Summary

Introduction and research problem
Governments, organisations and educators agree that education should not just focus on basic skills, but also on more complex outcomes such as metacognition. Youngsters must be prepared to deal with the rapidly changing society; they need to become life-long learners. Schools must provide opportunities for active, self-directed and independent learning to prepare students for this life-long learning. Metacognition plays an important role in this life-long learning. This study addressed the question how regular schoolteachers should structure their instruction when they want to stimulate the development of both basic skills and metacognition. For answering this question, we studied two research traditions, namely educational effectiveness and constructivism. From both traditions, one specific instructional model was chosen namely direct instruction and cognitive apprenticeship.

The direct instruction model is strongly related to educational effectiveness research. There is substantial empirical evidence that teachers can be trained to implement this model in a regular classroom setting. Furthermore, the direct instruction model proved to have a positive effect on achievement in basic skills. Direct instruction can be used for subject matters that are well structured, such as technical reading, and arithmetic. The model appears to be effective for non-native pupils and pupils from disadvantaged backgrounds. With respect to direct instruction, there is little evidence of the effectiveness in terms of more complex skills such as metacognition. Besides, differential effects of the model for pupils from different background are hardly studied.

The cognitive apprenticeship model (Collins, Brown & Newman, 1989) is based on constructivist ideas about learning. It focuses on the active involvement of pupils in the instructional process and on the development of metacognition. This model combines effective elements of instruction-psychological models such as reciprocal teaching, procedural facilitation and modelling. Research shows positive effects on complex skills, such as metacognition. However, this model has hardly been studied in regular classroom settings. In most studies, the treatment takes place outside the regular classroom or is carried out by the researcher or a computer program. With respect to cognitive apprenticeship, it unclear whether regular teachers can use the model in their regular classrooms, and whether it is suitable for teaching more basic skills and for pupils with different background characteristics.

This thesis studied the implementation of both direct instruction and cognitive apprenticeship in a regular classroom setting for the school subject of reading comprehension. The effects were studied both in terms of basic skills, i.e. reading comprehension skills, and complex skills, i.e. metacognition.
**Elaboration of the models**

To study the effectiveness of the models in a regular setting, regular schoolteachers needed to implement teacher behaviour that stems from either the direct instruction model or the cognitive apprenticeship model. Exemplary lessons and teacher training were developed to facilitate this implementation process. For the exemplary lessons, the theoretical models were translated into concrete teacher behaviours that characterise these models. The lessons based on the direct instruction model showed the characteristics content of prior lesson, presentation of new skills, guided practice, independent seatwork and feedback. The cognitive apprenticeship lessons contain the characteristics activating prior knowledge and problem solving, modelling, co-operative learning, articulation and reflection and applicability.

The teacher behaviours were incorporated in 16 lessons in reading comprehension. Thus, two versions of teaching materials were developed; one with teacher behaviour based on the direct instruction model and one with teacher behaviour based the cognitive apprenticeship model. The training consisted of five sessions with explanation of theory, modelling, practice and feedback in each session. Additionally, three coaching sessions were prepared related to lesson observations.

**Research design**

A quasi-experiment was developed in which one group of teachers learned to implement the direct instruction model (N=5), and another group was trained to apply the cognitive apprenticeship model (N=8). A control group of teachers (N=7) was not trained. All teachers taught grade 7 of primary schools and they all used the same teaching materials for reading comprehension (Ik Weet Wat Ik Lees). The two experimental groups received a rewritten version of these teaching materials. All pupils in grade 7 participated in the study. In the direct instruction group 68 pupils participated, in the cognitive apprenticeship group 114 pupils and in the control group 92 pupils.

The implementation of the two models was studied by classroom observation with a low-inference observational instrument about how teachers spend time in the lessons in reading comprehension and a high-inference instrument about the quality of instructional behaviour. The teachers in the experimental groups were observed five times; before, during (twice) and after the training and during a follow-up. The teachers in the control group were observed during the first and fourth observation in the experimental groups. Both the developments within the experimental groups and the differences between the three research groups were studied.

The effects of the two instructional models concern achievement in reading comprehension, metacognition and attitude. The achievement in reading comprehension was measured with a
vocabulary test. However, these results did not transfer to a higher achievement on the standardised comprehension test. Besides, these effects did not subsist during the following school year. Furthermore, the cognitive apprenticeship lessons had a positive effect on the metacognitive skills and on metacognitive knowledge. The pupils in this group retained this positive effect during the following school year. Thirdly, the pupils were more focussed on learning (element of attitude), but this effect was only found directly after the training.

Cognitive apprenticeship was more effective than direct instruction, especially during the follow-up. The pupils in the cognitive apprenticeship group scored significantly higher on the standardised reading comprehension test (follow-up) and the curriculum-specific test (post-test). During the follow-up, the pupils in this group also scored significantly higher on metacognitive skills. Finally, these pupils had a more positive perception of their own skills (post-test and follow-up) and they were more focussed on learning (follow-up).

The effectiveness of the models differed for pupils with different intelligence with respect to achievement in reading comprehension. Cognitive apprenticeship appeared to be more effective for high intelligent pupils, whereas direct instruction had more positive effects on the achievement of low intelligent pupils.

Finally, we studied whether the differences in outcomes could be attributed to specific characteristics of the two instructional models. We found that the effect of cognitive apprenticeship on the achievement on curriculum-specific test could be attributed to the general characteristic general quality of instruction. The effects of the two models on metacognitive skills could be attributed to several separate teacher behaviours. The general characteristics ‘preparatory discussion’ and ‘attention for skills’, apparent in both models, showed a positive effect. In addition, two characteristics of cognitive apprenticeship showed significant effects. ‘Modelling’ had a negative effect and ‘discovery learning’, an element of activating prior knowledge and problem solving, a positive effect on metacognitive skills.

Implications of this study for theory, future research and practice

This study combined instructional elements and output measures from two research traditions in one design. As a result, we now have evidence that the direct instruction model can be used to teach more complex skills such as metacognitive skills. Furthermore, we know that teachers can implement a cognitive apprenticeship model in a regular classroom setting. Besides, the use of cognitive apprenticeship in a regular classroom setting demonstrated to have a positive effect on reading comprehension and metacognitive skills, even after correction for pupil background characteristics. Cognitive apprenticeship was most effective for high intelligent pupils, whereas direct instruction was the most appropriate instructional model for pupils with lower intelligence. This implies that the effectiveness of the models interacts with pupil characteristics. We need more theory about the relation between
instruction and pupil background characteristics and the relation between instruction and learning goals. New research can be used to provide information about these relations. This study used a small sample of teachers. Future research should replicate this study with a larger sample to provide more solid evidence about the findings. The implementation of the instructional models was only studied with observational instruments. Future research into the implementation of instructional models should develop instruments that provide us with additional information that might influence the implementation of the model, such as the attitude of the teacher and the domain-specific skills and metacognitive skills of the teacher. This study used questionnaires to measure metacognition. This is only one way to measure metacognition. It can also be measured with interviews, thinking aloud protocols, and simulated tutoring. Research should study to what extent the four types of instruments are suitable for measuring metacognitive skills and how the results from the different instruments relate.

Translating the findings to educational practice, cognitive apprenticeship appears to be the most suitable instructional model for teaching reading comprehension and metacognition. However, the differential effects indicate that teachers need to take the abilities of their pupils into account when they choose instructional methods. Teachers should be flexible in using and combining elements from direct instruction and cognitive apprenticeship depending on the needs of the pupils.

Although the teachers in this study changed their instructional behaviour towards the instructional models, they still did not show all characteristics of the model. This confirms that it is not easy to change the instructional behaviour of teachers. In this study, the teachers received training and coaching and teaching materials that illustrated the instructional model. In practice, schools and teachers are generally expected to change their education on the basis of general notions and sometimes on the basis of teaching materials. This study showed once more that it is not realistic to expect educational innovations to happen without explicit information and teacher training.
curriculum-specific test and a standardised test for reading comprehension, and a standardised test for vocabulary. Metacognition was divided into metacognitive knowledge and metacognitive skills; both were measured with a questionnaire. The attitude of the pupils was also measured with a questionnaire dealing with different elements, such as attitude towards the lessons in reading comprehension and the perception of skills in reading comprehension. The pupils were tested before the treatment (pre-test), after the treatment (post-test), and a year after the treatment (follow-up).

The implementation of the models
The teachers that were trained to apply the direct instruction model showed significant developments on some characteristics of the model; namely content of prior lesson, presentation of new skills and independent seatwork. The teachers in this group primarily showed progress in the quality of their instructional behaviour, but they hardly changed the way they spent the lesson time. The developments resulted in significant differences with the control group concerning the content of the prior lesson and presentation of new skills. Furthermore, the quality of the instructional behaviour in general and the time the teachers spent on skills showed significant differences with the control group.

The teachers who were trained to implement the cognitive apprenticeship model showed significant developments on most of the characteristics. Despite these significant developments, the cognitive apprenticeship teachers only differed significantly from the control group on activating prior knowledge and problem solving and co-operative learning. Furthermore, the teachers in this group scored higher on general instructional quality and pay more attention to comprehension skills and metacognitive skills.

As a result of the training, the instructional behaviour of the teachers in the two experimental groups differed significantly. The cognitive apprenticeship teachers showed more attention for activating prior knowledge and problem solving, co-operative learning and applicability. The direct instruction teachers awarded more time and showed a higher quality on the characteristics: content of prior lessons, presentation of new skills, guided practice and independent seatwork. Thus, we can conclude that the teachers in the two experimental groups implemented significantly different instructional behaviour after the training and coaching.

The effects of the models
The lessons based on the direct instruction model did not have effect on achievement in reading comprehension, nor on the attitude of the pupils. The direct instruction model did show a significant effect on metacognition, both metacognitive skills and metacognitive knowledge. However, this effect disappeared in the following school year.

The lessons based on the cognitive apprenticeship model had a positive effect on achievement in reading comprehension, measured by the curriculum-specific test and the