

Further Muddying the Waters? A Comment on Bell et al's 2021 Definition of Youth Sport Specialization

Dear Editor:

The *Journal of Athletic Training* recently published an article by Bell et al,¹ who described a Delphi approach to develop a consensus-based definition of youth sport specialization. Here, we examine the utility of their proposal.

The central criterion of a scientific statement is empirical falsifiability.² Definitions of constructs must rest on defined terms and categories,³ and variables must be empirically measurable based on unambiguous operational definitions. Otherwise, statements may be “mere opinion”³ and a matter of faith rather than science.^{2,3}

OPERATIONAL DEFINITIONS

Bell et al¹ acknowledged that their proposal is preliminary and “under construction.” Nevertheless, we trust we can take their carefully chosen words literally, particularly given that they aimed to present a definition.

Their proposal comprises 4 components that consist of 21 elements, as outlined in the Table. Operational definitions are lacking for 20 elements. For example, exactly how does one determine whether or not (1) participation in a sport is “intentional”; (2) participation is “focused”; (3) practices are “organized”; (4) training is “structured”; (5) practice, training, and/or competitions are “regular”; (6) a potential restriction of opportunities and/or time for an activity has been causally evoked by one's main sport participation and not by any other factor (eg, lacking or diminishing interest, lack or expiring of activity programs, mutual restrictions of available opportunities and/or time among activities other than one's main sport); and (7) an athlete's motive to limit, end, or generally forgo other sports participation has been to enable focused single-sport participation and not any other motive (eg, lacking or diminishing interest, lack or expiring of programs for other sports, time demands of academics, other extracurricular activities, community engagement, family, or friends)? Furthermore, (8) relative to what baseline value across what time period does one determine the potential limitation of an activity?

Relatedly, the dichotomous nature of each element would require cutoff values. However, the relevant evidence needed to empirically substantiate cutoffs is not available. This is perhaps one of the reasons for the plethora of ad hoc definitions of *youth sport specialization* in the literature⁴ and for Bell et al's consent-based—rather than evidence-based—approach.

FORMAL LOGIC

The term “may” renders statements empirically meaningless.³ Meeting all or some of the elements in components 2.1–2.3 (Table) may or may not define an athlete as specialized.

Components and elements are connected by “AND,” “OR,” or “AND/OR” relationships. The formal logic of the AND relation between criteria 1d and 1e excludes cases in which either only other sports OR only other activities are restricted. The OR relationships among the elements in criterion 2.2 exclude cases in which athletes limited AND then ended other sport participation. The OR relationships among the elements in criterion 2.3 exclude cases in which both opportunities AND time for an activity are limited.

Bell et al's suggestion allows a wide range of participation patterns to be defined as specialized. The “AND,” “OR,” and “AND/OR” relationships of their 4 components and 21 elements define at least 4371 different combinations as specialization (meeting criterion 1 plus 0–9 elements in criterion 2, such that 2.1 can be fulfilled in 7 different ways, 2.2 in 3 ways, and 2.3 in 72 ways). The construction “such as” in criterion 2.3 implies further relevant activities, resulting in an even higher number of specialized combinations. Overall, the multiple relationships among the elements defy the Popperian imperative² that scientific statements should be formulated as simply as possible. This further impedes empirical testing of youth sport specialization.

SUMMARY OF CONCERNS

Bell et al's¹ proposal fails to meet the basic requirements of a scientific definition by (1) using several empirically meaningless criteria, (2) basing their definition on undefined key terms, (3) failing to operationally define variables, and (4) failing to provide cutoff values for dichotomized criteria. Taken together, under Bell et al's proposal, athletes can flexibly be categorized as specialized or nonspecialized, making specialization subject to opinion. In its present form, Bell et al's approach is therefore not suitable for guiding empirical research.

FUTURE DIRECTIONS

Bell et al,¹ along with other scholars,^{5–7} have suggested defining specialization as a dichotomous variable distinguishing *specialized* from nonspecialized participation patterns. However, this use is imprecise. One's participation pattern is generally defined by several continuous parametric variables, including starting age and amounts of

Table. Components and Elements of Bell et al's¹ Definition of "Youth Sport Specialization," Their Logical Structure, and Operationalization Status

Components, Elements, and Their Relations	Mandatory Status	Operational Definition
1. "Umbrella definition." ¹ <i>Necessary</i> conditions: <i>All</i> of ... (a) intentional [AND] (b) focused participation in a single sport [AND] (c) for a majority of the year [AND] that restricts opportunities for engagement (d) in other sports [AND] (e) other activities	1a–e must be met	1c: Yes All others: no
2. [AND] "Supporting elements." ¹ <i>Optional</i> conditions: <i>All, some, or none</i> of ... (2.1) >8 months/year single-sport participation that includes regular (a) organized practice, [AND/OR] (b) competitions, [AND/OR] (c) structured training (2.2) [AND/OR] to enable focused participation in a single sport, the athlete may have (a) limited, [OR] (b) ended, [OR] (c) generally foregone other-sports participation (2.3) [AND/OR] focused participation in a single sport limits opportunities [OR] time available for other activities such as limited available (a) opportunities [OR] (b) time for other sports; [AND/OR] (c) opportunities [OR] (d) time for academics; [AND/OR] (e) opportunities [OR] (f) time for extra-curricular activities; [AND/OR] (g) opportunities [OR] (h) time for time with friends; [AND/OR] (i) opportunities [OR] (j) time for community engagement; [AND/OR] (k) opportunities [OR] (l) time for further activities	Some or all of the elements of 2.1–2.3 may have to be met	All no All no All no

coach-led practice and peer-led play in both one's main sport and other sports through different ages.^{8,9} These continuous variables provide a more accurate description of athletes' participation patterns. At the same time, they enable us to determine in which aspects, and how closely, one's participation pattern corresponds to facets of a sport specialization construct. Researchers aim to describe, explain, and predict relationships between participation variables and outcomes, that is, the extent to which individual differences in participation variables predict individual differences in outcomes. Both participation variables and outcomes can be quantified.

Furthermore, participation patterns may yield short-term and long-term positive and negative outcomes, to different magnitudes and at different probabilities, including benefits (eg, performance, enjoyment, prestige, and financial income), costs (eg, opportunity costs, coaching, and facilities), and risks (eg, injury and burnout). Additionally, the values of outcomes may vary (eg, gold at the Olympic Games versus state championships or a contusion versus a bone fracture). Investigators should thus seek to explore 3 main questions for different participation patterns:

1. Which short-term and long-term positive and negative outcomes do the participation variables yield, to what magnitude, and at what probability?
2. What material and immaterial value does each positive and negative outcome have?
3. What is the eventual ratio of the summed value of all positive outcomes relative to the summed value of all negative outcomes accumulated throughout one's athletic career?

Such research is not possible when comparing only 2 dichotomized participation constructs, namely, specialization versus nonspecialization.¹ However, it is possible to quantify the different continuous participation and outcome variables and examine their relationships. This has been shown in multiple studies of performance outcomes^{9,10} and is presumably possible for health-related outcomes, too. To

empirically evaluate the relationships among participation and outcome variables, a specialization construct and the labeling of athletes as specialized or nonspecialized is neither necessary nor productive.

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REFERENCES

1. Bell DR, Snedden T, Biese K, et al. Consensus definition of sport specialization in youth athletes using a Delphi approach. *J Athl Train*. Published online March 31, 2021. doi: 10.4085/1062-6050-0725.20
2. Popper KR. *The Logic of Scientific Discovery*. Hutchinson & Co; 1959.
3. Aristotle: *The Organon*. Cambridge, MA: Harvard University Press; 1938.
4. Mosher A, Fraser-Thomas J, Baker J. What defines early specialization: a systematic review of literature. *Front Sports Act Living*. 2020;2(164):596229. doi:0.3389/fspor.2020.596229
5. Côté J, Baker J, Abernethy B. Practice and play in the development of sport expertise. In: Eklund R, Tenenbaum G, eds. *Handbook of Sport Psychology*. John Wiley & Sons; 2007:184–202.
6. Carder SL, Giusti NE, Vopat LM, et al. The concept of sport sampling versus sport specialization: preventing youth athlete injury. A systematic review and meta-analysis. *Am J Sports Med*. 2020;48(11):2850–2857. doi:10.1177/0363546519899380
7. Kliethermes SA, Marshall SW, LaBella CR, et al. Defining a research agenda for youth sport specialization in the USA: the AMSSM Youth Early Sport Specialization Summit. *Br J Sports Med*. 2021;55(3):135–143. doi:10.1136/bjsports-2020-102699

8. Barth M, Güllich A. Non-linear association of efficiency of practice of adult elite athletes with their youth multi-sport practice. *J Sports Sci.* 2020;39(8):915–925. doi:10.1080/02640414.2020.1851900
9. Güllich A, Macnamara BN, Hambrick DZ. What makes a champion? Early multidisciplinary practice, not early specialization, predicts world-class performance. *Perspect Psychol Sci.* Published online July 14, 2021. doi:10.1177/1745691620974772
10. Güllich A, Fass L, Gies C, Wald V. On the empirical substantiation of the definition of “deliberate practice” (Ericsson et al., 1993) and “deliberate play” (Côté et al, 2007) in youth athletes. *J Expertise.* 2020;3(1):1–19.