

1 Abstract

2 A Gap in the Education of Future Sport scientists?

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9 1. Introduction

10 Technological advances of the last
11 decades have seen a vast increase in data
12 availability in general but also in
13 particular in the domain of sport science.
14 Given the amount of data produced in
15 cycling and other endurance sports,
16 various models have been developed for
17 (among other aspects) predicting
18 performances based on historical data.

19 While the complexity of data analysis
20 tasks might not have changed (or even has
21 decreased), the possibilities have
22 drastically increased over the last years.
23 This is again also due to the increasing
24 amount of data collected. With the
25 emergence of low-cost, energy-efficient
26 GPS head units for cycling and the ability
27 to store and share data online, the amount
28 of data produced by athletes has
29 increased drastically. Recent years have
30 seen a big increase in available health-
31 /sports-related data due to (among other
32 factors) the introduction of 24/7
33 monitoring devices. Not only is managing
34 and making use of these datasets
35 challenging for non-technicians, but also
36 the increase in data availability raised the
37 complexity of some novel models (e.g.,
38 “deep learning”) thus also elevating
39 possibilities in analysis, which cannot be
40 assumed to be understandable.

41 While all this possibly equips sport
42 scientists, researchers, coaches, and also
43 athletes with many possibilities (e.g.,

44 monitoring, modeling, ...) the question to
45 be addressed is: are current and future
46 sport scientists prepared for this task?

47 2. “Data Science”?

48 In recent years “data science” has
49 become a “hot topic” and is perceived as
50 a field of research and study on its own
51 (De Veaux et al., 2017). Simply speaking,
52 data science examines and develops
53 methods for extracting information and
54 knowledge from data (Dhar, 2013).

55 As pointed out previously, the rising
56 amount of data not only increases the
57 possibilities for insights into performance
58 improvement, but also raises the bar with
59 respect to the required data science
60 competencies and skills required for
61 performing an analysis. Demands on
62 people designing such analytical tools rise
63 even further, when the analysis should be
64 automatically executable as soon as a new
65 or updated data set is available and
66 involve little or no effort by the data
67 provider (i.e., the person capturing data
68 during training). While commercial tools
69 and platforms such as TrainingPeaks,
70 WKO+, Today’s Plan, Strava, etc. have
71 addressed this issue and often allow
72 coaches and researchers to gain insights
73 into the performances of their athletes,
74 they are limited to a certain amount of
75 predefined metrics and analyses. They do
76 not offer the possibility to extended and
77 adapt analyses according to individual
78 needs or interests. Open-source software



79 such as Golden Cheetah, on the other
80 hand, can potentially be adapted in order
81 to fit individual needs with respect to
82 different types of available analysis
83 capabilities and their depth. However, the
84 skills required for extending the
85 functionality using built-in programming
86 interfaces or possibly extending the
87 functionality of the software by
88 modifying the source code often exceed
89 the technical skill levels that can be
90 expected from sport scientists.

91 Furthermore, especially when testing
92 novel sensors or models, existing software
93 often does not fit the requirements for
94 implementing the necessary testing
95 protocols. Consequently, ideas are either
96 not realised due to lack of possibilities or
97 are outsourced to software developers
98 who in turn (often) do not have the
99 required domain knowledge in sport
100 science. As a consequence, there is a high
101 chance of missing features or severe
102 analytical errors in the software due to the
103 missing domain knowledge.

104 In order to mitigate such problems,
105 (future) sport scientists should develop
106 skills and competencies in data science as
107 part of their professional training. A non-
108 exhaustive list of competencies relevant
109 for a rigorous data analysis could be along
110 the lines of the following topics:

- 111 • Understanding sensor
112 Technology
- 113 • (Mathematical) Modeling
- 114 • Visualisation of complex data
115 (more than just creating a
116 standard Excel chart)
- 117 • Data processing using a
118 programming language

119 This list promotes a broad
120 understanding of “data science”. For
121 example, “understanding sensor
122 technology” is usually not covered in
123 definitions of data science. However, a
124 thorough understanding of what can be
125 measured and how this process works is
126 required in order to be able to work with
127 data.

128 3. A Gap in Education?

129 While it is evident that sport
130 scientists need at least some degree of
131 education in topics related to “data
132 science”, there is a gap in the curricula for
133 sport sciences for them. A previous study
134 examined the curricula of sport science
135 universities in Austria revealing revealed
136 that only one university out of four
137 provided students with introductory
138 courses on these topics (Dobiasch & Oppl,
139 2020).

140 This finding might be generalisable
141 as also an examination of the
142 undergraduate programs of the Top 3
143 universities in the “2020 Global Ranking
144 of Sport Science Schools and
145 Departments” (University of
146 Copenhagen, Norwegian School of Sport
147 Sciences and Deakin University)
148 (*ShanghaiRanking’s Global Ranking of Sport
149 Science Schools and Departments*, 2021)
150 reveals similar results. While two
151 universities offer an introductory course
152 on statistics (being a relevant part of data
153 science), one of the examined curricula
154 does not even include such a basic course.
155 Furthermore, none of the examined
156 curricula included courses on modeling
157 or data processing, which would be
158 necessary to develop actionable
159 knowledge in data science (De Veaux et
160 al, 2017).

161 4. Closing the Gap?

162 At present, coaches and sport
163 scientists besides educating themselves
164 through self-study (e.g., using offers on the
165 internet) can also enroll into extra-
166 curricular offers of universities (e.g.
167 courses such as “Introduction to
168 Programming”). However, these choices
169 often have the downside of being too
170 detailed and targeted at other audiences
171 e.g. computer science students. Recently,
172 the possibility of targeted continuing
173 education courses has emerged. These
174 courses often offer “graduate certificates”
175 and follow a strict curriculum (Victoria
176 University, 2021).

177 Another potential solution are
178 projects aiming to promote and advance

179 programming education targeting broader
 180 (non-computer science) audiences that
 181 might prove valuable if integrated, for
 182 example, as extra-curricular activities into
 183 sport science curricula. One example of
 184 such a project is Codability (CodeAbility
 185 Austria, 2021) aiming to provide
 186 programming courses to broad audiences.
 187 Yet another solution might be a shift
 188 in existing curricula towards the
 189 integration of these topics into existing
 190 courses. For sport scientists, data science
 191 competences might be considered as
 192 transversal skills. For example, the
 193 ongoing ATSSSTEM project aims at the
 194 coherent development of transversal skills
 195 in an integrated STEM (science,
 196 technology, engineering and mathematics)
 197 curriculum. It provides educators with the
 198 formative digital assessment of transversal
 199 skills as learners develop real-world and
 200 authentic STEM competences (Costello et
 201 al., 2021). Similarly, the use of ICT tools can
 202 support integrating data science topics in
 203 sport science curricula.

204 5. Conclusions

205 The rising demands on sport
 206 scientists with respect to data analysis
 207 should also be reflected in their
 208 professional education and development.
 209 In order to not be left behind, the education
 210 of (future) sport scientist needs to improve
 211 with regard to data science and related
 212 topics. Additionally, the contents of
 213 continuing education programs should not
 214 remain on the level of learning to operate
 215 specific tools, but has to aim to develop an
 216 understanding for general concepts in data
 217 science, such as “computational thinking”.
 218 Only in this way, learners can be
 219 supported to develop transferable skills
 220 that can be adapted to the opportunities
 221 and challenges emerging with the

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222 continuing evolution of technical
 223 possibilities in data capturing and
 224 processing.

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