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Physical Education, Cognition and Agency

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Abstract

Traditional analytical philosophy of education assigns a peripheral place to physical education, partly because orthodox epistemology finds its cognitive claims implausible. An understandable but dubious response to this state of affairs is the attempt to relocate physical education within the academic curriculum, with its characteristic emphasis on theoretical knowledge and formal assessment. Dissatisfaction with this response suggests an analysis of physical activity in terms of practical knowledge or knowing how, but the results of this seem inconclusive. More recently, the development of neurocomputational and embodied-cognition approaches in cognitive science appears to offer alternative ways of understanding motor skill and physical activity, and thus of rescuing physical education from its marginal status. But these strategies are not unproblematic, particularly where questions of personal agency and motor control are concerned. Examination of these issues prompts a radical reconsideration of the traditional problem of physical education, and consequently of some familiar assumptions in the philosophy of education.

Keywords: physical education, epistemology, motor skill, cognitive science, dynamic systems, personal agency

Introduction: Physical Education from an Epistemological Standpoint

If there is a philosophical problem about physical education, it is a problem concerning its educational place or significance. Traditionally, sport, games and gymnastics were seen as activities set apart from school work as conventionally understood, offering perhaps a useful and wholesome recreational diversion from the academic business of the classroom; and analytical philosophy of education, in what might be called its mainstream form, and during its period of ascendancy in the second half of the twentieth century, seemed to provide theoretical endorsement for this practical arrangement. The extracurricular position of physical activities is readily explained in terms of the limited cognitive demands made by them. The exercise they provide and the growth they promote are physical, not intellectual or cognitive. And since the key to
educational significance is potential for promoting cognitive growth, physical education is without true educational significance. 'Physical education' is an oxymoron.

Two strands can be distinguished in the argument which supported this analysis (Peters, 1966, pp. 30–32, 158–159). One is the question of the value or significance of education seen exclusively in terms of cognitive growth. I shall touch on that question only briefly, towards the end of this article. The other concerns the nature of cognitive growth itself. This was regarded as a matter of the development of knowledge and understanding; and knowledge and understanding are primarily discursive or theoretical. Knowledge, according to the standard epistemological account, is rationally justified true belief. There were, admittedly, some problems with this account, but they did not affect the basic issue. Knowledge is of facts, and is expressed in propositions or statements: it is knowing that, the form of knowledge and understanding characteristic of the academic subjects of the curriculum. There is also, of course, knowing how (Ryle, 1949, chap. 2), the form characteristic of the non-academic or practical subjects such as physical education; but this is a matter of negligible educational consequence. There is not much to be made, in cognitive terms, of physical or motor know-how; initial learning and problem situations apart, the exercise of thought often seems superfluous or irrelevant to the practice of the skill itself, whereas the achievement through repeated practice of a kind of automatic fluency seems to be of the essence.

There are those who continue to accept an account broadly of this kind, and conclude that whatever place may be found for physical education in schools, it cannot be an unequivocally educational or curricular place (Carr, 1997, p. 203). But an understandably more popular response, among physical educators at any rate, has been to argue that if education makes cognitive demands, then physical education must somehow or other make an effort to satisfy them. The result in some cases has been the attempted transformation of physical education into an academic or quasi-academic subject, a body of discursive knowledge and understanding complete with classroom lessons and written assignments, and pupils achieving qualifications and certificates testifying to their grasp of the theoretical principles involved in sport, games, gymnastics and so on.

Alternatively, we might reject this pursuit of academic status (together with its exclusive claim to educational value) as delusive, and question also the curiously dismissive treatment accorded to knowing how in the traditional epistemological analysis. If physical education is an essentially practical affair, any attempt to depict it as a form or field of theoretical knowledge can only be deeply puzzling. The question then would be: does the idea of knowing how provide a more adequate basis for the cognitive claims of physical education? It is a simple enough matter to show that knowledge and understanding play a significant part in the practice of games such as tennis or football, where a grasp of the conceptual and normative principles governing an activity (what the aim is, how points are scored, what moves are illegal, and so on) is clearly a presupposition of meaningful engagement in it. And it is likewise evident that cognitive processes such as decision-making, judgement, problem-solving and reasoning, typically from means to ends, feature in the technical and tactical aspects of sports and games (in the identification and exploitation of one’s opponent’s
weaknesses, for example). The cognitive aspect of physical activities, expressed in terms of knowing how, is evident in cases such as these. Some issues call for clarification, however. For example:

1. Knowing how, in the examples given, seems to be no more than a kind of knowing that or applied theory. The conceptual, normative, technical and tactical knowledge sketched here in relation to games such as tennis and football is propositional or declarative knowledge. Knowledge of this sort typically comprises a set of prescriptions or instructions, capable of being formulated in natural language and set out explicitly for the benefit of participants. In such cases, no precise distinction between knowing how and knowing that (or knowing what to do) can be drawn (cf. Brown, 1971). Similar considerations apply in relation to (for example) motor activities such as dance and musical performance, where a language-like symbolic notation provides the required propositional form.

2. The term knowing how applies indiscriminately to games as different as chess and tennis. But clearly some distinction is called for. Physical or motor skills are not required for full and effective participation in chess; the physical movement of pieces on the board is both traditional and convenient, but not strictly required for playing the game, as devotees of its correspondence or online forms will readily testify. Football and tennis, on the other hand, are intrinsically physical activities; and whereas, in the case of chess, participation in the game can be completely specified in terms of (for example) written instructions sent by post or email, allowing the game to be played at a (spatial and temporal) distance, it is obvious that nothing analogous is possible for football and tennis. There is, moreover, no contradiction in saying that while my grasp of the concepts and principles of tennis is impeccable, and my tactical and technical knowledge is faultless, my actual performance is inept, clumsy and unskilled; but the claim to non-contradictoriness makes little sense if we substitute chess for tennis. Practical knowledge in its conceptual and technical form, in short, is both necessary and sufficient for full and effective participation in games such as chess; in tennis and football (and we might add musical performance and dance), it is necessary but not sufficient. Something further, a physical or motor performance element, is required.

3. Knowing how (in the applied-theory sense so far discussed) is not, given the considerations noted above, a sufficient condition of practical skill in activities such as football and tennis. We might therefore speak of a distinct sense of knowing how with reference to the motor performance elements of those activities, or to motor skills generally. Such skills are acquired or at least modified through learning, so it is reasonable to regard them as examples of practical knowledge. Of course, words of encouragement, support and advice play an important part in the
learning process here. But it seems fairly clear that the essential thing about learning skills of this kind is repeated practice rather than the acquisition of theoretical or verbal knowledge. This non-propositional form of practical knowledge might be given a distinctive designation, such as acquired physical ability or learned motor competence. The development of such competences and abilities is certainly of interest to physical educators, since it is obviously a precondition of effective participation in games, dance, gymnastics and the like.

4 We might, however, be inclined to suspect that a putatively non-propositional form of knowing how is not really knowledge at all, but something else entirely; though that would merely be to beg the question in favour of the traditional epistemological view of knowledge as essentially declarative or theoretical, and thus return us to our starting point: the view which consigns physical activity to the educational margins. We might go even further in contesting the cognitive claims of physical education: motor activity as such is not fully accessible to or dependent upon conscious cognitive control. Actions, understood as coordinated structures of intentional physical movement, are certainly under conscious control. They are expressions of personal agency, of our beliefs, deliberations, decisions, volitions and so on. We raise our arms and turn our heads at will. But head-turning and arm-raising depend causally on neuromuscular processes which are obviously not subject in the same way to conscious control. Cognition presumably initiates in some way these underlying physical processes, but they are not themselves things we do, actions we perform (Melden, 1961, pp. 59–61; Danto, 1973, p. 61; Thalberg, 1977, pp. 66–71). And we may be tempted to see in this familiar fact conclusive and indeed fatal evidence of the cognitive limitations of physical activity and thus of physical education. It would be unwise, however, to succumb to that temptation, since a similar inaccessibility to consciousness characterizes the underlying mechanisms of cognition itself: memory, language, problem-solving and so on likewise depend on unconscious processes (e.g. Dennett, 1987, p. 214; Jackendoff, 1990, pp. 45, 319–320; Lakoff & Johnson, 1999, pp. 10–13). Inaccessibility to consciousness affords no basis for a principled distinction between physical and cognitive activity.

From the epistemological standpoint, then, an uncertain light is thrown on the question of cognition in physical education. The distinction between knowing how and knowing that is less than clear. Some aspects of physical activity seem satisfactorily accounted for in terms of knowing how in its applied-theory sense. But the idea of a non-propositional form of cognition, seemingly required to complete the account of motor skill, is problematic. According to the traditional epistemology, the business of knowledge is with mental contents: beliefs and reasons, rather than the physical operation of nerves and muscles. We seem to have arrived at an impasse, and an alternative strategy may be needed. This might be available in an idea which has
become increasingly influential in philosophical thinking about mind and action: the idea that human thought and behaviour are to be explained in causal or naturalistic terms, that is, in terms consistent with scientific assumptions and standards of explanation. This move towards naturalization in philosophy has prompted some to declare the bankruptcy of the analytical philosophy and its ‘sentential epistemology’ (e.g. Churchland, 1989, p. 154; cf. Dennett, 2007) which dominated proceedings for much of the twentieth century. What is called for, from this standpoint, is a fresh, scientifically informed approach to the philosophical issues of knowledge, cognition and action. In what follows, I shall briefly review some developments proceeding from this view, and consider their significance for the question of the place of cognition in physical education. In particular, I shall examine two kinds of development: internalist views based upon information-processing or neurocomputational models of motor skill acquisition; and externalist views based upon the ideas of dynamic systems and embodied cognition.

The Internalist Perspective: Motor Representations and Neurocomputation

Traditional epistemology can be seen as an attempt to specify the norms or logical requirements which knowledge-claims must satisfy. As noted above, these are conventionally expressed in terms of truth, rationality or evidence and belief. An alternative approach to the problems of thought, reasoning, knowledge and understanding came to prominence in the late twentieth century, however. According to this approach, these philosophical problems are better understood not in the traditional way, that is by an a priori analysis of ordinary-language or intuitive concepts of knowledge, belief, thought and so on, but rather by taking seriously the outlook and achievements of cognitive science (e.g. Churchland, 1989, chap. 9; Kornblith, 1994; Fodor, 2000, 2008).

An important influence on the development of cognitive science is the principle, related to work in computing, information-processing and artificial intelligence, that the contents of beliefs and other cognitive states are represented by symbol structures which can be physically encoded (for a lucid review of these issues, see Shapiro, 2011, pp. 7–14). Neural structures and processes constitute the machinery which makes this physical encoding possible; and an obvious extension of this idea relates to skilled physical action. Such action typically calls for the exercise of coordinated, feedback-sensitive and flexible patterns of movement and thus of neuromuscular activity; and the ability to produce and repeat movement patterns of this kind at will strongly suggests the involvement of neurally encoded motor programs, schemata or representations (Schmidt & Lee, 2011, chap. 6). These representations are motor counterparts of the symbolic structures and processes which manifest our cognitive powers at work in the various contexts of propositional knowledge. Their associated neural mechanisms are located primarily within the motor areas of the central nervous system, but they are connected to the centres in the cerebral cortex which are responsible for conscious planning, perception, judgement, decision-making, reasoning and cognitive functions generally (e.g. Jeannerod, 1997, pp. 164–191). Motor control and performance, on this view, is the outcome of an internal process of computation, with
central commands being relayed to peripheral effector systems, and being themselves subject to modification and correction on the basis of sensory feedback.

How far does this talk of neural structures and motor programs illuminate the problem of the place of cognition in relation to skilled physical activity? The transition from the traditional approach, with its epistemological standpoint and its arguably outmoded vocabulary of propositional and practical knowledge, to a new conceptual framework in terms of information-processing, feedback loops and neural computation, might seem to represent an up-to-date, scientifically rigorous and altogether more promising prospect for the clarification and eventual solution of our problem. A philosophical paradigm shift has evidently been effected: cognition, whether in the intellectual or motor skill domain, is a function of computation on neurally encoded representations, and no principled distinction between theoretical knowledge and skilled physical activity (and thus between physical education and the traditional academic subjects of the school curriculum) can be drawn on metaphysical or epistemological grounds.

The neurocomputational view, however, has itself been subject to criticism in terms of its capacity to offer an adequate conceptual framework for the description and explanation of motor skill and indeed of cognition in general (for reviews of the issues involved, see e.g. Dreyfus, 1992; Schmidt & Fitzpatrick, 1996; Haugeland, 1997). Some of the arguments developed in the course of this debate turn on highly technical questions concerning, for example, the respective merits of serial and parallel processing models of cognitive functioning. Some focus on the seeming inability of the computational model to give a satisfying account of everyday reasoning and action. Others relate to the improbably immense scale and storage demands of the computational loads borne by hypothesized motor programs and feedback-analysing mechanisms: burdens presumably undertaken by the brains and nervous systems of (for example) small animals such as birds and squirrels, capable of virtuoso motor performance but not otherwise suspected of commanding prodigious computational resources (cf. Chemero, 2009, pp. 123–125).

Of particular interest is the problem identified by the physiologist N. A. Bernstein, himself a pioneer of the motor program concept. Bernstein understood that the complexity of human movement is such that it cannot possibly be accounted for in terms of a direct correspondence between central commands and peripheral muscular activity. This is partly a consequence of the multiple degrees of freedom, that is, possible movement configurations, associated with complex systems of joints and muscles, the independent action of which must be coordinated to produce effective movement (Schmidt & Lee, 2011, pp. 189–190). But it also reflects the fact that meaningful action characteristically occurs within a context, an external situation with properties of its own which are beyond the control of the agent. Motor outcomes cannot be fully determined by central plans and programs, because they are subject in various ways to physical and mechanical constraints (such as the effects of inertia, friction, gravity, momentum and muscular elasticity) arising from the interaction of the moving body and the physical environment together with which it forms a complex system (Bernstein, 1967, see e.g. pp. 145–147). To account for the behaviour of such dynamic systems in terms of internal information-processing and control mechanisms,
then, rather than in terms of the overall characteristics of the systems themselves, seems implausible, according to the approach which we shall now consider.

**The Externalist Perspective: Dynamic Systems and Embodied Cognition**

The neurocomputational account, according to its critics, burdens the hypothesized internal computer with unfeasibly heavy workload and storage demands, especially in relation to the degrees of freedom problem. It cannot, moreover, account for the part played by environmental factors in determining movement outcomes. It therefore proposes an artificial and unrealistic solution to the problem of cognition in physical education, and fails to do justice to the empirical facts.

In the light of these considerations, an alternative model of motor skill, and thus of the role of cognition in physical education, has emerged: one which constitutes a radical departure from familiar assumptions. In this model, the basic principle of both traditional epistemology and the neurocomputational approach is abandoned: that is, the idea of motor activity as *output*, the outward projection of inner control processes, the physical impact of subject or agent upon object or external world. The dualism of subjective agent and external object to be controlled or manipulated is decisively rejected in what have come to be variously known as dynamic-systems, embodied-cognition, situated-cognition or ecological approaches. The key idea here is that it is possible for complex systems which change over time (dynamic systems), including animal–environment systems, to settle into stable rhythms or patterns of coordination, equilibrium and self-organization without the need for a centralized internal controller to process and interpret input, determine output, analyse feedback, monitor performance, correct deviant behaviour and maintain stability. The spontaneous emergence of such patterns, according to proponents of this view, is a pervasive feature of the natural order, and in fact some of the deepest roots of dynamic systems theory are in mathematics, physics, chemistry and biology (e.g. Kauffman, 1995; Port & van Gelder, 1995; Prigogine, 1997).

These ideas are perhaps rather obscure, and their relevance to the issues examined in this article may not be immediately clear. One possible form of clarification runs as follows. The neurocomputational view is based on the model of the mind as a computer. Computers, however, while readily capable of certain sorts of exceedingly complex but narrowly specified operations, such as those involving numerical calculation, tend to perform less impressively in others, particularly those involving sensori-motor activity, which are everyday events in the lives of living creatures, including fairly simple ones (e.g. Dreyfus, 1992; Clark, 1997). The embodied-cognition view aims to capture this quality of everydayness by abandoning the internal computer model in favour of another: a piece of eighteenth century technology known as Watt’s flyball governor (for details, see van Gelder, 1997; Chemero, 2009, pp. 68–71; Shapiro, 2011, pp. 119–127). The great Scottish engineer James Watt (1736–1819) devised various means to make steam engines work efficiently, one of which was the flyball or centrifugal governor which bears his name. Watt’s governor is a feedback device, enabling steam-driven machinery to run smoothly by adjusting automatically to pressure variations within the system; variations which determine, in turn, the
behaviour of the flyball-linked intake-valve mechanism. There is nothing new in this model: Norbert Wiener made use of it in his classic work *Cybernetics* (Wiener, 1961, p. 97). But the key point about the Watt governor, according to Wiener, is that it is a purely mechanical feedback system: its self-regulating operations are determined by the overall physical dynamics of the system of which it is an integral part, and it involves no special central control, performance monitoring, data processing or calculating mechanisms. It represents, in fact, an ingeniously economical solution to the problem of how to achieve smooth, stable and efficient motor operation without the need for an internal computer.

The Watt governor provides an intriguing analogy; but can the dynamic systems perspective be applied directly to the questions discussed in this article? There is, in fact, a considerable volume of research studies exploring its application to the questions of cognition in general and motor skills in particular (Thelen & Smith, 1994; Port & van Gelder, 1995; Kelso, 1995; Chemero, 2009). To these researchers, it offers a framework of thought which intuitively captures many of the most striking features of motor skill: for example, the emergence through practice of movement patterns which are stable, fluent, flexible and responsive to environmental changes, natural, spontaneous and economical of effort.

It must be admitted that these detailed studies, typically focusing on strictly defined forms of movement such as the development of walking in infants, reaching and finger-wagging (Thelen & Smith, 1994, chaps. 1 & 9; Kelso, 1995, pp. 46–67), fall some way short of providing a comprehensive account of motor performance, or indeed matching the enthusiastic claims sometimes made about this approach. It would not be fair, however, or indeed appropriate in a philosophical examination of these issues to dwell on the empirical limitations of what is after all a still relatively youthful scientific project. The philosophical question is, rather, how far does the dynamic–embodied approach enable us to make sense of the role of cognition in motor skill? Its most notable feature is clearly the way in which it calls traditional ideas into question, and in so doing, suggests a radical reconsideration of the nature of cognition itself. Skilled physical movement is explained as the spontaneous emergence over time of stable, fluent, flexible and self-regulating motor patterns from the dynamic interplay of factors comprising the agent–environment complex. In the same way, cognitive, intellectual, social and affective capacities are developed in the course of such interactions; indeed, cognitive powers, as Piaget argued, are an emergent product of environmentally constrained sensorimotor activities (Piaget & Inhelder, 1969, pp. 3–27; see also Thelen, 1995, p. 73). The dynamic systems/embodied cognition approach, then, suggests an answer to our question which is very different from any of those considered so far. It is not merely, as in the epistemological approach, that there is practical knowledge which can be set alongside theoretical knowledge. Nor is it merely, as in the neurocomputational perspective, that skilled motor activity can be regarded as controlled by central programs in which the representation of movement is neurally encoded and processed in the same way as that in which symbolic structures or propositions are neurally encoded and processed. Rather, it is that the very idea of a sharp cognition–performance distinction, and the model of central control and peripheral execution which it embodies, cannot be adequate to
capture in a realistic way the processes, development and achievements either of thought or of action (cf. Port & van Gelder, 1995, p. 150).

**Dynamic Systems, Embodied Cognition and the Self**

The dynamic–embodied perspective aims at giving an account of cognition and motor skill which is not open to the empirical objections facing neurocomputational theories, and which is faithful to everyday experience. This speaks strongly in its favour. But if this admirable fidelity to common sense and experience is to be authentic, consistent and thorough-going, there are clearly issues to be faced.

The main issue, so far as this article is concerned, is easily stated. Dynamic–embodied theories seek to explain cognition and action in terms of the adaptive behaviour patterns which emerge spontaneously from interactions involving human beings (or other animals) and the environmental or ecological situations within which they are located. Even to describe things in this way, though, might be regarded as conceding too much to the Cartesian picture of mind and world, self and other, which proponents of dynamicism regard as discredited or obsolete. Kelso (1995, p. 8), for example, speaks of dynamic patterns exhibiting self-organization without the presence of a self. Clark (1997, pp. 216–217) suggests that traditional notions of selfhood might have to be revised in the light of a fuller appreciation of the embeddedness of thought and action. For Lakoff and Johnson (1999, pp. 267–289), the concept of self is to be taken metaphorically rather than literally. Chemero (2009, p. 77) considers the possibility that a mature dynamic–embodied cognitive theory would ultimately provide mathematical laws for human psychology, thereby rendering teleological explanation obsolete. Noé (2009, pp. 91–93) argues that the traditional concept of self as an internal controller of action is a distortion of reality. In examples such as these, it is evident that the dynamic–embodied claim of fidelity to everyday experience and common sense becomes less plausible, since all seem clearly to imply the essential unreality of the self and of personal agency, and the fading or submerging of the individual human being into the background, the context, the situation, the dynamic system, the world. The individual person becomes at most a component aspect of a complex totality: a bit-player in the collective. Such views might appeal perhaps to admirers of Buddhism and similar forms of mysticism, as is clear from the writings of Francisco Varela and his associates (Varela, Thompson, & Rosch, 1991). They will almost certainly appeal to admirers of Eugen Herrigel’s *Zen in the art of archery* (1953), a work of considerable interest to physical educators. They are less likely to appeal to those reluctant to abandon the common-sense or traditional notions of the individual, the self and personal agency. And if Chemero’s suggested replacement of teleological explanation (and thus of purposeful action) by mathematical law in human psychology is absurd, then it is a *reductio ad absurdum* of the view he propounds, since it is a legitimate inference from dynamicist premises. I shall now argue, however, by way of conclusion, that the notions of individual selfhood and personal agency are indispensable to any intelligible talk about education, and thus about physical education.
Conclusion: Education, Physical Education and Personal Agency

It will be useful at this point to return to the analytical philosophy of education with which we began, and according to which the claims of physical education were found to be problematic, if not indeed paradoxical. In R. S. Peters’ analysis of the concept of education (Peters, 1966, p. 45), three criteria or conditions for educational activities are specified, relating respectively to (1) value, (2) cognition, and (3) procedural issues. Much of the discussion of this analysis in relation to physical education has tended to concentrate on the first two of these conditions. But I now propose to shift the emphasis somewhat, to the third condition. I would argue that this should be seen as the fundamental condition, from which the others are derived. This is because what condition (3) brings into focus is the fact that in education we are dealing with human beings or persons (rather than brains, bodies, information-processing systems, dynamic systems or animal–environment complexes). This certainly means that educational procedures are subject to moral limits or restrictions relating to how human beings are to be treated. The third condition, in other words, functions in a negative or prohibitive way, ruling out practices such as indoctrination and conditioning. But it also has a profound positive significance, which Peters expresses in terms of *wittingness* and *voluntariness*. What this means is that pupils or students are to be regarded not only as moral patients, but (at least prospectively) as agents, persons, beings possessed essentially of certain powers: of conscious awareness, capacity for rational choice, thought, deliberation and purposeful action.

My argument is that it is *personal agency* which provides the ultimate grounds for the claim that education must involve the growth of reason, knowledge and understanding, since such growth is clearly an essential condition of its development. The question of aims and values in education generates controversy, much of which has centred on the claim that knowledge or cognitive growth is intrinsically worthwhile or valuable for its own sake. But what is clearly beyond dispute is that cognitive development is an intrinsic or constitutive feature of the development of the person as an agent, that is, a being capable of conscious and rational thought, able to direct or at least significantly shape his or her life in accordance with that capacity. And whereas it is possible to doubt the claim that education is committed fundamentally and exclusively to the principle of the pursuit of knowledge for its own sake (since, after all, a strong case can be made for the place of, for example, technical and vocational elements in education), it is not easy to see how a similar scepticism with respect to the claim that education is concerned with the promotion of personal growth might be justified. If, moreover, the idea of personal agency is central to education, then it is evident that doctrines which find it dispensable, in the manner suggested earlier by some proponents of the dynamic–embodied approach to cognition, cannot form any part of a coherent view of education; and thus of physical education.

The idea of personal agency, of wittingness and voluntariness, of conscious understanding and rational will, plays a central part also in showing the groundlessness or irrelevance of misgivings broached earlier regarding the inaccessibility to cognitive control of underlying neuromuscular processes. This, it was suggested, might seem to jeopardize the educational claims of physical activities. If automatic or unconscious
physical processes are not subject to conscious control, then of course they cannot be objects of educational concern. But physical education is not in fact concerned with such processes. Its concern is with motor skill and physical activity as expressions of personal agency; with physical or motor activity precisely insofar as it is amenable to conscious control in the service of the agent’s purposes, decisions and so on, and thus modifiable through learning. In this respect, we observed, the position of physical activities is no different from that of intellectual or academic pursuits, those involving the manipulation of symbols rather than physical objects, since these similarly depend ultimately on neurophysiological processes or mechanisms inaccessible to conscious control. Epistemological doubts regarding the characterization of physical activities in terms of knowing how are likewise readily dispelled. Much of the learning that goes on in physical education, we saw, can be described in terms of knowing how, that is, the acquisition of the conceptual, normative, technical and tactical equipment required for effective participation in physical activities. It seemed as if this might not be enough, since the basic motor skills, competences or physical abilities required for tennis, football, bicycle-riding and the like evidently do not call upon the kinds of applied theoretical knowledge found in instruction manuals. We seemed to find ourselves in an epistemological impasse: but despite the central place it traditionally occupies in analytical philosophy of education, epistemology is not the real issue here. The shift of emphasis proposed above requires that the metaphysical and ethical questions of selfhood and personal agency now indicate the path to be taken. Whatever their epistemic status, the non-propositional forms of knowledge, ability or skill discussed here are clearly manifestations of personal agency, of conscious volition, and they are capable, moreover, of development through practice, training and learning. Such development is a necessary condition of full and authentic participation in the activities concerned, and if those activities possess educational value then its legitimacy cannot seriously be put in doubt.

The neurocomputational and dynamic–embodied theories reviewed above were seen as ways of accounting for the role of cognition in physical activity. Neither approach offers the slightest support to the idea of the primacy of theoretical over practical knowledge. In that respect at least they provide thought-provoking alternatives to a traditional epistemology which finds the idea of physical and motor skills problematic, which is philosophically troubled by the seeming inability of thought to reach down to the level of nerves and muscles, and which consequently relegates physical activity to a marginal place in the school curriculum. I have argued, however, that neither approach can offer an ultimately convincing escape route from the impasse into which traditional epistemology seems to lead us. But the idea that there is a genuine philosophical problem about cognition in physical activity is itself a dubious one, inasmuch as it reflects epistemological views which are rooted in the metaphysics of mind–body dualism. That doctrine, which seems to play such a crucial part in the curricular fate of physical education, sheds no light whatever on the question of cognition, understood as an essential aspect of personal agency, but rather makes an unfathomable mystery of a plain and evident fact; namely, that the capacity for conscious reasoning, problem-solving, judgement and decision-making clearly manifests itself equally in practice and in theory, in action and contemplation. So far
as education is concerned, the question to be asked with reference to any of the multifarious possibilities and opportunities open for the exercise of this capacity is not whether it is mental or physical, or even (pace Peters, 1966, p. 159) how much there is to know; the answer to which might depend, after all, on how far one is able and willing to go. The question, rather, is whether and to what degree it affords scope for the kind of development as a person which is the goal of education. There is reason to suppose that the activities characteristic of physical education can provide a satisfactory answer to that question; but there is nothing at all to be said for the view that physical activities, in their failure to be theoretical, intellectual or academic, must be declared ineligible at the outset.

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