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MOTOR BEHAVIOR

Efficacy of Movement Analysis and Intervention Skills

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Abstract

The development of skillful movers is arguably one of the most important goals of physical education. According to the National Association for Sport and Physical Education (2004), skill proficiency and confidence are paramount to developing a lifelong commitment to being physically active. Yet these attributes are highly dependent on practitioners' analytical and interpretive judgments of observed performance as well as their prescription of appropriate intervention strategies for skill improvement. Alarmingly, research has repeatedly shown both pre- and in-service physical education teachers lack competency in movement analysis (e.g., Behets, 1996; Hoffman & Sembiante, 1975; Imwold & Hoffman, 1983). Consequently, traditional single subdisciplinary instruction in skill analysis and intervention in physical education teacher training programs is not working. Given the relationship between perceived competence and lifelong engagement in physical activity, the contention of this paper is that physical education teacher training programs must better prepare candidates in skill analysis. Toward that end, the efficacy and implementation of an integrated model is advocated.

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It is reasonable to assume people will stay active into adulthood if they have an activity they can do comfortably well (Tammelin, Nayha, Hills, & Jarvelin, 2003). There are various places where they can learn to perform an activity comfortably, and one of them should be in their physical education classes throughout their public school experiences. How teachers can help students to acquire skills necessary to perform comfortably is largely based on their ability to successfully analyze movement and subsequently engage in appropriate intervention strategies.

Movement Analysis Competency

What is movement analysis, and how good are teachers currently at performing these analyses? Knudson and Morrison (2002) defined movement analysis as "the systematic observation and introspective judgment of the quality of human movement for the purpose of providing the most appropriate intervention to improve performance" (p. 4). A review by Lounsbery and Coker (2008) provided insight into the answer to the second part of the aforementioned question, how good are physical education (PE) teachers in performing the critical functions in movement analysis? Let's review what the research tells us.

Hoffman and Sembiante (1975) looked at professional skills in analyzing a baseball swing and found coaches were 75% successful, physical educators were 65% successful, and a group of controls was similar at 63%. A year later, Biscan and Hoffman (1975) found that physical educators were no better than classroom teachers at competently analyzing a novel movement. Imwold and Hoffman (1983) further found that veteran PE teachers were no better at analyzing performance of a front handspring than were preservice PE teachers, and Behets (1996) produced similar findings for an analysis of a vault. Given the importance of fundamental motor skills as foundational to future sport specific skills, it was disturbing to note Morrison and Reeve's (1998) evidence that PETE students were no better at analyzing errors in throwing, striking, and kicking skills than were nonmajors. Similarly, Walkley and Kelly (1989) found preservice and in-service physical education (PE) teachers to be only 75% accurate in analysis of throwing and catching skills, and Stroot and Oslin (1993) found that preservice teachers' feedback was often provided about a component of the movement that had already been demonstrated with a high level of proficiency; components requiring intervention often were not addressed. These

findings should concern all of us as noted by Lounsbery and Coker (2008) who call for the "need to revisit the priority placed on motor skill acquisition in K–12 physical education curriculum and the prerequisite instructional practice of skill analysis" (p. 23).

Physical Literacy

One would hope the development of physical literacy is one of the main priorities, but is it happening? Physical literacy has been defined as "the development of fundamental movement skills and fundamental sport skills that permit a child to move confidently and with control, in a wide range of physical activity, rhythmic (dance) and sport situations" (Higgs, Balyi, Way, Norris, Cardinal, & Bluechardt, 2008, p. 5). Physical literacy is important because, as Hedstrom and Gould (2004) stated,

> children who feel competent about their physical abilities have been found to more often participate and persist in physical activity (PA), whereas children who do not have that sense of competence are more likely to not become involved or to discontinue involvement. (p. 21; see Figure 1)

Physical literacy has been shown to be an important predictor of participation in organized sport and lifelong PA (Carroll & Loumidis, 2001; Gallahue & Ozmun, 2006; Hedstrom & Gould, 2004).

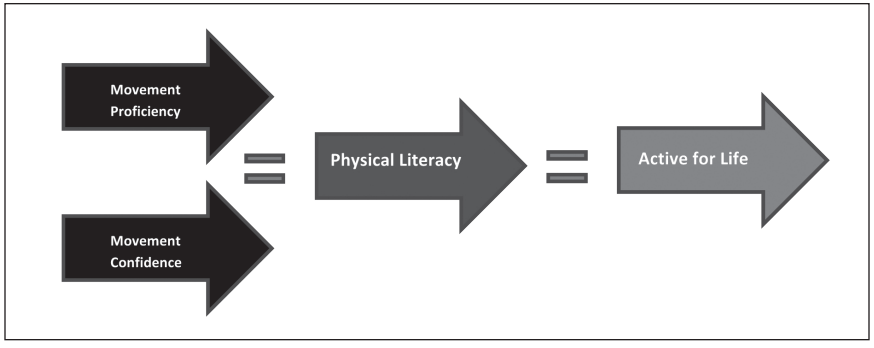

Figure 1. Development of Physical Literacy and Active Lifestyles (adapted from Higgs, Balyi, Way, Cardinal, Norris, & Bluechardt, 2008)

We have suggested a relationship between physical competency and lifetime physical activity. What is the literature support for this position? Stodden, Langendorfer, and Roberton (2009) suggested

a strong relationship between motor skill competency (MSC) and health-related physical fitness (PF), especially ballistic fundamental motor skills. Three decades ago, Seeveldt (1980) and, more recently, Clark and Metcalf (2002) indicated fundamental motor skills form the basis for future sport-specific skills, skillful movement, and PA. Thus, good movement analysis has to begin early in children's education and carry forward into later years.

Are there other influences that impact one's likelihood to pursue a lifetime of PA? Fairly early, Harter (1978, 1988) spoke about a child's perception of competence as an influence of future engagement in PA. Subsequently, several authors have examined how perceived competence influences future PA. Barnett, Morgan, van Beurden, and Beard (2008) stated, "Developing a high perceived sports competence through object control in childhood is important for both boys and girls in determining adolescent PA and Fitness" (p. 1). Furthermore, Kalaja, Jaakkola, Luikkonen, and Watt (2010) found perceived PA competence was a significant predictor of PA engagement. Carroll and Loumidis (2001) examined the quantity and intensity of PA participation outside of school for primary school children of both high perceived competence and low perceived competence. They found those with high perceived competence were involved to a significantly greater level than their low perceived competence counterparts.

Implications

Given the strong association between perceived competence and sustaining a physically active lifestyle, improvement of both perceptions of and actual movement competence among children and youths is a central construct in PE (Sherrill, 1998). According to Stuntz and Weiss (2010), performance improvements and feedback received from coaches and teachers are some sources of information "used by youth to determine how good they are at physical activities" (p. 436). This supports the contention of Pinheiro and Simon (1992) who stated, "The ability to diagnose motor skills is one of the most important competencies of a teacher of physical education and sport" (p. 288). Why then are we failing our future teachers, who then continue to fail our children, and what can we do about it? We need to do a better job of training our preservice teachers in the skill of movement analysis.

PE teacher training programs have traditionally relied on a "fragmented single sub-disciplinary approach" (Knudson &

Morrison, 2002, p. 1). One (or two) course in biomechanics clearly is not sufficient. The research we reviewed regarding teacher proficiency in skill analysis clearly indicates this approach is not working. Kelly and Melograno (2004) further suggested that given the large number of motor skills physical educators are responsible for teaching, most assessment training focuses on the concept of how to assess rather than actually training teachers to competently assess each of these skills.

If the development of physical literacy and movement competence is indeed a priority in PE, then PE teacher training programs must better prepare candidates in skill analysis. The first step to accomplishing this is to adopt an integrated approach.

Integrated Four Task Model

Knudson and Morrison (2002) proposed an interdisciplinary method to skill analysis that would serve the practitioner well. Their integrated model consists of four tasks that provide the practitioner with a systematic approach to skill analysis: (1) preparation, (2) observation, (3) evaluation and diagnosis, and (4) intervention (Figure 2).

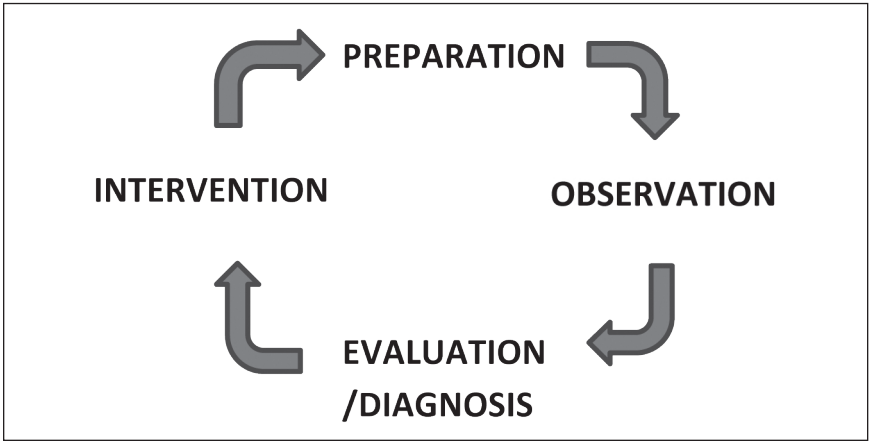

Figure 2. Integrated Skill Analysis Cycle (adapted from Knudson & Morrison, 2002)

The Observation Plan: Preparation and Observation

The first step to a good analysis is an accurate observation. To accomplish this, students must have in-depth knowledge about the activity and what the goal of the movement is. After identifying the requisite skill and its goal, students then must divide it into various

movement phases (e.g., preparatory, action, and follow through/recovery). A checklist of the key elements for each movement phase must then be created. Choosing observation strategies is the next step in this phase, including choosing the appropriate vantage points (i.e., distance and angle), the number of trials to be observed, and whether the observation will be conducted using only the naked eye or with video. With advances in technology, there are also many movement analysis systems currently available (e.g., Dartfish, Peak Motus) that will permit a deeper analysis as well as comparison of the observed technique to the correct technique.

Evaluation and Diagnosis

In reference to Figure 2 again, the next step is evaluation and diagnosis. During this phase, practitioners must be careful to treat the cause, not the symptom. In other words, the source of the error identified must be determined. Errors not only occur in the task and technique but also can be a function of the environment and the developmental level of the learner. Prior to intervening with the learner and sharing his or her observation, the observer must be certain as to where the errors occur. In essence, the observer must ask a series of who (the learner), what (the task), and where (the environment) questions. This is where an integrated approach that includes not only knowledge of biomechanics but also a good understanding of motor behavior principles will serve the observer well. Hoffman (1983) suggested errors could be related to deficiencies in critical abilities, skill, or psychosocial factors, as depicted in Figure 3.

Within skill performance alone, one can misperceive where to be in order to be successful or one can even make the wrong decision about what to do or when to do it. For example, slow motion execution is generally an error in technique. However, slow initiation of a movement is more than likely a perceptual or decision error. When there is time available to organize a response and the performer has a large repertoire of responses, an error made in such a situation is usually a decision error. Thus, a correct analysis will result from a careful, knowledgeable blending of biomechanical and motor behavior information.

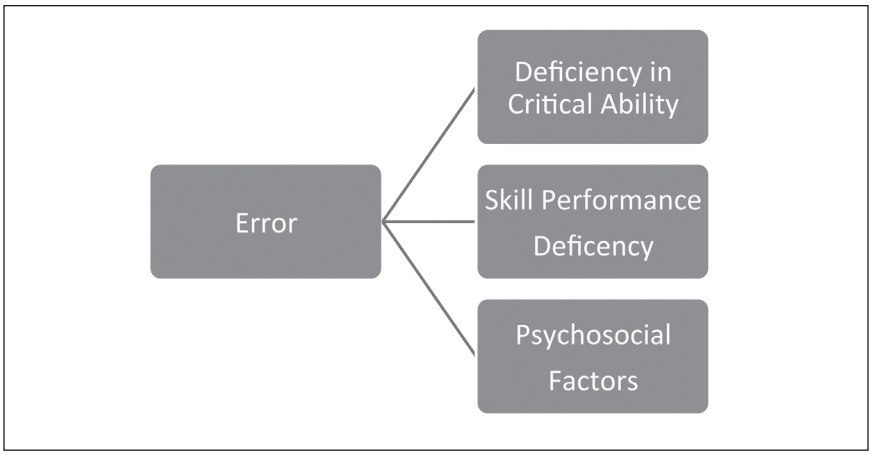

Figure 3. Sources of Errors (adapted from Knudson and Morrison, 2002, p. 116)

Intervention

In the final stage of the skill analysis cycle, the practitioner must select an appropriate intervention strategy to bring about the desired change that will lead to greater skill proficiency. An integrated subdisciplinary approach is once again critical to bridge the gap between knowing what correction needs to be made and developing effective strategies to assist the learner in making that correction. Although the provision of feedback is often the predominant method employed in error correction, a variety of intervention strategies from the various subdisciplines also exist that may better resolve the noted performance deficiency. For example, if a performance error is a result of fatigue, changes in the conditioning program may be prescribed (exercise physiology). On the other hand, a psychological intervention would be more appropriate for an athlete whose performance is hindered by negative self-talk (sport psychology). Manipulation of practice conditions, including the modification of rules and drill design, can assist in the development of perceptual skills necessary for quick and accurate decision making (motor learning and control). Finally, simply modifying equipment to ensure that it is developmentally appropriate may quickly rectify a faulty movement pattern (motor development).

Physical Education Teacher Training

Lounsbery and Coker (2008) asserted skill analysis preparation in PE teacher training programs must be grounded within an integrated

curriculum that identifies target courses for integration, establishes a systematic progression of those courses, affords multiple opportunities for authentic practice, and provides performance benchmarks for assessment. We purport the adoption of Knudson and Morrison's (2002) four task model as a first step toward this end. This model offers a systematic, interdisciplinary method upon which an integrated curriculum can be developed. Through a curricula review, PE teacher education programs committed to developing skill analysis proficiency can determine the target courses (including activity classes) to best implement the model based on the faculty expertise, course sequence, and opportunities for practice.

Summary

Keeping people engaged in lifetime PA must become a critical focus of our profession. The premise of this article is that when people perceive themselves as competent in physical activities, they will stay involved. But perceived competence is not sufficient; they must also become physically literate. Those who do are more likely to continue to engage and persist in PA into adulthood. It is imperative that physical educators become proficient in skill analysis in order to prescribe the intervention strategies necessary for the development of motor skills that will lead to lifetime PA participation. Traditional PE teacher training programs have proven ineffective. We therefore propose and recommend the adoption of Knudson and Morrison's (2002) integrated four task approach that includes greater opportunities for authentic practice to increase the potential for the development of movement analysis skills for future graduates of our programs.

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