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# Summary and Discussion



Within this dissertation, several studies with regards to the influence of problem-based learning (PBL) within law studies are described. PBL is a student-centered educational approach in which students work in small groups under guidance of a tutor on realistic, ill-defined problems. The PBL process starts with the initial discussion phase. Students discuss a problem (i.e., description of a situation that could happen in real-life) and hence activate their prior knowledge on the topic of the problem. They try to explain the described situation, but end up with questions regarding the problem at hand, since their prior knowledge is insufficient to fully grasp all aspects of the problem. This leads to the formulation of so called learning issues that ends the initial discussion phase. Then students have a few days of self-study (i.e., the second phase of PBL), in which they select and study different literature sources to answer the learning issues. Afterwards, students return to the group for the final reporting phase. Together, the studied literature is discussed and a coherent and complete answer to the learning issues is constructed. The tutor is present during the initial discussion and reporting phase. He/she adopts a role as facilitator. For example, in-depth questions are asked to students, rather than providing direct information (Barrows, 1996; Hmelo-Silver, 2004; Loyens, Paas, & Kirschner, 2012). PBL was developed with several goals in mind (Hmelo-Silver, 2004; Loyens et al., 2012; Norman & Schmidt, 1992): (1) the development of a flexible and extensive knowledge base, (2) acquisition of effective collaboration skills, and (3) problem-solving skills, (4) making students intrinsically motivated, and (5) helping students to become self-directed learners.

The PBL approach has been implemented in several (higher) educational institutes all over the world. PBL's origin lies in medical education and even though it has been applied to other disciplines as well (e.g., social sciences, engineering; Barrows, 1996; Hmelo-Silver, 2004; Loyens et al., 2012), the majority of the PBL research is conducted in medical education. In this dissertation, the influence of PBL is addressed in the area of legal education, a discipline that has not yet received a lot of attention in PBL studies.

The Erasmus School of Law of the Erasmus University Rotterdam implemented PBL as educational approach in the three-year Bachelor's curriculum. The implementation started in September 2012 for the three academic programs within the Erasmus School of Law: Dutch law, tax law, and criminology. Before the educational reform, the Bachelor's curriculum was more traditional in nature with lectures as core instruction. Besides the implementation of PBL, other changes in the organization of the curriculum and assessment system were made as well. Regarding the curriculum organization, courses were offered sequential instead of parallel after the implementation of PBL. With regards to the assessment system, the approach known as "Nominal is Normal" was applied (Vermeulen et al., 2012). Students need to obtain all 60 course credits in the first year, in order to continue to the second year. Two other important characteristics of "Nominal is Normal" are a reduction of the number of resits of examinations and that compensa-

tion of low, insufficient marks with higher sufficient marks is allowed. The aim of the implementation of PBL and the changes in curriculum organization and assessment system was twofold: (1) Improving the quality of student learning and (2) improving study progress in terms of better graduation rates (i.e., higher number of students that graduate from the Bachelor's program within four years). Graduation rates were rather low in the years before.

The research aims of this dissertation are in line with the aims of the implementation of PBL within the Erasmus School of Law and with the theoretical fundamentals of PBL. The first research aim focused on investigating PBL's influence on study *processes* and the second research aim on investigating the influence of PBL on study *outcomes*. In total, six studies are conducted. One study describes the experiences of the implementation. The other five studies answer the questions what the influence of PBL is on study processes (three studies) and study outcomes (two studies) within the Erasmus School of Law.

## MAIN FINDINGS

An extended description of the implementation of PBL at the Erasmus School of Law was given in **Chapter 2**. An overview of all changes that took place at the department (e.g., tutor training of the Seven-Jump method which is characteristic for PBL, training for teachers on how to develop their courses) was given. In addition, students' and teachers' experiences with PBL were questioned. These results gave an indication of whether the implementation of PBL had been successful in terms of the perceptions of the stakeholders. The quality of implementation is important, as it can affect the processes in PBL, and in turn student performance (Dolmans, De Grave, Wolphagen, & Van der Vleuten, 2005; Dolmans, Wolphagen, Van der Vleuten, & Wijnen, 2001).

Questionnaire results showed that students felt PBL helped them to study on a regular basis, and that PBL stimulated them to be actively involved in the learning process. The required preparations for the tutorial meetings might contribute to this. However, students also made some critical remarks regarding PBL. The reporting phase (i.e., discussion about studied literature) was sometimes experienced as not useful because the studied literature was simply summed up. Teachers reported that PBL students were more actively involved and studied on a more regular basis compared to students in the former, lecture-based program. Furthermore, teachers indicated that within the faculty, employees are dissatisfied with the PBL program. Dissatisfaction of teachers could be due to changing their teaching style (i.e., from a more directive role to a facilitating role), which is challenging for them (Ertmer & Simons, 2006; Kaufman & Holmes, 1996) and may have led to dissatisfaction.

## PBL and Motivation

Motivation was the topic of **Chapter 3**. The well-known Self-Determination Theory (SDT; Ryan & Deci, 2000) on motivation, was used as the theoretical background in two studies (Study 1 and 2) conducted in Chapter 3. SDT states that satisfaction of three needs (i.e., need for feelings of autonomy, need for feelings of competence, and need for feelings of relatedness) leads to more intrinsically motivated students. This motivation type is positively related to academic achievement (e.g., Taylor et al., 2014). Opposite of autonomous motivation is controlled motivation (i.e., avoiding feelings of shame or motivation due to external factors; Ryan & Deci, 2000), which is negatively related to academic achievement.

In Study 1, it was investigated whether the learning environment (traditional vs. PBL) satisfied the three needs of SDT, and the two types of motivation, autonomous and controlled motivation. A cohort comparison was made between third-year Dutch law students in the former, lecture-based Bachelor's program at the Erasmus School of Law and third-year Dutch law students in the PBL Bachelor's program. It was expected that students in PBL would experience more feelings of autonomy, competence, and relatedness. In addition, it was expected that PBL students would be more autonomously motivated and would experience less controlled motivation. Contrary to the expectations, no differences were found between the PBL students and students of the traditional, lecture-based program on autonomous motivation and controlled motivation, nor on feelings of autonomy and competence. PBL students did score higher on feelings of relatedness than students from the traditional learning environment.

To find an explanation for these mainly unexpected results, focus groups with PBL students were conducted in Study 2. In the focus group discussions, PBL students indicated the presence of some autonomy-supportive elements in PBL, such as choice in literature sources and room for own discussions in the tutorial meetings. However, they also identified some controlling elements, such as mandatory presence, and lack of choice in courses. The presence of both controlling and autonomy-supportive elements can provide an explanation for the lack of differences in autonomy feelings between both student cohorts. It is likely that in the lecture-based program, also both autonomy-supportive and controlling elements were present. Further, students in the focus groups reported feeling competent because of some PBL specific elements, like realistic problems, but also because of non-specific PBL elements, like obtained grades during the academic program. Feeling competent because of sufficient grades can also play a role in a lecture-based curriculum, and this could therefore explain why no differences emerged between both student cohorts. Finally, PBL students indicated that working in small groups contributed to feelings of relatedness. Students got to know their peers well in the tutorial meetings. Moreover, students felt the tutor was approachable in PBL. In sum, the results of the focus groups indicated that not all three needs were fulfilled

in PBL and that could explain why PBL students are not more autonomously motivated than students from the traditional learning environment.

### **PBL and Learning Strategies**

Students' learning strategies constitute an other important part of their study processes. Therefore, learning strategies were the second topic of study. Some learning strategies, like deep processing and self-regulation, are found to be positively related to academic performance (Boyle, Duffy, & Dunleavy, 2003; Richardson, Abraham, & Bond, 2012). Similar to Chapter 3, a cohort comparison between third-year Dutch law students of the lecture-based Bachelor's program and third-year Dutch law students in the PBL program at the Erasmus School of Law was made. This study was reported in **Chapter 4**. Research on how students learn in the three-year PBL program was investigated in **Chapter 5**, in which the focus was on the development of learning strategies, the relationship with academic achievement, and the relation with assessment.

A distinction among learning strategies was made based on Vermunt's (1998) distinction. Processing strategies are thinking strategies that students use to process learning material, consisting of three types i.e., deep processing, stepwise processing, and concrete processing. Within regulatory strategies, also three types are distinguished, i.e., self-regulation, external regulation, and lack of regulation. Based on previous studies (Lycke, Grøttum, & Strømsø, 2006; Mattick & Knight, 2007; Schmidt, Dauphinee, & Patel, 1987; Van der Veken, Valcke, Muijtjens, De Measeneer, & Derese, 2008) it was expected that the PBL environment would stimulate the use of deep processing better than the traditional learning environment. In PBL, prior knowledge is activated, which stimulates the process of elaboration. During self-study and the discussion in the reporting phase, students need to connect the existing knowledge to the newly learned knowledge. Furthermore, it was expected that self-regulation would be stimulated more in PBL than in the traditional cohort (English & Katsintas, 2013), because of the selection of one's own literature, careful planning of self-study time for tutorial group preparation, and the evaluation after the reporting phase in which students can indicate whether they feel they have studied enough.

Results of Chapter 4 revealed that PBL students reported more use of deep processing, more self-regulation, and more external regulation than the students in the traditional cohort. Effect sizes were, however, small. No differences between PBL students and students of the traditional, lecture-based program were found on stepwise processing, concrete processing, and lack of regulation. Results were partly in line with the expectations. It is assumed that the PBL environment stimulates the way students learn to a certain extent, and that students are better able to process material at a deeper level because they need to make connections between concepts and with the problem used in the initial discussion. In addition, higher scores on self-regulation are explained by the PBL processes that make sure students take their own responsibility in PBL. Results

further showed that external regulation turned out high among PBL students. Considering the external factors in PBL, this outcome is not really surprising. The tutor, fellow students in the tutorial group, and the required preparation for every tutorial meeting are elements in PBL on which students could depend their learning behavior.

In Chapter 5, another study on students' learning strategies within PBL was conducted with a focus on (1) the development of learning strategies, (2) the relationship between learning strategies and academic achievement, and (3) the level of knowledge tested in exams at the curriculum under study. Type of assessment was evaluated to shed light on the findings regarding the development of learning strategies. With respect to development, it was hypothesized that over the course of three years in PBL, deep processing, concrete processing, and self-regulation would increase. Moreover, it was expected that stepwise processing, external regulation, and lack of regulation would decrease over time. Regarding the relationship with academic achievement, deep processing and self-regulation were expected to positively relate to performance (e.g., Boyle, Duffy, & Dunleavy, 2003; Richardson et al., 2012), while stepwise processing was expected to be negatively related to academic performance (i.e., Lindblom-Ylänne & Lonka, 1999; Richardson et al., 2012; Zeegers, 2001) as well as lack of regulation (Lindblom-Ylänne & Lonka, 1999; Vermunt, 2005).

Results of Chapter 5 on the development of learning strategies over the three-year PBL Bachelor's program showed that deep processing stayed stable over time. Stepwise processing increased and then decreased towards the end of the program. Explanations for these findings will be discussed below in combination with type of assessment. Concrete processing increased over the years. This was expected, because PBL students work in a realistic context, making application of knowledge easier to accomplish (Schmidt, 1983). The results for both self-regulation and external regulation showed a puzzling pattern: a decrease in the first year, then an increase in the second year, and finally a small drop towards the end of the Bachelor's program. Although this specific pattern is hard to explain, it shows that there is no steady increase of self-regulation or decrease of external regulation over time, as was expected. Presence of external factors in PBL could serve as an explanation here (e.g., a tutor who provides too much information during meetings). Furthermore, lack of regulation declined over time. This is in line with results of previous studies (Donche et al., 2010; Donche & Van Petegem, 2009; Vermetten et al., 1999), which indicates that gaining experience with studying helps to manage the learning process better.

For the relationship between learning strategies and academic performance, only lack of regulation (i.e., difficulty with regulation of learning in general) was statistically significantly related to academic achievement. This relationship was, as expected, negative. Experiencing difficulties in regulation of learning was associated with lower academic achievement. Correlations between achievement and other strategies like deep processing

and self-regulation did not emerge. This suggests that for earning sufficient grades, other student qualities are needed as well. Still, development of these strategies is important for life after university, as students continuously need to be able to develop themselves.

The exams in the PBL program were evaluated on their required level of knowledge processing. Questions that focus on factual knowledge reproduction require a different kind of knowledge processing compared to questions that emphasize the application of knowledge. The analysis of exams demonstrated that the number of exam questions that focused on factual knowledge (i.e., simple knowledge processing) was high. Especially in the first academic year, but also in the third year, still about one third of the exam questions focused on basic, factual knowledge. Exam questions regarding application are highly underrepresented in all three years (although more present in the third year). This exam analysis might offer an explanation for some of the findings on the development of learning strategies. Students apply strategies necessary for obtaining a sufficient grade (Newble & Entwistle, 1986). With a strong focus on factual knowledge questions in exams, it is not surprising that students apply stepwise processing often, even in the final year of the Bachelors' program.

### **Knowledge Acquisition, Retention, and Application**

Ideally in education, students acquire new knowledge, create a deep understanding and are able to apply knowledge in different situations (i.e., transfer). Moreover, students should be able to retain knowledge over time, both during the academic program as well as afterwards. In **Chapter 6**, the focus was on both of these issues: influences of PBL on knowledge acquisition and retention, and the type of assessment. An experimental study was conducted in which students were randomly assigned to a PBL condition or a lecture condition. They learned about Dutch criminal law (the topic was self-defense and unreasonable use of self-defense) and were tested immediately after the learning phase (i.e., knowledge acquisition) and one week later (i.e., knowledge retention). The test contained three types of assessment: factual knowledge, application of knowledge, and transfer of knowledge. It was expected that in PBL, knowledge retention would be better because of the process of elaboration in PBL (i.e., prior knowledge is activated that helps connecting existing knowledge to newly learned knowledge and helps in knowledge retention; Dochy, Segers, Van de Bossche, & Gijbels, 2003; Schmidt, 1983). Regarding type of assessment, it was expected that in the lecture condition, performance on factual knowledge questions would be better (e.g., Albanese & Mitchell, 1993). On the other hand, application and transfer of knowledge were expected to be better among PBL students, due to working with realistic problems and the stimulation of deep processing (Gijbels, Dochy, Van den Bossche, & Segers, 2005).

Results in Chapter 6 showed no effects of time on any of the assessment types. A possible explanation could be the short time between immediate and delayed test (i.e.,



one week). Performance on factual knowledge was sufficient in both conditions (i.e., 6 or 7 out of 10), but significantly higher for participants in the lecture-based condition, in line with our expectations. Performance on the application assignment was insufficient in both groups, but was significantly better in the PBL condition, also in line with our expectations. Apparently, providing direct information in a lecture aids in acquiring factual basic knowledge, but the processes in PBL are more helpful when students need to apply knowledge. No differences were found regarding transfer of knowledge. An explanation here lies in the difficulty of transfer in general (Norman, 2009). Especially in a short-time experiment as the one presented in Chapter 6, it might be too difficult for students to master the material sufficiently to transfer it at a later point in time.

### **PBL and Study Progress**

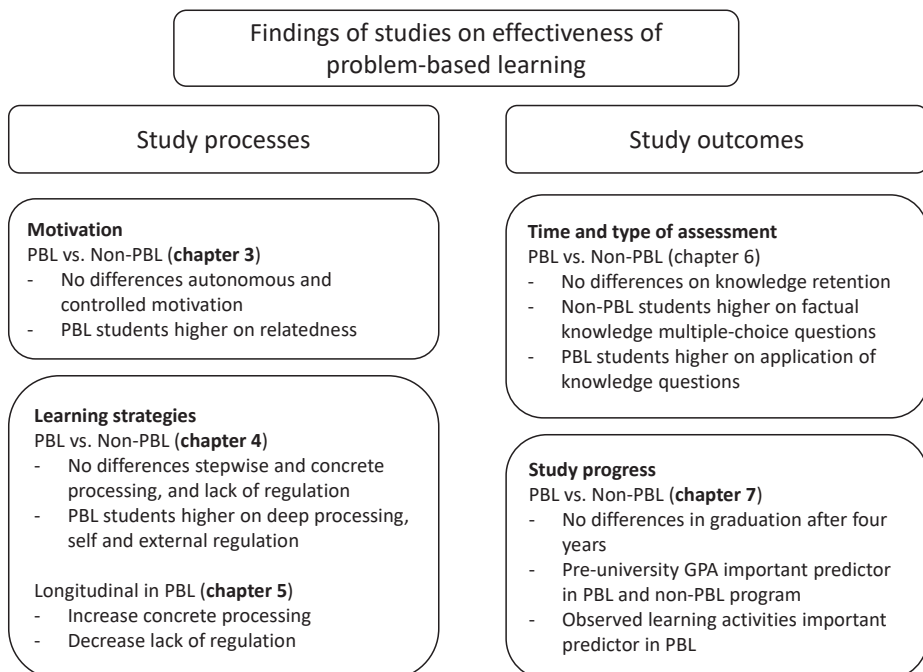
In higher education institutes in the Netherlands, the number of students graduating a Bachelor's program without a delay used to be quite low (Educational Inspectorate, 2009). Although graduation rates showed an increase since the report of Educational Inspectorate in 2009 (Educational Inspectorate, 2017), there is still room for improvement. Both students and universities would benefit from better study progress. **Chapter 7** contains a study that focusses on study progress. The curriculum organization (e.g., contact hours, room for self-study) and the assessment system play a role in improvement of study progress (e.g., Jansen, 2004; Schmidt et al., 2010; Vermeulen et al., 2012). The Erasmus School of Law aimed to improve study success and progress of the students. Several studies showed that in PBL less study delay is present and more students earn their degree compared to students of more traditional programs (Iputo & Kwizera, 2005; Schmidt, Cohen-Schotanus, & Arends, 2009a).

A lot of research has been conducted regarding factors that contribute to study success and progress and the factors that determine study success and progress. However, the majority of these studies were conducted in traditional curricula (e.g., Bruinsma & Jansen, 2009). The study of De Koning, Loyens, Rikers, Smeets, and Van der Molen (2012) is an exception and the authors investigated study success in an existing PBL curriculum. A specific PBL characteristic appeared to a strong predictor, namely observed learning activities. The tutor in PBL observes students' behavior and rate the behavior on certain criteria. For example, whether the students keep to the agreements (e.g., arrive on time), whether students are well prepared and actively involved in the discussion. At the end of the course, the tutors gives a grade on a ten-points scale for each students in the group.

This chapter makes a direct comparison between a PBL and lecture-based curriculum on study progress and its predictors. It was expected that study progress in terms of completing the Bachelor's program within four years, would be higher after the implementation of PBL at the Erasmus School of Law. Moreover, differences in which predictors play an important role in study progress in both learning environments were explored.

Results showed that the PBL program did not significantly differ in the percentage of students that completed the Bachelor's program within four years. In other words, study progress did not change after the implementation of PBL. It was further shown some factors were predictive in both learning environments, but also that some factors were specific predictors in either the traditional or the PBL environment. Pre-university GPA strongly predicts study progress in general, regardless of the instructional method used. In both environments, a positive relation between pre-university GPA and graduation in four years was shown. In the traditional cohort, age was an additional predictor: the younger students were, the better their study progress. In the PBL cohort, gender was the strongest predictor: female students had better study progress than male students. When the variable observed learning activities was added as a predictor in the PBL cohort, it turned out to be the strongest predictor of completing the Bachelor's program. The higher tutors graded the students on the quality of preparation for and active participation during the meetings, the more likely it was that students graduated within four years.

The main findings of the studies presented in this dissertation are presented in Figure 8.1. This figure contains the influence of PBL on both study processes and study outcomes.



**Figure 8.1.** Overview of the main findings of the influence of problem-based learning on study process and outcomes.

## MAIN DISCUSSION

Study processes and study outcomes in PBL were at the heart of the two research aims in the present dissertation. These two are closely related, as the factors regarding study processes – motivation and learning strategies – impact study outcomes (e.g., Richardson et al., 2012). Both positive effects as unexpected findings of PBL appeared in the current studies. First, the positive findings are discussed, followed by the unexpected findings.

With regards to study processes, an increase of concrete processing over time in the three-year PBL Bachelor program (Chapter 5). Concrete processing means that students are able to relate the learned material to practice and real-life situations (Vermunt, 1998). Somewhat in line with this finding were the results of Chapter 6, in which PBL participants outperformed the lecture condition on the application of knowledge. It could be argued that PBL stimulates knowledge application, because students work with authentic, ill-defined problems (Schmidt, 1983). These problems relate to real-life situations that students can encounter later in their professional life. PBL claims that when students learn in a realistic context during their academic program, they will be better able to relate and apply the knowledge in a similar situation (Schmidt, 1983). In the experiment of Chapter 6, the tutor referred in the reporting phase to the problem at hand, assuring students would relate the learned knowledge to the situation. Moreover, in the focus group discussions (Chapter 3) students indicated they enjoyed working with the problems in PBL, because the problem makes the learned knowledge more concrete.

A second positive result was that PBL students seem to be more self-regulated than students in the traditional cohort. So, they were better able to control the learning process. Chapter 4 demonstrated a small influence of PBL on students' reported use of self-regulation compared to students in the traditional program. Additionally, in Chapter 2 students were described as more actively involved in the learning process. In PBL, self-regulation is fostered because students need to select their own literature sources, plan and monitor self-study time, and evaluate their learning process (Loyens, Magda, & Rikers, 2008; Schmidt, 2000). Students indicated that PBL helps them to study on a regular basis. Moreover, teachers who had taught in both the lecture-based and the new PBL program observed PBL students as more actively participating than students in the former program. These experiences and observations indicate that students take responsibility for their own learning process, one of the aspects of self-regulation. Besides, being more actively involved in the learning process contributed to study progress. Results of Chapter 7 demonstrated that the grade on observed learning activities, was the strongest predictor of completion of the Bachelor's program in time in PBL. These findings indicate that being engaged in one's own learning, like being able to plan,

monitor, and evaluate study activities, is more present in PBL according to teachers, tutors, and students themselves and relates positively to study progress.

A third positive finding regarding PBL has been found in the reported feelings of relatedness, which were significantly higher than those of students in the former, lecture-based program. In the focus group discussions of Chapter 3, students mentioned that working in small groups with a tutor contributed to these feelings. In PBL, students get to know each other in the small group meetings that change each course (i.e., every five weeks). The change in tutorial groups enable connections to peers and building friendships. Moreover, students described that the tutor was approachable during the meetings that also contributed to their feelings of relatedness. Alternatively, students in the former program reported lower sense of relatedness. It could be argued that in the traditional program, a sense of anonymity among students was created due to the large-scale lectures. Teachers were perhaps less involved in students' learning activities and more distant than in PBL. Moreover, it is likely that in the former educational setting, less interaction between students took place.

Study 1 of Chapter 3 showed that the feelings of relatedness had no correlation with autonomous motivation, as was expected based on SDT (Deci & Ryan, 2000; Ryan & Deci, 2000). Still, feeling connected to fellow students and staff can be beneficial for other outcomes. For example, the model of Tinto (1975) states that the interaction between students and the academic environment influences student persistence. If students feel socially integrated in the academic environment, their commitment increases, preventing them from voluntarily dropout. In PBL, integration is stimulated by the small group size and the role of the tutor. The tutor provides more personal attention to the students compared to a teacher in front of lecture with a large number of students. The personal attention of the tutor to students could affect both course content as personal matters.

Despite these positive findings, some unexpected findings after the implementation of PBL showed up as well. The comparison studies demonstrated little differences regarding motivation and need satisfaction, and little differences with regards to several learning strategies. As mentioned, these components of study processes are related to academic performance (e.g., Richardson et al., 2012). Therefore, the fact that only small differences appeared in study processes might explain the non-significant difference in study progress after the implementation of PBL (Chapter 7). Moreover, the development of learning strategies demonstrated no major changes over time regarding deep processing and stepwise processing in the three-year PBL program. Several explanations could be offered here.

The first explanation lies in the assessment used in the curriculum. It is likely to assume that students adapt their learning strategies to the assessments applied in the academic program (Baeten, Kyndt, Struyven, & Dochy, 2010; Vermunt, 2005). For example, when exams focus more on factual knowledge questions, students will apply

stepwise processing more often. An evaluation of the course exams of the three years of the Bachelor's program (Chapter 5) showed that this was indeed the case in the curriculum under study. Factual knowledge questions (e.g., definitions of concepts) were highly representative in the first year exams, and even still in the third academic year. On the contrary, the number of questions that required complex knowledge processing like the application of knowledge were quite low in all three years. Stepwise processing was rather high among Dutch law students, in both the traditional lecture-based program (Chapter 4) and the PBL program (Chapter 4 and 5). The high number of factual knowledge questions in exams could explain why students apply stepwise processing and are not encouraged to develop the more demanding strategy of deep processing. Moreover, this could also explain why deep processing is not increasing over time. The study of Vermunt (2005) showed, in line with these results, higher reports of stepwise processing (i.e., more use of rehearsal and memorization techniques) among Dutch law students, compared to students of other disciplines (e.g., psychology students, arts students). This could indicate that the nature of the material to be learned in Dutch law does not always demand deep processing, but can also be managed with stepwise processing. However, when the focus of assessment is on the application of knowledge, instructions through PBL appeared more useful than providing a lecture as is shown in results of Chapter 6.

A second, more general explanation for the lack of differences found between students of the lecture-based and the PBL program is that the majority of the studies in this dissertation were conducted within the third and final year of the Bachelor's program. It is likely that third-year students, despite the learning environment they are in, feel more capable about their performance, are more motivated to study, and already gained experience over the years on which learning techniques help them.

A third explanation for the lack of differences might be an insufficient implementation of the PBL process. Implementing a new educational method requires and implies many changes for Faculty and staff. This is a complex and time-consuming process. Teachers needed to change their course materials and their teaching style. In the former educational program, teachers had a directive role and transmitted information to students in lectures. However, in PBL, teachers should adopt a facilitating role, and be more in the background. Changing their teacher style is challenging for teachers (Ertmer & Simons, 2006; Kaufman & Holmes, 1996) and could (especially in the beginning of the transition) result in dissatisfaction (Chapter 2). In the comparison studies of Chapters 3 and 4, the PBL students were third-year students from the *first* PBL cohort at the Erasmus School of Law. Complications regarding implementation are more likely to arise in a first cohort, as everything is new to both students and academic staff.

### Practical Relevance and Recommendations

Results showed that external factors play a role in the learning process and that students identify some controlling elements within PBL. Further, some of the processes within the PBL program are not optimally applied (e.g., literature summed up in reporting phase). Hence, PBL in practice is not always completely in line with the ideas and principles of PBL in theory, as also is described in Moust et al. (2005). We offer some specific recommendations to further optimize the implementation of PBL and study progress.

A first recommendation is that the application of knowledge should be emphasized in the reporting phase by the tutors. During the reporting phase, the focus should lie on the learning issues and the questions that arise from there and in addition, on combining different literature sources. Furthermore, students should relate the learned knowledge to the problem that was the starting point in the initial phase. If this is not happening automatically, the tutor can help to accomplish this. A tutor can refer to the problem during the reporting phase and even come up with different scenarios related to the original problem and ask how students would explain that with the studied literature.

A second recommendation is to put more focus on the application of knowledge in the exams and to increase the number of applications tasks during the years of the Bachelor's program. Being able to apply knowledge is an important skill that students need to acquire and control when they work in the professional field. PBL stimulates working in a realistic context and hence application of knowledge in real-life situations. The meta-analysis of Gijbels et al. (2005) showed that PBL students are better in application tasks than students of more traditional programs. Putting more emphasis on this in assessment will help students use relevant learning strategies like deep processing.

A third and final recommendation is based on the findings of Chapter 7. Students who are likely to fail the Bachelor's program could and should be identified at an early stage. Predictors of study progress in the PBL program indicated that pre-university GPA and observed learning activities of the first year are important factors in predicting study progress. Students who have a low pre-university GPA and low scores on observed learning activities could be offered with guidance on how to learn efficient and effectively. Hopefully, this contributes to the study success and progress.

### Strengths and Weaknesses of the Studies and Suggestions for Future Research

The studies in this dissertation address PBL in legal education. The findings of this dissertation therefore contribute to the existing literature. The majority of existing research took place in medical education. In order to generalize findings of PBL studies, research should be conducted in other areas of education as well.

Second, the studies in this dissertation have a broad variation of studies, in design and used analyses. Additionally, the studies are innovating compared to existing studies. Comparison studies, as well as a longitudinal, and an experimental study are included.

In Chapter 3, a mixed-method design was applied. Results of the quantitative study were supplemented with a qualitative study. The longitudinal design of the study in Chapter 5 is unique because longitudinal studies in PBL curricula are rather scarce. In Chapter 6, an experimental study was conducted, making sure all factors were kept under control. In general, there is a lack of experimental studies in existing PBL literature (Kirschner, Sweller, & Clark, 2006). Further, in Chapter 7, a comparison was made on the study progress predictors between PBL and non-PBL students within one university, which was not done before.

The studies in this dissertation are a first attempt to generalize findings of previous PBL effect studies in medical education to legal education. However, more research is necessary to further generalize the results. There are some limitations with the current studies. A first limitation in the studies on the implementation of PBL is that the implementation of PBL took place at the same time of the implementation of the new assessment system “Nominal is Normal”. At this point, it is difficult to answer the question to what factors the improved learning strategies and outcomes can be attributed. The didactical principles of PBL and “Nominal is Normal” are closely related. Both aim that students study on a more regular basis and reduce procrastination of students.

Second, all studies are conducted within the PBL curriculum of one faculty at one university. Results of these studies could be further generalized when other law schools in the Netherlands, Europe, or the world apply PBL and are willing to do research to the effects. Third, future research could focus more on student development within PBL during a longer time period than focus on comparison studies between cohorts. For example, research that investigate comparisons within Bachelor's programs in three years, and not just between cohorts, as most studies in this dissertation did. Other factors could play a role when performing research between the students of different cohorts, like pre-existing differences in the student groups.

A fourth limitation is that the studies on study processes, motivation and learning strategies, in Chapters 3, 4, and 5, mostly made use of self-reports. The most important reason to use self-reports is that study processes are difficult to observe. However, the risk of self-reports is that students could provide socially desirable answers. We recommend in future research to either make use of more objective measurements, or to add self-reported data with qualitative information to provide a broader sight on the results (as was done in Chapter 3 as well).

Finally, in the majority of the studies of this dissertation a comparison between the former educational program and the PBL program within the Erasmus School of Law was made. Even in the experimental studies, lectures were compared to instructions by PBL. However, in practice, these two instructional methods are often used to support each other. Results of Chapter 6 suggest that this is useful for performance on different types of assessment. Lectures appeared effective mostly for acquisition of factual

knowledge, while PBL instructions were effective for application of knowledge. Future research should therefore not focus much on the *comparison* between PBL and traditional learning environments, but more on the factors that could be improved within an educational method that combines PBL and lectures.