
	Individual or group but others are waiting	11.37	10.95	33.39	7.83	5.82	21.03
	Group - others keep going	2.66	4.55	7.80	1.91	3.30	5.14
	Individual - others keep going	3.31	5.66	9.74	7.29	4.66	19.57
What	Technique	1.69	2.42	4.95	2.57	3.55	6.91
	Instructional	1.57	2.39	4.62	19.37	9.54	52.03
	General Questions	0.46	0.95	1.34	4.14	3.46	11.13
	Tactics/principles	27.71	22.69	81.37	11.14	6.49	29.93
	Problem Solving	2.63	3.49	7.72	0.00	0.00	0.00
Knowledge	Lower order	17.17	13.82	50.42	36.71	12.00	98.62
	Higher order	16.89	13.22	49.58	0.51	0.95	1.38
Practice Activity	Session Introduction	1.37	2.13	4.04	1.74	2.80	4.68
	Individual	0.26	0.70	0.75	1.37	3.36	3.68
	Drills	7.46	9.80	21.89	10.31	10.15	27.71
	Small-Sided Games	13.60	17.22	39.93	11.31	8.34	30.39
	Large Games	11.37	12.99	33.39	12.49	9.95	33.54

6 Table 4.

7 *The average time (seconds) and percentage of the training session spent in each coded activity type.*

	Average Time (Seconds)		Percentage of Training Time	
	Mean	SD	Mean	SD
Individual Activity	304.91	310.59	6.32	6.92
Drills	711.37	535.88	14.59	11.37
SSG	865.00	617.92	18.44	14.09
Larger Games	1169.11	840.52	23.52	17.02
Transitions	306.09	197.19	6.15	3.80
Huddle	465.34	263.78	9.41	4.98
Freeze	799.00	413.40	16.53	8.13
Drink Break	252.14	128.45	5.04	2.47

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