An instructor is teaching the basketball jump shot to a group of young physical education students. She demonstrates the movement, pointing out all the components of a successful shot. The students line up at the baskets, eager to try.

The instructor observes many attempts but few baskets. Where should she begin to correct the multitude of errors she has just witnessed? Overwhelmed by the different ability levels and the vast array of jump shot features that could be pointed out, the instructor simply says, "Good effort; keep trying," and moves on to the next set of students. Little learning has taken place during the lesson.

This scenario can be seen time and again in skill-learning situations. Although the observation process in physical education has been identified as critical to effective instruction and to the development of competence in students (Allison, 1985), it is often not a recognized part of teacher education programs (Barrett, 1983). The goal of this article is to introduce to the field teacher a methodology for developing the art of observation through biomechanics. This methodology will help physical education teachers identify and prioritize the critical features, or checkpoints, of skills that students are required to learn.

Teacher and Student Responsibilities

The role of the teacher can be split into three areas: teacher development, teacher requirements, and teacher function. Teacher development involves deciding what information to initially send to the student, what observation methods to use, and how to correct errors. Teacher requirements include knowing the skill, the skill level of the student, what the skill looks like when done correctly, what the student is doing, and what prescriptions to use to remediate errors. The teacher then conveys that information to the student, who has the responsibility to receive the task assignment, perform the task, and receive feedback [ILLUSTRATION FOR FIGURE 1 OMITTED].

The physical education curriculum in higher education focuses mainly on the teacher requirements and functions. Activity classes focus on learning the skills themselves, while methodology classes focus on many of the other teacher requirements. Teacher development, however, is often lacking, especially the component of deciding what the critical aspects of given skills are.

Rink (1993) identifies the first component of using systematic observation as "deciding what to look for" (p. 276). However, she adds, "Determining possible causes of problems is not easy and requires a great deal of reflection on the part of the teacher" (p. 277). Along the same line of thought, Siedentop (1991) states:

For skill feedback to be effective, it has to be accurate... The teacher would have to know the skill well enough to accurately discriminate the presence or absence of critical skill elements in the student's performance. All the related evidence suggests that most teachers do not have this kind of discriminatory capability. (p. 39)

Currently, a kinesiology or biomechanics class is required for accreditation in the physical education curriculum in higher education (National Association for Sport and Physical Education, 1995). These
classes traditionally focus on the fundamentals of biomechanics, without explaining how to apply this information. Many biomechanics textbooks contain only brief sections on using knowledge for observation and analysis. All too often, published biomechanical analyses have little direct application for instructors. Therefore, rather than try to gain something useful from this type of course, many field teachers turn to the coaching literature for help in deciding the critical features of a skill.

The coaching literature, however, is often too general to be useful, or the hints given are meant to correct symptoms rather than causes of problems. Norman (1975) states, "Skill coaching...has been retarded by an inability to distinguish among causes of errors, symptoms of errors and idiosyncrasies in performance. Time is wasted trying to correct symptoms and idiosyncrasies, often to the frustration of both coaches and athletes" (p. 94).

Clearly, information from the biomechanics literature and the coaching literature needs to be brought together in a concise manner to aid teachers in developing critical features for skills. Knudson, for example, cited six key teaching points for the basketball jump shot (1993), all based on biomechanical research. The key factors give the instructor something specific to observe, and because there are only six, neither the student nor the instructor becomes overloaded. However, no provisions are made for different ability levels, and no indication is given of which key factors to examine or correct first.

Teacher Development: Checkpoints for Teachers

What to send. Teachers must be able to identify and prioritize the critical features or checkpoints of each skill that students are required to learn. Strand (1988) suggested using a manageable number of checkpoints for the different skill levels of a performance. The checkpoints in each skill level are further broken down into three phases: a pre-execution phase, an execution phase, and a post-execution phase. Within each phase are no more than three checkpoints. This approach provides many benefits:

* Critical features are divided logically according to skill level and degree of difficulty.
* It is easy to visualize all the checkpoints within a specific skill, which can provide a reference for instructors to use when writing lesson plans.
* The observation process itself is made easier by eliminating unnecessary checkpoints within certain ability levels.

A checkpoint system also can be developed through the use of a box diagram or model, as seen in figure 2. The idea of the model was developed by Hay and Reid (1988) as a tool for qualitative analysis. The result or goal of a skill is written in the top box, and subsequent boxes contain the factors which produce the result. Where possible, the factors included in the model should be mechanical quantities, and each factor should be completely determined by those factors that are linked to it from below. The benefits of models include the following:

* A mechanical basis explains the movement.
* Causes rather than symptoms can readily be addressed.
* Subsequent checkpoints have validity and reliability.

Many skill models exist (see, for examples, [ILLUSTRATION FOR FIGURE 2 OMITTED]; Hay, 1995; Hay & Reid, 1988), or models can be generated by the practitioner. The key to using models is to take the pertinent mechanical factors and develop them into understandable checkpoints.

How to observe. Checkpoints should be designed in a hub-to-spoke-to-rim fashion (Gangstead & Beveridge, 1984). That is, gross or large muscle or body movement (the hub) should be observed or addressed first, followed by movement radiating out from the body (the spokes). The rim, or the finest motor movements, are checked last. Efficient movement results when the large body parts drive the
finer, more detailed movements. Often the major problems with a skill performance are related to the gross motor movements, so attending to fine motor movements first is an ineffective approach. Once the checkpoints are completed, the instructor must decide whether to observe groups or individuals, and where to make the observations from. These decisions depend on the skill requirements and the plane or planes on which the movement takes place. The various components of a skill may be easier to view from different angles.

How to correct. Finally, the interaction between teacher and student should include both positive feedback and constructive suggestions for changes. Teachers need to remediate errors while also letting students know what components to keep using. Too often the good parts of a movement are lost while a student is busy concentrating on the negative aspects.

The Basketball Jump Shot

Table 1 shows a sample skill analysis for the jump shot in basketball. The checkpoints are developed from the mechanical factors leading to the goal of the model in figure 2 - accuracy (Brancazio, 1984). The model is based on biomechanical research and coaching information concerning the jump shot (Yates & Holt, 1982; Wooten, 1992; Knudson, 1993; Hay, 1995). The language used in the checkpoints is understandable to the student, but each component has a mechanical basis. Depending on the ability level being taught, the instructor can pick the checkpoints needed to develop competence in student performance. For the beginner, no more than nine checkpoints are given, while the advanced would have no more than 27. A progression of the requirements necessary for acceptable performance at each level is given.

Design of Models and Checkpoints

A top-down approach to designing the models and subsequent checkpoints [TABULAR DATA FOR TABLE 1 OMITTED] is just one of many possible approaches. Biomechanists can work with practitioners to develop goals and subsequent factors related to the goal. A bottom-up approach may also be an appropriate method. Teachers can take cues, hints, and comments given by coaches and work backwards through the models to check on the validity of such comments. If no valid connection can be made between the factors and the goal, then a new cue or comment should be developed that directly relates to the goal.

The Biomechanical Basis

Teachers and practitioners should pull out their old biomechanics course notes. They may be surprised at how much they remember and understand when looking at biomechanics from the standpoint of developing models and using checkpoints. In addition, instructors of methodology classes should work with biomechanics instructors so that the "how" and "what" of observation can become a component of a bio-mechanics class. If physical education instructors take the time to develop and organize models and checkpoints for skill analysis based on biomechanics, the quality of physical education will improve and the quantity of actual teaching will increase - and in turn, students' success rates will rise.

References

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