Summary

The aim of the studies in this thesis is to gain more insight into factors determining the effectiveness of postgraduate education in occupational medicine.

In the introduction (Chapter 1) I describe the context of these studies and the status of occupational medicine in the Netherlands. An overview of the occupational physician training programme is given. The education of the occupational physician is placed within the continuum of medical education. The medical doctor, in training to become an occupational physician is also carrying virtually full workload within an occupational health service. Sessions with a supervisor are often limited to a weekly or monthly consultation. Many participants in the occupational medicine programme choose to become an occupational physician as a late or second choice or as a second career, and already have a number of years experience as a medical doctor. The present occupational medicine programme in the Netherlands can be characterized as being somewhere between specialty training and continuing medical education.

Next I elaborate on the theme of educational formats. One of the questions that arises is if a problem-based learning approach can be applied to the postgraduate education in occupational medicine. Educational formats are not easy to describe. Even though problem-based learning is discussed at great length in the literature on medical education, it is still remarkably ill-defined. In our research project we defined problem-based learning as an educational format in which learning takes place in a small, self-directed group and in which actual problems and experiences of the participants form the beginning of the session. The learning process includes study of literature and it stimulates experimenting of the participants in their own practice. The process is facilitated by a tutor who is both a content- and an educational expert.
Summary

Apart from educational format, learning styles are features of the learning process that can potentially influence the outcome. For this reason I examined the learning styles of Vermunt and Kolb. Kolb’s theory of experiential learning is widely used and discussed in postgraduate medical education. In this thesis I considered Kolb’s learning styles as being potentially influential factors on learning.

Evaluation of medical education is often restricted to a description of the programme, the outcome and the level of satisfaction of the participants. I wanted to go beyond the descriptive design and beyond a description of the level of satisfaction of the participants. The design should include outcome measurements, both before and after the educational interventions, and preferably also a control group. The design that would yield the best evidence is a randomized controlled design in which participants are randomly allocated to the control or experimental group.

The main objectives of this thesis are to evaluate the effectiveness of parts of postgraduate education in occupational medicine, and to study the differences between the more traditional, lecture-based format and a problem-based format, using knowledge tests and performance indicators as variables of outcome.

Chapter 2 is a review of the literature concerning the effectiveness of problem-based learning in continuing medical education. Using problem-based learning, continuing medical education and controlled trials as search words, a search in Medline and several other databases revealed only six controlled evaluation studies that met the inclusion criteria. The level of evidence of effectiveness is assessed on the outcome variables knowledge, performance, degree of satisfaction of participants and health of patients. Five of these studies were published in the 1990s and one in 1988. Five studies were on general practitioners. Three studies compared problem-based learning with other educational formats. These three studies show no evidence that problem-based learning affects the outcome variables knowledge, performance and health, but do show moderate evidence of a greater degree of satisfaction gained from problem-based learning. The other three studies compared problem-based learning with no educational intervention. These studies show limit-
ed evidence that problem-based learning affects outcome variables. The conclusion of this chapter is that there is limited evidence that problem-based learning in continuing medical education increases knowledge, performance and patient health and moderate evidence that physicians are more satisfied with problem-based learning. A further study on this subject should be a well designed quasi-experimental or randomized controlled trial that compares problem-based learning with another educational format and preferably uses the performance of physicians and the health of patients as outcome variables.

CHAPTER 3 is a report of an experiment in which we evaluated the effectiveness of an educational programme on work rehabilitation guidelines for patients with low back pain. In a non-controlled experiment, with one group of participants and by employing measurements of knowledge (written knowledge tests) and performance (performance indicator scores) both before and after the programme, the effectiveness of the education is evaluated. The performance indicators give an impression of the occupational physicians’ competence, performance and the application of the guidelines in daily practice. The results showed that after the educational programme the scores on the knowledge test and on the performance indicators were significantly increased. We concluded that the educational programme contributed to the improvement of the participants’ knowledge of the guidelines on low back pain and to the improvement of the participants’ application of the guidelines in daily practise. The use of performance indicators seems to be a feasible way of providing feedback for the educational programme and also as a means of evaluating the programme.

The second experiment is reported in CHAPTER 4. The educational programme on work rehabilitation guidelines for patients with low back pain is re-evaluated. This time however, with other groups and in a quasi-experimental setting with a control group who did not receive any education on low back pain. This controlled experiment confirms the results of the first experiment: knowledge and performance in practice have improved and are more in compliance with the guidelines.
Summary

In the subsequent experiment, reported in Chapter 5 we extended our investigations in several ways. More physicians took part and all were from schools of occupational health in The Netherlands. Secondly, the content of the programme was more wide-ranging and this time concerned the guidelines for occupational health management of patients with mental health problems. In addition, we compared two different educational formats, a problem-based format versus a lecture-based format. Moreover, the preferred evaluation design was applied: the randomized controlled design. And finally we carried out a follow-up knowledge measurement test after fourteen months. The results of this study showed that both forms of postgraduate medical training are effective in increasing participants' knowledge and performance. We also concluded that, in spite of less favourable evaluations by the participants in terms of satisfaction, the problem-based programme appears to be more effective in improving performance than the lecture-based programme.

Chapter 6 reports on a further study on data collected in the third experiment. The objectives of this follow-up study were to investigate personal and contextual factors predictive for a successful outcome of the postgraduate programme on the guidelines for occupational health management of patients with mental health problems. The following personal and contextual variables were measured as potential predictors of outcome: gender, age, years of experience as a doctor, university of graduation, learning style (Kolb's definition), present employer (occupational health service) and educational format (problem-based or lecture-based). The main outcome measures were scores on knowledge tests and participants' performance in practice. The results were that female gender was positively related to both knowledge and performance, independent of the influence of other factors. Learning style showed a non-significant relationship with knowledge, but had no influence on performance. No interactions were found with course design (i.e. problem-based learning or non-problem-based learning format), but further research could reveal pointers which may lead to training courses tailored to meet the day-to-day problems of the students.
Summary

Chapter 7 is a general discussion of this thesis, which concentrates particularly on the topics of problem-based learning and on design and outcome measurement of educational research.

The first conclusion of our studies is that the educational programme yielded positive results in increasing participant’s knowledge and performance. The problem-based format seems to be more effective in increasing participants’ performance. However, the problem-based learning format was less popular with the participants. Our conclusion contradicts the view from the literature, as our review of the literature showed that there is moderate evidence that participants are more satisfied with problem-based learning. Using practice problems experienced by participants as the start of the problem-based educational session can be one of the factors in explaining a better performance outcome. It is a concrete experience and the first phase in Kolb’s experiential learning cycle. It helps participants to take on a learning task and to acquire a deeper understanding of information. Other explanations for the better outcome in performance of the problem-based format are probably the small, self directed group process and the tutor as facilitator of the PBL sessions. In the self-directed group sessions, the relevant and often unexpected problems put forward by the participants lead the learning process and stimulate the acquisition of learning skills. The role of the tutor, balancing between predominantly transmitting knowledge and stimulating in depth learning, is seen as important. We conclude that these characteristics of problem-based learning should be monitored as variables in a qualitative research design for example.

Further research into the meaning of ‘satisfaction’ in evaluation of education is recommended. The lower levels of satisfaction in the problem-based format were probably due the absence of the teacher in the traditional teaching role who is regarded as important opinion leader. Possibly, the predominantly reflective learning styles of the participants did not fit in with the problem-based learning format. A third explanation could be that the participants all carry a full work-load and they regard the one day in the week at the course as a day for themselves and prefer not to have to join in too actively.
We discuss the choice between a randomized controlled design and a qualitative design for purposes of evaluating educational interventions. The discussion on the value of randomized controlled studies seems to focus mainly on undergraduate medical education and medical curricula as a whole. In postgraduate medical education, especially when evaluating short courses, randomization is more feasible. A randomized design guarantees that the many different factors that can influence the outcome of an educational programme are allocated equally throughout the groups. One limitation of the RCT in educational interventions is that double blind allocation of participants is impossible. However, it is certainly possible to have single blinded studies in which those who assess outcome are blinded to the group allocation of participants. Qualitative and theory based designs, on the other hand, can yield valuable and useful information to designers of educational programmes about the way education works or is perceived by participants. None of these arguments opposes the idea that the ultimate proof of effectiveness has to come from controlled studies in which outcomes are assessed.

It is widely accepted that improvement of performance in practice is the goal of postgraduate medical education. However, performance in practice is not easy to measure. For pragmatic reasons we did not use observational methods, but performance indicators, based on physicians’ self-report. It is concluded that these performance indicators do reflect the quality of performance in practice. However, the validity and reliability of performance indicators should be further explored and a comparison with other assessment methods such as video observations would contribute to that. The use of patients’ health as an outcome variable in educational research is discussed and supported, though it is influenced by a whole range of factors within and outside a doctor’s control.

The general conclusions of the studies are that the postgraduate educational programmes that we studied were effective. The problem-based format has slightly better results in performance than the lecture-based format. However, participants in the problem-based format programme were, in contrast to findings in the literature, less satisfied. Gender and learning styles did not interact with the course
design, but turned out to be variables independently related to an increase in knowledge and performance. The experiences are a stimulus for future studies on the influence of participants' preferences for educational format, satisfaction with education and the measurement of patients' health as an outcome-measure. This will be the best support for the movement of Best Evidence Medical Education. For postgraduate education or continuing medical education we recommend the use of interactive, problem-based educational formats which contain clear learning objectives, small self-directed group sessions in which the actual problems and experiences of participants begin the session and a tutor facilitating the process. The educational programmes should have well-defined outcomes at the levels of knowledge, performance and patients' health.