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Computer-based Pedagogical Tools, Conceptual Reasoning Ability, and Statistical Understanding: A Literature Review

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ABSTRACT

Computer-based pedagogical tools can promote improved conceptual reasoning ability (Trumpower & Sarwar, 2010; Van der Merwe, 2012). A significant relationship exists between formative quiz access and student achievement (Stull, Majerich, Bernacki, Varnum, & Ducette, 2011; Wilson, Boyd, Chen, & Jamal, 2011). Additionally, access to multimedia objects has been linked to student achievement (Bliwise, 2005; Miller, 2013). Online tutorial sites and Massive Open Online Courses (MOOCs) appear frequently in the headlines (Christensen & Weise, 2014; Matthews, 2013; Swartz, 2015). The practice of combining short videos and formative quizzes as pedagogical tools for online instruction is increasingly more popular and expectations for academic outcomes from these online practices have swelled (Kessler, 2011; Lewin, 2013; Noer, 2012). The combination of videos and quizzes approximates an instructional feedback-corrective loop that correlates with significant gains in student achievement (Bloom, 1984; Kulik, Kulik, & Bangert-Drowns, 1990). Researchers often operationalize student achievement in terms of exam grades (Larwin & Larwin, 2011; Limniou & Smith, 2014; Sosa, Berger, Saw, & Mary, 2011). However, exam grades do not always capture student understanding of important concepts; students can generate accurate results without understanding the meaning of the results and how they influence decision-making (Ben-Zvi & Garfield, 2004; Tugend, 2013).
Studies involving Computer Assisted Instruction (CAI) indicate that computer-based pedagogical tools promote improved conceptual reasoning ability (Trumpower & Sarwar, 2010; Van der Merwe, 2012), a highly desired skill expressed by employers (NACE, 2013).