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**A review of behavioural measures and research methodology in sport and exercise
psychology**

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Abstract

The present study examined the development of methodologies and measures used in sport and exercise psychology (SEP) publications between 1979 and 2013. A systematic coding process was conducted on a total of 1377 manuscripts sampled from four long-standing SEP publications, namely *Journal of Applied Sports Psychology*, *Journal of Sport and Exercise Psychology*, *Psychology of Sport and Exercise*, and *The Sport Psychologist*. Analyses compared the type of behavioural or non-behavioural measures used, and the research design employed. Findings suggested that overall SEP has included more behavioural measures in comparison to other psychology domains, and there has been substantial sampling of sport and exercise behaviours using direct rather than indirect behavioural measures. The proportion of cross-sectional research designs were significantly higher than other research approaches employed in SEP (e.g., quasi-experimental, interventions, experimental, qualitative), and questionnaires have remained a dominant non-behavioural measure over time. Nevertheless, results indicated that SEP outlets publish a greater diversity of research methods and designs compared to general social and personality psychology, and have seen a gradual increase in qualitative, idiographic research approaches. Findings are discussed in line with SEP practice, and the potential implications for future works.

Key words: behaviour, measures, methods, research design, methodologies

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1 Research emanating from the domain of sport and exercise psychology has developed
2 substantially over several decades (Eklund, 2014) with an array of data collection methods
3 used in research, including behavioural observations, psychometrics, questionnaires,
4 psychophysiological measures, interviews, focus groups, and ethnography and action
5 research (Breakwell & Rose, 2006). Diversity in research methods is required for the
6 comprehensive examination of psychological theory and to improve scientific understanding
7 that informs applied practice. Varied research methods also facilitate the collection of diverse
8 data. Berkman and Lieberman (2011) described three main types of data within (social)
9 psychology, namely: self-report psychological or mental processes (e.g., paper and pencil
10 assessments of attitudes), indicators of neurological processes (e.g., task-related functional
11 activation) and behaviour (e.g., observation and measurement of actions). A recent
12 examination of the development of methodologies and measures in social psychology
13 research has revealed a shift towards investigations of mental processes and a decline in
14 behavioural measures (Patterson, 2008). Such observations indicate a trend toward studying
15 internal, typically self-report, processes at the expense of measuring an individual's actual
16 experiences of phenomena or behaviours (cf. Baumeister, Vohs & Funder, 2007) and
17 foreshadow limitations of the generalizability of psychological research (Dhimi, Hertwig &
18 Hoffrage, 2004).

19 Arguably, a central aim of psychology research is to emphasise the development of
20 understanding of or the control of behaviour, enabling psychologists to communicate theory
21 for the benefit of society, wherein science and society constitute a feedback loop (cf. Gergen,
22 1973). For instance, within the context of sport and exercise psychology (SEP), practitioners
23 are interested in how psychological constructs might affect behaviour in such settings, so that
24 interventions can be implemented to positively impact health, performance, and wellbeing.
25 Nevertheless, methodological trends in general social psychology suggest that the gap

26 between research and applied practice may be widening due to a decrease in the study of
27 behaviour (Dhami et al., 2004; Baumeister et al., 2007; Patterson, 2008). Moreover, it has
28 been argued that an overreliance on a small range of research methodologies and measures
29 may decrease convergent validity and confidence in the body of knowledge that surrounds a
30 given research topic - where this is pursued as part of the epistemological assumptions
31 aligned with positivist research designs (Biddle, 2000). In line with such views, the present
32 study seeks to explore the methodological and measurement developments in SEP journals
33 over the last four decades. First, we provide a consideration of the inclusion of behavioural
34 and non-behavioural measures in SEP research, before reviewing the types of methods
35 employed.

36 **Methodological and measurement issues in general social psychology**

37 There has been renewed emphasis in social psychology research on studying brain
38 and body processes at the behavioural level (Berkman & Lieberman, 2011). In a seminal
39 review of social psychology literature, Baumeister et al. (2007) highlighted that there has
40 been an overreliance on questionnaires and other techniques, which have supplanted
41 behavioural observation. Indeed, Baumeister et al. revealed a downward trend in the
42 measurement and study of behaviour in the *Journal of Personality and Social Psychology*,
43 from approximately 80% of studies in 1976 to fewer than 20% of studies in 2006. In
44 concluding their review, Baumeister and colleagues (2007) argued that despite the first ten
45 years of the 21st Century being named the “decade of behaviour” by the American
46 Psychological Association, social psychology research had maintained a focus on the study of
47 internal mental and neural processes (see also Berkman & Lieberman, 2011). While the
48 exploration of neural and psychological mechanisms is important, Baumeister et al. argued
49 that these inner processes are meaningless without understanding of how they relate to the
50 control of actual behaviour. That is, given the principle goal of psychological research to

51 create positive change in environmental settings, it is imperative that research samples and
52 has application to these naturalistic contexts.

53 Consistent with the above arguments, there is a need to consider the type or level of
54 behaviour measured within experimental contexts. For example, in examining the changing
55 incidence of behaviour in personality and social psychology research, Patterson (2008)
56 differentiated between direct (e.g., face-to-face behaviour/social interaction) and indirect
57 behavioural measures (e.g., reaction times in response to static images). Patterson recognised
58 that indirect measures have the potential to act as favourable alternatives to self-report
59 measures (e.g., questionnaires to examine mental states, such as conscious thoughts and
60 feelings). However, indirect measures, such as reaction time tests, differ substantially from
61 the diverse behaviours typically displayed during day-to-day, face-to-face interactions.
62 Indeed, despite observing a remarkable decline in overall behavioural measures from 70% in
63 1976 to 25% in 1996 and 2006 within the *Personality and Social Psychology Bulletin*,
64 Patterson (2008) emphasised the dearth of studies reporting what people actually *do* in social
65 settings (i.e., their contextual behaviours). That is, only 13% of the studies sampled by
66 Patterson in 1976 used direct social-behavioural measures, with this proportion declining to
67 just 4% in 2006. Therefore, a pressing concern highlighted across personality and social
68 psychology research is the decline of requisite behavioural measures within experimental
69 contexts (see also Davids & Araújo, 2010).

70 The shift observed in social psychology research toward the study of mental and
71 neural processes is in line with the “cognitive revolution” and the heightened interest in
72 attributing the causes of behaviour to these inner processes (Miller, 2003). That is,
73 psychologists have arguably begun to focus on the study of internal mechanisms to
74 understand the processes of behaviour without actually including behavioural measures
75 (Patterson, 2008). Baumeister et al. (2007) suggested that the reduction in behavioural

76 measures in general psychology might be due to the nature of behavioural data collection,
77 which can place a strain on time and resource demands in an area of research that is highly
78 competitive. For example, observing, coding and analysing behavioural responses, such as an
79 individual's facial expressions and nonverbal behaviour require a considerable amount of
80 time and effort. Moreover, it may be considered unethical when such measures are collected
81 in the context of an experiment that purposefully seeks to elicit anger or anxiety (Coan &
82 Allen, 2007).

83 **Methodological and measurement issues in sport and exercise psychology**

84 It is unclear whether the decline in behavioural research in general social psychology,
85 alluded to above, is evident within SEP. Nevertheless, methodological challenges in SEP
86 have long been acknowledged (e.g., Abernethy, Thomas & Thomas, 1993; Schutz, 1994). For
87 example, Schutz (1994) outlined various methodological problems in SEP, with the most
88 pressing relating to the definition of psychological constructs and the validity and reliability
89 of the instruments used to measure these. Specifically, psychological constructs are not
90 always directly observable but are inferred from behavioural or self-report measures (i.e.,
91 they are latent variables). For instance, an exercisers mood, or an athlete's personality traits
92 are often measured via completion of paper and pen questionnaires (e.g., Berger & Motl,
93 2000; Goldberg, 1990). Schutz (1994) proposed that researchers should consider the
94 definition, operationalization and valid measurement of latent variables through sound
95 theoretical foundations and rigorous standards in constructing measurement tools (i.e.,
96 questionnaire items). Moreover, Schutz suggested that researchers need to evaluate the
97 magnitude of an effect through reporting effect sizes (e.g., Cohens *d*) and make conclusions
98 about the importance of these magnitudes (i.e., the extent to which the change can make a
99 practical difference).

100 Despite Schutz's (1994) methodological recommendations, many researchers do not
101 always interpret effect sizes in terms of their practical significance (Cumming, 2014) and do
102 not connect questionnaire metrics to sport and exercise behaviours (see Anderson, McCullagh
103 & Wilson, 2007). For example, Anderson et al. (2007) sampled all the issues in the 2005
104 volumes of the *Journal of Sport & Exercise Psychology*, *The Sport Psychologist*, and the
105 *Journal of Applied Sport Psychology* and found, of the 54 studies that used quantitative
106 methods, 25 reported only paper-and-pencil metrics with no connections to behaviour.
107 Typically these measures provide an insight into how an athlete might feel, but often provide
108 little indication to how an athlete's behaviours might be affected. Therefore, findings could
109 translate poorly to sport and exercise environments. For instance, questionnaire based studies
110 that seek to assess psychological states prior to competition, such as the presence of certain
111 emotions (e.g., fear, joy), would be more useful in practice if scores on the questionnaires
112 were related to a magnitude of change in sports behaviours. Hence, Anderson argued that
113 SEP needs to improve the triangulation of psychometric and behavioural data to provide a
114 deeper understanding of individuals and psychological phenomena within naturalistic
115 settings.

116 SEP research has progressed through different paradigms of inquiry alongside the
117 changing nature of scientific discovery and the emergence of new methodologies and
118 theoretical approaches. Martens (1979) found that early sport psychology research methods
119 were borrowed from general social psychology, largely including stringent laboratory
120 experiments and manipulations (e.g., reductionist approaches) that did not always accurately
121 sample sport and exercise settings. Martens raised concerns over the gap between the
122 knowledge produced in the laboratory and the knowledge needed for applied practitioners.
123 That is, there may be limited generalization from the results derived from a laboratory task to
124 the applied/practical situation that a given SEP experiment is proposed to sample (see

125 Pinder, Davids, Renshaw & Araújo, 2011). Further, researchers have called for the
126 integration of data from a range of methodological approaches and study designs, in order to
127 provide a broader, richer understanding of phenomena (Jones, 1996; Tenenbaum & Bar-Eli,
128 1995). For example, Martens (2007) advocated a heuristic paradigm for SEP, emphasizing
129 idiographic and field study methodologies, which places humans in the centre of the process
130 of knowing and emphasises experiential knowledge. Indeed, scholars have encouraged the
131 use of idiographic (subjective) methods, including case studies, and qualitative designs,
132 seeking patterns in groups and identifying individual differences (Jones, 1996; Martens,
133 2007; Tenenbaum, Eklund & Kamata, 2012).

134 The review above indicates that sport and exercise psychologists recognise the need to
135 balance research approaches between nomothetic and idiographic designs, the integration of
136 quantitative and qualitative methods, and a stronger emphasis on the inclusion of behavioural
137 measures to bridge the gap between research and practice (see also Carron, 2007).
138 Nevertheless, Biddle (1997) noted that a large proportion of the SEP literature had
139 disregarded the importance of diversity in research methods, relying extensively on cross-
140 sectional questionnaire designs (see Table 2). Biddle examined the research methodologies
141 used in articles published in the *Journal of Sport and Exercise Psychology* and the
142 *International Journal of Sport Psychology* between 1985 and 1994. Findings demonstrated
143 that 40% of the studies used cross-sectional questionnaire designs, with less than one third
144 using experimental or quasi-experimental designs (see also Morris, 1999). The predominant
145 use of questionnaires in the SEP literature is in line with the increasing trend towards self-
146 reported data observed in general social psychology (e.g., Baumeister et al., 2007). Further,
147 Biddle (2000) suggested that SEP should reduce its use of cross-sectional questionnaires by
148 employing a diverse range of research methods (e.g., randomised controlled trials, large scale

149 meta-analyses, narratives, in-depth qualitative studies), in order to establish, “a credible bank
150 of evidence on which to base effective interventions” (p. 3).

151 In light of the above review, the aim of the present study was to examine the
152 development of methodologies and measures used in SEP publications between 1979 and
153 2013. First, we analysed if the decline in behaviour observed within general social and
154 personality psychology was mirrored in research published in SEP journals by comparing the
155 proportion of behavioural measures with non-behavioural measures overtime. Second, we
156 analysed whether behavioural measures included in SEP were indirect, or direct in nature,
157 and the types of non-behavioural measures utilised. Finally, and in line with previous reviews
158 of SEP research (see Biddle et al., 2001), we examined variation in the types of research
159 designs and methods used over time.

160 Method

161 Sample

162 In line with previous research examining the frequency of behavioural measures in
163 psychology (e.g., Baumeister et al., 2007) the current study adopted a systematic approach. A
164 step-by-step coding process was conducted on a total of 1377 manuscripts sampled from four
165 long-standing SEP publications, namely *Journal of Applied Sports Psychology*, *Journal of*
166 *Sport and Exercise Psychology*, *Psychology of Sport and Exercise*, and *The Sport*
167 *Psychologist*. Starting with the first odd numbered year of each journal, all the articles from
168 issues 1, 2 and 4 for every other journal year (e.g., 1979, 1981, 1983...) were analysed. A
169 coding system was adopted that allowed the quantification of the type of behavioural or non-
170 behavioural measures used, and the research design employed. The systematic sampling
171 approach adopted was informed by previous research in the general psychology domain. For
172 example, Baumeister et al. (2007), selected issues from March and May in years 1966, 1976,
173 1986, 1996, and 2006 in the *Journal of Personality and Social Psychology* for coding. Only

174 full length manuscripts were included, and any editorials, newsletters, contents pages, and
175 erratum were excluded from analyses. The number of manuscripts and studies for each
176 journal coded are presented in Table 1.

177

178 *TABLE 1 APPROXIMATELY HERE*

179

180 **Coding**

181 Coding was conducted to quantify the extent to which the dependent and independent
182 variables used in SEP were behavioural measures or manipulations. Behaviour was defined
183 as the actions made by participants in relation to the immediate environment (experimental
184 situation). Self-report measures (e.g., questionnaires and interviews) of past or hypothetical
185 behaviours were coded as no behaviour. Each behavioural variable was differentiated
186 according to the type or level of behaviour; specifically, direct behaviours entailed requisite
187 sport and exercise actions, while indirect behaviours entailed simplified sport and exercise
188 action (cf. Patterson, 2008). For instance, a “gold standard” direct measure of sports
189 behaviour would be the measurement of a requisite sports action against opponents within a
190 sports setting, such as the number of successful basketball free throws in a game, or a
191 participant’s competition running time. In contrast, indirect measures of sports behaviour
192 included reaction time tests, and other simulated sports measures and manipulations, such as
193 participants responding with shadow movements to a video or computer based display in the
194 laboratory (see Dicks, Button & Davids, 2010).

195 The authors worked together to establish the comprehensive coding criterion, which
196 was informed by extant literature (e.g., Baumeister et al., 2007; Patterson et al., 2011). Based
197 on the methods of Patterson et al. (2011) two individuals in the research team piloted the
198 coding for several issues (*Journal of Applied Sport Psychology*, year 2013, issues 1, 2 and 4).

199 The codes given to each article were then compared between authors to establish if any
200 discrepancies existed. Although no discrepancies emerged, judging the codes helped in the
201 development and improvement of the coding criteria. Following agreement of the coding
202 criterion one author coded the selected studies, of which a sample of 10% was also coded by
203 the remaining authors. No coding discrepancies were observed.

204 Each study was first coded for its topic (e.g., sport, exercise), before being coded for
205 behaviour (i.e., behaviour or non-behaviour). If the study included behaviour, it was then
206 coded as behavioural dependent, behavioural independent, or both behavioural independent
207 and dependent. Next, the behavioural variable was coded as direct or indirect behaviour. If
208 the study did not include behavioural measures, the research method adopted was coded (i.e.,
209 questionnaire; interview), or if the study was not empirical (i.e., reviews and commentaries) it
210 was coded as “miscellaneous” (Figure 1). The coding process was also conducted to quantify
211 the research designs used in SEP (cf. Biddle, 2000). Coding focussed on classifying research
212 studies as either; cross-sectional, experimental and quasi-experimental designs as well as the
213 inclusion of psychological interventions and qualitative approaches (see Table 2).

214

215 *TABLE 2 APPROXIMATELY HERE*

216

217 **Analyses**

218 The frequencies of every dimension and theme in the coding criteria (e.g., behaviour;
219 no behaviour) were calculated as a proportion of each year and journal being analysed. The
220 summative scores for all four journals were calculated for each year, and as a total of all
221 years, before being converted into percentages. The different coded themes (e.g., behavioural
222 measures vs. non-behavioural measures) were analysed over time by separating the
223 publication year into three different time stamps. Each time stamp encompassed a total of ten

224 years (i.e., 1979, 1981, 1983, 1985, 1987, 1989 consisted of a time stamp). Thus, three
225 different periods of time were compared; (i) 1979-1989; (ii) 1991-2001; and (iii) 2003-2013.
226 Time was entered into the ANOVA as the within subjects factor and the dependent variables
227 of interest, such as the frequency of behavioural measures vs. non-behavioural measures,
228 were entered into the ANOVA as the between-subject factors. The dependent variables
229 included behaviour vs. non-behaviour; direct behavioural measures vs. indirect behavioural
230 measures; comparisons between the types of articles containing non-behavioural measures
231 (questionnaires vs. interview vs. miscellaneous articles); and comparisons between research
232 methods (cross-sectional vs. quasi-experimental vs. experimental vs. intervention, vs.
233 qualitative). If the repeated measures ANOVAs indicated any significant effects, Bonferroni
234 corrected post hoc analyses using independent one-way ANOVAs and t-tests were conducted
235 to explore the relationships further, and effect sizes were reported (Partial Eta squared and
236 Cohen's d , respectively).

237

238 *FIGURE 1 APPROXIMATELY HERE*

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240

Results

241 Behavioural measures

242 Figure 3 illustrates that the number of behavioural studies published in the SEP
243 journals sampled has remained lower than non-behavioural measures between 1979-2013.
244 The proportion of behaviour and non-behavioural measures were similar in 1979. After
245 which, there was a gradual decline in measures of behaviour up to 1997, before trends in
246 behaviour increased between 1999 and 2013. The behaviour \times time ANOVA revealed a
247 significant main effect for behaviour, $F(1, 10) = 281.33, p < .01, \eta^2 = .97$. Overall, 35.4% of
248 articles published between 1979 and 2013 in SEP included behavioural measures and 64.5%

249 of articles included non-behavioural measures or manipulations. No significant effect for
250 time, $F(2, 20) = 0.01, p = .99, \eta^2 = .00$, or interaction effect, $F(2, 20) = 1.77, p = .19, \eta^2 =$
251 $.150$ was observed (Figure 3). These data indicate consistent differences between the use of
252 behavioural and non-behavioural measures in the SEP literature over time.

253

254 *FIGURE 2 APPROXIMATELY HERE*

255

256 *FIGURE 3 APPROXIMATELY HERE*

257

258 **Direct-Indirect Behaviour**

259 The behaviour type \times time ANOVA revealed a significant main effect for type of
260 behaviour, $F(1, 10) = 33.53, p < .01, \eta^2 = .77$. Overall, 28.51% of behavioural articles
261 published between 1979 and 2013 in SEP included direct behavioural measures and 10.55%
262 of articles included indirect behavioural measures and manipulations (Figure 2). Data
263 indicated no significant effect for time, $F(1.33, 13.29) = .45, p = .57, \eta^2 = .04$, but there was a
264 significant interaction effect, $F(1.33, 13.29) = 4.68, p < .05, \eta^2 = .32$ (Figure 4). Follow-up t-
265 tests revealed that there were no significant differences between direct and indirect
266 behavioural measures between 1979 and 1989, $t(10) = .82, p = .43, d = 0.47$. Nevertheless, in
267 comparison with indirect behaviour, there were significantly more manuscripts published
268 presenting direct behavioural measures between 1991 and 2001, $t(10) = 8.85, p < .01, d =$
269 5.11 as well as between 2003 and 2013, $t(10) = 5.47, p < .01, d = 3.16$.

270

271 *FIGURE 4 APPROXIMATELY HERE*

272

273 **Non-Behaviour**

274 Further breakdown of the non-behaviour articles (65.4%) revealed that 31.23% were
 275 questionnaires, 11.66% were interviews, and 20.68% were miscellaneous articles (i.e.,
 276 reviews, comments, position statements). The non-behaviour \times time ANOVA revealed a
 277 significant main effect for non-behaviour articles, $F(2, 15) = 86.45, p < .01, \eta^2 = .92$. There
 278 was no significant effect for time, $F(2, 30) = .46, p = .64, \eta^2 = .03$, however there was a
 279 significant interaction effect, $F(4, 30) = 9.65, p < .01, \eta^2 = .56$ (Figure 5). Follow-up one-way
 280 ANOVA comparing differences between non-behavioural methods between 1979 and 1989
 281 ($F(2, 15) = 20.48, p < .01, \eta^2 = .73$) revealed a significantly higher proportion of
 282 questionnaire and miscellaneous articles in comparison with interviews (both $ps < .01$). There
 283 was no difference between the proportion of questionnaire and miscellaneous articles at this
 284 time-stamp. Similarly, between 1991 and 2001 ($F(2, 15) = 27.80, p < .01, \eta^2 = .79$) there was
 285 a significantly higher proportion of questionnaire and miscellaneous articles in comparison
 286 with interviews (both $ps < .01$) but no difference between the proportion of questionnaire and
 287 miscellaneous articles. Finally, between 2003 and 2013 ($F(2, 15) = 39.22, p < .01, \eta^2 = .84$)
 288 there was a significantly higher proportion of questionnaires in comparison with both
 289 interviews and miscellaneous articles (both $ps < .01$). No significant difference was observed
 290 between interviews and miscellaneous articles.

291

292

FIGURE 5 APPROXIMATELY HERE

293

294 **Research Methods**

295 The methods \times time ANOVA revealed a significant main effect for research methods,
 296 $F(4, 25) = 18.29, p < .01, \eta^2 = .75$. There was no significant effect for time, $F(2, 50) = 2.10, p$
 297 $= .13, \eta^2 = .08$, however there was a significant interaction effect, $F(8, 50) = 2.16, p < .047,$
 298 $\eta^2 = .26$ (Figure 6 & 7). Follow-up one-way ANOVA comparing differences between

299 research methods between 1979 and 1989 ($F(4, 25) = 6.15, p < .01, \eta^2 = .49$) revealed a
300 significantly higher proportion of cross sectional designs in comparison with intervention ($p <$
301 $.01$) and qualitative designs ($p < .01$). Between 1991 and 2001 ($F(4, 25) = 6.51, p < .01, \eta^2 =$
302 $.51$) there was a significantly higher proportion of cross sectional designs in comparison with
303 both quasi-experimental ($p < .01$) and qualitative articles ($p < .05$) but no further differences
304 between proportions in the remaining methods. Finally, between 2003 and 2013 ($F(4, 25) =$
305 $15.50, p < .01, \eta^2 = .71$) there was a significantly higher proportion of cross sectional designs
306 compared to all other methods, including quasi-experimental ($p < .01$), experimental ($p <$
307 $.01$), interventions ($p < .01$), and qualitative articles ($p < .02$). Moreover, there was a
308 significantly higher proportion of qualitative articles compared to quasi-experimental articles
309 at this time-stamp ($p < .05$).

310

311 *FIGURE 6 APPROXIMATELY HERE*

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313 *FIGURE 7 APPROXIMATELY HERE*

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Discussion

316 The aim of the present study was to quantify the proportion of research methodologies
317 and behavioural measures used in SEP research between 1979 and 2013. Using a rigorous
318 coding criterion, the current study analysed the types of measures and methods used across a
319 total of 1377 manuscripts sampled from the *Journal of Applied Sports Psychology*, *Journal of*
320 *Sport and Exercise Psychology*, *Psychology of Sport and Exercise*, and *The Sport*
321 *Psychologist*. Previous research in other disciplines of psychology has reported a significant
322 decline in the use of behavioural measures over the past several decades (Baumeister et al.,
323 2007; Patterson, 2008). Rather than relying extensively on self-report measures (e.g.,

324 questionnaires), there have been calls in SEP for researchers to include behavioural measures,
325 in order to effectively bridge the gap between research and practice (Biddle, 1997; Patterson,
326 2008). Further, in sport and exercise, a related issue is the proposed need to better represent
327 the rich diversity of research methods in leading outlets (Biddle, 1997).

328 A key finding of the present analysis was that behavioural measures and
329 manipulations used in SEP research between 1979 and 2013 represent a significantly lower
330 proportion of studies (35.41%) compared to non-behavioural measures (64.85%). Baumeister
331 and colleagues (2007) reported that personality and social psychology research has seen a
332 significant decrease in behavioural measures overtime. In contrast, the current review of SEP
333 research found no decline in the proportion of behavioural measures between 1979 and 2013
334 (Figure 3). Therefore, the rapid decline in behavioural studies in *JPSP* and *PSPB* over the
335 past several decades (Baumeister et al., 2007; Patterson, 2008) was not replicated in *TSP*,
336 *JSEP*, *JASP*, and *PSE* over the 1979-1989, 1991-2001, and 2003-2013 time periods. Further,
337 when researchers have employed behavioural measures in SEP, there has been substantial
338 sampling of sport and exercise behaviours (i.e., direct rather than indirect behavioural
339 measures). That is, direct behavioural measures (i.e., requisite sport and exercise actions)
340 were used significantly more often in SEP research than indirect behavioural measures (e.g.,
341 simulated sport and exercise tasks) between 1991-2001 and 2003-2013 (Figure 4). Although
342 there have been renewed calls in some domains of SEP to ensure that researchers accurately
343 sample experimental contexts that are representative of sport and exercise settings (e.g.,
344 Pinder, Davids, Renshaw, & Araújo, 2011), the current results place SEP favourably in
345 comparison with other domains of psychological research (e.g., social and personality
346 psychology).

347 According to Anderson et al. (2007) a common problem in SEP is the lack of studies
348 empirically connecting self-reported metrics to sport and exercise behaviours. Anderson and

349 colleagues found that just under half of all quantitative studies reported paper and pencil
350 measures within the 2005 volumes of the *Journal of Sport & Exercise Psychology*, *The Sport*
351 *Psychologist*, and the *Journal of Applied Sport Psychology*. In support of this observation,
352 results from the present study indicated that the proportion of published manuscripts
353 presenting questionnaire and miscellaneous designs were significantly higher than interview
354 articles between 1979-1989, and 1991-2001. Between 2003-2013 the proportion of
355 questionnaires was significantly higher than both miscellaneous and interview articles. While
356 questionnaires have remained a dominant method in SEP, the number of miscellaneous
357 articles has substantially decreased between 2003 and 2013, and interview methodology
358 articles have gradually increased between 1979 and 2013 (Figure 5). These data indicate two
359 important findings. Firstly, SEP journals show a decline in miscellaneous articles and parallel
360 increase in empirical research, and secondly, SEP has seen an increase in idiographic
361 research approaches, such as the inclusion of qualitative interviews.

362 A potential implication for future work is for SEP research to become less reliant on
363 questionnaires, whilst being mindful of the argument that psychological constructs cannot be
364 directly observed or measured (see review of latent variables in psychology, Bollen, 2002).
365 Indeed, self-report measures are commonly seen as an important tool within SEP to capture
366 internal cognitions. For instance, the profile of mood states is commonly used to capture
367 feelings associated with exercise (e.g., Berger & Motl, 2000). Nevertheless, it has been
368 argued that researchers should be aware of the importance of connecting these cognitive
369 processes to behavioural outcomes (Anderson et al., 2007; Martens, 1987). To elaborate,
370 recent analysis revealed a potential dissociation between self-report measures of cognitive
371 load and systematic physiological measures (heart-rate variability) of cognitive demands
372 (Luque-Casado, Perales, Cárdenas & Sanabria, 2015), while self-report measures of decision-
373 making did not correlate with on-field performance measures (Nortje, Dicks, Coopoo &

374 Savelsbergh, 2014). These findings complement the proposal that the study of cognition in
375 sports performance is increasingly moving from a disjunction between mind and body to an
376 integrated relationship between thinking and skilled action (see Moran, 2012). This view was
377 inspired by James' (1890) dictum that, "my thinking is first and last and always for the sake
378 of my doing" (p. 333). Subsequently, it could also be argued that a primary requirement of
379 SEP is to conduct applied psychological research to help understand and address practical
380 issues (e.g., Carron, 2007). The differences in behavioural patterns between SEP and broader
381 psychology might, therefore, be due to the importance of research application within sport
382 and exercise environments. Future research is needed to examine the use of experimental
383 methods in other disciplines of applied psychology research to better understand such claims.

384 The present findings highlighted that the proportion of cross sectional designs were
385 significantly higher than other research approaches employed in SEP (e.g., quasi-
386 experimental, interventions, experimental, qualitative), especially between 2003 and 2013 (cf.
387 Biddle, 1997). Nevertheless, results illustrated that, overall, cross sectional designs accounted
388 for less than 25% of articles in SEP, compared to 40% reported in previous reviews (Biddle,
389 1997). This indicates that whilst cross sectional designs are used significantly more often than
390 other research methods in SEP, overall, reliance on this approach has substantially decreased
391 compared to previous reviews. This may be a consequence of the wide distribution of SEP
392 articles across a diversity of methods, including qualitative, interventions, correlational,
393 experimental, quasi-experimental, longitudinal, and case study designs (Figure 6). These
394 findings are in line with calls for the integration of data from an array of study designs to
395 provide more detailed knowledge of psychological phenomena (Jones, 1995; Tenenbaum &
396 Bar-Eli, 1995). Notably, the gradual increase in qualitative and interview articles in SEP (see
397 Figure 7E, and Figure 5, respectively), support calls for researchers to examine SEP with a
398 focus on in-depth individual differences and experiences of phenomena, rather than relying

399 on the establishment of group averages (e.g., Barlow & Nock, 2009; Martens, 1987). This
400 emergence is in line with the growing appreciation and use of rich qualitative methodologies
401 in SEP research, including inter alia ethnography and narrative inquiry, in which researchers
402 can embrace complexity through examining the multiple meanings that individuals attach to
403 their subjective experiences (Smith & Caddick, 2012).

404 The emerging changes in SEP highlight an increased emphasis on studying individual
405 differences in research. Recently, it has been argued that SEP provides an ideal platform to
406 study the individual differences between elite athletes' cognitive processes and neuroanatomy
407 (Walsh, 2014). For instance, Taubert et al. (2015) examined expertise-related differences in
408 brain anatomy through measuring changes in MRI results of individual athletes over a period
409 of 2 years. Taubert and colleagues argued that group analyses may fail to detect structural
410 brain alterations linked to the individual performance levels of an athlete. Therefore, in light
411 of these findings and the potential adoption of research methods and measures from
412 neuroscience, it is possible that the proportion of such research designs will increase. Further,
413 these research directions can help identify meaningful differences between individuals, rather
414 than ignoring inter-subject variability (see Barlow & Nock, 2009). Nevertheless, it has been
415 suggested that some of the limitations imposed by the techniques used in some neuroscience
416 research might have implications for the degree to which findings can be generalised. For
417 instance, Mann, Dicks, Cañal-Bruland, and van der Kamp (2013) proposed that the
418 experimental requirements imposed by neuroimaging techniques can restrict experimental
419 tasks, causing them to be over simplified and not representative of skills used in a natural
420 sports environment. Hence, there might be some concerns with the appropriate replication of
421 experimental tasks with the fundamental components of behaviour, if and where such
422 applications are the aim of research.

423 It is plausible that the diversity of research methods reported in the current analysis
424 reflects the different sub-disciplines of psychology (e.g., applied sport psychology, skill
425 acquisition, social psychology) research that comprise SEP. Different research questions
426 might benefit from a specific research method, or approach. For instance, to investigate
427 positive organisational psychology in sport, Wagstaff, Fletcher, and Hanton (2012) used
428 ethnography in order to capture a rich and in-depth understanding of how individuals
429 perceived that they regulated their emotions. Elsewhere, Micai, Kavussanu and Ring (2015)
430 used a correlational design to investigate the effects of executive function on aggression in
431 sport. They measured athlete's executive function with cognitive tests in the laboratory and
432 correlated these findings with self-reports of aggressive behaviour. Thus, there is a diverse
433 array of methods that can be used in SEP depending upon the particular research aims.
434 Alternatively, using varied research methods in SEP could prove invaluable for the
435 development of knowledge on psychological phenomena. That is, the same research question
436 could be examined with a variety of methods and approaches to provide a holistic analysis of
437 a particular subject area. As technological advances permit the systematic manipulation and
438 measurement of human behaviours outside of the confines of the laboratory environment,
439 there may even be an increase in behavioural measures in future SEP works. Such advances
440 would potentially place SEP in a favourable position in comparison with other disciplines of
441 psychology (Baumeister et al., 2007; Patterson et al., 2011).

442 In conclusion, the findings from the present review suggest that overall SEP has
443 included more behavioural measures in comparison to broader psychology. This finding is
444 encouraging, and researchers should aim to maintain this positive development through
445 including dependent behavioural variables in SEP, especially direct behavioural measures
446 that can be generalised to sport and exercise environments. Although self-report data
447 provides valuable data and has an important place among a pantheon of research methods,

448 researchers should be mindful of overreliance on such measures, and should aim for a
449 balanced research approach. The present findings suggest that SEP outlets are publishing a
450 greater diversity of research methods and designs compared to general social and personality
451 psychology. An iterative process of analysis between these different scientific approaches,
452 and integrated methodologies is encouraged for the development of research knowledge in
453 SEP (see Barlow & Nock, 2009). Together, researchers can evaluate the meaningfulness of
454 their data and how it might impact and benefit SEP practice.

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Table 1. The number of included and excluded manuscripts for each journal analysed over time from 1979 – 2013.

Year	JSEP			TSP			JASP			PSE		
	Study	Manuscript	Excluded	Study	Manuscript	Excluded	Study	Manuscript	Excluded	Study	Manuscript	Excluded
1979	20	20	7	–	–	–	–	–	–	–	–	–
1981	20	19	5	–	–	–	–	–	–	–	–	–
1983	26	26	6	–	–	–	–	–	–	–	–	–
1985	19	19	6	–	–	–	–	–	–	–	–	–
1987	23	20	6	16	16	7	–	–	–	–	–	–
1989	27	25	3	20	20	6	16	16	3	–	–	–
1991	29	23	3	23	23	7	11	11	3	–	–	–
1993	25	23	6	23	23	3	17	17	0	–	–	–
1995	22	21	3	20	20	8	11	11	2	–	–	–
1997	22	22	0	22	22	4	20	20	2	–	–	–
1999	18	16	1	23	23	2	20	19	2	–	–	–
2001	14	14	0	19	19	0	15	15	0	11	10	3
2003	24	24	1	16	16	14	20	20	1	23	20	11
2005	24	24	4	20	19	16	19	19	0	24	23	9
2007	21	21	4	19	19	9	26	23	0	29	26	7
2009	23	19	8	20	20	8	26	25	1	50	46	9
2011	23	22	4	19	19	14	23	22	1	43	38	10
2013	30	26	4	25	25	10	26	26	2	50	50	7

N.B. The study number for each journal has been illustrated separately as some manuscripts included multiple studies.

Table 2. Definitions of the primary research designs investigated in the current study (Smith, 2010).

Research method/ design	Description
Cross-sectional	A study that collects data from a sample at one point in time, as opposed to a longitudinal design that collects data on at least two separate occasions.
Experimental	A study that tests a hypothesis through the manipulation of an independent variable to measure changes in the dependent variable through using an intervention or a control condition.
Quasi-experimental	A research approach in which participants are not randomly assigned to groups, but selected based upon naturally occurring features, such as social economic status, sports skill level etc.
Qualitative	Studies adopting a methodological position that emphasizes words rather than quantification in the collection and analysis of data.
Intervention	Strategies or actions performed to bring about a change in an individuals' behaviour, or emotional state. For instance, in sport psychology a goal setting intervention might be used to enhance sports performance, or an exercise intervention could be implemented to improve mood.

1 **Figure Captions**

2 **Figure 1.** Coding categories, comprising the area of research (i.e., sport, or exercise), the
3 inclusion of behavioural measures, or manipulations, and the type of behavioural and non-
4 behavioural measures (i.e., direct vs. indirect, and questionnaire vs. interview vs.
5 miscellaneous, respectively).

6 **Figure 2.** Coding themes from a cumulative score of all years (1979-2013) across the four
7 sampled sport psychology journals (PSE, JASP, TSP, JSEP). The percentage of studies
8 include behavioural measures (B); indirect behavioural measures (Indirect); direct
9 behavioural measures (Direct); non-behaviour (N), questionnaire (Q); interview (I); and
10 miscellaneous articles (Misc).

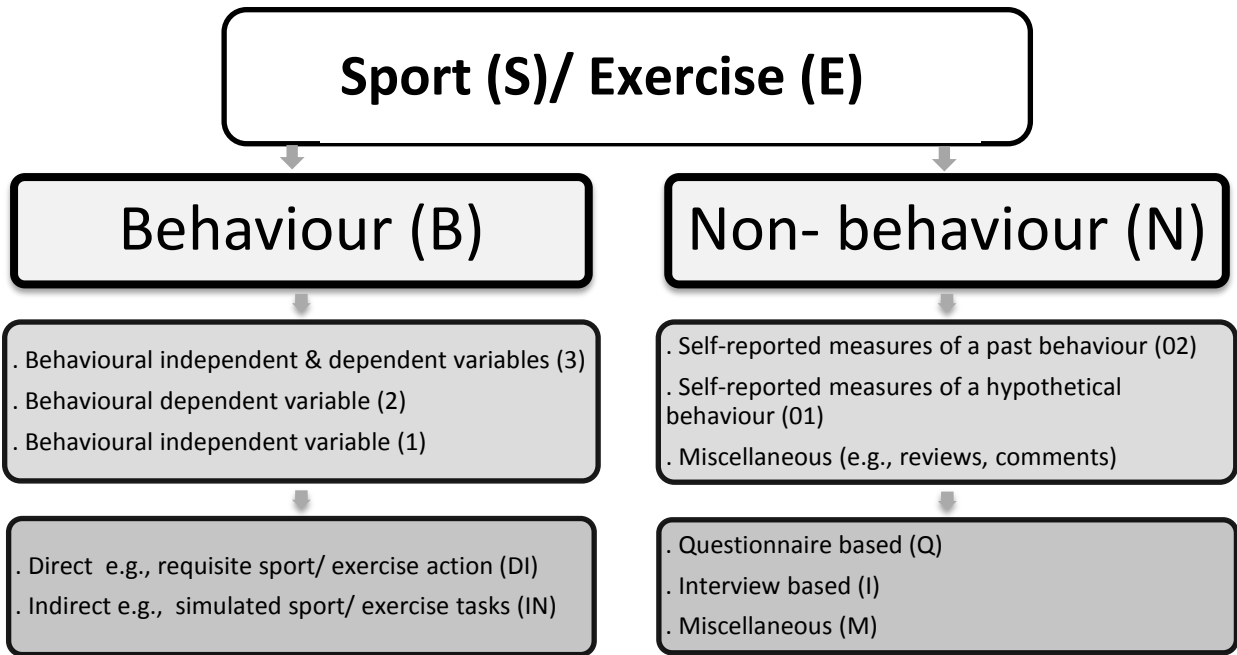
11 **Figure 3.** Percentage of studies including behaviour (B), or non-behaviour (N) from a
12 cumulative score of all four journals for each year analysed.

13 **Figure 4.** The percentage of direct and indirect behavioural measures from the sum of four
14 long standing journals over time (PSE, JASP, TSP, JSEP).

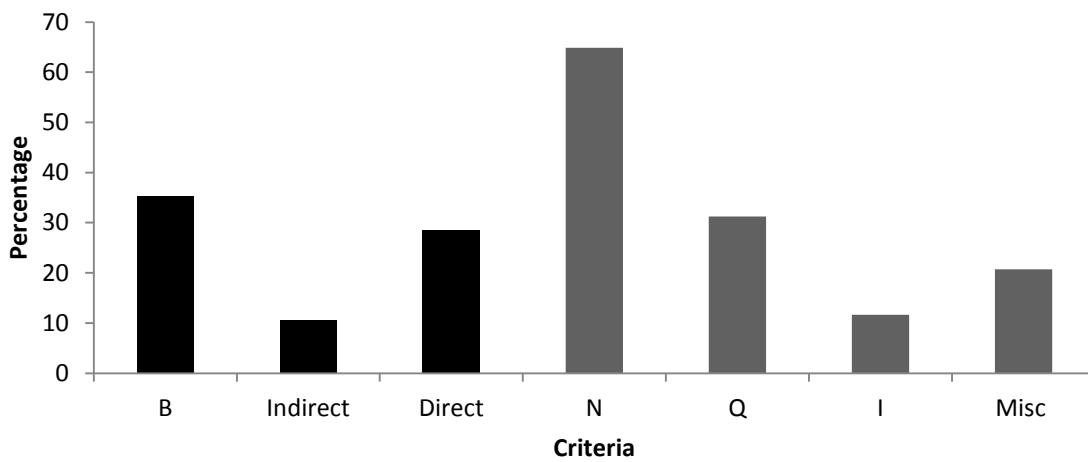
15 **Figure 5.** The percentage of studies including questionnaires (Q), interviews (I) and
16 miscellaneous papers, such as reviews (Misc), over time within sport psychology.

17 **Figure 6.** The total proportion of research methods used for four sport psychology journals
18 (PSE, JASP, TSP, JSEP) over time. Research method/ design include, cross-sectional (CS);
19 experimental (EX); quasi-experimental (QEX); interventions (INT); qualitative (QUAL);
20 longitudinal (LON); correlational (CORR); and case study design (CASE).

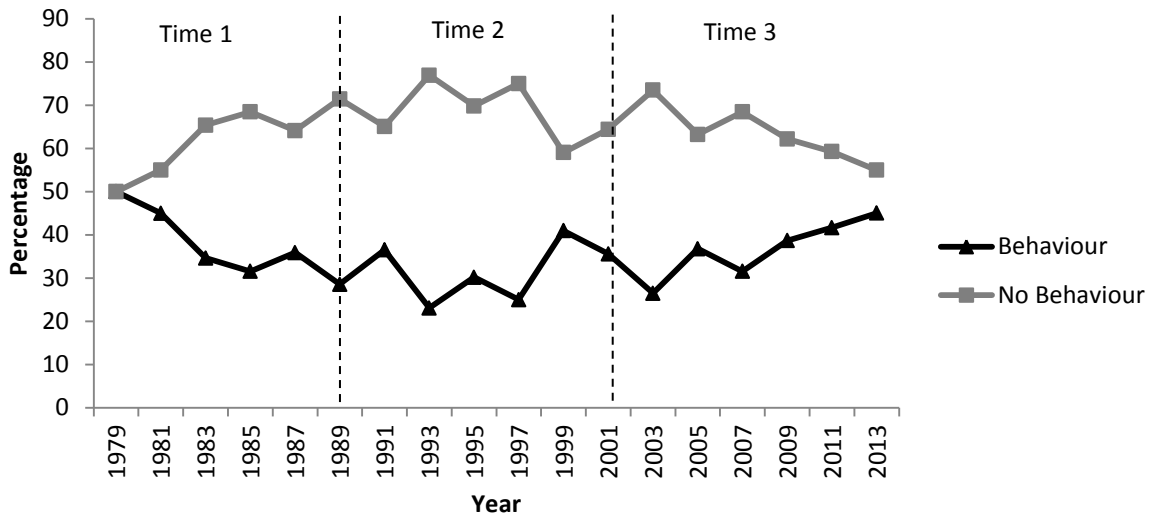
21 **Figure 7.** The percentage of research methods adopted over time. Figure A illustrates cross-
22 sectional research patterns; figure B represents quasi-experimental proportions; figure C
23 illustrates experimental patterns; figure D presents the percentage of interventions; and figure
24 E illustrates qualitative approaches over time.



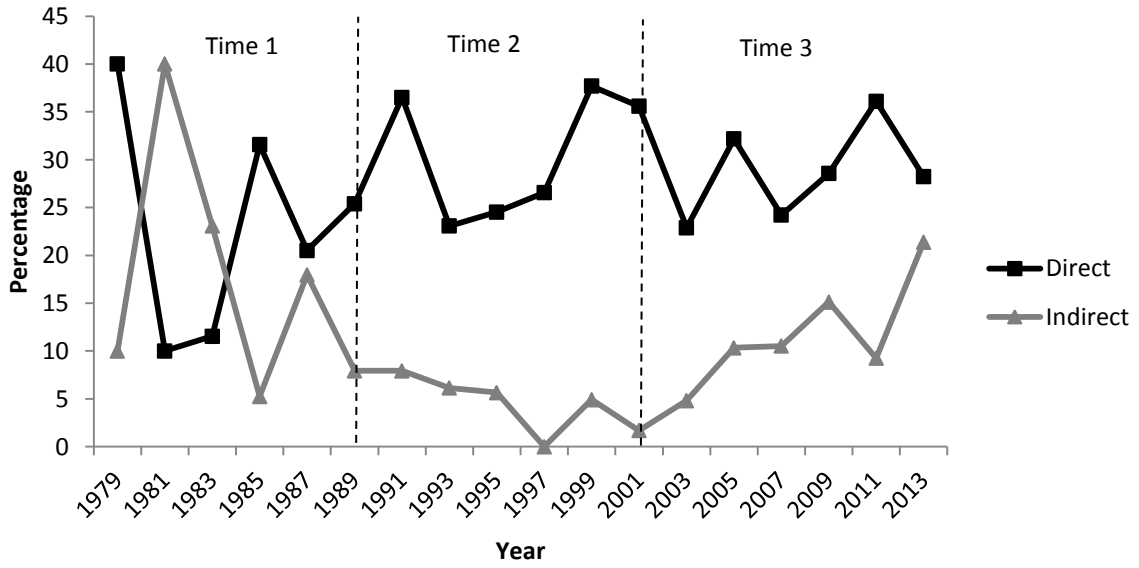
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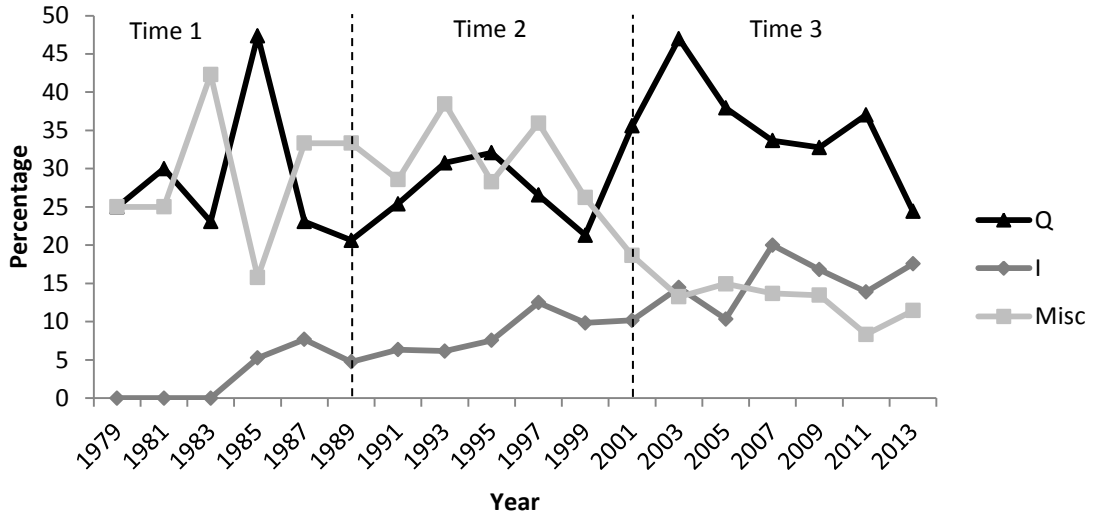
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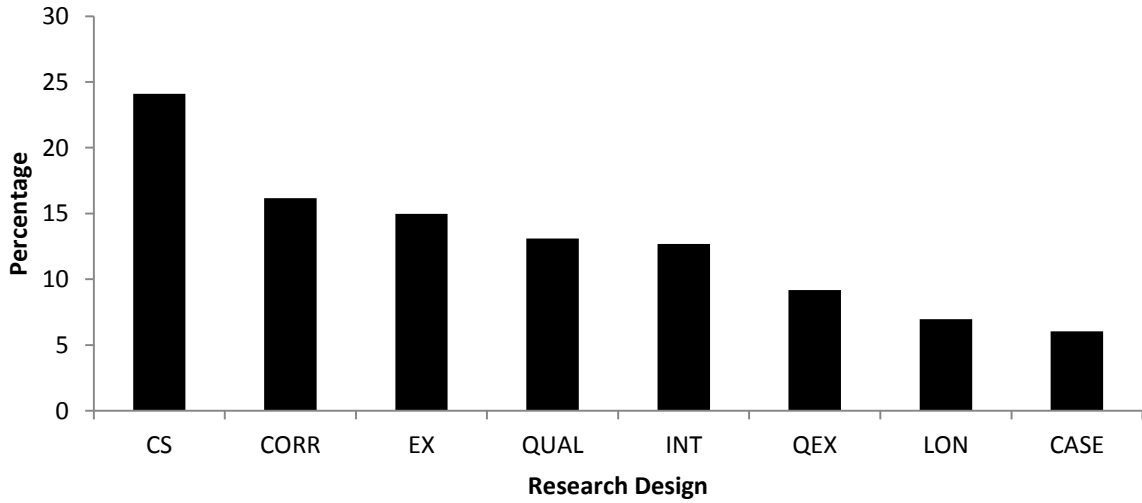
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