Curriculum Alignment of K-12 Physical Education and Kinesiology —Part 1

Focus and Folk Knowledge

DAN LANDERS *SCOTT KRETCHMAR*

Misfocus, not misalignment, is the problem.

In this article we argue that content misalignment is *not* a central problem in the preparation of future physical education teachers. The courses taught in most college curricula are generally relevant for professionals who will be teaching movement skills and exercise routines for enjoyment and healthful living to children. However, based on recent research in kinesiology and developmental psychology, we think that the focus in the curriculum should be expanded from its current concentration on health benefits to a more expansive list of outcomes including, in particular, cognitive functioning. By focusing on cognitive well-being, this article will highlight a most important extrinsic benefit of physical activity, one that will also strengthen the position of physical education in schools.

Of course a shift in focus is not a panacea that will automatically lead to an improved pedagogical curriculum, since difficulties with application may remain. We argue that the fundamental problem is one of translating theory into practice, of taking scientific propositions—like those related to activity and cognitive functioning—and turning them into pedagogical values, perceptions, strategies, and other pedagogical arts. If we are not careful, problems with translation can make elements of the college curriculum appear to be irrelevant, denigrating, or even insulting to teacher candidates. This can happen when care is not taken to acknowledge the gap between propositions and artful behavior, when the proper role of "folk knowledge" is not appreciated, and particularly when personal experiences in sport, games, play, and other forms of physical activity are not a part of the teacher preparation curriculum. However, because issues with translation presuppose an initial direction and content from which translation occurs, we will begin with the matter of a proper focus for teacher education curricula and subsequent professional practice. This takes us to our analysis of health and cognitive functioning.

Is Our Focus Wrong?

The national trend to reduce physical education (PE) instructional time has little to do with any misalignment of content derived from kinesiology departments and what goes on in K-12 PE classes in the United States. Content such as human movement and the health aspects of physical activity are taught in most kinesiology programs, and this content appears relevant to K-12 education. We believe that school administrators and school board members, who have the most to say about what is taught in K-12 schools, do not contemplate how much their offerings are tied to college departments. Instead they base their curricular decisions on state educational standards and the content that is currently emphasized on the state achievement tests used to measure these standards. Most states do not have detailed academic

standards for PE, and nowhere is PE content measured on state achievement tests (Sibley & Etnier, 2003).

If a kinesiology–K-12 PE misalignment were an important factor in the decline of PE instructional time, we would expect to see greater losses of instructional time for PE than for other, better-aligned subjects. According to research conducted by the Center on Education Policy (2006), the K-12 subjects that would be considered to demonstrate better alignment with their respective college departments (e.g., "social studies," which is linked to college history, geography, and political science departments, and "art and music," which is linked directly to art and music college departments) suffered even more instructional time reductions (33% and 22%, respectively) than PE (14%) in 2005 and 2006. These data do not support the argument that a misalignment of kinesiology content and K-12 PE content is responsible for the decrease in PE instruction time. Therefore, we need to look elsewhere for reasons why K-12 PE time has been declining.

For the past 10 years, one of the project assignments in Dan Landers's exercise psychology class has been to conduct a structured interview with K-12 school board members, school administrators, or superintendents (hereafter referred to as "K-12 school administrators") about the relative importance of PE in their school or district curriculum. So far, responses have been collected from approximately 50 people. What we anecdotally find when K-12 school administrators are forced to rank the various K-12 school subjects in order of importance is that math, language arts, and to a lesser degree science are given the highest rankings, while PE, vocational arts, and health are given the lowest. Social studies and history subjects are typically ranked in the middle. Many K-12 school administrators are very vocal in the importance they attach to PE, but some almost apologetically state that they must give preference to course subjects that relate directly to state standards and state achievement tests. They also point out that this preference has been forced on them and exacerbated by No Child Left Behind legislation. More than ever, they are acutely aware that failure to meet state standards in math and language arts can result in schools being closed and administrators losing their jobs. Bowing to this pressure, K-12 school administrators have (sometimes reluctantly) reduced time for PE and other subjects that are not perceived as "central" to state standards and achievement tests so that more class time can be given to the "central" or "core" subjects. This anecdotal information provides food for thought and suggests that the decrease in instructional time may be a function of PE becoming more "marginalized" in the K-12 curricula (rather than "misaligned").

Why has the content that is typically derived from kinesiology not been more effective in convincing K-12 school administrators that physical activity is not "marginal" but "central" to the core mission of K-12 education? Some of the blame can be placed on physical educators who use content derived only from exercise physiology to argue that physical activity for children and adolescents is healthy for them now and in the future. This health content has little relevance to K-12 school administrators, who place "health" content among the bottom-ranked school subjects. In the interviews we have conducted, 10 percent of the administrators have even stated that they believe that health and PE content should be taught more by the parents of the children than by the schools. It is not that they do not believe that physical activity has benefits, such as curtailing the obesity epidemic in the United States. It is that they do not consider the schools to be the best place to for this to occur.

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They perceive their priority to be that of educating youngsters in the "core" content areas of math and language arts. From their perspective, physical educators have been justifying a "non-central" subject (i.e., PE) with another school subject that school officials regard as "non-central" (i.e., health). Therefore, we believe that school administrators would be less inclined to decrease K-12 PE class time if they were convinced that physical activity helps people perform better on cognitive tasks like achievement tests. Can a solid argument, based on stringent scientific evidence, be made that physical activity actually improves the cognitive functioning of children and adolescents? If so, perhaps this "mental health" research evidence is more likely to get the attention of K-12 school administrators than the current use of "physical health" research evidence.

There is a wealth of human and animal literature relating to the ability of exercise to enhance cognitive functioning. This literature has been recently reviewed by Landers and Arent (2007). In this article we will summarize the evidence from at least 14 narrative and four meta-analytic reviews that have concluded that exercise enhances cognitive functioning. The most persuasive and relevant meta-analytic review for our discussion was conducted by Sibley and Etnier (2003). Across the 44 studies examined, children and adolescents (ages 4-18) who exercised showed a pre- to post-exercise-intervention gain in cognitive functioning that was significantly higher than that of the control group of non-exercisers. These findings did not differ as a function of whether the exercise was acute or chronic, or whether it consisted of resistance or circuit training, perceptual-motor training, aerobic activity, or—most important—a PE program. In none of the four large-scale longitudinal studies reported in this meta-analysis was a decline in academic test performance related to more time spent in PE. In fact, in three of these longitudinal studies, academic performance was found to improve as PE class time was increased. Another study (Castelli, 2005) found that third- to fifth-grade students' physical fitness was significantly related to their performance on standardized state exams in science and math. These human studies are

consistent in demonstrating that exercise, physical activity, and physical fitness are all related to the enhancement of cognitive functioning.

Why this relationship exists has been brought to light in the extensive research literature on animals and humans. A DNA micro-array analysis of rodents that ran long distances on running wheels found selective increases in several genes associated with learning and memory; in the development of capillaries, synapses, and nerves in the brain; and in cell survival pathways. These changes occurred primarily in the hippocampus, a brain site known to be associated with memory and learning. Exercise-trained rats have been shown to negotiate mazes more quickly and to have better retention than sedentary rats. The process of developing new brain cells (i.e., neurogenesis) that is believed to occur with physically active rodents is also believed to occur in primates and humans. In studies in which people practiced juggling for three months or bicycled around London for two years in an attempt to memorize street routes, results from magnetic resonance imaging (MRI) showed that gray matter in the hippocampus, a brain region rich in neurons, was enlarged relative to white matter in the brain. The increased development of blood vessels after exercise may also relate to suggestions that exercise increases the blood supply to areas of the brain that are used for cognitive functioning.

A very recent study sheds further light on the cerebral blood-volume changes that occur with exercise in animals and humans. Pereira and colleagues' study (2007) indicated that mice that were exercise-trained for two weeks had significant increases in cerebral blood volume (CBV) in the dentate gyrus of the hippocampus (one location for neurogenisis) compared to mice that were sedentary during this time. Pereira et al. (2007) also examined CBV in 11 healthy subjects, who completed 12 weeks of aerobic exercise (60 minutes, 4 times a week). The researchers found that from weeks 0 to 12, CBV increased significantly only in the dentate gyrus of the hippocampus. VO2 max values also increased significantly, and higher VO2 max values were correlated with higher CBV in the dentate gyrus. These 11 individuals also completed a modified Rey Auditory Verbal Learning Test, which allows cognition to be tested during delayed recall, recognition, and source memory. These subjects performed significantly better on "Trial 1" learning after exercise with a trend toward improvement on all-trial learning and delayed recall. Changes in "Trial 1" learning were significantly correlated with VO2 max changes, and pre-post changes in CBV in the dentate gyrus were significantly correlated with post-exercise "Trial 1" learning. This study clearly shows, in both humans and mice, where the locus of these exercise-induced changes occurs in the brain (e.g., dentate gyrus).

In short, physical educators need to be aware of the recent findings showing that exercise enhances cognitive functioning. If they used the exercise and cognitive functioning research findings in their rationale to justify PE time in schools, concerns about PE being irrelevant might be alleviated. In other words, if this were a new focus for our pedagogical curriculum and services, physical education should be seen as highly relevant to the overall academic priorities of most school districts.

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The Lack of Folk Knowledge

A new focus, however, is not the sole basis for change and improvement. We need to take the argument further. Let us assume that this recommendation has been accepted and that future teachers entered a college curriculum that places a sufficient emphasis on cognitive development and functioning. Would the knowledge and attitudes gained from this curriculum be sufficient to bring about the desired cognitive outcomes? Knowing that much is at stake, how would this change the art and science of good pedagogy? These questions are provocative because it is one thing to understand propositions about teaching for enhanced cognition and another to possess the attitudes, perceptions, feelings, skills, and strategies that make a practitioner effective. The content may be fine, but may not go far enough.

One reason for this can be traced to problems with translation. Theorists are notoriously and almost unanimously naïve about the difficulty in making the move from the theory they dispense to practical application. To be sure, some findings translate directly to the gymnasium: "Exercise A promotes more electrical activity and blood flow in the cortex than activity B. Thus, all other things being equal, and assuming the efficacy of electrical activity and blood flow for cognitive development, A is the more valuable activity."

Unfortunately, things are not always equal, and some theory is not so easily applied. The complex interaction of genes, environment, and health; the effects of capitalism on the health industry; and the influence of internal-locus-of-control on persistence are cases in point. What exact pedagogical behavioral changes are required by these theories? It may be hard to say.

To complicate the translation matter further, the "in-gymnasium" experience is usually more complex than the "in-laboratory" experience. Bare-bone scientific facts have to be contextualized, genderized, Americanized, and humanized before they can be put to best use. The distance from the fact to the decisions and habits of concrete application is often considerable. The journey from one to the other requires wisdom, experience, good judgment, careful observation, in-context experimentation, as well as practice,

and yet more practice.

It is clear from this that translation problems can produce perceptions of irrelevance among PE majors, even when the content is absolutely crucial. But problems with translation do not stop here. This perceived irrelevance is sometimes compounded by an equally serious problem—one of denigration. This pedagogical putdown can be generated by the following message that is frequently delivered by theory professors either tacitly or explicitly: "This is crucial, bedrock information that is needed in your profession. If you truly understand this information, you will know what to do and moreover, because you are rational beings, you will do it."

The first statement, however—the one about this being bedrock information—is only partly true, and the second one about automatically knowing what to do (let alone doing it) is false. Yet, when teacher candidates cannot see why the information is crucial and cannot apply it directly to their diverse situations, they are inclined to feel that it is their fault. This is so because of the stature accorded to science and rationality in our academies and society. The problem—our students may reason—does not lie with scientific scholarship. Everyone knows it is important. The problem must lie more with them. They must be stubborn, unappreciative, or simply dense. Thus, students lose confidence for at least partly unjustified reasons.

The roots of this problem transcend kinesiology and can be traced to an attack on common sense. We have all heard the mantra of reductionist science: "things are not always as they seem." We are said to understand the larger phenomenon by breaking it down into its smaller elements. Global behaviors need to be understood by looking for underlying mechanisms. The visible can be explained by the hidden. Science has been remarkably successful in doing just that by breaking things down into atoms, genes, alleles, quarks, and who knows what else, but there is a second side to this story that we have too often missed.

While it is true that things are not always as they seem, it is also true that things are sometimes *precisely as they seem.* Moreover, being able to see these things takes education and training—that is, efforts that produce eyes that see, ears that hear, fingers that feel, and so on. In fact, many people who are supposedly well educated but chronically ineffectual probably lack this very ability. They cannot see things precisely "as they seem."

This kind of personal knowing is called folk knowledge or folk psychology in the literature (e.g., Gould, 2003; Midgley, 1994). Since the rise of science, folk knowledge has been under attack. It was believed that it would be replaced—not complemented—by reductive, abstract, entirely objective kinds of knowing. As science became more sophisticated, it was believed that folk knowledge would become less and less useful. We would become less inclined to trust our eyes and more likely to trust what we know or understand to be true. It is easy to see how this undercut the confidence of practitioners. Their intuition told them that personal knowledge derived from years of experience should be trusted, but their education was often sending them contrary messages. Modern, well-educated physical educators, they were told, do not do what seems right. Rather, they should resist many of their intuitions and trust what they understand (scientifically) to be true.

The highly competent practitioner actually complements scientific understanding with ever richer resources from folk knowledge—from seeing how the theory does and does not apply

The move to pedagogical competence in the classroom or gymnasium, however, does not proceed quite in this direction. The highly competent practitioner actually complements scientific understanding with ever richer resources from folk knowledge—from seeing how the theory does and does not apply, from sensing the right time for this kind of motivation, or from judging intuitively who needs more attention and who does not. This requires one to see teaching partly as an art that is grounded as much on ingrained folk insight as on explicit scientific understanding. Master teachers, in fact, import scientific fact into their eyes and hands and ears—so they subsequently see their students and the dynamics of the class from science-informed eyes and from a wealth of personal experience, even if that science is no longer explicitly available to recall for any verbal reports.

This shows that science or theory and superb teaching skills are not opposed to one another, nor is theory irrelevant. As noted earlier, scientific findings about exercise and cognitive functioning might reshape physical education—what goals physical educators teach toward, how they teach, what activities they teach, who receives priority attention, and who does not. Of course, science or theory in a curriculum can be *perceived* as irrelevant by future teachers when it is too abstract or when it is aimed more at producing clones of the professors than competent instructors. And it is *experienced* as irrelevant when it has not been embraced, digested, and ingrained—when it has not been transformed from bare fact to personal habit, tendency, and artful conduct. Understanding something well does not directly translate into new pedagogical feels and habits. This takes on-site practice, repetition, and experimentation.

When this occurs, a remarkable transformation takes place. Teaching becomes easier and better, and the teacher may not even be able to get back in touch with the theory that was partly responsible for this behavioral transformation. But teacher candidates who cannot make this transition quickly are not dense. They are simply as human as the instructors who are teaching them.

Good science, in fact, is analogous to good teaching.

Young researchers may be given theory about how, for example, inductive reasoning works. These propositions too are encountered as irrelevant or puzzling in relationship to the various concrete tasks undertaken by good researchers. Eventually, the theory begins to seep into the young scientists' flesh and bones, so now they see the world differently: as skilled inductive thinkers and as artists of science rather than as those who mechanically try to apply the theory of inductive reasoning to scientific tasks.

If theoreticians in kinesiology were more appreciative of the way theory works in their own lives, they might be more attentive to the difficulties of translation encountered by pedagogy students. These students, on this line of reasoning, would see that facts as bare facts are often irrelevant until they are ingrained through practice. "Not getting it" is not a reason for denigration or feelings of inferiority among teacher candidates any more than it was for their instructors who also had trouble "getting it" initially. Both need sound pedagogical experiences that help to bridge the gap between mere understanding and embodied artistry.

> Good thinking is what counts—whether intuitive or reflective, verbal or non-verbal, context-specific or context-general, in a laboratory or on a soccer pitch.

If the theory-practice divide promotes denigration unnecessarily, a second phenomenon probably has even more insidious effects. It is insulting when the phenomenon that gives rise to professional activity—the very thing that may well promote better cognitive functioning—is largely excluded from the teacher preparation curriculum. This phenomenon, of course, is physical activity.

The clear implication of excluding movement is that first-hand experiences of moving well do not add anything important to our knowledge of activity. In other words, skilled movement is not a valid way of knowing. Theory promotes understanding; activity does not. This curricular asymmetry helps to perpetuate the myth of the one-way relationship of theory informing practice. Practice, on the other hand, does not (in this view, cannot) return the favor.

This reinforces cultural stereotypes related to Cartesian mind-body dualism. The mental trumps the physical, understanding is more valuable than feeling or intuition, abstractions are more important than concrete experience, and therefore academic subjects in school are more important than the embodied arts, including dance and physical education. How ironic it is, and how hurtful it can be, for teacher candidates who plan to devote their life to the promotion of skilled movement to be told by their curriculum and professors that skilled movement is non-intellectual and of little educational value. On the contrary, if we are whole, integrated beings, movement is and should be both useful and meaningful—both a means to an end, like better cognitive functioning, and a delightful end in itself.

Once again, this one-way relationship of practice being dependent on theory is flimsy, because concrete, advanced experience actually funds research and theory. Good investigators need to know where to go, what to look for, and which hypotheses are potentially fruitful and which ones are not. Where do these clues come from? From advanced life experiences in the subject matter at hand. The more advanced the experience, the better the clues.

Theory is, from this perspective, the handmaiden of practice. Some would say it always has been and always will be thus indebted. Theorists, it has been said, probably have more to learn from great pianists, painters, architects, golfers, and scientists than the other way around (e.g., Polanyi & Prosch, 1975). The vast stores of intuitive knowledge possessed by great performers (as a product of experimentation, apprenticeship, and understanding) are things of beauty that deserve respect in their own right.

This is true, as well, for our understanding of cognitive development. Experiences of complexity in movement, for instance, increase the plausibility of the idea that exercise enhances cognitive development. Different activities produce experiences with different cognitive content, and this may provide guidance for future controlled study. First-hand experiences with various forms of intrinsic and extrinsic motivation to exercise persistence (and thus, enhanced cognitive development) provide clues for what works and what does not and also provides ideas for future research.

These reflections on cognitive development and artful practice point to a more democratic conception of the educationally stimulated freedom that pedagogy graduates could experience than the one that is operative in most major programs. The primacy of theory over practice is based on the notion that freedom attaches to parts of the self—specifically to the mind. A more democratic notion would suggest that freedom attaches to places and problems. The more places that can be visited and the more problems that can be solved, the greater the freedom one possesses. This enhanced freedom would be one of the products of a balanced curriculum. A balanced curriculum would need to focus both on the *themes* that best depict the value of physical activity in education and also on *places* where movement experts need to be competent and thus experience freedom. Teacher candidates need to believe the right things, value the right values, and portray physical education in the most powerful way possible. An emphasis on cognitive functioning provides just this kind of direction.

Teacher candidates also need to be competent when examining a cadaver, looking through a microscope at muscle tissue, evaluating a biomechanical formula, understanding social forces that help to shape movement, getting an unruly group of students organized, as well as catching an oncoming ball, swimming across a body of water, and biking though the mountains. Because we know that theory can inform practice,

we need to be competent in theory places and with theory problems, theory equipment, and theory rules. But because practice also informs theory, we need to be competent in pedagogical locations and movement places too.

Hopefully the message would be clear for teacher candidates. Good thinking is what counts—whether intuitive or reflective, verbal or non-verbal, context-specific or context-general, in a laboratory or on a soccer pitch. These kinds of dichotomies, about which too much has been made in higher education and in which too much power has been invested, need to be reconceptualized as complementary, interactive aspects of a whole education (Kelso & Engstrom, 2006).

Complementary thinking helps us to see that exercise, perhaps unsurprisingly, leads to better cognitive functioning in math places and English places and logical reasoning places. This reduces the irrelevance of physical education for promoting core educational goals. But skilled physical activity, like artful teaching, is a form of good thinking in its own right, a brand of thinking that is cultivated by practice, judgment, and the acquisition of a great deal of folk knowledge. This realization helps to reduce irrelevance in a second sense—the irrelevance of theory for enhanced folk knowledge and, conversely, folk knowledge for stronger theory.

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Dan Landers (landers@asu.edu) is a professor in the Department of Kinesiology at Arizona State University in Tempe, AZ 85287. Scott Kretchmar (rsk1@psu.edu) is a professor in the Department of Kinesiology at Pennsylvania State University in University Park, PA 16802.

McCullick

Continued from page 46

This is a fair comparison because the group of scholars was a veritable "Murderer's Row" of minds on par with the skills of Ruth, Gehrig, Lazzeri, and Meusel: Chuck Corbin, Lynn Housner, Scott Kretchmar, Dan Landers, Amelia Lee, Larry Locke, Thomas McKenzie, Jerry Thomas, and Kathleen Williams.

The forum was one of the best-attended early sessions in NASPE's recent history. In fact, the feedback was so overwhelmingly positive, the scholars were asked to put their talks into article format for this feature, which will conclude in the next issue of *JOPERD.* Be forewarned that in these articles the scholars do not always agree with one another. Regardless of their position, they provide the profession with food for thought. As organizers of the forum, we hope you will not only enjoy reading these articles, but will also start a conversation with your colleagues about the central issue: what should be taught in K-12 physical education?

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Bryan McCullick (bamccull@uga.edu) is an associate professor in the Department of Kinesiology at the University of Georgia in Athens, GA 30602. Ang Chen is a professor in the Department of Exercise and Sport Science at the University of North Carolina–Greensboro, in Greensboro, NC 27402.

Corbin

Continued from page 50

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Charles B. Corbin (chuck.corbin@asu.edu) is an emeritus professor in the Department of Exercise and Wellness at Arizona State University in Mesa, AZ 85212. Thomas L. McKenzie (tmckenzie@sdsu.edu) is an emeritus professor of exercise and nutritional sciences at San Diego State University in San Diego, CA 92182.