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Primary school students' learning experiences of, and self-beliefs about competence, effort, and difficulty: Random effects models

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ABSTRACT

Expanding research on individual differences in students' self-beliefs about ability, effort and difficulty, we investigated the variability and interrelatedness of situation-specific learning experiences of competence evaluation, effort exertion and task difficulty during one week at school. In total, 292 students in years 5 and 6 (M_{age} 10.5 years) filled in electronic questionnaires during 15.3 learning episodes on average during one week (SD = 4.3; *Range* = 2–34, Total $n_{experiences}$ = 4,566). Students' learning experiences varied substantively across situations (r_{ICC} from .21 to .28), and were differentially interrelated between students (r_{SD} from .28 to .40; random slope SDs .14 to .20). Using multilevel structural equation models (MSEM), we found that students who on average, across situations, evaluated their competence higher exerted less effort in situations and evaluated their competence higher at difficult tasks. Higher performers exerted more effort at difficult tasks, girls exerted more effort than boys for the same level of competence evaluation, and students who in general found school difficult evaluated their competence higher at easier tasks. The investigation of situation-specific learning experiences provides insights into student belief systems in educational contexts which complement our knowledge of individual difference in such beliefs.

1. Introduction

Research on students' self-related beliefs about their competence (i.e., ability) and effort (e.g., effort exertion, effort regulation) in relation to their school performance is central in several fields of educational psychology (e.g., Covington & Omelich, 1979a, 1979b; Little, 1998; Skinner, Chapman, & Baltes, 1988). In many theoretical conceptualisations, ability and effort beliefs have been related to perceived difficulty or demand levels (Heider, 1958; Malmberg & Little, 2007; Malmberg, Wanner, & Little, 2008; Nicholls, 1984). Relations between these beliefs have generally converged around the following patterns: A higher level of ability allows the person to exert less effort to be successful given a certain difficulty level of a task; More effort needs to be exerted to compensate for a lower level of ability, particularly when attempting to solve a difficult task; Effort exertion and time spent on a task provide feedback to the individual on their ability, which in the longer term forms a base for attempting or withdrawing from subsequent tasks and challenges (Nicholls, 1984; Nicholls & Miller, 1984). Students' self-related beliefs about ability, effort and difficulty vary by school subject (Malmberg, Hall, & Martin, 2013), school-type (Malmberg et al., 2008), country (Stetsenko, Little, Gordeeva, Grasshof, & Oettingen, 2000), and change over time (Little, Stetsenko, & Maier, 1999). These beliefs are susceptible to performance feedback in the classroom (Hattie & Timperley, 2007), and in experimental conditions (Mueller & Dweck, 1998). There are only few studies of situational experiences of such beliefs. These are the diary studies of Schmitz and Skinner (1993), Musher-Eizenman, Nesselroade, and Schmitz (2002), Schmitz and Wiese (2006), and Tsai, Kunter, Lüdtke, and Trautwein (2008), and the electronic diary study of Tolvanen et al. (2011). We contribute to the literature on children's self-beliefs in ability, effort and difficulty by focusing on the situation-specific learning experiences of competence evaluation (i.e., task success and understanding), effort exertion, and task difficulty. In the present study, we go beyond previous cross-sectional, longer-term longitudinal and diary studies in three ways. First, we collected situation-specific learning experiences over repeated learning episodes during one week at school using Personal Digital Assistants, PDAs (Malmberg, Woolgar, & Martin, in press). Second, we investigated the variability of, and interrelations between learning experiences. Third, we investigated whether person characteristics (age, gender, and school performance) and self-beliefs (agency beliefs in ability, effort, and perceived difficulty) predicted and moderated learning experiences. We specified state-of-the art random slope models in Multilevel Structural Equation Models (MSEM).

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The time-perspective within which we investigated situation-specific learning experiences is posited between diary studies (e.g., one report at each math or language class for up to 30 lessons; Schmitz & Skinner, 1993) and micro-analytic studies (e.g., trace data from computer environments; Azevedo, Moos, Johnson, & Chauncey, 2010). The time-frame of all learning experiences during one week at school was chosen as students were expected to experience a reasonable number of different school subjects, a range of tasks and projects within each subject, and interact with a broad range of peers and teachers. On this basis we expected to yield samples of experiences of each student, with plausible variability ("ups and downs"), stationarity ("stable flow") and differential interrelatedness ("different reactions to various challenges") of their learning experiences. We hope that insights into the microcosm of learning experiences can contribute to our understanding of learning as a process (Hattie, 2008; Schmitz, 2006), allowing for a unique window into student belief systems and intrapersonal dynamics (e.g., Molenaar, Huizenga, & Nesselroade, 2003; Nesselroade, 2001).

1.1. Ability, effort and difficulty

In models of action-control (Kuhl, 1985; Kuhl & Goeshke, 1985; Little, 1998) and perceived control (Skinner, 1996; Skinner, Zimmer-Gembeck, & Connell, 1998), actions are considered volitional, goal-oriented and self-regulatory. Such a perspective of human agency is rooted in action-theoretical approaches to human development (Brandtstädter, 1998; Heider, 1958) and motivation (Heckhausen & Heckhausen, 2008). While means–ends beliefs and strategy beliefs refer to the perceived determinants of performance (e.g., ability, effort, luck), agency-, capacity-, and self-efficacy beliefs are defined as an individual's perception of possessing the skills, resources and abilities required for realizing a certain goal (Little, 1998; Skinner et al., 1998). Students' agency beliefs in ability and effort are consistently the strongest predictors of academic success (e.g., Little, Oettingen, Stetsenko, & Baltes, 1995), and differ from causal attributions to effort and ability (Schmitz & Skinner, 1993). A personal sense of agency is formed in early childhood through mastery experiences and gradual realization that outcomes are contingent on one's own actions (Skinner, 1986). In the school year sequences of mastery experiences and past performance form a base for concurrent self-evaluations (Bong & Skaalvik, 2003). This enables a gradual increase in volition and self-regulation of behavior and cognition, particularly through the volitional exertion of effort (Kochanska, Murray, & Harlan, 2000; Kuhl, 1985). Viewing effort as a limited resource of energy within the individual, effort exertion renders the self (i.e., ego) to be depleted after energizing volition (Baumeister, Bratslavsky, Muraven, & Tice, 1998), depending on the level of challenge the individual is up against (Dermitzaki & Efklides, 2001; Heider, 1958; Malmberg & Little, 2007; Malmberg et al., 2008; Schmitz & Skinner, 1993).

Children learn to discern their level of ability as a function of how much effort or time they exert, in relation to how difficult a task is (Nicholls, 1984). Effort can be gauged by time spent on a task and level of exhaustion upon completion. As effort exertion is considered to be the behavior most controllable by the self (Kuhl, 1985; Pintrich, 2000; Schmitz & Skinner, 1993), it can be regarded as a "double-edged" sword, as students who fail after exerting effort have been shown to attribute their failure to inability (e.g., Heider, 1958), while those who fail after exerting less effort are less likely to do so (Covington & Omelich, 1979a, 1979b). Children's attributions have also been found to be susceptible to whether they receive feedback that attributes success to their effort or their ability. For example Mueller and Dweck (1998) found that children who received initelligence praise instead of effort praise after failure displayed less task persistence, less enjoyment, and made more low-ability attributions.

Towards the end of primary school children learn to differentiate between how able and effortful they are, and how difficult or challenging they find school (Malmberg & Little, 2007). Such differences are also evident among youth in different secondary school tracks (Malmberg et al., 2008). Students' use absolute (e.g., performance referenced), normative (e.g., teachers, parents, peers, or society expectations), or relative comparisons (i.e., comparison of outcomes with others; Nicholls, 1984) for arriving at conclusions about the level of difficulty of a task. From these comparison processes they gradually become aware that not everyone can be "the best" (Nicholls & Miller, 1984). The difficulty of a task is a crucial indicator of how much effort might be needed for successful completion. Students' ability to regulate their overt behavior, that is to exert more effort when they are confronted with an optimally challenging or difficult task, is a key feature of a mastery approach (Pintrich, 2000). Likewise, withdrawal of effort in a challenging task constitutes a helpless pattern (Kuhl, 1985; Pintrich, 2000).

1.2. Situation-specific learning experiences

Although much knowledge about students' personal beliefs about their ability, effort, and perceived difficulty has been accumulated, there are to date only few studies of students' situation-specific competence, effort, and difficulty perceptions, namely the diary study of Schmitz and Skinner (1993) and Musher-Eizenman et al. (2002). In their diary study (Schmitz & Skinner, 1993) students reported on average two assignments or tasks in each subject per week, on more than 25 occasions. Students reported on interpersonal measures of control, situational measures of subjective time use effort exertion, subjective performance evaluation and subjective estimations of task difficulty (prior to assignment was graded) attributions in the case of both success and failure. They found larger intrapersonal variation (i.e., pooled differences *within* individuals) in competence-related beliefs (i.e., daily reports of maths and language related effort, performance, attributions and expected control) than interpersonal variation (i.e., differences *between* individuals), showing that students varied more within themselves than between each other. Using correlational, lagged, and multivariate time-series analyses of intrapersonal and interpersonal beliefs and perceptions (i.e., aggregated reports during the diary days), the authors concluded that intrapersonal perceptions and beliefs have functional relationships different from interpersonal perceptions and beliefs.

Using Dynamic Factor Analysis in a pooled sample analysis (subsamples of the Schmitz & Skinner, 1993 study), Musher-Eizenman et al. (2002) found stronger concurrent associations between constructs and a greater stability in perceived control and task demands from one day to the next for higher achieving students. Neither of these two studies allowed for individual differences in direction and magnitude in associations between variables (e.g., associations between two variables can vary from positive to negative and weak to strong). Such individual differences in associations can be investigated using random slope models.

1.3. Self-beliefs and learning experiences in the Learning Every Lesson (LEL) study

In their overview of definitions and measurements of self-concept and self-efficacy, Bong and Skaalvik (2003) suggested that self-beliefs such as self-concepts and self-efficacy are relatively stable over time, while situation-specific cognitions and perceptions are more malleable and susceptible to contextual circumstances. Models of action-control (e.g., Kuhl & Goeshke, 1985) and self-regulation (e.g., Boekaerts & Corno, 2005; Pintrich, 2000) pose that students with high levels of control, agency and self-beliefs can in situations draw on their skills, resources and abilities when implementing goal-directed actions in real time. At the situation-specific learning experience we conceptualized competence evaluation to be a situation-specific "equivalent" of action control beliefs of ability, effort exertion a situation-specific "equivalent" of agency belief in effort, and task difficulty a situation-specific equivalent of perceived difficulty. Empirical findings support this model. For example, Schmitz and Skinner (1993) found students with higher