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Effects of cooperative learning and concept mapping intervention on critical thinking and basketball skills in elementary school



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ABSTRACT

Helping students develop their critical thinking potential may assist them in effectively developing motor skills. This study examined the effects of cooperative learning and concept-mapping interventions on students' critical thinking and skill learning during physical education. 170 fifth-grade students were assigned to a cooperative learning condition ($n = 54$), a concept-mapping condition ($n = 57$), and a control condition ($n = 59$). The students were subsequently assessed in terms of their basketball skills and critical thinking skills. The results showed greater improvements of basketball skills improvements and critical thinking skills among the students in the cooperative learning condition and the concept-mapping condition than among those in the control condition. The results indicated that peer-cooperation and concept-mapping mediated the learning of motor skills and offered a learning environment that assisted critical thinking in the context of physical education.

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1. Introduction

Effective physical education supports the developments of motor skills and critical thinking skills (Donnelly, Helion, & Fry, 1999). Recently, the cultivation of students' critical thinking skills has been greatly emphasized in school physical education (Lodewyk, 2009; McPherson & Kernodle, 2007). Lodewyk (2009) suggested that motor skills performance always involves the development of critical thinking skills when solving a problem. Critical thinking in physical education, which is mainly characterized by challenging students to produce unique solutions to movement problems (McBride & Bonnette, 1995), has therefore become an important strategy for enhancing personal critical thinking. Methods for improving elementary school students' critical thinking in a teaching and learning environment, however, have scarcely been studied (Barrett, 2005; Raab, 2007; Ripoll, Kerlirzin, Stein, & Reine, 1999).

Abbreviations: CL, cooperative leaning in teaching physical education; CM, concept Mapping in teaching physical education.

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1.1. The definitions of critical thinking in physical education

Since the initial advocacy of critical thinking research by McBride in 1990, the proposed definition of critical thinking has changed from a unidimensional concept to a multidimensional one, that is, from factors related to personal characteristics to those concerning the social milieu (McBride & Xiang, 2004). What more recent works on critical thinking have emphasized, however, is that multiple components must converge in order for critical thinking to take place. In his Componential Model of Critical Thinking, Chou, Huang, Huang, Lu, and Tu (2015) defined critical thinking as being characterized by intellectually disciplined information processing in learning motor skills. According to Chou et al. (2015), five components are essential for the cognitive process of making reasonable and defensible decisions in learning motor skills: assumption identification, induction, deduction, interpretation, and evaluation of arguments. In the Cognitive Model of Critical thinking Schema, McBride (1992) used the case study method to explore the thought processes of individuals with highly developed critical thinking and proposed a schema of critical thinking to clarify the relationships between cognitive and psychomotor outcomes. He concluded that a person with critical thinking skills is unique, developmental change is multidimensional, and the critical person is an evolving system for problem solving in learning motor skills. He also reported that the evolutions of critical thinking skills are influenced by teaching methods, motivation, emotions, and environments. In the Peer Learning Model of Critical Thinking, Dyson (2002) proposed that two systems highlight the improvements of critical thinking: the interactions of the field in learning physical education and knowledge gained through collaborative groups and peer interactions. This model emphasizes that individuals construct knowledge through social interactions with their peers, facilitated by their teachers. Social interaction provided a means for students to view problems from multiple perspectives and enhance their critical thinking in learning motor skills. Similarly, in the Interactive Perspective of Critical thinking, McBride and Cleland (1998) underscored the interaction of three core elements: the individual, other people, and the learning environment. Moreover, in the Developing Concept Theory of Critical Thinking, Lodewyk (2009) claimed that learners were facilitated by teachers in improving their knowledge and reasoning. He also suggested that critical thinking skills could help learners to correct misconceptions about motor skills and strategies by mapping the interrelatedness of concepts within the discipline.

Although the aforementioned literature shows that critical thinking may be influenced by multiple approaches, a consensus exists that among these influential approaches, problem solving in learning motor skills has the most direct and strongest effects on an individual's critical thinking skills, and such approaches can be divided into three categories: knowledge, teaching-learning environments, and abilities (Dyson, 2002; McBride & Xiang, 2004). As for knowledge, Chou et al. (2015) also argued that a basic level of motor skills and problem solving within a specific knowledge domain, along with deep knowledge of the subject, is required in order to develop movement skills. In addition, they proposed that teaching and learning could foster a learner's critical thinking in physical education. Apparently, using specific teaching-learning methods is the most fundamental and key element of critical thinking that can lead to the development of proficient movement in physical education.

As for teaching-learning environments, the second element noted above, their importance has been highly emphasized in a famous critical thinking scheme for motor skill performance (McBride, 1992). Brennan, Brownson, Kelly, Ivey, and Leviton (2012) have illustrated that dispositions such as problem solving and thoughtfulness are important for the performance of critical thinking in physical activities. Based on a thorough literature review and empirical findings, Chou et al. (2015) suggested two factors influencing critical thinking which could improve motor skills performance: teaching strategies and learning environments. They found that in critical thinking skills, these factors were positively related to an individual's motor skills performance.

As for abilities, the third element noted above, Rawahi (2015) regarded critical thinking as a kind of capacity that integrates problem solving for motor skills with learning processes, procedures, and performance. Ennis (1996) declared that the range of skills, knowledge, and perspectives positively impact an individual's critical thinking performance. Yeh (2009) also argued that critical thinking involves using reasonable and defensible strategies. Along the same lines, McPherson and Kernodle (2007) argued that critical thinking requires the ability to understand relationships among physical activities and concepts, and to organize the content of physical activities into conceptual frameworks in order to engage in the performance of physical activities. Lodewyk (2009) found that such problem-solving abilities such as organizing and analyzing problems, planning and adjusting working progress, staying judgmental in solving problems, and being sensitive in making observations were positively related to critical thinking performance. Therefore, both cognitive and metacognitive abilities are essential for critical thinking skills.

1.2. The definition of the cooperative learning method

Cooperative learning in physical education is an instructional method in which students work together in small groups to learn in psychomotor, cognitive, and affective domains (Dyson, Griffin, & Hastie, 2004; Iserbyt, Madou, Vergauwen, & Behets, 2011). It is characterized by various forms of student-student interactions through physical activities (Barrett, 2005; Donnelly et al., 1999; Dyson et al., 2004). To date, most cooperative learning studies are attempted in the context of physical activity levels or skill performance as well as problem solving, and most research regarding cooperative learning has therefore focused on the improvement of physical activity levels. For example, Chen (2001) claimed that cooperative learning is the practice of applying social skills from face-to-face interaction in peer relationships to physical activity in order to improve problem solving. In the same vein, Hannon and Ratliffe (2004) declared that, in the context of physical education, group

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