



Research paper

Executive function during teacher preparation

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H I G H L I G H T S

- This three-year study examined executive function during teacher preparation.
- Student teachers were identified with three measurement points across three years.
- BRI and MI growth trajectories are explored.
- The findings may have implications for teacher preparation programs.

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This three-year study examined executive function development during teacher preparation. The sample consisted of 231 students in spring at Time 1, 36 students at Time 2, and 109 students at Time 3. Results indicate a non-significant decrease in the longitudinal mean change of metacognition index (MI) and behavioural regulation index (BRI) over time. MI growth trajectories had a nonlinear trend, while BRI growth trajectories had a linear trend during pre-service teacher preparation. Findings from the current study suggest that no value is added to students' executive functioning during three years of tertiary education. Implications for teacher preparation programs are discussed.

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1. Introduction

In a world where globalisation, international competitiveness, and new technologies have resulted in the move towards neo-liberal education policies, it is commonplace to assert that school systems are only as good as the teachers who populate them. As Sahlberg (2012, p. 1) asserts, “research and experience both suggest one factor that trumps all others: excellent teachers”. Musset (2010) highlights the important link between teacher preparation and student outcomes, echoing OECD (2005, p. 26) findings which suggest that ‘quality of teaching’ has been found to be “the single most important school variable influencing student achievement,” thus intensifying the investigation of teacher preparation programs. Many OECD member countries including the United States, the United Kingdom, Australia, New Zealand, Turkey and the Netherlands, have experienced problems attracting and retaining

effective teachers (McKenzie, Santiago, Sliwka, & Hiroyuki, 2005). As a result teachers' preparation and understanding of student needs and appropriate teaching strategies have proven to be critical factors to their practice (Musset, 2010; Wayne & Youngs, 2003).

A growing number of education researchers and practitioners assert that explicit, systematic integration of executive function—more broadly social and emotional learning (SEL)—in teacher educator programs is at the forefront of efforts to revitalize teacher education. Yet, because of the current focus on teacher quality, SEL is marginalized in most teacher education programs (Bridgeland, Bruce, & Hariharan, 2013; Fleming & Bay, 2004). Researchers in the field of educational psychology have long promoted the importance of executive function for student learning. Moreover, a number of U.S. states have adopted SEL standards or guidelines for the implementation of SEL in school districts. However, in most cases there is a gap between these standards or guidelines, and what is happening in pre-service teacher education (Jones & Bouffard, 2012). Moreover, whilst executive function is often examined in primary and secondary education to explain academic performance it has never been reported longitudinally and/or during teacher preparation. The premise of this study was to

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examine the executive function of pre-service teachers longitudinally during their teacher preparation program.

In the next section, the conceptual framework for the research is clarified including discussion of the dependent variable—executive function. This shows that there is evidence to suggest that working with student teachers' executive function is likely to be an important aspect in developing teaching skills. This study also addressed potential questions including the relationships between executive function and student outcomes. The research is located in its local and international context. Afterwards, the methodology used in the research is described along with the Behaviour Rating Inventory of Executive Function-Adult Version (BRIEF-A; Roth, Isquith, & Gioia, 2005a). Finally, the findings from this longitudinal study on executive function are reported and possible interpretations of these findings are explored.

2. Conceptual framework

2.1. Executive function

Traditionally, memorization has been the method used to assess learning. Remembering facts and figures and being able to replicate this content on demand was how successful learning was measured. However, contemporary research has conceptualized learning in a broader way—as a process of developing adaptive competence (or adaptive expertise). This means that while memorization is part of learning, it does not fully encompass learning. Early research focused on the role of practice and repetition and the value of rewards and punishments in learning. This research has strongly influenced the way we do schooling. Contemporary research has placed more of an emphasis on the role of understanding in learning. People become better learners when they understand the way in which they learn. They also become better at applying their learning to new contexts and problems.

Over the past three decades, research in educational psychology has identified a set of powerful executive function strategies that have been found to help students comprehend difficult material and to study and retain information (Collins, Dickson, Simmons, & Kame'enui, 2003; Gioia, Isquith, Guy, & Kenworthy, 2000; Pressley & Woloshyn, 1995). Executive Functioning (EF) pertains to a variety of higher order thinking processes (e.g., attention, self-control, planning, and decision making) that are necessary for purposeful, goal-directed behaviour (Shonkoff & Phillips, 2000). The ability to regulate these processes is referred to as executive control (Derryberry, 2002; Perner & Lang, 1999) and is essential to adaptive functioning throughout one's lifespan (Shonkoff & Phillips, 2000). A related body of research has identified means of teaching students strategies for self-regulation, such as monitoring their own comprehension and setting their own learning goals (Paris & Paris, 2001; Schunk & Zimmerman, 2003). The rising public awareness of the importance of executive function has resulted in the development and implementation of many school-based interventions designed to promote student outcomes such as academic achievement and executive function (Maynard, Solis, & Miller, 2014; Randolph, Rosenstein, & Michaels, 2014). Specific strategies that have been particularly well researched are as follows.

- Evidence supports students summarization of previously read information as an effective executive function strategy (Armbruster, Anderson, & Ostertag, 1987; Brown & Day, 1983; Taylor & Beach, 1984). Summarizing information using graphics (Berkowitz, 1986), “web” strategies (Baumann, 1984) or with peers (Dansereau, 1988; Fantuzzo, Polite, & Grayson, 1990; O'Donnell, 1996; 2000; Meloth & Deering, 1992; 1994) have

been implemented widely and demonstrated evidence of effectiveness.

- Visualization and imagery have found to be effective and have been studied extensively (Gambrell & Bales, 1986; Hattie, Biggs, & Purdie, 1996; Pressley, Levin, & Delaney, 1982).
- A widely used comprehension and vocabulary development teaching strategy involves students generating questions about material as they read (Beck & McKeown, 2001; Davey & McBride, 1986; King, 1994). Research shows that students' activation of prior knowledge through questioning and then relating this to current material increases comprehension (Dewitz, Carr, & Patberg, 1987; Hansen & Pearson, 1983).
- Evidence has shown the achievement benefits of self-regulatory strategies (Schunk & Swartz, 1993), including self-verbalization (Schunk & Cox, 1986), and self-monitoring (Zimmerman, Bonner, & Kovach, 1996). Zimmerman and Kitsantas (2005) found that self-regulation strategies accounted for as much as 93% of the variance in student performance on standardized tests. Zepeda, Richey, Ronevich, and Nokes-Malach (2015) examined the impact of an intervention with eighth grade students. Results from a randomised experiment suggest that treatment students demonstrated significantly higher achievement and self-regulated learning outcomes.

At the same time, education policies are increasingly supportive of the use of programs with strong evidence of effectiveness (WWC Standards Handbook Version 3.0; WWC, 2014), especially in high poverty schools (Title I, Part A, of the Elementary and Secondary Education Act outlines schools with percentages of students from low-income families of at least 40% may use Title I funds, along with other Federal, State, and local funds, to operate a schoolwide program to upgrade the instructional program for the whole school). Since these policy and practice changes, there has been general agreement that teachers should effectively implement executive function strategies, and a consensus that such strategies should be taught using programs and practices that have demonstrated strong evidence of effectiveness. Yet beyond this broad agreement, what do we really know about teachers and beginning teachers own levels and trajectories of executive function? There exists no study to date that examines pre-service teachers' executive function trajectories.

2.2. Teachers' executive function

A growing body of evidence suggests the ability to work with behaviour and emotion regulation is an important part of the teachers' skill set. The emotional competencies of teachers have been found to influence the climate of their classrooms (Corcoran & Tormey, 2012a; 2012b; 2013), and students' academic performance (Baker, 1999; Battistich, Schaps, Watson, Solomon, & Lewis, 2000; Durlak, Weissberg, Dymnicki, Taylor & Schellinger, 2011; Wentzel, 2002; Zins, Bloodworth, Weissberg, & Walberg, 2007). Anderson (2002) highlights that the teachers' ability to understand and regulate cognitive processes may be one of the most essential competencies of a classroom teacher. Within their professional practice, teachers contend with high level decisions regarding curriculum content, selection of appropriate teaching methods, inclusion/exclusion, pupil differentiation, and school discipline (Abbott and MacTaggart, 2010; Conway, Murphy, Rath, & Hall, 2009; Gleeson & O'Flaherty, 2016; Hansen, 2001; Mahony, 2009; Noddings, 1997; O'Flaherty & Glesson, 2017). Goodlad, Soder, and Sirotnik (1990) identify a number of potentially unsettling questions that teachers navigate throughout their practice including exploring issues pertaining to freedom and autonomy, using authority to pursue change in the lives of young people, and accepting

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