The Sources of Self-Efficacy in Experienced Competitive Endurance Athletes

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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES 1

Abstract

Endurance athletes draw on several sources of self-efficacy, but there is a limited understanding of what information within these sources specifically contributes towards self-efficacy. An increased understanding and awareness of the sources of self-efficacy for endurance performance would allow the design and delivery of more effective self-efficacy interventions. The aim of the current study was to identify sources of self-efficacy specific to the endurance sport domain. Semi-structured interviews were conducted with twelve experienced competitive endurance athletes who had been competing in their endurance sport for an average of 12.2 ± 6.25 years. Interviews were recorded, transcribed verbatim, and analysed using deductive thematic analysis. Past performance experiences, physiological states, social/verbal persuasions and emotional states were generated as initial themes. Within these themes, six sub-themes were identified: cumulative experiences, challenge and adversity, physical familiarity, social support, self-talk, and doubt and worry. Our results indicate that endurance athletes make use of several sources of self-efficacy in the formation and maintenance of their self-efficacy beliefs. Specifically, the culmination of experiences, experiences of overcoming challenge and adversity, and a sense of physical familiarity appeared to key sources in the endurance sport domain.

Keywords: endurance sports; social-cognitive; qualitative

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23   The Sources of Self-Efficacy in Experienced Competitive Endurance Athletes

24   Endurance sports are characterised by continuous, dynamic, and whole body exercise tasks

25   (McCormick, Meijen, & Marcora, 2015), often seen in the form of running, swimming, or cycling.

26   Despite differences in the mode of movement, endurance sport performance is often underpinned

27   by similar physiological and psychological determinants (Joyner & Coyle, 2008; McCormick,

28   Meijen, & Marcora, 2015). One psychological determinant identified by McCormick et al. (2015)

29   was self-efficacy, which exists within the broader remits of social-cognitive theory.

Social-Cognitive Theory and Self-Efficacy

30

31   In social-cognitive theory human functioning is governed by a process of triadic reciprocal

32   determinism that exists between an individual's personal events, their behaviour, and their

33   environment (Bandura, 1997). Central to this process, is the understanding that individuals have

34   the capability for control over their own thoughts, emotions and behaviours. This capability for

35   control occurs through the possession of a variety of socio-cognitive mechanisms such as

36   symbolisation and vicarious modelling (Bandura, 1997). Symbolisation allows individuals to

37   assign weight and meaning to events and create internal models of experience (e.g. their view of

38   themselves and their own capabilities), whereas vicarious modelling occurs through the

39   observation of other individual's actions and consequences. Through these mechanisms'

40   individuals develop a series of beliefs about themselves and the world around them. Of these

41   beliefs, self-efficacy is argued to be one of the key factors in understanding human functioning

42   (Bandura, 1997).

43   Self-efficacy refers to the ''belief in one's capabilities to organize and execute the courses

44   of action required to produce given attainments" (Bandura, 1997, p.3). It represents an individual's

45   belief as to what they are capable of doing, such as a runner believing they are capable of

46   completing a marathon in a particular time. When an individual possess a strong sense of self-

47   efficacy they are likely to set themselves more challenging goals in relation to the task (Bandura

48   & Locke, 2003), invest more effort into the task (Tenenbaum & Hutchinson, 2012), and display

49   higher levels of perseverance when faced with obstacles and difficulties (Feltz, Short, & Sullivan,

50   2008). Although it has been suggested that that high levels of self-efficacy in certain situations

51   may have null, or negative effects on performance (e.g. Halper & Vancouver, 2016) the majority

52   of research has continually linked with self-efficacy with superior performance in sport and

53   exercise settings (Feltz et al., 2008; Moritz, Feltz, Fahrbach, & Mack, 2000; McAuley & Blissmer,

54   2000).

Self-Efficacy and Endurance Performance

56   The relationship between self-efficacy and performance is also evident in the endurance sport

57   domain. A positive relationship between self-efficacy and performance in a variety of endurance

58   sports including Ironman triathlon (Burke & Jin, 1996), distance running (Bueno, Weinberg,

59   Fernández-Castro, & Capdevila, 2008; Martin & Gill, 1991), and swimming (Miller, 1993) has

60   been consistently observed. Self-efficacy may lead to improvements in endurance sport

61   performance because of two mechanisms: pain tolerance and perception of effort. The ability to

62   tolerate high levels of exercise induced pain has been suggested to be an important determinant of

63   endurance performance (Astokorki & Mauger, 2016; Mauger, 2014), and self-efficacy has been

64   associated with improvements in pain tolerance (Bandura, 1997; Johnson et al., 2012). Self-

65   efficacy can improve pain tolerance as it encourages the engagement of more adaptive coping

66 mechanisms, and also ensures an individual's engagement for longer periods of time (Peerdeman,

67 van Laarhoven, Peters, & Evers, 2016). Self-efficacy is also associated with reductions in

68 perception of effort (Hutchinson et al., 2008; Robbins, Pender, Ronis, Kazanis, & Pis, 2004), and

69 perception of effort is another important determinant of endurance performance (Marcora, 2009;

70 McCormick et al., 2015).

71 Given the positive relationship between self-efficacy and endurance performance, and the

72 evidence for potential mechanisms explaining this relationship, the possession of robust and

73 accurate self-efficacy beliefs is likely to be a desired outcome in endurance athletes. In order to

74 achieve this, it is important to understand how self-efficacy beliefs are formed, maintained and

75 altered.

76 The Sources of Self-Efficacy

77 Self-efficacy beliefs are generated through a series of cognitive processes involving the selection,

78 interpretation, and integration of several sources of information (Bandura, 1997; Maddux, 1995).

79 An individual's experiences and success are hypothesised to be the most powerful source of self-

80 efficacy information (Bandura, 1997). If these past experiences are perceived to have been

81 successes, this will result in an increase in self-efficacy, whereas if past experiences are perceived

82 to have been failures, this will undermine self-efficacy. Factors such as task difficulty, external

83 support, and occurrences of failure can all contribute to the efficacy value assigned to a past

84 performance (Bandura, 1997). Past performance experiences have been consistently demonstrated

85 to be one of the most cited sources of self-efficacy in sporting settings (Chase, Feltz, & Lirgg,

86 2003; Samson, 2014).

87   Vicarious influences are another source of self-efficacy information, and these are based

88   around learning and modelling from others. Watching someone persevere with a difficult task can

89   help develop self-efficacy towards this task, if the observer feels the person they are watching, the

90   modeller, is similar to them (i.e. sex, skill level, age) (Bandura, 1997). This can have implications

91   relating to pacing in endurance events, where individuals may choose to make decisions based on

92   how others around them are performing (Corbett, Barwood, Ouzounoglou, Thelwell, & Dicks,

93   2012).

94   Social and verbal persuasions act as a third source of self-efficacy. These can represent

95   feedback and support from coaches and training partners, expectations from others, and self-talk.

96   Regarding the appraisal of verbal persuasion as a source, the expertise and credibility of the

97   provider, the framing of the performance feedback and the degree of disparity between what is

98   said and the individuals own beliefs regarding their capabilities are all influential factors (Bandura,

99   1997; Stoate, Wulf, & Lewthwaite, 2012).

100   Physiological states are a further source of self-efficacy, and refer to feelings of strength,

101   arousal, pain, fitness, and fatigue that are cognitively appraised by individuals in order to ascertain

102   their ability to successfully meet the task at hand. Bandura (1997) hypothesised that the more

103   physically demanding a task, the greater the contribution towards self-efficacy that physiological

104   states would make. This hypothesis has received some support as distance runners preparing for a

105   marathon cited physiological states most often (Samson, 2014), and physiological states have been

106   less cited as sources of self-efficacy in less physically demanding sports such as golf (Valiante &

107   Morris, 2013).

108   The last proposed source of self-efficacy relates to an individual's perceptions of their

109   emotional states. Similarly to physiological states, individuals appraise and interpret their

110 emotional state and they consider how this relates to their experiences. Self-efficacy beliefs are

111 often enhanced through positive emotions and decreased through negative emotional states (Martin

112 & Gill, 2002). In an endurance context, the experience of positive emotions, such as feelings of

113 happiness and calmness have been linked with increased levels of self-efficacy in road wheelchair

114 racing (Martin, 2002).

115 Alongside these sources of self-efficacy, it is also necessary to consider research which has

116 examined sources of sport-confidence. The sport-confidence model was proposed by Vealey

117 (1986), in response to the need for sport specific models of self-confidence. Sport-confidence

118 differs from self-efficacy in that it represents a more general sense of confidence (e.g. I am a

119 confident athlete) as opposed to being related to a specific task (e.g. I am confident in my ability

120 to do well in this race). Vealey et al. (1998), through a series of studies with high school and

121 collegiate athletes, identified nine sources of sport-confidence. Similarly, Hays et al. (2007) also

122 identified nine sources of sport-confidence in 'World Class' athletes. Several of the sources

123 identified by Vealey and Hays demonstrate an overlap with Bandura's sources of self-efficacy,

124 most likely because self-efficacy was used as the basis for sport-confidence. For instance,

125 "coaches' leadership", "social support", and "coaching" all can be considered part of the social

126 and verbal persuasions source (Feltz et al., 2008). Several of the sources identified, however, did

127 not appear to fit into any of the proposed sources. For instance, Hays et al. (2007) identified a

128 source of "innate ability" which referred to an athlete's belief that they had been born with certain

129 positive characteristic that benefitted them in their sport. Whereas such a finding may at first

130 appear to indicate the existence of further sources not identified by Bandura (1997), what it instead

131 may represent is an example of the appraisal and attributional processes which accompany the

132 formation of self-efficacy beliefs. The belief in "innate ability" may be a way for athletes to

133   attribute their performances to internal, stable, and uncontrollable causes, which has been

134   previously demonstrated to lead to increases in self-efficacy (Gernigon & Delloye, 2003). These

135   findings help demonstrate the need to not only understand *what* information contributes to self-

136   efficacy beliefs, but also *why* and *how* this information may contribute.

137   Although there are likely to be similarities in the sources of self-efficacy across the sporting

138   domain, such as the importance of training, coaching, and previous winning experience, there is

139   also likely to be substantial variation in both the salience of the sources, and the information within

140   these sources that contribute to self-efficacy (Feltz et al., 2008). For instance, the source of

141   "physiological states" may have increased salience for more physically demanding sports such as

142   distance running, compared to less physically demanding sports such as archery. The only study

143   to date to examine the sources of self-efficacy in an endurance sport context is by Samson (2014),

144   who investigated the sources of self-efficacy in a group of distance runners who were engaging in

145   a training program for an upcoming marathon. Physiological states, verbal and social persuasions,

146   and past performance experiences were the three most frequently cited sources of self-efficacy for

147   the athletes. Whereas the study helped to identify the salience of the different sources and provided

148   further evidence that athletes draw on a range of sources, it did not identify what information

149   within these sources contributes towards self-efficacy, and also how and why this may occur.

150   Identification of the sources of self-efficacy beliefs in the endurance sport would be an important

151   step in the development and delivery of self-efficacy interventions (Short & Ross-Stewart, 2009).

152   The current study, therefore, sets out to investigate the sources of self-efficacy in the endurance

153   sport domain. Specifically, three research questions are proposed:

154   1. What is the salience of the different sources in the endurance sport domain?

2. What specific information within these sources contributes towards self-efficacy for the endurance sport domain?

3. How and why does this information contribute to self-efficacy beliefs for the endurance sport domain?

Method

Research Philosophy

The current study was approached from a critical realist perspective. Central to critical realism is that ontology is not reducible to epistemology, and that human knowledge only captures a small part of a deeper reality (Fletcher, 2017). As opposed to positivist or constructivist perspectives, critical realism treats the world as theory-laden, but not theory-determined (Danermark, Ekström, Jakobsen, & Karlsson, 2002). Those who adopt a critical realist perspective can gain knowledge 'in terms of theories, which can be more or less truth like' (Danermark et al., 2002, p. 10). This acknowledgement and acceptance of theories in critical realism, provides further justification for its use in the current study, given the current study's focus on Bandura's social-cognitive theory (Bandura, 1989).

Research Design

The current study employed a qualitative design, using semi-structured interviews for data collection. Semi-structured interviews help provide an understanding of an individual's perceptions and experiences, and allow a more in-depth investigation of these than can be achieved in focus group settings. Given that the sources of self-efficacy are predominately represented by an individual's perceptions (e.g. physiological states) or their experiences (e.g. past performance experiences), this provided a justification for the use of semi-structured interviews (Bandura,

177 1997). Semi-structured interviews have been successfully used previously to identify sources of

178 self-efficacy in academic (Britner & Pajares, 2006) and sporting contexts (Samson, 2014; Valiante

179 & Morris, 2013) as well.

Participants

181 Following university ethical approval, twelve experienced competitive endurance athletes (seven

182 males, five females) were recruited for the study. Participants were recruited through prior

183 completion of an online survey[1] ($n = 5$), social media ($n = 5$) and from emails ($n = 2$). Participants

184 were told that the study would entail discussing their self-belief as athletes, and how this self-belief

185 has formed and developed over time. Four endurance sports were represented: distance running

186 ($n= 4$), triathlon ($n = 4$) swimming ($n = 2$) and cycling ($n = 2$). Eligibility criteria for the study

187 required participants to have been competing in an endurance sport for at least five years, to have

188 completed at least two competitive events, races or competitions over the previous year, and to be

189 currently training at least three times week. Participants had a mean age of 40.76 ± 12.25 years,

190 had been competing in their chosen endurance sport for an average of 12.2 ± 6.25 years, and trained

191 for 11.58 ± 2.81 hours a week. Seven of the participants were age-group competitors, three were

192 club level athletes, and two were current age record holders.

Interview Protocol Development

194 The first stage in the development of the interview protocol was to consult previous research which

195 had investigated the sources of self-efficacy using a qualitative approach (Britner & Pajares, 2006;

196 Samson, 2014; Valiante & Morris, 2013). Examination of the interview protocols used in these

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[1] The online survey related to the initial validation of a new endurance sport self-efficacy scale, and formed the basis of Study 2 in Anstiss, Meijen, Madigan, & Marcora (2018).

197 studies revealed a common pattern of asking participants for their confidence in the specific

198 domain being investigated, and then exploring the participant's rationale for the score that they

199 gave, using the sources of self-efficacy as follow up questions. A similar approach was therefore

200 adopted for the current study.

201   In line with the recommendations of Marshall and Rossman (2014), initial questions in the

202 interview were designed to access descriptive information before addressing questions specific to

203 the study. During these initial questions, participants were also encouraged to discuss why they

204 had taken up their endurance sports, their reasons for taking part, and what they enjoyed about it.

205 Following this, participants were asked to rate the confidence they had in their abilities to perform

206 well in their specific endurance sport on a scale of 0 (no confidence at all) to 100 (completely

207 confident). Participants were asked why they gave the confidence rating that they did. The semi-

208 structured questions then focused around the five sources of self-efficacy. Examples of questions

209 used were: "To what extent do you think your past experiences contribute to your confidence

210 rating?", "Are there any people who influence your confidence rating?" "How does how you feel

211 physically contribute towards your confidence rating?". After the discussion on the proposed

212 sources of self-efficacy, participants were also asked if there were any other factors that influenced

213 their belief in themselves. For those participants who reported a lower level of self-efficacy in

214 their own abilities (a confidence rating of 70 or lower based on the generally high levels of self-

215 efficacy reported by athletes; Feltz et al., 2008) they were asked an additional question "What

216 would need to occur for your confidence rating to increase?" In line with qualitative practice, open

217 rather than closed questions were used to encourage elaboration (Marshall & Rossman, 2014). The

218 interview protocol was piloted with two endurance athletes, who gave feedback and comments on

219   the clarity of questions. Potentially leading questions were rephrased and additional information

220   explaining the confidence rating were added. A full interview protocol is available on request.

Procedure

222   Prior to the start of the interviews all participants provided informed written consent. Ten of the

223   12 interviews were conducted through either phone ($n = 4$) or Skype calls ($n = 6$), the other two

224   interviews were conducted in person at the lead researcher's University Department office.

225   Interviews were conducted between March and June 2016, with one interview generally occurring

226   each week. Although some disadvantages of Skype interviewing have been noted in the literature

227   (e.g. missing social cues, technical issues), the advantages of online interviews (e.g., allowing

228   contact with geographically distant participants) are established (Smith & Sparkes, 2016). The

229   beginning of the interview was spent establishing guidelines, and what to expect in terms of

230   questions. Participants were also told that they would receive a copy of the interview transcript to

231   check for accuracy. All interviews were carried out by the lead researcher and recorded by a

232   Dictaphone. Throughout the interviews, the lead researcher took notes to highlight areas for further

233   probing and to help ensure adequate pacing. This pacing refers to the need to ensure that

234   participants did not feel rushed within the interview (i.e. a constant barrage of follow-up questions)

235   and that each component of the interview (i.e. the different sources of self-efficacy) was given

236   sufficient time to be discussed.

237   Recordings were transcribed verbatim. Interview length ranged from 35 to 52 minutes. All

238   transcripts were proofread and checked for accuracy by the lead investigator. Only minor

239   discrepancies related to misheard geographical place names were reported by participants checking

240   for accuracy.

241 **Analysis**

242 Analysis was carried out using Nvivo software (Version 10) using a deductive thematic analysis.

243 Deductive thematic analysis was chosen as the current study had clear theoretical links (socio-

244 cognitive and self-efficacy theory), was approached from a critical realist perspective, and the

245 research questions pertained to the a priori established sources of self-efficacy (Bandura, 1997).

246 Thematic analysis was also deemed suitable as the research questions related to the sources of self-

247 efficacy across endurance sport, and thematic analysis allows for an understanding of patterns

248 across individuals (Braun & Clarke, 2006).

249   This analysis involved six phases: familiarisation with data (reading and re-reading the

250 data, noting initial ideas); generating the initial codes (identifying the proposed sources of self-

251 efficacy, collating data relevant to each source); searching for themes (collating codes into

252 potential themes, gathering all data relevant to each potential theme); reviewing themes (checking

253 if the themes work across participants and endurance sports); defining and naming themes (refining

254 specifics of each theme and sub-theme, generating clear definitions and names for each sub-theme,

255 generating clear inclusion and exclusion criteria); and producing the results (selecting illustrative

256 extract examples, relating the analysis to the research questions and the theoretical background)

257 (Braun & Clarke, 2006). To start, a list of core codes (the sources of self-efficacy) were generated

258 in line with self-efficacy theory (Bandura, 1997). These were past performance experiences,

259 vicarious influences, social/verbal persuasions, physiological states, and emotional states.

260 Definitions for these core codes where based on Bandura's initial definitions (1997), and more

261 recent definitions (e.g. the splitting of physiological and emotional states; Feltz et al., 2008). The

262 'essence' of these core codes and their resultant themes is presented in Table 1. No constraints

263 were placed on how many sources a piece of information could be coded under. Information that

264   did not appear to fall under the proposed codes, but still appeared to be associated with self-

265   efficacy, was labelled under the code of 'Other'. This process was done to ensure that potentially

266   relevant information was not missed. These codes then formed the basis for the initial themes,

267   through which sub-themes were then examined. Each sub-theme was judged to capture "something

268   important about the data in relation to the research question(s) and represents some level of

269   patterned response or meaning within the data set" (Braun & Clarke, 2006, p. 82).

270   To help promote trustworthy and credible data, a number of procedures were carried out

271   by the research team. First, throughout the analysis process, an audit trail was kept by the lead

272   researcher in the Nvivo program. This audit trail detailed information pertaining to how and why

273   raw information was coded, and also information pertaining to the generation of themes. This

274   process helped encourage greater levels of reflection, and also promoted a consistent logical

275   approach to the analysis. Second, a process of critical dialogue between the lead researcher and

276   other members of the research team was employed. The purpose of this critical dialogue was to

277   encourage reflection upon, and exploration of, the different interpretations of the transcribed data

278   (Smith & McGannon, 2017). This process led to the refinement of several of the themes. Third, to

279   promote resonance in the work, illustrative quotes are provided in the results section, to enable

280   readers to interpret the data in the most meaningful and transferable way to them (Braun & Clarke,

281   2006).

Results

283   Past performance experiences, physiological states, social and verbal persuasions, and emotional

284   states were identified as themes, and six sub-themes within these four themes were identified from

285   the analysis. 'Cumulative experiences' and 'challenge and adversity' were identified as sub-

286   themes in the theme of past performance experiences. A sub-theme named 'physical familiarity'

287　was identified drawing from both past performance experiences and physiological states. From

288　social and verbal persuasions, two sub-themes were identified, 'social support' and 'self-talk'. One

289　sub-theme was identified from emotional states which was 'doubt and worry'. No theme was

290　identified for vicarious influences. The themes and their sub-themes are presented in Table 1.

291　　　　　　　　　　　　**[INSERT TABLE 1 NEAR HERE]**

292　**Past Performance Experiences**

293　Past performance experiences was the most cited source of self-efficacy. The athletes talked about

294　how their experiences in training and in competitions, races, and events contributed towards their

295　self-efficacy. Past performance experiences were the core 'framework' of their self-efficacy

296　beliefs as it gave them clear examples and reference points of what they were capable of achieving.

297　The training process was also mentioned, as participants felt that their confidence in their own

298　abilities arose from knowing that what they completed in training could be translated to more

299　competitive environments. Within past performance experiences the first sub-theme that was

300　identified was cumulative experiences.

301　　　**Cumulative experiences.** Rather than focusing on one particular event or success, the

302　endurance athletes drew on the volume and consistency of their experiences and successes. This

303　focus had led to a gradual increase in self-efficacy over time, with each new event and experience

304　adding to the already existing framework of experiences. R1, a distance runner, described this

305　occurrence:

306　　　I think its gradually increased over time - as I've increased the distance... so I've done 10 mile

307　　　runs and 10k runs, and then you're thinking well I'll do a half-marathon and I think with each

308　　　race you gain more confidence.

309   This culmination of experiences and successes enabled endurance athletes to gain an

310   accurate awareness of their own performance capabilities. S1, a marathon swimmer, described this

311   process when discussing one of their most difficult swims:

312   I didn't jump in immediately and say I was going to swim the channel or I am going to swim

313   round {redacted}, which I did last year, which is 44 miles. I incrementally increased year upon

314   year. As I could push the boundaries out of what I was achieving I knew I could do a little bit

315   more, it gave me the ability in the self-belief to know that actually let's have a go swimming

316   around {redacted}, let's do 44 miles.

317   Further support for the role of cumulative experiences in helping raise self-efficacy was

318   provided by T3, a triathlete, who discussed having a low level of self-efficacy in their own ability.

319   When asked what would help raise this, they commented:

320   I think for that confidence to increase is just a matter of time, and just a matter of competing

321   more at half ironman distance or stepping up to full ironman distance. I think it is a matter….

322   just a matter of time. The sheer number of races.

323   **Challenge and adversity.** In addition to the volume and consistency of experiences, the

324   second sub-theme identified centred on the experiences of having persevered and/or worked

325   through challenging or adverse situations. The role and importance of these experiences was raised

326   by T2, a triathlete:

327   So I think in triathlon you can draw on races that have been hard or times that you have struggled

328   and knowing that you have overcome them and managed to finish it, or do better than you think

329   anyway - so I think those experiences definitely, definitely are really important.

330   Several of the endurance athletes also mentioned drawing on experiences of overcoming

331   adversity from outside the endurance sport domain. This included experiences in other sports and

332   exercise settings, but also other non-exercise related experiences including childbirth,

333   bereavement, and redundancy from work. Each of the experiences helped provide the athletes with

334   an understanding of their own coping capabilities. T4, a triathlete, discussed how their experiences

335   as a multi-sport athlete during their childhood and adolescence contributed to their beliefs:

336   I was an athlete as a kid, so there's some of that that's given me that confidence as well. You

337   know I know how to push through these things ... You know softball and basketball aren't quite

338   triathlon, but you still have confidence in your athletic ability. Say even though it's not from

339   endurance sport per sé, knowing that you can push through difficulties, issues and negative

340   aspects from softball and basketball, that's what's helped.

341   **Physiological States**

342   Physiological states was mentioned extensively by the athletes. The athletes described both the

343   sensations they feel when taking part in their endurance sport (e.g. pain, fatigue, cramping) but

344   also those which occur more chronically, such as the sensations felt in the build up to an event.

345   The athletes reinforced that how their body was feeling was an important factor in their perceived

346   capability for what they were about to engage in. In order to guide this process, the athletes

347   described comparing their current sensations to those that they had experienced previously. These

348   points helped form the basis of the sub-theme of physical familiarity.

349   **Physical familiarity.** When performing in their endurance sport the endurance athletes

350   were constantly engaged in an appraisal process of their physical sensations (e.g. pain, discomfort,

351   fatigue, exertion). This appraisal was based on an athlete's own prior experience of knowing what

352 their body should be feeling and a knowledge of the work required to complete their task.

353 Therefore, it represented a combination between the sources of past performance experiences and

354 physiological states. Dissonance between the perceived and the expected could result in a lowering

355 of self-efficacy, as it could suggest that the athlete was not capable of meeting the demands of the

356 task or their own expectations. R2, a distance runner, discussed this awareness of their own body:

357 I'm kind of very, very aware of feelings within my own body - in terms of what feels right and

358 what feels wrong. What feels bad and what feels good. I do know if that I get to 1k or 2k in a

359 5k race, and I feel like I'm running through treacle already it's probably not going to be a good

360 result.

361 In comparison, congruence between the current sensation and the expected sensation

362 ensured that self-efficacy remain unchanged even when faced with 'negative' physiological

363 sensations as pain, fatigue, and exertion. S2, a marathon swimmer, spoke about the sensations of

364 pain that they often encountered during long swimming events:

365 I know that for example after about 8 hours the biceps of my arms get really sore and I know

366 that after 9 hours I would have swum through it. So when I get to that point, I say to myself you

367 can just keep going you know this is going to go, and you just keep doing it.

368 **Verbal and Social Persuasions**

369 Verbal and social persuasions were described as playing an important role in the reinforcement of

370 efficacy beliefs by the endurance athletes. Verbal and social persuasions were described as being

371 most impactful following a successful experience, as it helped reinforce that experience for the

372 athlete. The athletes also described the use of self-talk as a method of reinforcing their own

373 perceived capabilities.

374   **Social support.** Endurance athletes drew social support from both domain specific sources

375   (coaches/training partners) but also from friends and family. For those athletes who trained with

376   coaches or training partners, the perceived credibility and expertise of the social support was

377   important in the both formation and reinforcement of efficacy beliefs. T4 recalled the support they

378   received from their coach and training partner before a major event:

379   Having the girl I train with and my coach telling me that I'm the fittest I've ever been, that "It's

380   your day - Go and do it, and show us what you can do". And when you know that someone of

381   that ability is saying that to you - then you know that you can do it... and it kind of gives you

382   the belief that you can do it

383   As well as reinforcing existing self-efficacy beliefs, verbal persuasions were also beneficial

384   in challenging an athletes own conceptions of their ability. T2 discussed how their coach

385   encouraged them to alter their belief on what they were capable of using a combination of verbal

386   encouragement and performance experiences.

387   And I said 'no I can't do it' and they said 'yes you can'. So I did and when it was all done I ran

388   8'10s (mile pace) or something stupid and now I'm like 'ooh I can do it'. So you know. That's

389   how my coach works on trying to show me. You do have the ability, but you talk yourself down.

390   So that's kind of how they try to lift me is by showing me that I can do it.

391   Outside of coaches, training partners and significant others were also an important source

392   of verbal persuasion. C2 raised the importance of verbal confirmation from their training partners

393   and girlfriend:

394   I would say listening to the people who I train with and the listening to my girlfriend it does

395   affect me. It affects me in a positive way because it's given me an uplift and if people can see

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396 it in me, then I think that's got to be there, obviously that reinforces the positive feelings of I

397 can.

398 **Self-talk**. Ten of the twelve athletes described using self-talk throughout events. Self-talk

399 was primarily used to help reinforce an individual's capability for performing a task and the

400 athletes suggested they used it most frequently in difficult or challenging situations. C1, a cyclist,

401 mentioned how self-talk was important for reaffirming their ability during difficult periods in a

402 race:

403 There always is that sort of conflict in your own mind… when the race is hard, you try to tell

404 yourself, 'it's going to get easier', or 'I can push through this'. I've gone harder, I've gone

405 harder.

406 The type of self-talk (instructional/motivational) used also changed based on the situation.

407 When athletes believed they were capable of performing well in a situation, self-talk was more

408 likely to become positive and confirmatory, reinforcing the current experiences. Conversely, in

409 situations where an athlete may have low self-efficacy (for example the swimming component of

410 a triathlon) athletes instead often adopted motivational self-talk. T3, a triathlete, raised how the

411 type of self-talk varied during triathlon:

412 It's very much situational based. If for example, I'm swimming, my swimming is my weakest

413 discipline so particularly in open water I consider myself very inexperienced as an open water

414 swimmer so I will be trying to give myself motivation, remind myself of the technique, remind

415 myself of the bigger picture rather than actually allowing the self-doubt, the negativity to creep

416 in. Whereas something like cycling I've got a much better understanding of what my cycling

417 abilities are and what my limits are. Again, under those circumstances I talk to myself much

418   less. But when I do, it's more around "Yeah this is a really quick ride" or "things are going

419   well".

Emotional States

421   Emotional states was a source of self-efficacy talked about less frequently. Although the athletes

422   felt that both positive and negative emotions were constant in their endurance sport, they felt that

423   these did not contribute significantly towards the creation or reinforcement of their own efficacy

424   beliefs. Despite this, doubt and worry was identified as a sub-theme in relation to the feelings of

425   the athletes prior to an important competition, race or event.

426   **Doubt and worry**. Doubt and worry primarily occurred when athletes were attempting to

427   push the boundaries of their own performance, as they did not have the prior experience of success

428   to draw on. These sensations of anxiety could in turn influence self-efficacy beliefs. T1, a triathlete

429   who was making the change from Olympic triathlon to Ironman triathlon, remarked on this feeling:

430   It's inexperience right, I haven't biked 180 Km ever, which is the bike portion of the race, and

431   it gets me a bit worried sometimes. Running a marathon as well like it is just sort of, running a

432   marathon is like this huge social thing whatever, it is a bit worrying….

433   However doubt and worry were not always regarded as a negative. In comparison, the

434   majority of the athletes felt that the sensations of doubt and worry they experienced led to better

435   levels of preparation and performance. R3, discussed this:

436   In my view you need to have that bit of doubt, that bit of doubt you see keeps you on edge,

437   keeps you sharp, it keeps you just at the sweet spot, that you know for example in a full

438   marathon you know you have got to prep. You know what you have got to take on, you know

439   you got to fuel properly, you know you have got to do all your things that prepare. Being

440   cavalier about it leads to too many things that could go wrong.

441

Discussion

443   This study investigated the sources of self-efficacy in endurance athletes. In line with previous

444   research (Samson, 2014), our findings highlighted that endurance athletes drew on several sources

445   in the formation and maintenance of their self-efficacy beliefs, in particular past performance

446   experiences, physiological states, social and verbal persuasions, and emotional states. Within these

447   sources, cumulative experiences, challenge and adversity, physiological familiarity, social support,

448   self-talk, and doubt and worry were identified as sub-themes. No consistent theme was identified

449   for vicarious experiences.

450   Past performance experiences was were identified as the key source of self-efficacy for the

451   endurance athletes in the current study. This finding is in line with both theory (Bandura, 1997;

452   Maddux, 1995) and prior research (Feltz et al., 2008; Valiante & Morris, 2013), which has

453   established past performance experiences as being the most powerful source of self-efficacy.

454   Singular dramatic experiences have been suggested to be a key factor in the formation of efficacy

455   beliefs (Ericsson & Anders, 2006) but in the current study the athletes alluded more to both the

456   volume and consistency of their own experiences. These cumulative experiences helped provide

457   the athletes with a clear understanding of their own capabilities, which resulted in gradual increases

458   in self-efficacy over time. This gradual increase in self-efficacy may also result from the perceptual

459   and physiological adaptions which occur over time due to training. Future research which

460   examines the relationship between self-efficacy and perceptual/physiological adaptations from

461   training is warranted.

462   Experiences of challenge or adversity was also identified as a central source of self-

463   efficacy. Bandura (1997) claimed that successes that occurred despite difficulties and adversity

464   would contribute more towards self-efficacy than success that came without difficulty. Although

465   the majority of the athletes drew on experiences from within the endurance sport domain, several

466   also discussed drawing on experiences from other non-sporting related domains. Self-efficacy

467   theory hypothesises that experiences which occur within a specific domain will be the most

468   powerful contributor towards self-efficacy (Bandura, 1997), but, as the present study clearly

469   demonstrates, other non-domain experiences can also contribute. This contribution from non-

470   domain experiences is likely to occur when individuals are able to identify shared subskills

471   between the experiences (Bandura, 1997). Specifically, this focus on adversity related experiences

472   may be related to coping self-efficacy. Coping self-efficacy is hypothesised to be more

473   generalizable than other forms of self-efficacy (Bandura, 2002; Chesney et al., 2006), where if an

474   individual believes they can utilise various coping skills when faced with stressors, this belief is

475   likely to generalise across domains. Caution must be taken, however, when considering the role of

476   adversity related experiences in helping form self-efficacy beliefs. Overcoming adversity has been

477   suggested to lead to positive improvements in several psychological constructs (Sarkar, Fletcher,

478   & Brown, 2015), but it may also be that the reason for overcoming the adversity was the presence

479   of initial constructs, such as self-efficacy (Savage, Collins, & Cruickshank, 2017). Therefore it

480   may be that adversity related experiences help reinforce self-efficacy beliefs, rather than create

481   new ones, and only individuals who already possess robust self-efficacy beliefs may be successful.

482   Previous research which has examined the role of physiological states has largely focused

483   on perceptions before an event (Chase, Feltz, & Lirgg, 2003; Samson, 2014). In the current study,

484   however, physiological states were predominately mentioned in relation to performing the task

485   itself. Rather than a discussion on particular states or sensations, what was identified from the

486   analysis was a concept of constant physical appraisal. This constant appraisal of current

487   physiological states represents what is known as a 'proximal' source of self-efficacy (Maddux,

488   1995). Proximal sources of self-efficacy are immediate and current sources that inform perceived

489   capabilities when engaging in a task (Maddux, 1995). This appraisal focused on a comparison

490   between the current sensations (proximal) and the expected sensations which were based on

491   previous experiences. These previous experiences in turn represent a 'distal' source of self-

492   efficacy. Distal sources are those based on experiences and information received in the past. This

493   concept of physical familiarity, and its drawing together of physiological states and past

494   performance experiences also reinforces the theoretical prediction that the sources of self-efficacy

495   overlap (Bandura, 1997). The relationship between distal and proximal sources of self-efficacy

496   has, surprisingly, not received much explicit attention in the self-efficacy literature (Maddux,

497   1995). In comparison, this monitoring of the current physiological state (interoception) and the

498   appraisal between current physical sensations and expected sensations has been highlighted and

499   documented in several areas of research relating to endurance performance (Brick, MacIntyre, &

500   Campbell, 2016; Tucker, 2009). Research has not, until this study, explicitly linked this process to

501   self-efficacy. Given that this process can provide individuals with an understanding of their current

502   progress towards a task and their capabilities for achieving this, it is likely to directly influence

503   self-efficacy. Severe dissonance might lead to individuals perceiving that they do not possess the

504   capabilities to achieve their goals and therefore they might disengage from the task. Evidence

505   comes from research into ultramarathons where unexpected pain at early stages was one of the

506   most significant predictors of withdrawal from the event (Hoffman & Fogard, 2011).

507   Social support and verbal encouragement have been previously demonstrated to be

508   effective tools to help raise an athlete's self-efficacy (Feltz et al., 2008) and the current results

509   support this. Central to the role of social support and verbal encouragement were both the

510   perceived expertise of the provider and the relationship with the athlete. These two mediating

511   factors have also been supported by prior research into self-efficacy (Valiante & Morris, 2013)

512   and social support (Rees & Freeman, 2007). Self-talk was also identified as a key source of self-

513   efficacy. This finding links with prior research which has demonstrated that both distance runners

514   (Samson, 2014) and professional golfers (Valiante & Morris, 2013) make use of self-talk to help

515   maintain their efficacy beliefs.

516   Emotional states was not as widely discussed as the other sources of self-efficacy, with

517   only worry and nerves emerging as a consistent sub-theme. This result is not entirely surprising,

518   as other researchers have often failed to demonstrate a clear impact of emotional states on self-

519   efficacy (Samson, 2014; Valiante & Morris, 2013). This, however, does not mean that emotional

520   experiences are not present in endurance performance, but rather that how they contribute to self-

521   efficacy remains unclear. It has been argued that emotional states may better be understood as a

522   moderating factor on the relationship between past performance experiences and self-efficacy

523   rather than existing as a standalone source (Feltz et al., 2008; Maddux, 1995).

524   Although some athletes discussed making comparisons with others competitors, no

525   consistent themes were identified within the source of vicarious influences. Other research has also

526   often failed to find an impact of vicarious influences on self-efficacy in experienced athletes

527   (Samson, 2014; Valiante & Morris, 2013). This may be because vicarious influences are

528 hypothesised to contribute most to self-efficacy when individuals are first engaging in a behaviour,

529 as they lack suitable past experiences to draw on (Bandura, 1997).

530 **Implications**

531 From these findings the current study offers several theoretical implications. First, advancing

532 previous qualitative research on sources of self-efficacy (e.g. Samson, 2014), the current study is

533 the first to identify sources of self-efficacy specific to the endurance sport domain. Alongside this

534 identification of specific information, the current study also provided some insight into how and

535 why this information may contribute towards self-efficacy. This is apparent based on the theme of

536 "physical familiarity". The current study also provided evidence for the overlap that may exist

537 between the sources of self-efficacy. Despite often being depicted as distinct entities, the sources

538 of self-efficacy do possess a significant amount of overlap (Bandura, 1989; 1997). It may therefore

539 be worthwhile for researchers to begin to move away from considering the sources of self-efficacy

540 as 'distinct' entities. A consideration of specific experiences and information, and the cognitive

541 processes that accompany these, could provide more theoretically informed interventions than

542 those which only focus on specific sources of self-efficacy (Feltz et al., 2008; Short & Ross-

543 Stewart, 2009).

544 Alongside the theoretical implications, the current study also offers applied implications.

545 First, interventions aimed at increasing self-efficacy should look to cover several of the sources of

546 self-efficacy preferably in unison (Short & Ross-Stewart, 2009). In order to achieve this it may be

547 beneficial to either expose athletes to experiences which contain several of the sources or ask them

548 to reflect on experiences which have. Specifically, reflection on experiences of overcoming

549 challenge or adversity may be particularly beneficial to endurance athletes. Athletes who do not

550 possess enough endurance sport domain experience in managing common endurance sport

551 demands such as pain and discomfort (McCormick et al., 2018), could reflect on their experiences

552 in other domains. Most individuals have likely overcome some difficulty or adversity in an aspect

553 of their life, and being able to encourage athlete's to draw on these experiences could be beneficial

554 and help improve or reinforce an individual's self-efficacy, particularly related to coping.

555 **Limitations and Future Research**

556 It is also important to consider the limitations of the current study. The use of one-off semi-

557 structured interviews as a data collection technique may have resulted in an over-simplified

558 understanding of the sources of self-efficacy. Additionally, research investigating the sources of

559 self-efficacy has often attempted to include both individuals high and low in self-efficacy (Pajares

560 & Urdan, 2005), but the majority of participants in the current study reported high levels of self-

561 efficacy in their own abilities. It may be that the formation and maintenance of self-efficacy beliefs

562 in high self-efficacy individual could be qualitatively different than low self-efficacy individuals.

563   The findings discussed in this study offer several avenues for future research. Research

564 which attempts to examine if these findings are replicated in different samples of endurance

565 athletes (e.g. elites or athletes with lower levels of self-efficacy) would help demonstrate if the

566 sources of self-efficacy identified in this study are common across the whole endurance sport

567 domain. Additionally, whereas the current study attempted to and succeeded in identifying shared

568 sources of self-efficacy across endurance sports, future research could attempt to identify

569 discipline or distance specific sources of self-efficacy. Understanding these sport specific sources

570 is the next logical step from the current study and would allow further refinement of interventions

571 and promotion of self-efficacy in endurance athletes. Future research could also investigate how

572 self-efficacy beliefs may change during endurance events. Given that endurance events or

573 competitions can last between several hours to several days, this provides ample time for changes

574   in self-efficacy to happen (Gist & Mitchell, 1992). These in-event changes are likely to relate to

575   an interaction between the different sources of self-efficacy (e.g. distal past performance

576   experiences and proximal physiological states). Examinations of these interaction between the

577   sources, and potential moderators or mediators of these interactions, would help provide

578   theoretical and practical implications.

579   In conclusion the current study provides a novel contribution to the literature on self-

580   efficacy in the sport domain. It identifies domain specific sources of self-efficacy for endurance

581   athletes and reinforces several key tenets of self-efficacy theory, specifically, how the salience of

582   the sources may change based on task demands, and also the overlap between the sources of self-

583   efficacy. Within these domain specific sources of self-efficacy, the role of cumulative experiences,

584   experiences of challenge and adversity and a sense of physical familiarity were identified as key

585   sources of endurance athlete's self-efficacy. These findings can be useful in the design and delivery

586   of self-efficacy based intervention and also offer further avenues for future research.

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732   **Table 1. Overview of Themes and Sub-Themes**

733

Themes (Sources of Self-Efficacy)	Essence of theme (Bandura, 1997)	Sub-themes	Essence of the sub-theme
Past Performance Experiences	Any references to the athletes' past experiences in their endurance sport. This included experiences in training and competition as well as both successes and failures.	Cumulative Experiences	Experiences build on each other i helping to provide an accurate an stable framework of perceived capability.
		Challenge and Adversity	Experiences of encountering and/or overcoming challenges and adversity.
Physiological States	Any references to perceptions of physical states.	Physical Familiarity	An endurance athlete's awarenes of what their body should be feeling, when engaging in their endurance sport and what this meant in regards to their capabilities.
Social/Verbal Persuasions	Any references made about encouragement and/or support received from either others or oneself.	Social Support	Support received from both sporting related and non-sporting related others.
		Self-talk	Attempts made to enhance perceived capability through the use of self-talk
Emotional States	Any references to emotions, feelings or affect.	Doubt and Worries	Sense of worry and doubt over performance ability both prior to and while competing.