invite educational practitioners to consider ways to enhance metacognitive monitoring and study regulation in computerized environments.

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PAPER PRESENTATION

Think peer! The potential of reciprocal peer tutoring in promoting students' metacognition

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It is widely recognized that metacognition is an important mediator for successful and high-level learning, especially in higher education. Nevertheless, few higher education programs succeed in effectively preparing students for metacognitive self-regulation. The present study explores the potential of reciprocal peer tutoring (RPT) to promote both university students' metacognitive knowledge and their metacognitive regulation skills. The study was conducted in a naturalistic higher education setting, involving 67 students tutoring each other during a complete semester. A multi-method pretest-posttest design was used combining a self-report questionnaire (assessing students' metacognitive knowledge and their perceived metacognitive skilfulness) with the analysis of think-aloud protocols (revealing student's actual use of metacognitive strategies). Results indicate that RPT has no significant impact on students' metacognitive knowledge nor on their perception of metacognitive skilfulness. In contrast, RPT significantly influences students' actual metacognitive regulation. After the intervention, students demonstrate significantly more frequent and a more varied use of metacognitive regulation skills and strategies, especially during the orientation, monitoring, and evaluation phase. Furthermore, results point at an increase in more profound and higher-quality strategy use after participation in the tutoring programme.

Theoretical framework

Since high quality learning requires metacognition, its promotion is assumed to be a worthwhile objective in current education (Meijer, Veenman, & van Hout-Wolters, 2006). In line with Brown (1987) we conceptualise metacognition as being comprised of metacognitive knowledge and metacognitive regulation. Metacognitive knowledge refers to learners' understanding about the way they process information when performing academic tasks. Metacognitive regulation involves a set of self-regulatory skills that are used by learners to orchestrate their learning. Brown (1987) distinguishes orientation, planning, monitoring, and evaluation as the major regulation skills.Especially in higher education, learners' metacognitive awareness and skilfulness are crucial for academic success (Cornford, 2002). However, few students possess sufficient metacognitive competence to self-regulate their learning adequately (Maclellan & Soden, 2006). The present study makes an important contribution to both theory and practice by exploring the promotion of university students' metacognition from the theoretical perspective of metacognition as a socio-cognitive construct (Volet, Vauras, & Salonen, 2009). According to this view, metacognition has a social dimension by nature and can best be stimulated through social interactions, in which metacognitive strategies can be modelled and internalised. More specifically, we examine the potential influence of reciprocal peer tutoring (RPT), as a particular type of collaborative learning. The following research questions are put forward: What is the impact of RPT on higher education students' (1) metacognitive knowledge; (2) perceived metacognitive regulation; and (3) actual metacognitive regulation?

Method

Participants and setting

Sixty-seven students Educational Sciences participated. Students were randomly assigned to twelve small and stable tutoring groups (5-7 students). The face-to-face RPT-program was a formal component of students' curriculum and consisted of nine weekly sessions (each taking 90 minutes).

Intervention

The RPT-program was same-age and reciprocal, for literature shows that especially tutors gain numerous academic, affective, and metacognitive insights (Falchikov, 2001). Since the tutor role is exchanged among participants in RPT, all students got equal opportunities to gain from the tutoring environment. During the sessions, students worked on authentic assignments, demanding high levels of cognitive processing. The entire RPT-program was designed taking into account research-based guidelines promoting effective tutoring (Topping, 2005). We structured peer interactions by developing a tutor curriculum script for each session (King, 1998). Furthermore, all students participated in a compulsory preliminary training in generic tutoring skills and received ongoing support in interim feedback and reflection sessions (Falchikov, 2001).

Design and instruments.

A multi-method pretest-posttest design was used, combining off-line self-reports with concurrent think-aloud protocol-analysis. All students completed the 'Metacognitive Awareness Inventory' (MAI) (Schraw & Dennisson, 1994) before and after the RPT-intervention. The subscale 'knowledge of cognition' assessed students' metacognitive knowledge. Cronbach's a was .78 (pretest) and .81 (posttest). The subscale 'regulation of cognition' measured students' self-reported use of metacognitive skills. Cronbach's a was .90 (pretest) en .89 (posttest). Additionally, students individually performed a think-aloud task (Meijer et al., 2006). By analysing the verbal protocols, students' actual metacognitive skills underlying performance could be identified. Based on the literature, a coding scheme was developed. The scheme represents a hierarchical model of metacognitive regulation, in which orienting (task analysis, content orientation, structuring task instructions), planning (planning in advance, interim planning), monitoring (monitoring of strategy use, comprehension monitoring, monitoring of progress), and evaluating (product and process evaluation) are situated as the main categories.

Data analysis

Pretest and posttest scores on the MAI were compared by means of paired-samples t-tests. Two trained coders independently double coded 23% of the think-aloud protocols. Cohens' kappa (κ=.80) indicated high interrater reliability. After coding, the occurrence of metacognitive skills at pretest and posttest was compared quantitatively by means of paired-samples t-tests.

Results

Results of the paired-samples t-tests on students' self-reported metacognitive knowledge and regulation reveal no significant difference between pretest and posttest scores (respectively t= -1.25, df= 58, p= .215 and t= -0.65, df= 58, p= .515). However, results of the think-aloud protocol analysis on students' actual metacognitive regulation show differing outcomes. First, students orientate themselves significantly more on task execution after the RPT-intervention, by paying significantly more attention to task-analysis (t= -14.76, df= 58, pd= 2.55), structuring task instructions (t= -3.02, df= 58, pd= 0.75), and orientating themselves on the content of the task (t= -7.81, df= 58, pd= 1.52). Second, students are significantly more active in monitoring both their comprehension (t= -9.88, df= 58, pd= 1.72) and their progress (t= -8.78, df= 58, pd= 1.67). A significant effect on students' monitoring of strategy use could not be distinguished (t= -1.64, df= 58, p= .106). Third, students engage significantly more in metacognitively evaluation of both learning outcomes (t=-12.15, df=58, p.001, d=2.46) and their problem solving process (t=-5.00, df=58, pd=0.92). In contrast, RPT did not yield a significant effect on students' metacognitive planning (t= -2.14, df= 58, p= .063). In sum, after the RPT-intervention, students apply metacognitive skills more frequently and show a more varied use of specific metacognitive strategies, particularly when orientating, monitoring, and evaluating. Results of the more detailed analyses on specific metacognitive strategies will be presented at the conference.

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PAPER PRESENTATION

The relationship between metacognition, intelligence and text-learning performance.

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Metacognition and intelligence are both important predictors of learning outcomes. However, the nature of the relationship between these two constructs has not been clarified, yet. Considering inconsistent results from several studies, we wanted to test the hypothesis that whether these discrepancies are due to issues related to measuring metacognition. If this is the case, we expected that different metacognitive measures would lead to different relational patterns among metacognition, intelligence and learning performance. For testing our hypothesis, we used three measures for assessing metacognition namely, accuracy ratings, think aloud protocols and a self report questionnaire. The Raven's Standard Progressive Matrices was used for assessing intelligence. The participants were fifth grade elementary students (N= 91, 47 girls, 44 boys, Mage = 10.04 years, age range: 9-11 years). The results of the study indicated that intelligence do not correlate significantly neither with the scores from the self-report questionnaire nor with the scores from think aloud protocols. On the other hand, there is a significant correlation between accuracy ratings and intelligence scores. The results, also, showed that the scores from the self-report questionnaire do not contribute to students' text-learning performance. Accuracy ratings, together with intelligence predict text-learning performance and both predictors have their own unique contribution. The scores from the think aloud protocols, together with intelligence contribute to text-learning performance but think aloud protocols do not have predictive value independent of intelligence. In conclusion, the findings of the study showed that when we use different metacognitive measures, we get different results.

Metacognition and intelligence are both important predictors of learning outcomes. However, the nature of the relationship between these two constructs has not been clarified, yet. Current conceptions of intelligence strongly support the relationship between metacognition and intelligence (e.g., Binet & Simon, 1916; Naglieri & Das, 1997; Sternberg, 2003, 2005), but several studies has revealed inconsistent results. Some researchers have reported significant positive correlations between metacognition and intelligence (e.g., Schneider, Kßrkel & Weinert, 1987; Swanson, 1990, 1992; Alexander & Schwanenflugel, 1994). On the other hand, some studies have revealed that there is no substantial correlation between the two (e.g., Allon, Gutkin & Bruning, 1994; Coutinho, 2006; Yalç?n & Karakas, 2008). Also, there are studies showing negative significant correlation between metacognition and intelligence (e.g., Dresel & Haugwitz, 2005). Veenman and colleagues, also, focused on the relationship between metacognition and intelligence but extended their research to the relation of both variables with learning performance (e.g., Veenman, Elshout ve Meijer, 1997; Veenman &Verheij, 2003; Veenman & Beishuizen, 2004; Veenman, Kok ve Blßte, 2005; Veenman & Spaans, 2005; Van der Stel & Veenman, 2008). The researchers introduced three models for explaining the relationship between metacognition and intelligence as predictors of learning performance. The mixed model suggests that metacognition and intelligence are related but metacognition has a surplus value on top of intelligence for the prediction of learning. According to the intelligence model, metacognition cannot predict learning independent of intelligence as metacognition is a manifestation of intelligence. The independency model suggests that the two variables are entirely independent predictors of learning. Considering these inconsistent results from several studies, we wanted to test the hypothesis that whether these discrepancies are due to issues related to measuring metacognition. If this is the case, we expected that different metacognitive measures would lead to different relational patterns among metacognition, intelligence and learning performance. Results from several other studies using multiple metacognitive measures discredits the measures that are frequently used in metacognitive research and compels researchers to scrutinize what these measures are really measuring (e.g. Desoete, 2008; Cromley & Azevedo, 2006; Saraç & Karakelle, 2010).For testing our hypothesis, we designed a multi-method study, to investigate the relationship between metacognition and intelligence as predictors of learning performance. We used three measures for assessing metacognition namely, accuracy ratings, think aloud protocols and a self report questionnaire. The participants were presented a text-learning task. They were requested to think aloud while they were studying the text. After the participants finished studying the text, they were asked to rate how well they think they understood the text on a rating scale. Their learning performance was assessed by a post-test consisting of 15 multiple choice questions (a=.77). The Raven's Standard Progressive Matrices was used for assessing intelligence. The