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ARTICLE

The relation between self-regulated strategies and individual study time, prepared participation and achievement in a problem-based curriculum

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ABSTRACT In problem-based learning (PBL) students are encouraged to take responsibility for their own self-regulated learning process. The present study focuses on two self-regulated learning strategies, namely time planning and self-monitoring. Time planning involves time management, scheduling and planning one's study time. Self-monitoring involves setting goals, focusing attention and monitoring study activities. The aim of this study was first, to assess students' time planning and self-monitoring skills and second, to investigate how time planning and self-monitoring skills are related to actual individual study time, (un)prepared participation in the tutorial group and cognitive achievement. 165 first-year psychology students, enrolled in a problem-based curriculum, filled in a questionnaire (response 77 %) and their scores on two tests of cognitive achievement were used. Results showed that students who are better time-planners and who have better self-monitoring skills were more efficient in allocating their individual study time (spent less time on individual study), prepared more appropriately for the tutorial group meeting (although not significant [n.s.]) and achieved higher scores on cognitive tests.
KEYWORDS: *achievement, individual study, problem-based learning, self-regulated strategies*

Introduction

A recent article on self-regulation (Boekaerts and Corno, 2005) concludes that there is no simple and straightforward definition of the construct of self-regulation. In general, self-regulation can be seen as a process in which an individual plans, organizes, self-instructs, self-monitors, and evaluates at various stages of the learning process (Boekaerts, Pintrich and Zeidner, 2000; Schunk and Zimmerman, 2003; Zimmerman, 2002). Comparing the major self-regulation models in education, each model emphasizes slightly different aspects of self-regulation (Pintrich, 2000). Winne (1995), for example, emphasizes the cognitive aspects whereas Corno (2001) emphasizes the volitional, and McCaslin and Hickey (2001) describe the sociocultural aspects of self-regulation. Nevertheless, all models of self-regulated learning in education share certain basic assumptions (Pintrich, 2000). One of these shared assumptions is that students construct their own meanings, goals and strategies based on the availability of internal or external information (for an extensive overview see Pintrich, 2000). In other words, students are active, constructive participants in their learning process. A second assumption is that students are capable of monitoring and managing aspects of their own cognition, motivation, behaviour and learning environment (Pintrich, 2000). Monitoring can be seen as the assessment of feedback information, managing has to do with taking control of learning tasks and activities. PBL is an example of a learning environment in which these assumptions are emphasized.

PBL and self-regulation

In PBL students are encouraged to take responsibility for their own self-regulated learning process. Independent and active learning is stimulated by discussing problems in small groups (Barrows and Tamblyn, 1980; Schmidt, 1983). A problem describes a set of phenomena requiring an explanation. The discussion provides unanswered questions, formulated as learning issues, which subsequently serve as a guide for independent learning. Students take an active role in selecting appropriate learning resources, planning their study time and monitoring and managing their cognitive study activities. This process is helpful in the development of students' self-regulated, lifelong learning skills (Barrows, 1985; Walton & Matthews, 1989). However, evidence that supports the effectiveness of PBL seems limited. Studies, including large meta-studies which examine the effectiveness of PBL consistently demonstrate that students following a PBL approach generally do not differ from their peers in conventional curricula on measures of knowledge, although they are more satisfied with their

learning environment than conventional students (see, for example, Albanese and Mitchell, 1993; Colliver, 2000). Some evidence is found that students develop self-regulated learning strategies in PBL. Rankin (1992) investigated whether students in a problem-based curriculum become self-regulated learners, comparing four medical schools of which three were problem-based and one was conventional. The results showed that students in a problem-based curriculum made greater use of the library and of self-selected (as opposed to faculty-selected) reading materials, and felt more competent in independent information seeking skills. These findings are supported by other studies (Albanese and Mitchell, 1993; Blumberg, 2000; Blumberg and Michael, 1992; Evensen and Hmelo, 2000). Thus, it seems that when students are responsible for their own learning, they acquire autonomous learning skills essential for life-long learning.

However, it is not clear to what extent students demonstrate self-regulated learning strategies when they are relatively new to PBL and less experienced with the concept of PBL. When students are introduced to PBL they are faced with a new learning environment and whilst PBL has the capability to be an environment in which students can meet their own learning goals and interests, some students may be at risk of failure in such environment through the lack of self-regulated strategies. Van den Hurk et al. (1999a) showed that first year students are uncertain about what literature should be studied and confine themselves more strictly to the content of the learning issues but that in later years students study more according to their own learning needs and interests. When students are able to regulate their own learning process and when the instruction programme is not heavily externally regulated, there is no friction in the learning process of students (Vermunt, 1995). However, in the case of low self-regulation, and given that PBL is by definition a loose study environment, there is a real danger that students low in self-regulation encounter loose teacher regulation. Symptoms of friction are, for example, negative effects on the learning process or learning outcomes (Vermunt and Verloop, 1999). Therefore it is important to know how students with different levels of self-regulated strategies participate and perform in PBL. Do they differ in using the available individual study time? Do they differ in their preparation to participate actively in the tutorial group and finally how do they differ in performing on the final test of cognitive achievement?

PBL and learning outcomes

In a problem-based curriculum 40 per cent of the total scheduled learning time is allocated for instruction and 60 per cent for individual study (Van der Vleuten et al., 1996). Instruction in PBL includes tutorial meetings,

lectures and practicals. Individual study includes searching, studying and preparing literature for the tutorial meetings. Students are expected to spend time on preparing for the next tutorial meeting (reporting and elaborating on the literature) in order to test hypotheses and share knowledge to synthesize the information acquired from their individual studies. Dolmans et al. (1998) and Das Carlo et al. (2003) found that, according to the views of students, interaction contributed substantially to the success of the tutorial group. Interaction was strongly related to elaboration which means that students were able to answer each other's questions or explain the material to other group members. Lack of interaction and lack of elaboration can occur for several reasons. A situation in which lack of interaction in the reporting phase may occur is, according to De Grave et al. (2001), when students have all read the same materials from the same book during individual study. Another reason can be a lack of preparation. Van den Hurk and colleagues (1999b) showed that if students prepare extensively, for example by making summaries to explain the text in the next tutorial meeting, the depth of the reporting in the group will increase. However, practical experience shows that students often participate in tutorials without any preparation. As a result there will be less interaction and elaboration and this will affect the learning process and the learning outcome. Less research however has been done on what causes the lack of preparation. This could be related to the students (lack of) self-regulated learning skills.

Academic achievement related to self-regulated learning has been the focus of research by Pintrich and Schrauben (1992) and Ablard and Lipschultz (1998). Studies show that students who are high achievers use self-regulated learning strategies to a greater degree than low achievers (Risemberg and Zimmerman, 1992). Pintrich and Garcia (1991) found that students who set goals, plan effectively and monitor goal progress are more likely to achieve higher on knowledge tests than students who fail to engage in these activities. Zimmerman (1994) found that time planning and management training helped students to better self-regulate their use of study time and in turn improved their results.

The study described here focuses on two self-regulated learning strategies important in PBL, namely time planning and self-monitoring. Time planning involves time management, scheduling, planning, and managing one's study time. Self-monitoring involves setting goals, focusing attention and monitoring study activities. The aim of this study is first, to assess students' time planning and self-monitoring skills and second, to investigate how time planning and self-monitoring skills are related to actual individual study time, (un)prepared participation in the tutorial group and cognitive achievement.

Method

The study was conducted in the first year of the Bachelor programme at the Faculty of Psychology at Maastricht University in the Netherlands. The Faculty of Psychology uses PBL as its educational approach. Students work in small group tutorials, in which they are presented with problems in cognitive and biological psychology. The first year of the Bachelor programme starts with training in PBL, allowing students to practise skills needed for this student-centred teaching method. This first week is followed by two course periods of 7 weeks each. In each course period students take two courses at the same time (an 'A' and 'B' course). These two periods are followed by a 4-week period in which only one course (for example a statistical course) is offered. After this third course period, again two 7-week course periods follow, each with two different courses (again an 'A' and 'B' course), concluded with another 4-week course period with one course.

During the course periods in which two courses are followed at the same time, students have three tutorial group meetings per week: two meetings for course 'A' and one meeting for course 'B'. The other week they will have one meeting for course 'A' and two meetings for course 'B'. In the seventh week of the course period, course 'A' will have the last meeting on Mondays and the exam (block test) on Wednesdays. Course 'B' will have its last meeting on Tuesdays and the exam (block test) on Fridays.

Material

Prior to the construction of a questionnaire, 4 first-year students were interviewed to gain more insight into which factors students consider most important in regulating their individual study. Based on their responses a questionnaire was developed. Students were asked to give their opinion on each item using a 5-point Likert scale ranging from (1) 'totally disagree' to (5) 'totally agree'. In this questionnaire four items assessed the extent to which students feel capable of managing their individual study time. This factor is called 'time planning'. An example of an item is 'I feel I have sufficient individual study time to study the literature for both courses'. Three items measured the extent to which students feel capable of monitoring their cognitive learning strategies shifting from one PBL course to the other. An example of an item is 'During my individual study I feel capable of monitoring the content of the learning issues'.

The questionnaire contained two additional questions. In the first question students had to estimate the mean time they spent on individual

study per week. Several studies (Ericcson et al., 1993; van Til et al., 1997) have shown that this method provides a reasonably valid indicator of the actual time spent. Comparisons of time estimates in retrospective reports and diaries have revealed that respondents generally overestimate the time spent in retrospective reports such as questionnaires. For the present study this means that the actual time spent by students was probably less than they reported. In the second question students had to mention exactly how often they participated in a tutorial meeting during the two courses without any literature preparation. Cognitive achievement was measured by using the scores of two block tests. The major goal of the block test is to assess students' knowledge about the block contents and to provide the students with information on their achievement in relation to the course objectives. The test consists of 40 multiple choice questions, the final score being expressed on a scale of 1–10. An example of a multiple choice question within the domain of learning and development is:

> The ability to successfully cope with one's own emotions and those of others is known as:
>
> a) theory of mind
> b) internal working model
> c) emotional competence
> d) strange situation.

Procedure

The questionnaire was administered to all first-year Psychology students ($N = 213$). Students were all about 18 to 20 years old, and their prior education was broadly at the same level. All had been exposed to a mainly teacher-centred approach prior to enrolling in the university. Students filled in the questionnaire after they had finished two courses: (A) 'Learning and development' and (B) 'Visual perception'. Both courses started in the eighth week of the academic year of 2002–03. In total 165 students filled in the questionnaire (response 77 %).

For each student a mean score of the items measuring both factors (time planning and self-monitoring) was calculated. To facilitate data interpretation, the mean scores of these factors were categorized into four groups: very low (score lower than 2), low (score between 2 and 3), high (score between 3 and 4) and very high (score higher than 5). The number of students in each group was comparable. For each group the following were calculated: mean time spent on individual study (average of the two courses A and B), prepared participation in the tutorial group (average of two courses A and B) and mean score on the block test (average of two courses A and B).

Analyses

To assess the construct validity of the two factors measured with 7 items factor analyses was carried out. The constructs in the model yielded the two predicted factors. To assess the reliability of the clusters, Cronbach's Alphas were computed. Differences between students' scores in each factor on individual study time, prepared participation and test-score were analysed using ANOVA.

Results

Results in Table 1 show that the mean scores of time planning and self-monitoring were rather low, which means that students experience difficulties with time planning and monitoring their study activities.

Figure 1 gives the mean time spent on individual study for four groups; students scoring as very low, low, high and very high ranges on each factor. Results in Figure 1 show that the higher the students score on the factor time planning the lower their individual study time (varying from 13.2 hours per week to 7.2 hours per week). The scores between these groups are significant [$F(3, 162) = 4.05$, $p < .009$]. For the factor self-monitoring this pattern is about the same [$F(3, 163) = 3.00$, $p < .018$]. The higher the students score on the factor self-monitoring the lower their individual study time (varying from 11.9 hours per week to 9 hours per week).

Figure 2 shows that students who have a low score on time planning, as well as on self-monitoring, most often participate in tutorial meetings without preparation. Neither the factor time planning [$F(3, 162) = 2.01$, $p > .23$] nor the factor monitoring [$F(3, 162) = 0.797$, $p > .52$] showed any significant differences between groups for being unprepared.

In Figure 3 a trend is shown that the more appropriately students planned their time the higher their score on the block test. However, these

Table 1 **Mean scores (Mean), standard deviation (SD), number of students (N) and Cronbach's Alpha (Alpha) of the variables**

Variable	*Mean*	*SD*	*N*	*Alpha*
Time planning	2.5	0.8	165	0.79
Self-monitoring	2.8	0.8	165	0.77
Individual study time	11.1	6.3	163	
Unprepared participation tutorial (tot. 20)	2.7	2.6	164	
Block test (score 1–10)	6.0	1.4	215	

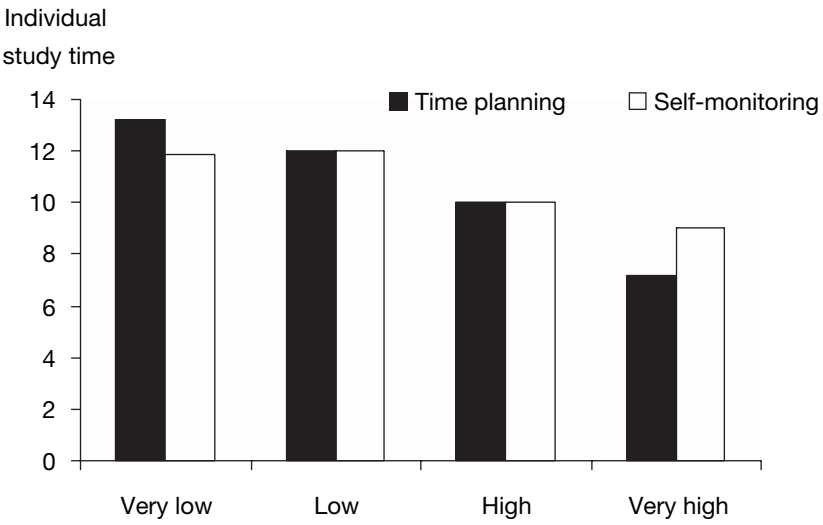

Figure 1 **Mean hours spent on individual study for both factors, split up for students scoring very low, low, high and very high on each factor**

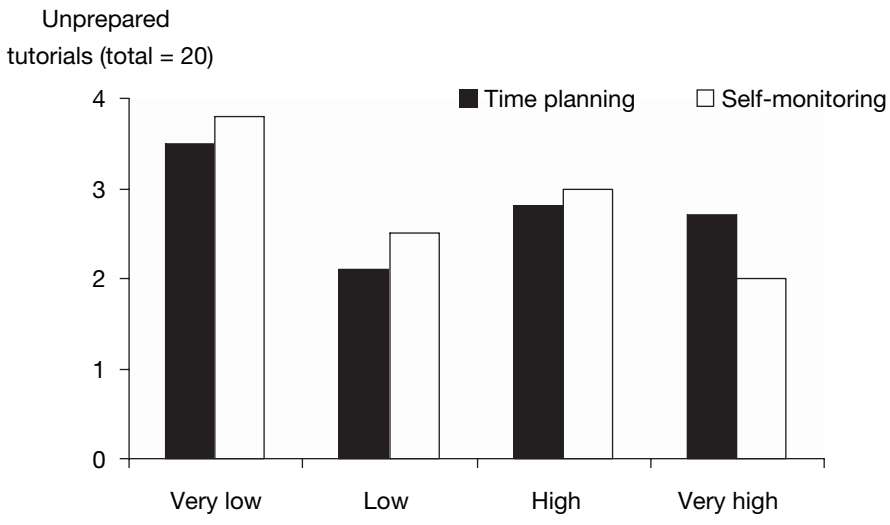

Figure 2 **Number of unprepared tutorials (total of 20 tutorials) for both factors, split up for students scoring very low, low, high and very high on each factor**

differences were not significant [$F(3, 161) = 1.98$, $p > .38$]. Significant differences were found on the factor self-monitoring [$F(3, 161) = 3.48$, $p < .008$]. The more appropriately students monitor their study activities and the more they apply themselves, the higher the block test score.

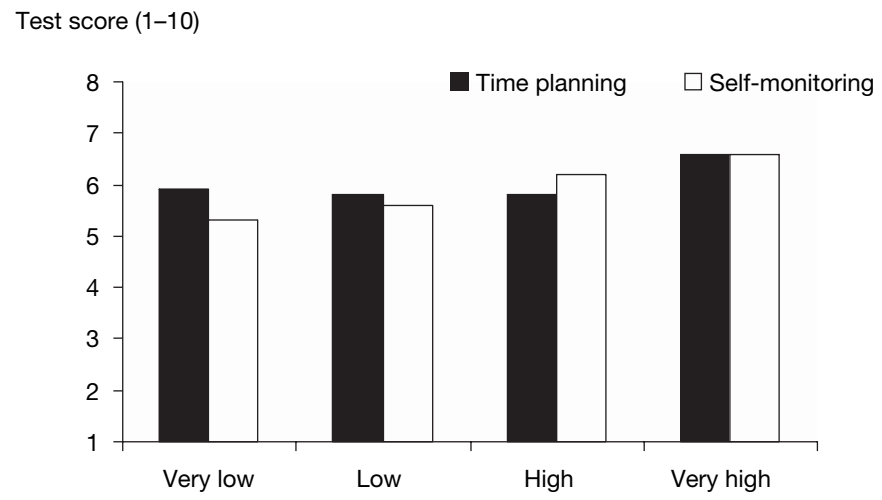

Figure 3 **Mean scores on block test factors, split up for students scoring very low, low, high and very high on each factor**

Conclusion and discussion

The aim of this study was first to assess time planning skills and self-monitoring skills of first-year students with little experience in PBL. Results from this study suggest that students experience difficulties in time planning and monitoring their individual study activities in a problem-based curriculum. Most of these students have experience of a teacher-centred way of learning. In contrast, PBL requires students to take more ownership over how and when learning takes place. The learners are the focus and the teacher plays an important but peripheral role as a tutor so there is less direct explanation from teachers, and less guidance. Students must learn to study independently (for example, they must define which learning goals are important and which literature will be relevant to study the learning goals). That the results of the present study show that a majority of the students experience difficulties in managing their learning activities does not provide any evidence that the students who did badly on the PBL course would have done better in another teaching context, for example, in a classroom where a more teacher-centred approach is adopted. An expansion of the study to investigate this question would be very interesting.

Although this study makes clear that students experience difficulties in time planning and monitoring, it is in general not clear how students can develop self-regulation skills. Some conceptualize self-regulation as a general disposition that students bring into their studies, whereas others

conceive of self-regulation as a property of the person-in-situation and attend to domain-specific self-regulated strategies that develop through experience within and across situations. According to Pintrich (2000) students can learn to be self-regulated and that self-regulation is a way of approaching academic tasks which they learn through experience and self-reflection. Weinstein and Mayer (1986) believe that 'good teaching teaches students how to learn, how to remember, how to think, and how to motivate themselves' (1986: 315). They developed a general study and learning skills programme for students and a Learning and Study Strategies Inventory (LASSI) to provide students with feedback before and after the course. Students with learning difficulties and insufficient study skills especially benefit from these interventions in terms of improved cognitive achievement. Hofer and Yu (2003) designed an undergraduate course in order to teach college students to be self-regulated learners. They investigated training effects and concluded that a course on self-regulation (including cognitive and motivational components) can be helpful for students.

However, Biggs (1999) argues that there are certain limits to what certain students can achieve, and these are beyond the teacher's control. However, good teaching practice can narrow this gap as 'good teaching is getting most students to use higher order cognitive level processes which the more academic students use spontaneously' (1999: 4). These studies indicate that regulation is not a general disposition but can be learnt. Further research should focus on how intervention programmes can be designed to help students regulate their time and focus in the service of goals. Another explanation for the differences between students in applying self-regulating skills, for example planning time and self-monitoring, is that students start their academic career with different backgrounds. For example age and prior educational experience can be crucial factors.

The second aim of this study was to investigate how time planning and self-monitoring skills were related to actual individual study time, (un)prepared participation in the tutorial group and cognitive achievement. This study suggests that students who are better time-planners and who have better self-monitoring skills seem to be more efficient in allocating their individual study time (require less individual study time), prepare more appropriately for tutorial group meetings (although n.s.) and score higher on cognitive tests. Planning time and monitoring study activities seem to be important regulation skills; they are also difficult skills to use according to most students.

Students who are highly skilled in monitoring their study activities seem to benefit more than less skilled students in terms of efficiency and cognitive achievement. This finding is in agreement with the results of the

study by Pintrich and Garcia (1994) who found that students who set goals, plan effectively and monitor goal progress are more likely to achieve higher on cognitive tests than students who fail to engage in these activities. Therefore it is important in all learning environments in which active learning is required to offer study programs in which students learn how they can be skilled self-regulated learners. To assist students in being effective in their learning strategies students must also become aware of alternative ways of approaching different learning situations (McKeachie, 1988). According to Collins et al. (1989), this awareness comes about naturally when students learn from their tutors (apprentice) how to think about academic work, to reason through problems, to question assertions and present arguments, and to use activities such as time planning and monitoring. In other words, as teachers model and explain their thinking in the variety of tasks and activities they expect students to perform, students can eventually take over.

Limitations and future research

There are several widely validated assessment instruments for measuring self-regulation strategies. Examples include the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1993) and the Self-Regulated Learning Interview Schedule (SRLIS; Zimmerman and Martinez-Pons, 1988). The advantage of these instruments over the use of the non-validated questionnaire developed for use in this study is that these include not only time planning and monitoring but also motivation and volitional components, such as effort management, organizational strategies and persistence at difficult or boring tasks. The questionnaire used in this study was developed in the context of PBL, and although it appeared to be reliable, it was not validated. Further research, using these instruments, is recommended. Furthermore, a combination of instruments would be preferable over a single instrument for assessing self-regulation as a process (Boekaerts and Cono, 2005). A further limitation of this study was that all the findings derived from student opinions. Although students are in an optimal position to witness and comment upon many of the investigated factors, their primary role is to learn, not to be observers of the processes in which they are engaged. They are not necessarily critical observers of these processes at this stage of their development. Therefore, additional studies of the issues investigated here are clearly needed. A desirable strategy in a future study, for example, would involve direct observations, by skilled observers, of the way in which students participate in the tutorial group. Differences between students in applying self-regulating skills, for example planning time and self-monitoring, may in part be attributable to the fact that students start their academic career with different backgrounds. For example, age and prior educational experience

can be crucial factors. Although the students varied little in age and educational background, one of the limitations of this study is that specific baseline data about the various levels of prior learning experience, motivation or intelligence across the cohort of students involved was not gathered. Our future research will investigate these and other factors which may impact on self-regulated strategies.

Some suggestions for future research can be drawn from this study. First, the study focused on self-regulated strategies of first-year students. Future research should look at the further development of self-regulated strategies over the years of study. In addition, how the process of the development of such strategies in the new, more (social) constructivist learning environment in HE today takes place. In other words learning environments should be investigated in terms of the affordances and constraints they provide for the development of self-regulation skills. For example, it should be investigated in what way social interactions in the tutorial group (for example, in PBL or other collaborative learning environments) may be helpful in the development of self-regulation strategies and how these interactions can improve prepared participation given that in such groups peers have the opportunity to model and discuss their own learning strategies. Second, more intervention studies must be conducted to determine how students progress in their capacity to apply effective learning strategies. It should be investigated what interventions might be effective in changing ability in self-regulation, efficiency and cognitive achievement. Third, further investigation is needed into the dynamic process of development of self-regulation strategies.

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