Scaffolding in teacher-student interaction: exploring, measuring, promoting and evaluating scaffolding
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CHAPTER 1
GENERAL INTRODUCTION
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If I had to reduce all of educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly. (Ausubel, 1968, p. vi)

Adapting support to learners’ existing understanding, which is the key characteristic of scaffolding, is crucial in promoting learning (Pino-Pasternak, Whitebread, & Tolmie, 2010). In order to be able to actually connect to students’ existing understanding, it is necessary to first ascertain this existing understanding before giving support, as Ausubel implies. An important vehicle for ascertaining students’ understanding is interaction and dialogue (Mercer & Littleton, 2007). Interaction between teacher and student is therefore vital for learning. The importance of social interaction in the learning process is stressed in sociocultural theories (e.g., Vygotsky, 1978) where learning is seen as a social activity and knowledge as constructed in interaction with others such as teachers.

Yet, ascertaining students’ understanding and teaching them accordingly in social interaction appears to be a major difficulty for teachers (Ruiz-Primo & Furtak, 2007). Mainly the assessment of students’ existing understanding appears to be problematic (Wittwer & Renkl, 2008).

Drawing on sociocultural theories of learning, this dissertation aims to develop our understanding of how teachers can (learn to) adaptively support students who work in groups and how such support affects students’ learning. This is relevant for classrooms and schools in general, but especially for classrooms and schools employing innovative pedagogies. Innovative pedagogies, which are related to sociocultural and/or social-constructivist theories, have been implemented in an increasing number of schools over the last decades. In these pedagogies, the teacher is expected to stimulate students’ active knowledge construction and to differentiate support, often within a context of small-group learning. However, although some guidelines have been formulated for primary education (e.g., Van Oers, 2009), the new role of the teacher in these innovative pedagogies is often described in vague and abstract terms (e.g., Hargreaves, Moyles, Merry, Paterson, Pell, & Esarte-Sarries, 2003).

The theoretical concept of scaffolding, represents a teaching method that meets
the demands of this new teacher role (e.g., Lin, Hsu, Lin, Changlai, Yang, & Lai, 2012). However, the operationalisation of this theoretical concept diverges and the term scaffolding has been used loosely in the past decades as a synonym for any type of support (as argued by Mercer & Littleton, 2007; Stone, 1998a). So both on a theoretical and a practical level, scaffolding needs a clearer conceptualisation and needs therefore to be further explored.

Furthermore, no measurement instrument for measuring scaffolding in the classroom, that takes into account the dynamic nature of scaffolding, is available. Scaffolding in classroom practices has often been measured focusing on teacher actions or strategies only (e.g., Meyer & Turner, 2002). However, scaffolding is a dynamic process that takes place in interaction between e.g., teacher and students. Therefore, both teacher and student actions need to be analysed. More specifically, scaffolding is about adapting support to students’ understanding. So to measure scaffolding, it is not only needed to analyse both teacher and student actions, but it is crucial to map the dynamic adaptation of a teacher’s support to a student’s understanding. To enable any thorough scaffolding research that analyses scaffolding validly, i.e., mapping the dynamic adaptation of the teacher’s support, developing a measurement instrument of scaffolding is crucial.

Probably because of the dynamic nature of the concept, performing scaffolding is difficult and therefore found to be scarce in classroom practice (Oh, 2005). Teachers thus need guidance in developing scaffolding skills. However, no professional development programmes for the promotion of scaffolding are available. Because scaffolding is an appealing concept and a teaching method that is expected to be effective, finding ways of promoting scaffolding is vital.

Finally, scaffolding is expected and assumed to positively affect student learning (Roehler & Cantlon, 1997), both with regard to achievement and with regard to affective and motivational aspects of learning, i.e., students’ engagement with learning. Scaffolding support keeps a task understandable and challenging at the same time. However, little is known about the effects of scaffolding in classroom situations as few (quasi-) experimental studies have been conducted in such a context. To develop our understanding and the potential of scaffolding in classroom situations, it is necessary to evaluate its effects in practice.

Summarising, conceptualising scaffolding and finding ways to measure and promote scaffolding is essential for enabling research on the effects of scaffolding. The aims of this dissertation are therefore to:
1) *Explore* the notion and process of scaffolding
2) Develop ways to *measure* scaffolding
3) Find ways to *promote* scaffolding
4) *Evaluate* the effects of scaffolding on students’ engagement and achievement

**THEORETICAL FRAMEWORK**

**Introduction**

Scaffolding metaphorically refers to the process of giving tailored support to students. Scaffolding is:

- Connecting – maintaining – supporting – letting go

as described by Tom, a teacher who participated in one of the studies of this dissertation. His ingenious definition elegantly describes the special type of support that scaffolding is, in that scaffolding:

- **Connects** to students’ current understanding
- **Maintains** students’ attention and engagement
- **Supports** students’ only there where necessary
- **Lets go** of the control as students progress

Scaffolding is a powerful and promising concept for several reasons. First, scaffolding is a useful tool for describing and analysing differentiated support. Within a classroom, different students have different needs. This makes the teacher’s job challenging. There are many ways in which a teacher or even a school system can meet differentiation needs. On a school level, classes or subject courses can be streamed according to ability. Within a classroom, students can be given different tasks or can be allowed to work on similar tasks at their own pace. On a micro-level, teachers can differentiate their help or instruction in interactions with students. Instructional interactions form an important aspect of teaching and the way teachers support their students in those interactions is considered crucial (Seidel & Shavelson, 2007). Support that is adapted to the level of the student can be considered useful as well as efficient; support that underestimates a student’s understanding is redundant as the student can perform the task alone; support that overestimates a student’s understanding will not be useful to the student and is thus also redundant. Support that is adequately adapted
to a student’s understanding is likely to be useful to the student; it will help the student take a next step in the learning process.

The concept of scaffolding, referring metaphorically to the temporary construction that is used to erect a building, appeals to the imagination and allures to teachers and researchers (e.g., Mercer & Littleton, 2007). Metaphors are helpful in grasping constructs; they are helpful in conceptualising complex relations and they serve as mnemonic devices. Saban, Kocbeker, and Saban (2007) illustrated this in their study in which teachers often mentioned scaffolding as a metaphor for teaching. Scaffolding is an attractive concept because it offers a neat metaphor “for the active and sensitive involvement of a teacher in students’ learning” (Mercer, & Littleton, 2007, p. 18). The general image of scaffolding in construction work and scaffolding support have many parallels such as: (a) both a construction scaffold and scaffolding support provided by a teacher are meant for assistance, (b) both a construction scaffold and scaffolding support provided by a teacher are temporary; it is removed when not needed anymore, (c) both a construction scaffold and scaffolding support provided by a teacher are adaptive, and (d) both a construction scaffold and scaffolding support provided by a teacher have the purpose for the building or student to stand independently. The strong parallels between the general image of a scaffold and teacher support give the concept of scaffolding its elegance and value. A further and more precise anatomisation of the metaphor, however, does not seem useful. That is, relating the elements of the metaphor (e.g., the scaffold, the construction worker, the building that is constructed) directly to the elements of scaffolding support (e.g., the help itself, the tutor, the tutee etc.) is not fruitful as the explanation of the metaphor can then in fact become quite confusing (cf. Stone, 1998a). It rather should be used as a kind of a broad representation or mnemonic device both by researchers and by teachers.

The sociocultural background of scaffolding

Scaffolding was initially used in the context of parent-child interaction (Wood, Bruner, & Ross, 1976) but was in the mid to late 70’s expanded to the classroom context (e.g., Cazden, 1979). Scaffolding has been adopted in many contexts by many authors. It played, for example, a major role in frameworks such as the model of Apprenticeship (Rogoff, 1995), the Cognitive Apprenticeship model of Collins, Brown, and Newman (1989), Reciprocal Teaching (Palincsar, 1986), Situated Learning (Lave & Wenger, 1991), and Assisted Performance (Tharp & Gallimore, 1988).

The concept of scaffolding stems from a sociocultural background (Vygotsky, 1978) and is also used in constructivist perspectives (e.g., Duffy & Cunningham, 1996). According to these theories, each learner constructs his or her own knowledge
in culturally-embedded social interaction. Each learner absorbs new knowledge and understanding into his or her existing understanding of the world. Therefore, different learners will develop different meanings of the same learning materials, concepts, everyday notions, etc. As learning takes place in social interaction and within a certain culture that is always present, cultural tools and signs play a crucial role in the learning process. In other words, “learning is mediated by tools and signs” (Duffy & Cunningham, 1996, p. 179). A child’s development advances through the appropriation of mediational means (Vygotsky, 1978). Especially language has been acknowledged to be a major mediational tool by many sociocultural theorists (e.g., Bakhtin, 1981; Vygotsky, 1978; Wertsch, 1979). If learning takes place in social interaction, language and talk are important tools for communicating and for guiding learning. Through the use of language, a more knowledgeable other (e.g., a teacher) can explain, instruct, and question to guide learning. By using language, a learner can express his or her understanding, reason and ask questions and thus learn. By using language, the teacher and the student can co-construct knowledge together in interaction; they can interthink (Mercer & Littleton, 2007). Without language, the co-construction of knowledge would be much more difficult, if not impossible.

Scaffolding is related to one of Vygotsky’s most well-known concepts, namely that of the Zone of Proximal Development (ZPD) (Vygotsky, 1978). Vygotsky argued that educators should be concerned with two developmental levels: the actual level and the potential level. The ZPD represents “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). According to Vygotsky’s theory, all development first takes place in social interaction before it takes place on an individual level. On both levels, language plays a crucial role. Teacher-student interaction as well as student-student interaction (e.g., small-group work) thus are fundamental interactional settings for learning according to sociocultural theories.

Some have criticised the concept of scaffolding, mainly for suggesting that the students’ role is a passive one and for its focus on the predefined end to which the teacher leads the student (Donahue & Lopez-Reyna, 1998; Duffy & Cunningham, 1996). In this dissertation, scaffolding is seen as a process that gives the teacher a guiding role – drawing upon Vygotsky who asserted that all learning was guided by a more knowledgeable other (such as a teacher). We see scaffolding conversations as purposeful conversations in which the teacher’s task is to keep the goal of the learning activity in mind. This does not, however, imply that the teacher is the only person who guides the learning process. Within the purposeful interaction, there is still space for each learner’s own conceptions and these conceptions in fact play a crucial role in the
scaffolding process as the teacher needs these to build upon. The teacher and the student thus contribute both to the learning process as they co-construct knowledge together.

Scaffolding as contingent teaching

Wood, Bruner, and Ross (1976) introduced scaffolding as a “process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts” (p. 90). They stressed contingency as a critical characteristic of scaffolding support. The degree to which a teacher controls those elements of the task that are initially beyond a learner’s capacity should be contingent or dependent upon a student’s understanding. “Contingent control helps to ensure that the demands placed on the child are likely neither to be too complex, producing defeat, nor too simple, generating boredom or distraction” (Wood, 1991, p. 108). Thus, when a student struggles, the teacher should make the task easier by increasing the degree of control whereas when a student succeeds, a teacher should make the task more challenging by diminishing the degree of control. This principle is called the contingent shift principle. Helping students while applying contingent shifts in control appeared to be very effective in one-to-one situations with regard to e.g., self-regulated learning (Mattanah, Pratt, Cowan, & Cowan, 2005; Pino-Pasternak et al., 2010; Stright, Neitzel, Sears, & Hoke-Sinex, 2001), block-building and puzzle construction tasks (Pratt, Green, MacVicar, & Bountrogianni, 1992; Pratt & Savoy-Levine, 1998; Wood & Middleton, 1975) and long-division math homework (Pino-Pasternak et al., 2010; Pratt et al., 1992). Note that contingency is about the adaptation of control, not about whether or not a student actually succeeds in doing a task. When teaching contingently, the degree of control is faded over time and the task responsibility is slowly handed over to the student (Wood & Wood, 1996). In their studies, Wood and his colleagues distinguished several levels of control from little control (general verbal prompts) and medium control (indicates materials) to high control (demonstrates) (cf. Wood, 1991).

The context and what happened before, is thus very important in this interpretation as “the pattern of responses by the teacher to a child’s momentary successes and failures judged in relation to the instructions which predated them is the basis for our evaluation” (Wood, 1991, p. 104).

Another way in which a teacher can act contingently is to connect to and use the actual words and expressions of the students in the ongoing conversation, i.e., to take up the students’ language and understanding. When uptake (Nystrand, Wu, Gamoran, & Zeiser, 2003; Wells, 2010) takes place, what a student says is (partly) determining the course of a conversation; the teacher acknowledges and uses what a student has
said while deepening that understanding. This does not mean that the teacher cannot introduce new or more academic concepts. However, he or she preferably does so while acknowledging and connecting to the students’ language.

The challenge of contingent teaching

Even though teachers are charmed by the idea of scaffolding, they sometimes also express a certain degree of reserve claiming that it is nothing new or special but rather something they have already been doing. However, although the idea seems self-evident, acting contingently is far from being easy.

Wood (1991) acknowledged that it is difficult to teach children contingently, even in an experimental situation with a straightforward task. In a classroom situation with up to 30 students, often with open-ended tasks, acting contingently seems even a bigger challenge. Contingency entails two aspects: (1) diagnosing students’ understanding, and (2) adapting support to that understanding. As both aspects appear to be problematic from the empirical literature, it is not surprising that being contingent is difficult.

The first aspect of contingency is diagnosing students’ understanding. Diagnostic skills are generally recognised as a distinct feature of successful teaching (Borko, Mayfield, Marion, Flexer, & Cumbro, 1997; Seidel & Shavelson, 2007; Wittwer & Renkl, 2008). However, diagnosing students’ understanding is an activity that is found to be scarce in classroom practice (Elbers, Hajer, Jonkers, Koole, & Prenger, 2008; Lockhorst, Wubbels, & van Oers, 2010; Nathan & Petrinoso, 2003; Snow & Swanson, 1992; Wittwer & Renkl, 2008), mainly due to its difficulty. Diagnosing students’ understanding appears to be a great challenge for teachers for several reasons: (1) they do not always know how to diagnose students’ understanding, (2) they might suffer from cognitive overload when both having to deal with the (complex) subject matter and with students’ conceptions of that subject-matter, and (3) they experience time constraints when teaching. These three reasons are elaborated below.

First, teachers do not always know how to diagnose students’ understanding (Morrison & Lederman, 2003). Teachers generally tend to:

(1) Give support right away without first diagnosing students’ understanding. This is an automatic reaction or a habit (Elbers et al., 2008). Helping is the teachers’ job and when a student has a problem, the natural thing to do seems to be to start helping right away.

(2) Use more general sources of information which might not be specific enough to draw conclusions on a student’s understanding of a particular
concept or topic (Elbers et al., 2008). Teachers for example use general estimations of students’ understanding or general knowledge they have about a student – such as “this student is a bad reader”, “this student cannot concentrate well” etc. However, this estimation often appears to be inaccurate (Begeny, Krouse, Brown, & Mann, 2011). In addition, teachers might know from experience with a particular task what obstacles students generally experiences and sometimes then make assumptions about a particular student’s understanding based on this experience.

(3) Ask diagnostic questions that focus on a student’s own estimation of understanding (Chi, Siler, & Yeong, 2004). An example of such a question is: “Do you understand?” These kinds of questions elicit so called **claims of understanding** (Koole, 2010; Sacks, 1992) such as “yes” or “no” and actually do not give the teacher insight into how a student understands something. Moreover, students do not appear to be proficient in estimating their own understanding (Chi, de Leeuw, Chiu, & LaVancher, 1994; Rozenblit & Keil, 2002; Wittwer & Renkl, 2008). And even if students were proficient at estimating their own understanding, eliciting such limited information would still hamper real common understanding between teacher and student.

(4) Tend to use their own knowledge as a reference point. Epley, Keysar, van Boven, and Gilovich (2004) referred to this as **egocentric bias**. Once certain knowledge structures have developed, it is difficult to put oneself in a novice’s position and to imagine how a novice understands things. This often results in an overestimation of students’ understanding, especially in the case of low-performing learners (Begeny et al., 2011; Wittwer, Nückles, & Renkl, 2010).

Second, Feldon (2007) mentioned that teachers might suffer from cognitive overload when both having to deal with complex subject matter and with another person’s understanding of that complex subject matter at the same time. This makes diagnosing students’ understanding and deciding which support a student needs at the same time difficult.

Third, a more practical reason for teachers to undertake no diagnostic strategies is that of time constraints in classroom practice (Elbers et al., 2008). Especially in authentic classroom situations with often up to 30 students, there seems to be just too little time to diagnose students’ understanding and giving support right away seems quicker.
The second aspect of contingency is *adapting* the support to the students’ understanding. Wittwer and Renkl (2008) for example indicated that instructional explanations only work under certain conditions. One crucial condition is that the explanation is adapted to the prior knowledge of a student. Just providing general explanations is not effective (Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001; VanLehn, Siler, Murray, Yamauchi, & Baggett, 2003; Webb & Mastergeorge, 2003; Webb & Palincsar, 1996). Being adaptive also appears to be a considerable challenge (Ruiz-Primo & Furtak, 2007; Yackel, 2002). However, according to the review of Wittwer and Renkl (2008), the main reason why adapting explanations is so difficult is that teachers (and tutors) have difficulties with assessing or diagnosing students’ understanding, as elaborated above. In an experiment, Nückles, Wittwer, and Renkl (2005), for example, helped tutors by providing them with information on the students’ understanding. In reaction to that, the tutors were able to vary the amount and type of help provided in a tailored way.

**Student Engagement and Scaffolding**

From a sociocultural perspective, scaffolding is hypothesised to positively affect students’ engagement (e.g., Meyer, 1993; Turner, Meyer, Cox, Logan, DiCintio, & Thomas, 1998). In a general sense, engagement refers to “the quality of a student’s connection or involvement with the endeavour of schooling and hence with the people, activities, goal, values, and place that compose it” (Skinner, Kindermann, & Furrer, 2009). Three types of engagement are usually distinguished: (1) behavioural engagement, (2) emotional engagement, and (3) cognitive engagement (Fredricks et al., 2004).

Behavioural engagement refers to student participation and involvement in learning or academic tasks in a narrow sense and school-related activities in a broader sense. Most studies investigate on-task behaviour, as is done in this dissertation, but positive conduct and participation in extracurricular activities are also aspects of behavioural engagement (Hughes, Luo, Kwok, & Loyd, 2008).

Emotional engagement represents the positive and negative reactions of students to others in school (Fredricks et al., 2004). It links to concepts such as attitudes, motivation, interest, identity, emotions and value and is used here as a framework to focus on students’ attitudes towards the support style of their teacher and the tasks at hand.

Cognitive engagement refers to the investment and willingness to try hard and work thoughtfully in order to grasp ideas (Fredricks et al., 2004).

Scaffolding involves students as co-participants in the learning process by
providing just enough challenge while keeping task performance always feasible. The provided support lies within the Zone of Proximal Development (Vygotsky, 1978). Wood et al. (1976) indicated that one of the important scaffolding functions is that of frustration control and this can be achieved by providing support that is contingent which enables students to successfully perform a task. In turn, students might thus appreciate scaffolding as this type of support is tailored to their understanding and helps them proceed. Mariani (1997) described the anxiousness that might arise in students when the task is too complex and/or too little support is given. Scaffolding can thus be a tool to balance the degree of challenge and the degree of support.

Numerous studies have demonstrated that students’ engagement is inextricably related to students’ achievement which makes the importance of student engagement clear. Students who are highly engaged perform better (and students who perform better have generally higher engagement levels) (Fredricks, Blumenfeld, & Paris, 2004). However, apart from its important relationship with and effect on achievement, engagement with the learning context is also an important end in itself (Volman, 2011).

Although scaffolding is hypothesised to affect student engagement, hardly any empirical research has investigated this claim.

Student Achievement and Scaffolding

A bit more research has been performed on the effects of scaffolding on students’ achievement compared to engagement, be it mostly in the contexts of parental scaffolding or tutoring. From a sociocultural perspective, scaffolding is hypothesised to positively influence students’ achievement: contingent support enables students to succeed at a task (Mattanah et al., 2005).

There is some empirical evidence showing that contingent teaching affects students’ performances (Seidel & Shavelson, 2007). However, most studies have been conducted in one-to-one computer-mediated tutoring situations or in the context of parental face-to-face scaffolding. In one-to-one computer-mediated tutoring situations, unadjusted or wrongly adjusted explanations hindered tutees’ learning about computer-related issues and clinical psychology (Nückles, Winter, Wittwer, Herbert, & Hübner, 2006; Wittwer, Nückles, Landmann, & Renkl, 2010). Both explanations that are too difficult and explanations that are too easy have detrimental effects on students’ learning; explanations that are too difficult can cause a comprehension breakdown whereas if an explanation is too easy (i.e., the information provided is already known), attending to this information might prevent the tutee from processing other, more elaborate information (cf. Wittwer et al., 2010; Wittwer & Renkl, 2008).

In the context of parental scaffolding (also one-to-one), challenging contingent
support appeared to be a crucial factor in affecting learners’ outcomes such as self-regulated learning (Mattanah et al., 2005; Pino-Pasternak et al., 2010; Stright et al., 2001), block-building and puzzle construction tasks (Pratt et al., 1992; Pratt & Savoy-Levine, 1998; Wood & Middleton, 1975) and long-division math homework (Pino-Pasternak et al., 2010; Pratt et al., 1992).

In classroom situations, the effects of contingent support have hardly been studied. Chiu (2004) investigated how two secondary teachers supported students who worked on math problems in small groups. Teachers who evaluated students’ learning before giving support were found to be more effective. However, the actual contingency of the support was not measured. Ruiz-Primo and Furtak (2006; 2007) showed in their small-scaled studies that science teachers who actually used or took up the information that was gathered on the students’ understanding – who worked on science problems – were more effective which indicates the effectiveness of scaffolding.

Considering the potential of the concept and the paucity of effectiveness research on scaffolding in classroom situations, this dissertation aimed to investigate the effects of scaffolding on both students’ engagement and their achievement.

**THIS DISSERTATION**

Context of this Dissertation

Pedagogic innovations, which are related to sociocultural theory and/or social-constructivism, have been increasingly implemented in the last decades in the Netherlands. In primary education, for example, developmental education, in which learning is embedded in meaningful practices and activities, has been implemented in about 10% of the primary schools in the Netherlands (Van Oers, 2009). Following these theoretical approaches, the teacher is not expected to transmit knowledge, but to construct knowledge together with students in an interactive way. Furthermore, the integration of separate subjects is considered important in these approaches (e.g., Van Oers, 2009). Integrating separate subjects into integrated subject areas or into themes (such as integrating the subjects of geography, history and economics into the integrated subject area of social studies) is considered to make learning more meaningful for students; it matches more with the way children naturally think about the world (e.g., Beane, 1997, cited in Van Boxtel et al., 2009). Integrating subjects is thus expected to make learning more attractive and challenging for students (Lattuca, Voigt, & Fath, 2004).

Secondary education and especially prevocational schools, attended by 56%
of the children (CBS, 2011), engaged in developing such pedagogic innovations concerning the role of the teacher and the integration of subjects. Three innovative types of education are being distinguished in the Netherlands, next to traditional education. In 2007, 33% of lower secondary education (age 12 – 14) was characterised as traditional education called scenario 1 type of education (Monitor Onderbouw, 2007). In scenario 2 schools, separate subjects continue to exist but projects are introduced in which small-group work is important (in 2007, 31% of all lower secondary school in the Netherlands chose this scenario). In scenario 3, schools integrate subject areas that consist of different subjects, such as social studies that consist of geography, history and economics, and teachers are expected to stimulate students’ active knowledge construction and to differentiate support. Using small-group work is another feature in this scenario. In 2007, 23% of all Dutch lower secondary schools chose this scenario and most of these schools were prevocational schools. In the last scenario, scenario 4, separate subjects do not exist anymore: students learn so-called competences in thematic education. In this scenario, teachers are also expected to stimulate students’ active knowledge construction and to differentiate support. In 2007, 5% of all Dutch lower secondary schools chose this scenario. The innovations that were introduced in the majority of prevocational schools in the Netherlands, affected the role their teachers were expected to adopt, namely that of scaffolding the active learning of students.

Social studies

The subject area of interest in this dissertation, namely that of Social Studies, is a subject area in which the subjects of geography, history, and economics are integrated. Social studies is the most commonly implemented integrated subject area in innovative schools; ninety-one percent of all schools that work with subject areas, which are mostly prevocational schools, have implemented social studies (Monitor Onderbouw, 2007). The majority of the schools that participated in one of the studies of this dissertation implemented this subject area (scenario 3), while some participating schools offered students projects but also kept the separate subjects (scenario 2).

Students appear to have difficulties in understanding and using substantive concepts, which is one of the major aims of social studies (e.g., Kneppers, Elshout-Mohr, van Boxtel, & van Hout-Wolters, 2007 for Economics; Leat, 1998 for Geography; Van Drie & van Boxtel, 2008 for History; Taylor, 2008 for Geography) and therefore of the lessons studied in this dissertation. Lee (2005) described substantive concepts as “key concepts of the discipline” (p. 31). In history, for example, substantive concepts refer to “historical phenomena, structures, persons, and periods” (Van Drie & van Boxtel, 2008). Most of the lessons studied in this dissertation were part of a five-lesson
project on the European Union (see Appendix A). Examples of important substantive concepts in this European Union project are democracy, internal market, and border.

Studies focusing on students’ understanding of substantive concepts in social studies showed that students’ understanding of these concepts and their ability to use these concepts was rather limited (Kneppers et al., 2007; Van Drie & van Boxtel, 2008). Van Drie and van Boxtel (2003) argued that students found understanding and using these concepts difficult – amongst other reasons – because: (1) these concepts are abstract and theoretical and understanding of related concepts is often needed in order to understand a particular concept, and (2) there is often no fixed meaning of a substantive concept in social studies as experts also differ in their interpretations. In addition, a concept can mean different things in different time periods.

As scaffolding is expected to be an effective way of supporting students, this teaching method might help students in this problematic aspect of social studies.

Small-group work

As already noted, small-group work plays an important role in innovative pedagogies. Working in groups provides a stimulating learning context for students as different viewpoints are expressed and reasoning takes place collaboratively (e.g., Reznitskaya et al., 2009). Until recently, the role of the teacher in small-group work generally received little attention (Webb, 2009). Currently, more studies on the teachers’ role in small-group work are being performed, but still little attention is paid to the role of scaffolding or contingency in supporting small groups. However, also in the literature on collaborative learning, the importance of this aspect of support giving is being acknowledged now (Webb, 2009). It is argued that it might not so much be the type of support given that determines the effectiveness of the support, but rather the degree of contingency of the support. However, to our knowledge, almost no studies focused on the degree to which teachers gave contingent help in supporting small groups.

Promoting and studying collaborative learning skills was not an aim and focus of the studies in this dissertation. We focused on how teachers supported students (who worked collaboratively in small groups) with regard to the subject-matter. Collaborative learning or small-group work was the setting in which support was given. In the intervention studies in this dissertation (described in Chapter 5, 6, and 7, see Table 1), the teachers were thus encouraged to promote students’ understanding of the subject-matter, not their collaborative skills. The stimulation of collaboration mainly manifested itself in the design of the project that was used in the studies. This means that the assignments the students worked on were designed in accordance with the principles
Chapter 1

of cooperative learning (Johnson & Johnson, 1974), namely: positive interdependence (students need each other), direct face-to-face interaction, individual accountability, interpersonal skills, and attention for reflection on group processes (see Appendix A).

Outline and Research Questions of this Dissertation

This dissertation consists of six connected studies, representing four phases (Table 1).

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In the following, each phase will be elucidated. An overview of the research question, aim and data of each study can be found in Table 2.

Phase 1: Exploring scaffolding

In Phase 1, the following main question was explored: How can scaffolding be conceptualised and characterised? The concept of scaffolding is often used as a synonym for just any support and thus tends to lose its theoretical context (as argued by Stone, 1998a). Therefore, we first focused on the conceptualisation of scaffolding.

In Chapter 2, a literature study is described. To be able to connect to the research strand of scaffolding and its findings and to conceptualise scaffolding, a thorough literature review was performed on the last decade’s scientific literature on scaffolding in the classroom. In this review, the relevant scaffolding literature of the last decade was reviewed with regard to the conceptualisations, appearances and effectiveness of scaffolding. A conceptualisation was provided, a framework of scaffolding strategies
was developed and special attention was paid to scaffolding measurement issues.

In Chapter 3, a case study on the scaffolding behaviour of three prevocational social studies teachers at innovative secondary schools is presented. Few systematic analyses of scaffolding in naturalistic settings are available. The case-study was performed in innovative schools because we expected to find more scaffolding there than in traditional schools; teachers in innovative schools are generally expected to take on a scaffolding role of guiding students’ learning as opposed to transmitting knowledge. Three lessons of each teacher were videotaped and the teachers participated in a stimulated-recall interview afterwards. A model of contingent teaching was developed for the purpose of this study. The model consisted of three steps: (1) diagnostic strategies, (2) checking the diagnosis, and (3) intervention strategies. The teachers’ lessons were analysed in the light of this model while attending to their degree of contingency. The ways the teachers helped students were investigated, resulting in a description of patterns of contingent and noncontingent teaching.

Phase 2: Measuring scaffolding

Measuring scaffolding is a complex endeavour and no valid instrument is available. The aim of Chapter 4 therefore was to develop two frameworks for measuring scaffolding; a qualitative and a quantitative framework. The central research question of this phase was: How can classroom scaffolding in teacher–small-group interactions be analysed from a contingency perspective that takes the interactive nature of scaffolding into account? The qualitative instrument focused on general phases of giving support and was based on the model of contingent teaching that was introduced in Chapter 3. The quantitative contingent shift framework was developed to enable the investigation of the actual degree of contingency of the teachers’ support upon a student’s understanding. In this chapter, these instruments are presented, explained and illustrated.

Phase 3: Promoting scaffolding

In Phase 3, the following main question was addressed: How can scaffolding be effectively promoted? As scaffolding is an important teaching method, finding ways to promote scaffolding and especially teachers’ diagnostic skills is crucial. In the literature, however, few guidelines as to how exactly scaffolding can be conducted and learned exist which makes the design of a development programme for teachers highly relevant. In addition, promoting scaffolding was necessary from the research’s point of view as scaffolding appears to be scarce: in order to be able to study scaffolding and
Chapter 1

its effectiveness (which was the aim of the study described in Chapter 7), scaffolding needed to be promoted.

In Chapter 5, the design and evaluation of a professional development programme (PDP) on scaffolding is described. In this study, a PDP aimed at promoting scaffolding was developed. The PDP was designed and evaluated together with four social studies teachers of prevocational secondary education. The four teachers participated during two terms. Again, the key aspect of scaffolding – contingency – was focused upon in this study and the model of contingent teaching (containing the steps of: (1) using diagnostic strategies, (2) checking the diagnosis, and (3) using intervention strategies) was used and further developed. It was hypothesised that by promoting teacher’s diagnostic skills, teachers would also teach more contingently than before. The teachers were videotaped on nine occasions and they were additionally asked to reflect on their lessons afterwards making use of video-examples of their own lessons. The teachers’ knowledge of scaffolding was measured using mind maps and their scaffolding practice was analysed using the videos and the qualitative instrument developed in the study of Chapter 4.

In Chapter 6, the effects of (a shortened version) of the PDP developed in Chapter 5 were investigated in an experimental study. Because of the experimental design, causal effects of the PDP on teachers’ classroom practice could be established. Thirty social studies teachers of prevocational education participated; 17 teachers participated in the professional development programme on scaffolding (i.e., scaffolding condition) whereas 13 teachers did not (i.e., nonscaffolding condition). All teachers taught the same five-lesson project on the European Union (Appendix A). The effects of the PDP were studied in terms of: (1) the quantity of steps of contingent teaching (diagnostic strategies, checking the diagnosis, and, a step that was added later, checking students’ learning), and (2) the quality of all steps of contingent teaching. All teachers in the scaffolding condition were filmed each lesson and each lesson was reflected upon with the researcher using video material of that lesson. All teachers in the nonscaffolding condition were filmed twice (their first and their last lesson). The video files formed the main body of data for this study. Teachers’ contingency was measured using the contingent shift framework developed in Chapter 4 and was additionally characterised by looking at the extent to which the teachers acknowledged and used students’ ideas in their subsequent help (i.e., uptake).

Phase 4: Effects of scaffolding

In the last phase of this dissertation, Phase 4, the following main question was sought to be answered: What are the effects of scaffolding on students’ engagement and
achievement? As indicated, the effects of scaffolding in authentic classroom situations have hardly been studied before. Scaffolding is presumed to positively affect student engagement and achievement but most studies until now have been correlational and no study was performed in the context of prevocational education.

In Chapter 7, the effects of scaffolding on student engagement and achievement were tested. In this experimental study, 30 teachers and 768 students participated; 455 students formed the experimental or scaffolding condition (their teachers participated in the PDP) and 313 students formed the control or nonscaffolding condition (their teachers did not participate in the PDP). All teachers taught the same five-lesson project on the European Union. The contingent shift framework was used to measure the degree of contingency of the teachers’ support. Students’ on-task behaviour (as an indicator of behavioural engagement), appreciation of teacher support and the task (as indicators of emotional engagement), and students’ achievement as measured with a multiple-choice test and a reasoning assignment (Appendix B) were established.

In Chapter 8, the research findings of all studies are summarised and integrated. Contributions of this dissertation, directions for future research and implications for educational science and for practice are discussed.
Table 2

*Overview of the Chapters and Studies of this Dissertation*

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Type</th>
<th>Title</th>
<th>Aim</th>
<th>Data gathered</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General introduction</td>
<td>Discuss theoretical background and give an outline of the dissertation</td>
<td></td>
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<tr>
<td>PHASE 1: Exploring scaffolding - How can scaffolding be conceptualised and characterised?</td>
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<tr>
<td>2</td>
<td>Literature review</td>
<td>Scaffolding in teacher-student interaction: A decade of research</td>
<td>Provide an overview of research on scaffolding in the classroom of the last decade, particularly with regard to its conceptualisation, appearances and effectiveness</td>
<td>2007/2008</td>
<td>66 articles</td>
</tr>
<tr>
<td>3</td>
<td>Case study</td>
<td>Patterns of contingent teaching in teacher-student interaction</td>
<td>Distinguish patterns of contingent and noncontingent teaching</td>
<td>2007/2008</td>
<td>3 schools 3 teachers</td>
</tr>
<tr>
<td>PHASE 2: Measuring scaffolding - How can classroom scaffolding in teacher–small-group interactions be analysed from a contingency perspective that takes the interactive nature of scaffolding into account?</td>
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<tr>
<td>4</td>
<td>Methodological</td>
<td>Measuring scaffolding in teacher – small-group interactions</td>
<td>Develop measurement frameworks for scaffolding in teacher – student interactions</td>
<td>2009/2010</td>
<td>-</td>
</tr>
<tr>
<td>PHASE 3: Promoting scaffolding - How can scaffolding be effectively promoted?</td>
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<tr>
<td>5</td>
<td>Developing</td>
<td>Promoting scaffolding in small-group work</td>
<td>Develop a professional development programme to promote scaffolding</td>
<td>2008/2009</td>
<td>2 schools 4 teachers</td>
</tr>
<tr>
<td>6</td>
<td>Experimental</td>
<td>Scaffolding in small-group work – An intervention study</td>
<td>Investigate effects of PDP based on model of contingent teaching on teachers’ classroom practice</td>
<td>2009/2010</td>
<td>20 schools 30 teachers</td>
</tr>
<tr>
<td>PHASE 4: Evaluating scaffolding - What are the effects of scaffolding on students’ engagement and achievement?</td>
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<tr>
<td>7</td>
<td>Experimental</td>
<td>Effects of scaffolding on students’ engagement and achievement</td>
<td>Investigate the effects of scaffolding on students’ engagement and achievement</td>
<td>2009/2010</td>
<td>20 schools 30 teachers 768 students</td>
</tr>
<tr>
<td>8</td>
<td>General conclusion and discussion</td>
<td>Summarise and integrate the research findings and contributions of the six studies</td>
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