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Implicit Theories of Ability in Physical Education:
Current Issues and Future Directions

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Abstract

Purpose: In light of the extensive empirical evidence that implicit theories have important motivational consequences for young people across a range of educational settings we seek to provide a summary of, and personal reflection on, implicit theory research and practice in physical education (PE).

Overview: We first introduce the key constructs and theoretical propositions associated with implicit theories. We then include a brief summary of the research findings on ability beliefs in school PE, which we draw on to identify several key issues that we feel are crucial to furthering our understanding of this topic. We conclude by offering a number of ideas for future research and discuss the potential misinterpretation of implicit theories when applied to professional practice in PE.

Conclusion: We argue that researchers need to address more nuanced questions around implicit theories to prevent this area of inquiry from stalling. Moreover, we need to provide teachers with more specific recommendations to help them integrate theory and research into practice.

Keywords: *implicit theories of ability; incremental beliefs; entity beliefs; PE; young people; motivation; review*

59 then include a brief summary of the research findings on ability beliefs in PE that focus on
60 samples under 18 years of age, which we draw on to identify several issues that we feel are
61 crucial to furthering our understanding of this topic. From this discussion, we offer a number
62 of ideas for future research and conclude with issues in the application to practice. We
63 include some of the potential misconceptions in the application of Dweck's work in the
64 classroom and take into account the unique aspects of the teaching and learning environment
65 in PE and beliefs about athletic ability. Arguably, research in PE (and sport) has 'stalled' in
66 recent years and we hope that one outcome of this review will be to rejuvenate scientific
67 inquiry into implicit beliefs.

68 **Theoretical Overview**

69 The 'growth mindset' has become a popular term, emerging from an extensive
70 programme of research by Dweck and her colleagues (see Dweck, 1999; Dweck & Molden,
71 2005 for overviews). Initial work focused on student's helplessness and attributional patterns
72 after failure and identified that an individual's implicit theory, their view about the stability
73 or malleability of human attributes and behaviors (in this case intelligence²) can affect
74 students' motivation, achievement, learning and behavior (Dweck, 1986, 1990, 1999; Dweck
75 & Elliott, 1983; Elliott & Dweck, 1988). Two implicit theories were identified: an
76 incremental³ theory of ability that reflects the view that our attributes and behaviors are
77 malleable, controllable qualities that can be developed; and an entity theory of ability that
78 reflects the view that our attributes and behaviors are fixed, stable quantities.

79 Dweck (1999) argues that the two implicit theories create a meaning system through
80 which students attempt to understand their world and organise their experiences. Beliefs act
81 as a lens through which students view and judge their achievements and disappointments.

² Following this initial work on intelligence a range of human attributes and behaviors have been studied in relation to implicit theories, for example, athletic ability, interpersonal relationships, personality, social judgement, stereotyping, and morality.

³ For the purpose of this article, we will adopt the terms incremental and entity rather than growth and fixed mindsets to be consistent with the scientific literature in physical education.

82 Consequently, the endorsement of one theory over the other has potentially important
83 consequences for the individual as the theories are viewed as alternative ways of constructing
84 meaning. Implicit beliefs can influence what the student values, how they approach tasks and
85 challenges, and how they respond to the outcomes of tasks. This is achieved through
86 underpinning the goals that students focus on (Elliott & Dweck, 1988).

87 Specifically, the endorsement of an incremental implicit theory is proposed to lead to
88 the adoption of mastery goals and focuses the individual on improving their ability. It is
89 associated with a range of positive cognitive, affective and behavioral outcomes, such as,
90 higher achievement, lower levels of anxiety and self-handicapping, higher levels of
91 satisfaction and enjoyment, and more effective self-regulation (Biddle, Wang, Chatzisarantis,
92 & Spray, 2003; Blackwell, Trznewniewski, & Dweck, 2007; Good, Rattan, & Dweck, 2012;
93 Ommundsen, 2001ab, 2003). On the other hand, the endorsement of an entity implicit theory
94 is proposed to lead to the adoption of performance goals and focuses the individual on
95 proving their ability and is associated with a more negative set of outcomes, depending of the
96 individual's level of perceived competence (i.e., one's beliefs about his or her ability in an
97 achievement domain). These outcomes include higher levels of amotivation, self-
98 handicapping and anxiety and lower levels of satisfaction and self-regulation (Biddle et al.,
99 2003; Ommundsen, 2001ab, 2003). The differences between the two implicit theories and
100 students' motivational responses become most evident when students are facing challenges or
101 setbacks. For an entity theorist, the different processing framework created by this belief and
102 its links with associated structures such as performance goals, lead the individual to perceive
103 their ability "to be an important and permanent personal attribute" (Dweck & Leggett, 1988,
104 p. 264). Consequently, when entity theorists encounter failure they regard it as an indicator
105 that, since their current ability is inadequate, their future ability will be inadequate too. They
106 therefore doubt their ability to be successful in the future and exhibit a maladaptive response

107 to failure. In contrast, individuals who endorse incremental beliefs and encounter failure do
108 not view it as indicating that their current ability level is fixed and permanently inadequate.
109 The belief that current ability level can be improved leads them to exhibit a more adaptive
110 response to the failure such as making attributions to personal and controllable factors. These
111 contrasting responses and outcomes experienced by individuals' endorsing different implicit
112 theories have been evidenced across a range of human attributes and behaviors (Dweck &
113 Molden, in press), including athletic ability (Biddle et al., 2003; Ommundsen, 2001abc, 2003;
114 Warburton & Spray, 2008, 2009, 2013).

115 **Research Findings in Physical Education**

116 In this section, we review studies that have focused on the conceptualisation and
117 application of Dweck's incremental and entity theories of ability in PE. We are mindful that a
118 related area of research is that of the undifferentiated and differentiated conceptions of ability
119 grounded in the work of Nicholls (1989). We refer readers to this parallel research literature
120 for further reading (Li & Xiang, 2007; Xiang, Lee, & Williamson, 2001; Xiang, Solomon, &
121 McBride, 2006).

122 A recent systematic review and meta-analysis of implicit theory research identified 16
123 empirical studies conducted in the PE context prior to September 2014⁴ (Vella, Braithwaite,
124 Gardner, & Spray, 2016). Eleven of these studies in PE⁵ were cross-sectional, descriptive
125 studies (plus 3 longitudinal studies and 2 experimental studies), with all but one study using
126 either the original version of the Conceptions of the Nature of Athletic Ability Questionnaire
127 (CNAAQ; Sarrazin et al., 1996) or the revised version (CNAAQ-2; Biddle et al., 2003).
128 Fourteen of the studies focused on child/adolescent samples (age range 10-16 years) and
129 these had sample sizes ranging from 98 in one of the experimental studies to 682 in one of the

⁴ An updated search, using the terms from this paper for the period from September 2014 to November 2016, revealed no empirical studies have been published since this time.

⁵ Readers are referred to the review but note that it covers research across PE, sport and physical activity. We have focussed here on the results associated with studies in PE.

130 cross-sectional studies. A range of variables were included in these studies in addition to
131 implicit theories of ability, for example, motivational climate, achievement goals, perceived
132 competence, enjoyment, autonomous and controlled motivation, anxiety, satisfaction, self-
133 handicapping, self-regulation strategies, task difficulty, amotivation, performance on a task,
134 achievement over time in PE, persistence, effort, boredom, and cheating acceptability.
135 Support for the theoretical propositions of an entity theory of ability being associated with
136 maladaptive outcomes and an incremental theory of ability being associated with adaptive
137 outcomes was found in all types of study.

138 Cross-sectional evidence (Biddle et al., 2003; Corrion et al., 2010; Cury, DaFonseca,
139 Rufo, & Sarrazin, 2002; Ommundsen, 2001abc, 2003; Wang & Liu, 2007) identifies that
140 individuals who more strongly endorsed the view that sport ability was a fixed, stable
141 quantity were more likely to report higher levels of performance goals, cheating acceptability,
142 perceptions of a performance climate, controlled motivation, anxiety and self-handicapping
143 and lower levels of enjoyment, perceived competence, satisfaction and autonomous
144 motivation. On the other hand, individuals who more strongly endorsed the view that sport
145 ability was malleable were more likely to report higher levels of mastery goals, enjoyment,
146 perceived competence, perceptions of a mastery climate, satisfaction and autonomous
147 motivation and lower levels of cheating acceptability, controlled motivation, anxiety and self-
148 handicapping in PE. Moreover, evidence also suggests that implicit theories of ability can
149 apply to students' views about their ability in specific activities in the PE curriculum in
150 addition to the domain level of sport ability in general (Spray & Warburton, 2003). The
151 nature of the activity and the skills and abilities required for success in the different activity
152 areas of the curriculum appear to influence which implicit theory an individual endorses. For
153 example, when students were participating in games activities they were more likely to

154 endorse an incremental belief, but when they were participating in gymnastic activities they
155 were more likely to endorse an entity belief about ability (Spray & Warburton, 2003).

156 The longitudinal evidence in PE (Warburton & Spray, 2008, 2009, 2013) represents
157 the only work of this type on implicit theories in the physical domain and has consistently
158 revealed the importance for PE teachers to not only foster an incremental theory of ability but
159 also to minimise the development of an entity theory of ability. Over time, the relationship
160 between an entity theory of ability and performance goals strengthened, particularly for those
161 focused on avoiding incompetence. These findings were evident across the transition from
162 primary to secondary school and during Key Stage 3⁶ (Warburton & Spray, 2008, 2009).
163 Specifically, in their 2008 study of 140 primary school children, Warburton and Spray found
164 that across the transition to secondary school higher levels of an entity theory of ability in
165 year 6 of primary school was associated with a focus on outperforming others in year 6 and
166 that this association was maintained across year 7 of secondary school. However, students
167 who reported an increase in their endorsement of an incremental theory of ability during year
168 7 reported an increase in their focus on goals concerning self-improvement and task mastery
169 during this time. This evidence suggests that minimising the development of entity beliefs
170 prior to the transition to secondary school is important if we are to encourage adaptive
171 motivational responses in our young people.

172 Experimental evidence on implicit theories of ability in PE is limited in terms of the
173 number and quality of studies (Vella et al., 2016). In a quasi-experimental design, Li (2006)
174 examined the relationship between implicit theories and students' understanding of the
175 meaning of effort after practicing a novel task. Contrary to hypotheses, most students,
176 regardless of their implicit theory, believed in the efficacy of effort and only partial support
177 was found for students with stronger incremental views endorsing the view that trying hard

⁶ Key Stage 3 refers to the three years of schooling in England and Wales when students are 11-14 years old (Education Act 2002, part 6).

178 would allow them to reach their full potential. However, the author noted some limitations of
179 the study design that need to be considered in future experimental work, such as the length of
180 time of engagement with the novel task, the types of effort statements used, and the use of an
181 ego-involved practice environment.

182 Only two experimental studies have attempted to mirror the early work of Dweck and
183 her colleagues (Dweck & Leggett, 1988; Dweck, 1999) to manipulate or prime students'
184 implicit theory prior to a PE task and observe the effect on a range of outcomes (Moreno,
185 Gonzalez-Cutre, Martin-Albo, & Cervello, 2010; Spray, Wang, Biddle, Chatzisarantis, &
186 Warburton, 2006). These studies revealed initial evidence of a causal link between implicit
187 theories, goal preference, ability attributions and situational intrinsic motivation. Students in
188 the incremental group were found to report higher levels of situational intrinsic motivation
189 (Moreno et al., 2006) and focus on goals that valued learning, self-improvement, and mastery
190 of the task following failure feedback (Spray et al., 2006). Students in the entity group were
191 more likely to focus on goals that valued outperforming others and being the best both before
192 and after failure feedback. They were also more likely to blame their ability for their failure
193 than those in either the incremental or the control conditions (Spray et al., 2006). Despite
194 these initial encouraging findings, it is important to note that of these two studies only Spray
195 and colleagues included a manipulation check to determine if the priming of the implicit
196 belief had been effective. In their discussion, they noted that although they were successful in
197 priming the beliefs in the two experimental groups, there was no significant difference in
198 incremental beliefs between the incremental group and the control group. It seems that the
199 participants in the study were predisposed to endorsing incremental beliefs and thus reading a
200 passage was not sufficiently compelling to create a difference in incremental beliefs (see
201 Spray et al., 2006).

202 **Reflections on Implicit Theory Research in Physical Education**

203 Conceptualisation of Implicit Theories of Ability in Physical Education

204 Although we can trace the conceptualisation of the two implicit theories to the work
205 of Dweck and her colleagues (Dweck, 1986; Dweck & Leggett, 1988) in that we are referring
206 to the view of athletic ability as a stable or malleable attribute, there are important conceptual
207 and measurement nuances that need to be considered. Much of the early research of Dweck
208 and her colleagues was experimental and laboratory-based and focused on priming a
209 dominant implicit theory for a particular task or activity and observing differences in
210 responses. There has been very little of this type of research in PE where research interest in
211 this area was developed with a view to exploring implicit theories using survey-based
212 research designs in the field. Consequently, as noted above, research in PE has
213 overwhelmingly relied on two particular measures of implicit theories of ability, the CNAAQ
214 and the CNAAQ-2, which reflect a multidimensional view of athletic ability.

215 In developing the CNAAQ, Sarrazin and colleagues (1996) drew on the wider
216 achievement motivation and motor behavior literatures to conceptualise athletic ability.
217 Combining the work of Fleishman (1964), Ackerman (1990) and Schmidt (1982), Sarrazin
218 and colleagues distinguished between skills and abilities to consider that athletic ability can
219 be viewed both in terms of the underlying aptitudes, basic capabilities, and capacities that
220 reflect abilities, and specific skills that are learned through participation and performance.
221 Initially, in line with Dweck's measures of implicit theories, students were asked to choose
222 between dichotomies of whether sport ability was the result of a gift or the result of learning,
223 if it was stable or unstable, and if it was general to many sports or if it was specific to
224 particular sports. However, students were not able to exclusively choose between conceptions
225 of sport ability in this way since they perceived that both options in the dichotomy
226 contributed to sport ability. Consequently, athletic ability was conceptualised via six separate

227 dimensions (gift, stable, general, learning, unstable/incremental, specific) and the strength of
228 endorsement for each dimension was assessed using a Likert scale (Sarrazin et al., 1996).

229 The conceptualisation of athletic ability was developed further by Biddle and
230 colleagues (2003) in the CNAAQ-2 as there was limited empirical support for the general and
231 specific subscales of the CNAAQ (see Biddle et al., 2003 for a discussion of these
232 limitations). The CNAAQ-2 proposes a hierarchical structure to the conceptualisation of
233 athletic ability, with the higher order incremental belief underpinned by improvement and
234 learning subscales, and the higher order entity belief underpinned by gift and stable
235 subscales. The conceptualisation and measurement of implicit theories in PE therefore allow
236 students to indicate their level of endorsement of these lower-order beliefs. However, despite
237 this attention to developing an appropriate conceptualisation of athletic ability and suitable
238 measurement instruments, there has been no research that has used the lower-order subscales
239 of the CNAAQ-2. Instead, researchers have invariably chosen to collapse the four subscales
240 into the higher-order incremental and entity scales⁷.

241 Overall, the CNAAQ-2 can be argued to have made a useful contribution in
242 supporting and developing implicit theory research in PE and sport. However, work in other
243 domains has more closely aligned the measurement of implicit theories to that of Dweck and
244 her colleagues (see Dweck, 1999 for an overview). It is noticeable that the entity items in
245 other domains do not have the hierarchical structure of the CNAAQ-2 and have a clear focus
246 on the issue of a lack of change or difficulty in changing an attribute or behavior. While that
247 is the case for the ‘stable’ subscale of the CNAAQ-2, one could question whether the
248 classification of the ‘gift’ subscale as indicative of an entity belief is warranted. The items on
249 this subscale focus on the idea of natural talent, being born with certain qualities, and having
250 certain gifts to be good at sport or PE. However, why should having a ‘gift’ or ‘natural talent’

⁷ It should be noted that Ommundsen’s (2001ab, 2003) work on implicit theories of ability in PE did explore the lower-order scales; however his research used the CNAAQ and not the CNAAQ-2.

251 for sport or PE be considered to represent a fixed, stable view of ability? Indeed, many
252 athletes and coaches speak of natural talent and how it can be developed and built upon
253 through hard work and effort, suggesting that a talent or gift for sport is not wholly affiliated
254 with a view of ability as a stable, fixed entity (Jowett & Spray, 2013). Attending to these
255 measurement and conceptualisation issues is necessary if future research in PE and sport is to
256 advance our understanding of the effect of implicit theories in these achievement domains.

257 **Fluidity and Antecedents of Implicit Theories of Ability**

258 Dweck and her colleagues (Blackwell et al., 2007; Molden, Plaks, & Dweck, 2006;
259 Murphy & Dweck, 2010) have demonstrated that implicit theories of intelligence are
260 sensitive to intervention and can be manipulated through direct priming. However, much of
261 the research on implicit theories in PE has focused on how ‘chronic’ individual differences in
262 theory endorsement are associated with a range of adaptive or maladaptive outcomes (Biddle
263 et al., 2003; Ommundsen, 2001ab, 2003). In other areas of research (personality, intelligence,
264 social intelligence, and stereotypes), implicit theory endorsement has been found to change
265 without direct message priming, suggesting fluidity in implicit theory endorsement (Leith et
266 al., 2014; Steimer & Mata, 2016). When individuals were sufficiently motivated by a salient
267 situational goal (protection of their self-concept or self-esteem, or self-enhancement), they
268 shifted their implicit belief in service of the goal. Even though these shifts were small in both
269 studies (Leith et al., 2014; Steimer & Mata, 2016), the shift in the strength of endorsement
270 was strategic as it resulted in important consequences for individuals (i.e., reactions to failing
271 a test, perceptions about their strengths and weaknesses or successes and failures, willingness
272 to overlook past transgressions, and judgements about criminals’ rehabilitation). These
273 strategic shifts in implicit theories appear to play an important role in personal decisions and
274 Leith and colleagues (2014) suggest that understanding when, how, and why individuals shift
275 their implicit theory could provide useful information for designing interventions and making

276 recommendations for practice. For example, students could be more receptive to an
277 incremental message after a failure rather than a success, since they would not want to view a
278 failure as something that was stable and enduring (Leith et al., 2014; Steimer & Mata, 2016).
279 These issues concerning the self-regulation of implicit beliefs have yet to be explored in PE
280 but would appear fruitful and useful in developing our understanding of motivation in PE.

281 **Can an Entity Theory of Ability Be Adaptive?**

282 The evidence in education for the negative effects of an entity theory of ability on
283 learning, motivation, and achievement is compelling, particularly for the chronic
284 endorsement of an entity belief (for overviews see Dweck, 1999, Dweck & Molden, in press,
285 2005). However, the recent research on the fluidity and antecedents of implicit theories
286 raises the question of whether an entity theory of ability could be adaptive (Leith et al., 2014;
287 Steimer & Mata, 2016). For example, in these studies when an individual was considering
288 their strengths, weaknesses, successes, and failures, a move towards viewing their strengths
289 and successes as stable and enduring (entity) and their weaknesses and failures as subject to
290 change (incremental) allowed them to reach desired conclusions about themselves that
291 boosted or protected their self-esteem. In this case, an entity theory of ability served an
292 adaptive purpose in relation to self-enhancement. In the PE context where our successes,
293 failures and competence are so salient and evaluated so publicly, the ability to move towards
294 an incremental or entity theory based on situational demands would appear to be a useful
295 self-regulatory ability in young people.

296 Moreover, further support for the adaptive aspects of an entity belief can be argued if
297 we concede that in PE an entity belief includes the view that sport ability is a natural gift, as
298 per the conceptualisation in the CNAAQ-2. This additional aspect to an entity belief about
299 sport ability means that not only are successes and strengths viewed as being stable and
300 enduring but also as due to an innate natural talent. It is conceivable, and intuitively

301 appealing, that when individuals have a particular strength or are successful in PE that
302 believing this is due to a natural gift will also serve an adaptive function in relation to self-
303 enhancement. Therefore, believing that something they are good at is due to something
304 special about them that will not change in the future has the potential to lead to positive
305 cognitions, affect, and behaviour among students. The fluidity of implicit theories of ability
306 and the associated implications on learning, motivation, and achievement have yet to be
307 explored in the educational setting.

308 Another aspect that has the potential to elucidate positive aspects of an entity belief is
309 the interaction between an entity belief and perceived competence. This has received little
310 empirical attention in the PE literature despite being a key element of the Achievement
311 Motivation Model (Dweck, 1986, 1990; Dweck & Leggett, 1988). The model predicts that an
312 individual with an entity belief is likely to adopt a performance goal and when accompanied
313 by high perceived competence should lead to adaptive outcomes. However, the initial work to
314 validate the CNAAQ-2 concluded that there was no support for the moderating role of
315 perceived competence (Biddle et al., 2003) and little further testing of this proposition has
316 occurred. Furthermore, in the approach-avoidance framework (Elliot, 1997, 1999), implicit
317 theories and perceived competence are both proposed to be antecedents of achievement goal
318 adoption. To date, research, has tended to examine these antecedents in isolation to observe
319 their effect on approach-avoidance goal adoption (Ommundsen, 2001ab; Warburton & Spray,
320 2008, 2009).

321 Research in PE has also done little to explore the proposition that the differences in
322 implicit theories and motivational outcomes will be most apparent under conditions of failure
323 (Dweck, 1999). The limited experimental evidence that does exist in the PE literature
324 suggests that there were differences in goal preferences and ability attributions following
325 failure between incremental and entity theorists but not on affective reactions or future

326 participation intentions (Spray et al., 2006). In their discussion, Spray and colleagues note the
327 need to create more realistic failure manipulations such that the failure feedback is
328 compelling and more akin to the on-going nature of feedback in PE classes. This will help to
329 exploit the differences in implicit theory endorsement and their likely effects on motivation,
330 learning, and achievement. Consequently, addressing this issue and exploring the effects of
331 the interaction of entity beliefs with perceived competence would help clarify the adaptive or
332 maladaptive effect of entity beliefs in PE.

333 **Future Research Directions**

334 In light of the current empirical research and the key issues we highlight above, we offer
335 some avenues of inquiry that we hope will further develop our understanding of implicit
336 theories of ability in the PE context. Specifically, three avenues for future research are
337 presented.

338 **Chronic and Fluid Implicit Theories**

339 We know little about how or when young children develop an implicit theory about
340 their sport ability. In his recent chapter, Spray (in press) highlights the need to explore the
341 socialisation of implicit beliefs, in terms of who is important in this process. We also need to
342 explore how our chronic implicit theories are formed, for example, what role do early
343 experiences of success and failure in PE play in shaping our beliefs? If our implicit theories
344 are used to help us reach desired conclusions about ourselves, then being exposed
345 consistently to situations where a particular belief supports this conclusion may lead to that
346 theory becoming the dominant theory (Leith et al., 2014). What temporal patterns of success
347 and failure are required to develop a 'chronic' incremental theory of ability? Evidence from
348 education suggests that students who constantly succeed or who are praised for performance
349 are likely to develop an entity theory of ability (Mueller & Dweck, 1998), but at what age are
350 children susceptible to these messages about their sport ability?

351 Following the line of inquiry in social psychology, we also need to explore the
352 fluidity of beliefs in the PE context. Are particular students more able to self-regulate their
353 implicit theory? If so, who are they, what are their characteristics, what conditions facilitate
354 or hinder this, and what are the consequences of this self-regulation of implicit theories?
355 Moreover, what salient situational goals are present in PE that would motivate such shifts?
356 Once established that students in PE can self-regulate their implicit theory of ability, we can
357 explore the relationship between chronic and fluid implicit theories of ability and the effects
358 on motivation, learning, and achievement in PE.

359 **Priming of Implicit Beliefs in Physical Education**

360 Future research should also focus on experimental work to develop more compelling
361 ways to prime students' implicit beliefs. This work is important as it has potential practical
362 implications for supporting and guiding teachers in how to influence young people's implicit
363 theories in their classes. We need to know what is the best way to deliver the message
364 (written, verbal, video), what does the message need to contain, what is the optimal dose, and
365 who should we give it to (primary or secondary school children)? We also need to explore the
366 practical aspects of incorporating an incremental message into a school curriculum for
367 teachers. For example, is it a generic message followed up with specific individual
368 interactions with each student? How is it incorporated into a unit of work particularly if the
369 unit of work is 6-8 weeks in length, and will students believe they can improve and develop if
370 the unit of work is not long enough?

371 **The Lower-Order Beliefs**

372 Following our discussion of the conceptualisation issues of implicit theories in the PE
373 literature, we believe it is important for future research to clarify the conceptualisation of
374 incremental and entity beliefs. We highlight that the lower-order gift belief may not be
375 conclusively associated with an entity theory of ability. Future research that explores the

376 effects of the lower-order beliefs on a range of outcomes may help elucidate some of these
377 concerns regarding the conceptualisation of implicit theories of ability. Moreover, this
378 research will also be useful in the practical context in that it could provide teachers with a
379 more specific focus for their feedback. For example, does believing your ability can improve
380 have a greater effect than believing it can be learned when participating in an educational
381 setting such as PE?

382 **Application to Practice**

383 **Misconceptions in the Application to Practice**

384 In a recent series of articles, Dweck (2015, 2016ab) Dweck recognised that there are a
385 number of misconceptions in how her theory and research are being translated into practice in
386 schools. She expressed her “fear that the mindset concepts, which grew up to counter the
387 failed self-esteem movement, will be used to perpetuate that movement” (Dweck, 2015, p.
388 20), or will be used to justify why some students are not learning and improving, and
389 acknowledged that there is an outbreak of false growth mindsets in educators. We summarise
390 three common misconceptions below.

391 ***Misconception 1: Effort alone will lead to an incremental implicit theory and the***
392 ***associated learning and achievement outcomes.*** Dweck (2015) identified this misconception
393 as the most commonly associated with an incremental implicit theory. Effort and an
394 incremental theory are often viewed as interchangeable, but as identified earlier in this article,
395 the incremental theory is about the meaning system it creates in our interpretation of and
396 connection to a range of behaviors and attributes, of which effort is but one. In an incremental
397 theory, effort is an important part of the learning and improvement process, but it is only one
398 element of a repertoire of skills and strategies (i.e., resilience in the face of failure, seeking
399 out challenges, focusing on mastery goals) that students with this theory have at their
400 disposal. The risk with this misconception is that teachers will focus their praise on effort,

401 that effort praise will be used when learning outcomes are poor or absent, and teachers may
402 neglect to focus on helping students to focus on new or different strategies for learning.

403 ***Misconception 2: We are either an incremental or an entity theorist.*** Much of
404 Dweck and her colleagues' (Dweck, 1999) research has been based on the priming of an
405 incremental or an entity theory in students prior to the completion of a task and then
406 examining how the prime affected students' motivation, behavior, and performance. Students
407 were labelled as incremental or entity theorists based on the priming that had taken place.
408 Responses to a series of entity-focused items evaluated the effectiveness of the priming in
409 which high scores reflected an incremental theory and low scores an entity theory. This
410 priming focus is an important aspect of the research evidence that has largely been ignored or
411 lost in translation to educators and has led to the belief that students have either an
412 incremental or an entity theory of ability. Students may therefore be labelled as incremental
413 or entity theorists, rather than having access to both implicit theories which are primed or
414 accessed based on environmental cues and self-concerns.

415 ***Misconception 3: An incremental theory means that students can achieve anything.***
416 An incremental theory of ability is not associated with the belief that students can achieve
417 anything. Instead, it is a belief that with effort, motivation, the right strategies, help, and
418 support, students can improve on their current level of achievement. It is not suggesting that
419 all students will achieve to the highest level or become the next most talented mathematician,
420 writer or sportsperson. Embedded in Dweck's (Dweck, 1986, 1990; Dweck & Leggett, 1988)
421 framework are two key ideas: (a) people are capable of change, not that they will change their
422 current behavior; and (b) that people's future potential cannot be predicted by their current
423 behavior or from a small subset of behaviors shown at a relative early stage in their life. This
424 misconception does not mean that educators should not set high expectations for their

425 students. Instead, these expectations should be appropriate to the student and the teacher
426 should help the student to develop the skills and strategies to successfully meet them.

427 **Further Issues in Applying Implicit Theories in Physical Education**

428 In view of the considerable empirical evidence that exists regarding the adaptive
429 consequences that follow from endorsing an incremental theory of ability, a number of
430 authors (Spray, in press; Vella, Cliff, Okely, Weintraub, & Robinson, 2014; Warburton &
431 Spray, 2017) have offered theoretically- and empirically-based suggestions to support
432 teachers and coaches in applying this area of research to their practice. Vella and colleagues
433 offer six instructional strategies that aim to promote the adoption of an incremental belief
434 about ability while minimising the adoption of an entity belief. Their strategies include
435 focusing on effort and persistence, facilitating challenge, promoting the value of failure,
436 defining success as effort, the promotion of learning, and providing high expectations.
437 Moreover, Spray offered an examination of how an understanding of implicit theories of
438 ability could inform practice through the pedagogical practices used by teachers and coaches.
439 We refer readers to these sources for a more detailed description. Our aim in this section of
440 the review is not to repeat this information but to offer a discussion of some of the key issues
441 that arise in the application to practice due to the nuances of the PE context.

442 *Focusing on effort and defining success as effort.* In the process of acquiring and
443 developing physical skills, young people move through different phases of learning,
444 cognitive, associative, and autonomous (Fitts & Posner, 1967). These phases reflect changes
445 in the fluidity and proficiency of movement whereby an economy of effort in movement
446 production is reflective of successful performance. Consequently, effort in the PE context
447 may have different meanings for those in the different phases of learning. Teachers should
448 avoid the inclination to provide generic effort feedback such as ‘keep on trying’ to all
449 students. Instead, teachers could provide slightly different forms of effort feedback for

450 students in the different stages of learning. For example, students in the autonomous phase of
451 learning require effort feedback related to the desire to continue improving and developing
452 their skills in a range of movement situations. Those in the associative phase require effort
453 feedback related to continuing to refine their skills and seeking feedback to improve further.
454 Those in the cognitive phase require effort feedback related to persistence in the face of
455 challenges and difficulties in trying to work out how to perform the skill, and continued effort
456 in trial and error learning. Moreover, it is also important to ensure that effort feedback is
457 accompanied by gains in learning and that success is not only defined as effort. All too often
458 students can be praised for their effort without an accompanying improvement in learning,
459 which may bolster their self-esteem at a particular moment, but does little in the long term to
460 improve their skills and abilities.

461 ***Avoiding entity phrased feedback.*** The role of the teacher in providing feedback to
462 students is critical in the promotion of an adaptive implicit theory of ability in PE. If teachers
463 wish to minimise the adoption of an entity belief, avoiding entity phrased feedback such as
464 ‘you really showed them,’ ‘you’re a quick learner,’ or ‘you’re a natural at this’ is important.
465 These phrases may be used with little conscious awareness, as one of the challenges of the PE
466 context is that the nature of learning environment means that much of the feedback provided
467 to students in a lesson is verbal and instantaneous. While these phrases may be well intended
468 in an attempt to boost students’ self-esteem and efforts to keep trying, they may lead to future
469 motivational problems. Moreover, teachers themselves will have been exposed to the general
470 discourse surrounding sport ability and that performers have a natural talent or ability and
471 thus may be unaware of the negative implications of such feedback.

472 ***Promoting the value of failure.*** The public nature, and ease with which an
473 individual’s (in)competence in PE can be evaluated by others, can mask the value of failure
474 to the learning process. This salience of competence may promote a concern with self-

475 presentational aspects that reinforce the view that failure is an indicator that they are not good
476 enough. Consequently, students become more likely to endorse an entity belief, cannot see
477 that mistakes are an inevitable part of the learning process, and will strive to avoid any
478 situation in which their competence in PE is challenged. These outcomes can be despite the
479 best intentions of the teacher to provide opportunities for challenge and progression.

480

481

Conclusion

482 Physical education is an important context in which to study the motivational processes of
483 young people, as it is the one physical setting experienced by all young people through its
484 compulsory place in the school curriculum in many countries. PE provides many of our first
485 experiences with competence and incompetence in the physical domain. Indeed 'bad'
486 experiences of school PE are often cited as a reason for inactivity across the lifespan, and for
487 the failure of young people to understand the importance of leading physically active
488 lifestyles beyond the school curriculum. In light of these wider implications, and the
489 continued global concern over young people's health (World Health Organisation, 2016), it is
490 imperative that we have an understanding of the motivational processes affecting young
491 people's experiences in PE.

492 Our review has shown that there is much to commend about the research on implicit
493 theories of ability in PE. Young people's views about the nature of their ability undoubtedly
494 have important consequences in the PE setting. We identified a number of key issues that
495 require further research attention and clarification and it is important that we address these
496 aspects if we are to fully understand the influence of implicit theories of ability on young
497 people's motivation toward PE. In particular, the fluidity of implicit theories and the
498 antecedents that influence students' ability to regulate their self-theories represent important
499 opportunities for future work. More widely, we look forward to undertaking and reading

500 about research endeavours that advance the utility of this long-standing motivation

501 framework for professional practice in PE.

502

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