Critical Thinking in the Psychomotor Domain

Carl Gabbard and Ron McBride

Child development theorists continue to recognize importance of utilizing cognitive, affective, and psychomotor domains to develop individuals to their fullest potentials. While each domain provides unique contributions to human development, interactive benefits among the three domains warrants consideration. Contemporary theory and research support potential of using experiences within the psychomotor domain to stimulate cognitive and affective development.

In an effort to maximize cognitive performance, recent reports and dialogue from the research community (Brookfield, 1987; Follman, 1988; Sternberg & Bhana, 1986) have focused attention on identifying and teaching critical thinking skills. While primary role of the cognitive domain in stimulating critical thinking skills is apparent, potential benefits of collaborative cognitive/psychomotor experiences in developing and utilizing these processes should be considered. This paper presents an overview of critical thinking and, by drawing upon motor learning theory, describes how critical thinking skills may be fostered in the psychomotor domain. Mosston's (1986) spectrum of teaching styles are illustrated as one vehicle by which critical thinking might be introduced to the field of physical education.

Overview of Critical Thinking

Identification of critical thinking skills and the question of how teaching/learning strategies promote stimulation of such cognitive processes are focal points in educational literature. Today's children are provided with such an enormous amount of information requiring rote memory learning that higher-level thinking skills such as ability to problem-solve are not being as fully developed. Naisbitt (1982) reported that only 30 years ago approximately 17% of the work force held information related jobs. By 1982 approximately 60% were engaged in such activities and by the end of the decade, the figure may be as high as 75%. To meet projected work skill demands in a complex information processing environment, educators are being pressured to prepare students to be critical thinkers and not just rote-memory learners.

One of the primary issues in the critical thinking dialogue centers on identifying and defining critical thinking skills. Ennis (1985) described critical thinking as "reflective and reasonable thinking that focuses on deciding what to believe or do." Sternburg (1985) interpreted the term as comprising mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts. Brookfield (1987) contended that critical thinking is embedded in everyday adult tasks and not just associated with ivory tower activities. Critical thinking is associated with processes of "identifying and challenging assumptions and imagining and exploring alternatives" (p. 229). Webster's dictionary also supports this concept by defining "critical" (in this context) as involving careful judgment or judicious evaluation and performing of scholarly emendations. A common description expressed among several definitions is ability to enquire, explore, and mediate a problem, rather than learning through more direct stimulus-response mode.

The authors suggest, that to invoke critical thinking, learning/teaching strategies that focus on inquiry and process of discovery are crucial. During the course of discovery, critical thinking skills may be activated in the form of such cognitive functions as comparing, contrasting, categorizing, hypothesizing, synthesizing, and problem solving. Some educators suggest that the final phase of cognitive processing is ability to be creative; hence, produce new knowledge. To initiate inquiry (the medium for developing critical thinking skills), the student must move away from cognitive acquiescence.

According to Festinger (1957) and supported by Mosston and Ashworth (1986), there must be a process of cognitive dissonance; a disturbance that stimulates desire to inquire and seek solutions. Without a mediation phase (i.e., time needed for the brain to *research*), the learner does not engage in critical thinking functions and regresses to a simulus-response state of learning.

Figure 1 presents a model of discovery based upon notions of Festinger (1957), Bruner (1961), and Mosston

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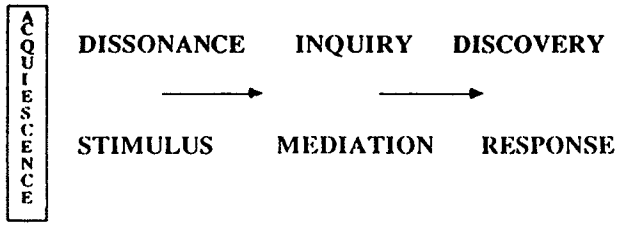
Figure 1



and Ashworth (1986). Figure 2 provides theoretical placement of critical thinking in the discovery process.

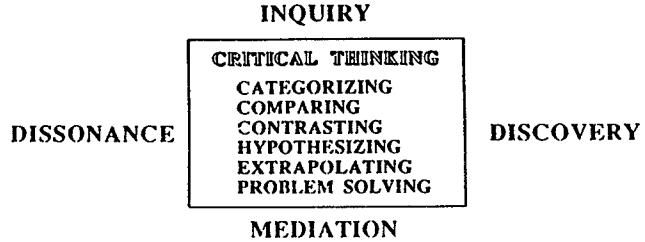
Critical Thinking in the Psychomotor Domain

Schema Theory.

Significance of providing opportunities for developing and utilizing critical thinking skills within the psychomotor domain is well-founded from a contemporary learning theory viewpoint. Schema theory (Schmidt, 1975; 1988) clearly supports necessary interaction of cognitive and neuromuscular processes for executing efficient motor performance. Several cognitive functions used in developing one's intellect are also found in forming and executing a motor program (e.g., comparing, evaluating, memory processes, attention, and imagery). Much like Piaget's notion of a schema, Schmidt proposed an explanation of how individuals learn and perform a seemingly endless variety of movements.

Schema theory suggests that motor programs stored in memory are not specific records of movements to be performed. Rather, they represent a set of general rules, concepts, and relationships (schemas) to guide performance. Simply stated, individuals store in memory past movement experiences. This storage of *movement elements* and their relationships to each other is referred to as movement schema. An individual generates schema

Figure 2



to program (i.e., in a sense *piece together*) desired movements. Schema theory treats motor programs in much the same manner as concepts are negotiated in the cognitive domain. The motor program begins with features from the cognitive domain and perceptions of incoming information. For example, the child that has practiced throwing a ball soft and hard, near and far, should formulate a good cognitive awareness of what may be in the middle.

Motor schema (concepts) for a general skill area (e.g., throwing, jumping) are bounded by dimensions related to space, time, and muscular force. Each dimension represents a continuum that may (depending upon experience) be very limited or quite robust and diverse. Schmidt contends that the greater the variety of experiences produced by the individual, the more diverse the schema becomes, resulting in an increased capability to move effectively.

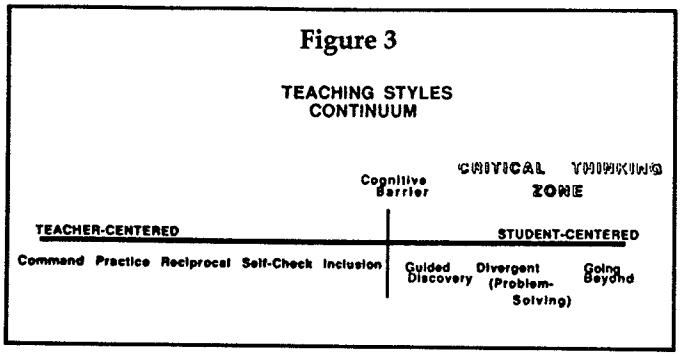
Practical suggestions for applying Schema theory (Gabbard, 1984; Graham et al., 1988; Schmidt, 1977) parallel characteristics associated with critical thinking. Learning/teaching strategies should provide opportunities to participate in a variety of experiences that challenge assumptions, explore alternatives, and engage the learner in the process of problem solving. These experiences are assumed to add to cognitive/psychomotor schema, aiding the individual in formulating effective mental strategies coupled with performance of skillful movements. It would appear then, that development and use of critical thinking skills not only forms foundation for greater levels of cognition, but may also provide the individual with a vigorous motor skills repertoire.

Mosston's Teaching Styles Spectrum

Introducing appropriate learning/teaching strategies is crucial in developing critical thinking skills. An example of a set of strategies having implications for developing these characteristics through use of both behavioral domains is presented by Mosston (1981; 1986). As seen in Figure 1, to engage in critical thinking, students must move out of a learning condition in which they passively accept information presented by the teacher. This S→R type of learning is seen in demonstration/replication methodology typically used in elementary classrooms. Figure 3 presents Mosston's (1981) continuum with additional notations related to critical thinking and the *discovery process.*

According to Mosston's basic tenets, teaching styles may be placed on a continuum representing kinds of decisions made by either teacher or student. Line of demarcation between styles that reflect student acquiescence and emergence into the *discovery zone* is also

Figure 3



provided. Mosston emphasizes that the continuum is not a style-versus-style situation, nor does it constitute a target that should move progressively from left (command) to right (going beyond). Styles are selected based upon such considerations as desired learning outcomes, time, class size, facilities, discipline, and perceived maturity of the class.

The first five styles (command to inclusion) are characteristically teacher-centered. The instructor determines the subject matter and conditions surrounding the learning-teaching process. Demonstrations are emphasized and serve as models (correct solutions) for students to replicate. If the teacher were to use the first five styles with the same general subject matter, emphasis would move from a very direct teacher-student relationship (command), to practicing specifically described skills at stations (practice), to working with partners on prescribed tasks (reciprocal), to performing tasks individually (self-check), or being allowed to achieve objectives within prescribed performance levels (inclusion).

A frequent comment in support of using these styles emphasizes their merit in instructional efficiency. Goals are related to tasks that are generally based upon specific objectives. The process is time efficient and relatively little *wasted* time occurs. Another characteristic associated with this end of the continuum is effective use of teacher control of student behavior.

While these styles provide teachers with several options for producing learning outcomes, little opportunity for exploring new or alternative solutions through inquiry exists. As noted earlier, a common factor in the teacher-centered styles is reproduction of demonstrated skills or knowledge content. Beginning with *guided discovery*, student and teacher theoretically cross the discovery threshold and enter the discovery zone. Student-centered teaching styles provide opportunities for inquiry and for developing critical thinking skills.

Guided discovery, though a long used teaching strategy in European countries, is a relatively new innovation to teaching physical education in American schools. During the late 1960's and early 1970's learning/teaching by discovery, as an alternative to traditional direct instruction, was introduced to the United States and Canada from England. Initially used with young children to foster an understanding of movement concepts (e.g., time, weight, space and flow), lessons concerned with creative dance and creative games have also used the discovery teaching approach.

By modifying an existing teaching strategy, emphasis can be shifted from simply generating movement solutions to cognitive processes *used* by students to generate these solutions. Solutions are then translated into movement patterns. With guided discovery, students are led into the discovery zone with guidance that proceeds in a step-by-step converging process. Although students are provided with a problem having a predetermined solution, opportunities for critical thinking are offered. If the student ventures too far from the path toward discovery, additional guidance is provided. The teacher, however, never volunteers the correct solution. Students are allowed to *discover* this for themselves.

The standing long jump will be used to illustrate the process. Prior to the lesson, the teacher has already determined that proper mechanics (form) of the task represents the final objective. The class would be challenged to discover ways to jump for distance. With guidance, the teacher allows students to explore variations related to base of support, arm position, trunk position, leg position, and landing. The exploration process can be accomplished through efficient management of the environment. Using small groups in conjunction with numerous learning stations can provide ample opportunities for practice and self-discovery. Guided discovery in this instance develops critical thinking primarily through processes of comparing and contrasting.

The guided discovery approach can also be used when teaching traditional sports skills. For example, during a basketball unit, a teacher may introduce a lesson with a series of questions about ways in which a team may bring a ball up the court. Having already targeted passing as the lesson focus, students can be guided to this eventual solution. A specific pass may be identified and then students allowed to experiment or *discover* the most efficient way to perform a chest pass, bounce pass, baseball pass, and so on. Although the teacher has a specific end point in mind, learners are encouraged to explore and experiment in a carefully controlled or *guided* environment. By comparing and contrasting as well as formulating and testing hypotheses, students can not only *discover* how to perform these skills, but also generate strategies when one pass might be more appropriate than another to use in different situations.

Divergent teaching style—sometimes referred to as problem solving—further invokes development of criti-

cal thinking by allowing numerous acceptable solutions to a problem. Where guided discovery converges to a somewhat specific solution, the divergent style engages the brain to seek multiple solutions to a problem. Additional cognitive operations such as categorizing, synthesizing, and hypothesizing are employed. Again, using jumping-for-distance problem, less teacher guidance is provided and the notion that several appropriate solutions are possible, is accepted.

Orienteering is another activity that is well suited to the divergent teaching style. Students, either individually or in teams, may be challenged to locate a series of checkpoints on a course. Each checkpoint is worth points—the farther away from the starting area, the higher the point value. Students would be challenged to locate as many checkpoints as possible within a specified time limit. The individual or team with the highest point value would be declared the winner. As with the above example, many different solutions are possible and, so long as solutions are obtained within stated guidelines, they are acceptable. With the divergent style, the student determines which solutions are applicable to the problem. Consequently, the learner has greater control over subject matter.

The ideal conclusion to developing critical thinking skills is student capability of categorizing and evaluating information, problem solving, and hypothesizing with minimal if any, teacher involvement. Mosston described this condition as *going beyond* to the realm of creativity and invention. While practical aspects of fostering this condition in a classroom setting are debatable, few would deny merits of producing students capable of and motivated to *going beyond*.

This is not to say, however, that Mosston's strategies represent the only vehicle in which critical thinking skills can be introduced to the psychomotor learning domain. Hurwitz (1985) presents an eight-step instructional model that purports to "define the macro-structure of any instructional strategy" (p. 194). This eight step approach might also be considered for implementing critical thinking skills in the physical education setting. Additionally, Joyce and Weil (1980) described 24 models of teaching nested within four broad categories listed as information processing, personal, social, and behavioral. Many of these models are well suited for implementing critical thinking skills in the psychomotor environment. Mosston's model is cited here because it is perhaps the most widely known and acknowledged model in physical education and is flexible enough to adapt to almost any teaching situation.

In sum, then, while the psychomotor domain presents several unique contributions to human development, there is also potential to enhance significantly cognitive and effective behaviors. Goal of producing individuals who can work independently and create new alternatives to accomplish desired objectives, is universal to education. Producing critieral thinkers through the psychomotor domain represents but one conduit through which educators might work towards attaining this goal. ♦

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