

A conceptualisation of whole-class scaffolding

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The concept of scaffolding refers to temporary and adaptive support, originally in dyadic adult-child interaction. It has become widely used, also in whole-class settings, but often in loose ways. The aim of this paper is to theoretically and empirically ground a conceptualisation of whole-class scaffolding so that it remains close to the origin of the scaffolding concept, but also provides scope for features not salient in one-to-one interaction. Drawing an analogy with Vygotsky's concept of Zone of Proximal Development we argue why the extension to whole-class settings is justified. We further distinguish three key characteristics for whole-class scaffolding—diagnosis, responsiveness and handover to independence—and illustrate these with examples from a teaching experiment focusing on whole-class scaffolding language in a multilingual mathematics classroom (age 10–12). The empirical data led to a metaphorical distinction between online and offline enactment of key characteristics, during respectively outside whole-class interaction. Diagnoses can namely also be made outside lessons, for instance by reading pupils' work; responsiveness can also be realised in adapting instructional activities; and handover to independence can also be fostered in the design of lessons. In addition to this layered nature (online vs. offline), whole-class scaffolding is often distributed over time. Finally, whole-class scaffolding is cumulative with pupils' independence emerging as the cumulative effect of many diagnostic and responsive actions over time. We suggest these three features are at the core of whole-class scaffolding that is deliberately employed to foster long-term learning processes.

Scaffolding has become a key concept in many educational areas. It originates from the context of one-to-one problem-solving to conceptualise adults' supportive role in children's learning (Wood *et al.*, 1976). Since its introduction, many scholars have adopted the metaphor to describe and study a teacher's temporary support that helps pupils to perform a task they cannot complete by themselves and that is intended to bring pupils gradually to a state of competence in which they can complete a similar task independently. This type of classroom scaffolding has been extended to less task-oriented types of scaffolding, such as 'cultural' scaffolding (Pawan, 2008) and 'social' scaffolding (Williams & Baxter, 1996; Nathan & Knuth, 2003), as well as to scaffolding that occurs in symmetrical groups of pupils, or in peer-peer interactions (see De Guerrero & Villamil, 2000; Fernandez *et al.*, 2001). The original concept was also extended beyond a focus on teachers and peers by scholars who include a range of support types such as tools and resources as scaffolding mediators (see Brush & Saye, 2001; Davis & Miyake, 2004).

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This article focuses on another extension of the scaffolding concept, namely its application in whole-class situations, as advocated by several scholars (see Van Lier, 1996; Hogan & Pressley, 1997). One setting in which whole-class scaffolding has been investigated concerns multilingual classrooms. Over the last few decades scholars in the field of content-based language instruction (Echevarria *et al.*, 2008; Gibbons, 2002, 2009) have argued that scaffolding language is a fruitful way of promoting multilingual pupils' development of subject-specific registers needed at school. As this type of language development permanently needs attention, whole-class scaffolding has been advocated (Gibbons, 2002; Hammond, 2001).

The advantages and disadvantages of such concept extension to new areas must be carefully thought through. Palincsar (1998) already warned for atheoretical use of the scaffolding concept. More generally, Bal (2009) argued that the changeability of 'travelling concepts' is part of their usefulness provided that they are used neither rigidly nor sloppily. The concept of scaffolding would be used rigidly if we adhered so strictly to the original definitions that temporary adaptive support in whole-class settings cannot be called scaffolding even though it is in the spirit of the original idea. Loose use of the scaffolding concept is the case if it is stretched so far that almost any support in classroom interaction (Meyer & Turner, 2002), or even aspects of classroom organization, artefacts and sequencing (Anghileri, 2006) are called scaffolding. The latter trend of overgeneralising has already been criticized by many scholars (see McCormick & Donato, 2000; Pea, 2004; Myhill & Warren, 2005; Puntambekar & Hübscher, 2005; Mercer & Littleton, 2007).

Thus, there is a need for a conceptualisation of whole-class scaffolding that keeps as close as possible to the spirit of the origin of the scaffolding concept, but that leaves room for features not salient in one-to-one interaction. We wanted the conceptualisation to be based not only on a review of the literature, but also on an empirical study. The empirical study consisted of three teaching experiments in which we have iteratively improved our conceptualisation and better enacted whole-class scaffolding. We use data from the third teaching experiment to illustrate the resulting conceptualisation. The aim of this article is to provide this theoretically and empirically grounded conceptualisation for scaffolding in whole-class settings.

Theoretical background

We now first describe the history and characteristics of the scaffolding concept as commonly used in one-to-one settings. Subsequently, we argue why the scaffolding concept is expandable to whole-class settings on theoretical grounds. Last, we present three key characteristics for whole-class scaffolding which are the starting point for our conceptualisation.

Scaffolding characteristics in one-to-one settings

Wood *et al.* (1976) summarize scaffolding as 'the 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 described six tutor actions that constitute the process of scaffolding: (1) recruiting interest in the task; (2) reducing the degrees of freedom

(simplifying the task); (3) maintaining direction toward the goals of the task; (4) marking critical features; (5) controlling frustration; and (6) modelling the preferred procedures by demonstrating, so that the learner can ‘imitate it back’ (p. 98). The adult’s adaptive role in this process was explicitly expressed by Wood *et al.* (1978) in the notion of contingency, which has remained a key aspect of scaffolding in the literature. The process of handing over to independence was first described by Bruner and Sherwood (1976) when analysing a learner’s agency in a peekaboo game. Later on, Bruner (1983, p. 60) described this ‘handover principle’ in another non-educational context of language acquisition at home, as a ‘process of “setting up” the situation to make the child’s entry easy and successful and then gradually pulling back and handing the role to the child as he becomes skilled enough to manage it’.

Over the years, scholars have modified the interpretation of the scaffolding metaphor in different directions, while some aspects remained constant. In a review study focusing on face-to-face interactions, Van de Pol *et al.* (2010) distinguished three scaffolding key characteristics: contingency (also referred to as responsiveness); fading; and transfer of responsibility (also referred to as handover to independence). Some scholars, however, also drew attention to other dimensions of scaffolding. Stone (1998), for example, included the following two aspects in his characterisation. Firstly, the adult draws on a repertoire of methods and strategies for providing support. Secondly, the adult is to diagnose carefully the learner’s current level of understanding. The characteristic of diagnosing was also implicitly included in an often cited definition from Maybin *et al.* (1992, p. 188, emphasis added):

It is help which will enable a learner to accomplish a task which they would *not have been quite able to manage on their own*, and it is help which is intended to bring the learner closer to a state of competence which will enable them eventually to complete such a task on their own.

Puntambekar and Hübscher (2005) identified ongoing diagnosis as a key characteristic of scaffolding. They argue that the adult should have knowledge of the child’s changing capabilities and understandings while the instruction progresses.

In our endeavour to stick to the original characteristics of scaffolding we chose the labels of diagnosis, responsiveness and handover to independence, for reasons that we explain later in this article. However, we first draw an analogy with the closely related concept of *zone of proximal development* (ZPD; Vygotsky, 1978) to underpin why we think it is theoretically justified to expand the scaffolding concept to whole-class settings.

Expanding the concepts of ZPD and scaffolding to whole-class settings

Vygotsky’s (1978, p. 86) most cited definition of the ZPD is:

It is 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.

The concept of ZPD, which is said to be Vygotsky’s ‘most important legacy to education’ (Wells, 1999, p. 313), was first explicitly related to the scaffolding metaphor

by Cazden (1979). She was also the first to extend the scaffolding metaphor from its original use in the context of dyadic adult–child interactions to teacher–pupil interactions in classroom settings. Vygotsky (1978) articulated the role of instruction in the ZPD as follows: ‘Instruction is only useful when it moves ahead of development’ (p. 212), ‘leading the child to carry out activities that force him to rise above himself’ (p. 213). In more recent scaffolding research, this crucial role of the teacher has been advocated by many scholars (see Wells, 1999; Gibbons, 2002; Mercer *et al.*, 2004; Gillies & Boyle, 2005) with the learner’s autonomy as the ultimate aim (Mariani, 1997; Walqui & Van Lier, 2010). Ever since its introduction in 1976, the scaffolding metaphor has frequently been used to describe how educators can best provide assistance to learners within the ZPD to help them move forward to independence (Jadallah *et al.*, 2010).

However, the ZPD concept is divergently understood (as observed by Wells, 1999; Lantolf & Thorne, 2006). This can probably be explained by the unfinished character of the concept at the time Vygotsky died (Lantolf & Thorne, 2006). That is, only eight of Vygotsky’s published works mention the ZPD (Chaiklin, 2003) and these hold characterisations of the ZPD that are inconsistent with one another. Hence, a major challenge in the field of educational theory includes interpreting and deploying the concept in a way that is compatible with Vygotsky’s theory as a whole. One such interpretation includes the extension from its use in the context of individual learners to use in the context of groups of learners. Several scholars have theorized upon notions of communal ZPD, group ZPD, group zone, joint ZPD and intermental development zone (see Nyikos & Hashimoto, 1997; Wells, 1999; Mercer, 2000), while others conducted empirical investigations into these (Fernandez *et al.*, 2001; Nathan & Kim, 2009).

Scholars have argued that this extension of ZPD is well compatible with the broader sociocultural theory from which it stems. Guk and Kellogg (2007) noted that employing the most cited ZPD definition has led to many scholars investigating *individual* pupils’ ZPD and one-to-one scaffolding, whereas the broader context of Vygotsky’s work points at a more social and *whole-class* context for the ZPD. This is in line with Van der Veer and Valsiner (1991), who conclude from chronologically reading Vygotsky’s work that his ZPD concept developed from narrow testing contexts to ‘the general problem of the relation of education and cognitive development’ (p. 329). Others also assumed it was possible to establish the ZPD of the class as a whole as it allows us to conceptualise the social distribution of mind (see Wertsch, 1991). This view coincides well with the idea of the social formation of mind that forms the core of sociocultural theory (Wertsch, 1985). From this perspective, contributing to whole-class discussion is essential for knowledge transition from the intermental to the intramental plane (Wells, 1999) as is expressed in the notions of ‘forum’ (Bruner, 1990), collective work (Leont’ev, 1978) and ‘common knowledge’ (Edwards & Mercer, 1987).

The analogy with the presumed strength of a group ZPD due to its social mediation underpins the claim that scaffolding may be a powerful teaching strategy in whole-classroom interaction. Theoretical and empirical studies on characterising whole-class scaffolding are rare, but some scholars give directions for conceptualisation. Cazden (1996, p. 175) argued on theoretical grounds that ‘group scaffolds are

conceivable, in which ZPD's for individual members will differ but within a range that makes collaboration in a common effort still possible'. Nathan and Kim (2009) empirically investigated whole-class scaffolding by distinguishing teacher utterances in whole-class settings eliciting pupils' lower and higher order thinking. Hogan and Pressley (1997) studied a teacher's whole-class scaffolding strategies in a community of enquiry that fostered pupils' deeper understanding and independent thinking. Although studies like these point to the possibility and necessity of identifying whole-class scaffolding, the definitions and operationalisations used tend to either diverge from the original key characteristics of scaffolding, or do not theoretically justify why the concept of (whole-class) scaffolding is applicable.

Scaffolding characteristics in whole-class settings

Having justified through an analogy with ZPD that the scaffolding concept can be conceptualised at the whole-class level, we elaborate on the three aforementioned characteristics as being applicable and operationalisable in whole-class settings. *Diagnosis*, firstly, has been implicitly or explicitly included in leading definitions of scaffolding (see Wood *et al.*, 1976; Maybin *et al.*, 1992). Others have claimed diagnosis to be essential for contingency, and thus for scaffolding (Puntambekar & Hübscher, 2005; Van de Pol *et al.*, 2011). Secondly, in doctrinal interpretations of Vygotsky's work the ZPD is argued to be a diagnostic tool meant to assess the child's current state (Chaiklin, 2003; Lantolf & Thorne, 2006). Acknowledging the strong link between the ZPD and scaffolding thus implies that adaptive support can only be successful if the actual developmental level is diagnosed. Thirdly, promoting teachers' scaffolding asks for explicitly focusing on diagnosing (Van de Pol *et al.*, 2012). On the spot judgments needed for understanding how to best facilitate pupils' learning (Wells, 1999) are a demanding undertaking for teachers in whole-class settings (Smit & Van Eerde, 2011). Therefore, diagnosing deserves explicit attention if we aim to realize scaffolding in whole-class settings. The act of diagnosing, in our view, need not directly precede the actual adaptive response and should therefore not be blurred into the concepts of contingency or responsiveness, but explicitly distinguished.

The second key characteristic of whole-class scaffolding that we distinguish is *responsiveness* (also referred to as contingency). This broadly used notion best captures the adaptive nature of scaffolding. Moreover, it is argued to be at the heart of the scaffolding process (Van de Pol *et al.*, in press).

The third key characteristic we distinguish is *handover to independence*, for this is the ultimate aim of the scaffolding process. In this notion the temporary nature of scaffolding is captured. This temporary nature is sometimes included in the notion of fading (e.g., Van de Pol *et al.*, 2010). We argue that (successful) handover is a process that includes fading of the teacher's support (cf. Puntambekar & Hübscher, 2005), which is why we do not distinguish fading as a separate key characteristic.

When requiring whole-class interaction to have these three characteristics, challenges arise. The most prominent is the often mentioned challenge of working collectively with multiple ZPDs—thus working with multiple layers of understanding and skills (see Hogan & Pressley, 1997; Myhill & Warren, 2005). This makes

diagnosing, being responsive, as well as handing over to independence much more complex than in one-to-one settings. In line with Nathan and Kim (2009), however, we view a group ZPD to exist *alongside* individual learners' ZPDs. That is, we do not deny the existence of individual learners' ZPDs in whole-classroom settings, but we do regard, for instance, responsiveness as a characteristic that can also be enacted upon the class as a whole.

Investigating scaffolding language in multilingual whole-class settings

Because we focus on the enactment of whole-class scaffolding *language* in a *multilingual* setting, we briefly discuss these two specificities of this research setting. Both aspects come together in Ohta's (1995) definition of the ZPD in the field of second language (L2) learning: 'the difference between the L2 learner's developmental level as determined by independent language use, and the higher level of potential development as determined by how language is used in collaboration with a more capable interlocutor' (p. 96). In analogy, De Guerrero and Villamil (2000) argue that scaffolding in the second language would 'consist of those supportive behaviours, adopted by the more expert partner in collaboration with the L2 learner that might facilitate the learner's progress to a higher level of language development' (p. 53). As pointed out in Walqui and Van Lier's (2010) 'pedagogy of promise', the Vygotskian idea of teaching that is oriented towards the development of pupils' future potential is particularly beneficial for second language learners.

Developing a 'higher level of language development' is not a simple linear process. Taking a sociocultural perspective on second language learning, we view language development as an ongoing process of participating in situated social dialogue. Second language learners are to become part of a certain community in which they learn to understand and express the language belonging to that community (Gibbons, 2006). Pupils at school learning subject matter *while* learning a second language are exposed to an even bigger challenge. They need to develop the so-called context-reduced, academic registers used in particular school subjects and at the same time realise academic development in these school subjects. Scaffolding the development of these subject-specific languages is thus essential for participating at school. Moreover, we need to emphasize that scaffolding such development of a second language is a world apart from small-scale problem-solving. The former cannot be done within short episodes of discourse, but needs to be viewed against a background of longer periods of time. We include this long-term dimension in our conceptualisation of whole-class scaffolding. We now describe and illustrate how key characteristics of whole-class scaffolding were enacted in our third teaching experiment.

Origin of the empirical data

In this section we describe the research setting of the design experiment that we drew on for conceptualising whole-class scaffolding. In the next section we discuss the enactment of the three scaffolding characteristics: diagnosis, responsiveness and handover to independence. These are subsequently illustrated by examples from the

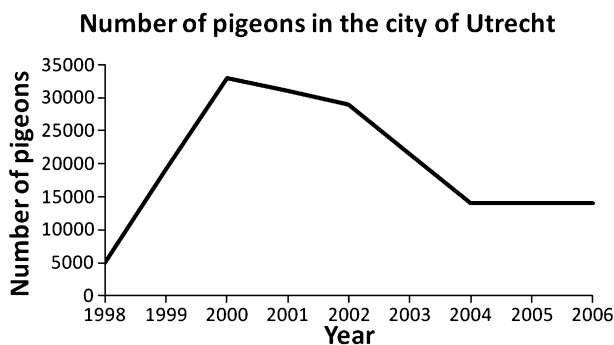
third teaching experiment from a dual design research project. This type of design research focuses on both teachers' and pupils' learning (Gravemeijer & Van Eerde, 2009; Smit & Van Eerde, 2011).

Setting and participants

The teaching experiment was carried out in the last two years of a suburban primary school (age 10–12). Based on the two previous teaching experiments, nine lessons were given with a focus on scaffolding the language needed for reasoning about line graphs. Lessons were given weekly and lasted 60 to 70 minutes. The number of pupils speaking Dutch as a second language was 19 out of 22, the majority being second or third generation Moroccan and Turkish pupils. The teacher, participating in all three teaching experiments, had 17 years of experience in primary education, partly in multilingual classrooms.

Lesson design

As we aimed to promote the enactment of whole-class scaffolding language in a specific mathematical domain (line graphs), we needed to (re)design lessons that would foster this in a classroom setting. To this end, we employed the teaching and learning cycle (see Derewianka, 1990; Gibbons, 2009). This cycle consists of a series of four stages in which a particular text type needed at school is introduced, modelled, jointly practised, and eventually individually performed by the pupils. In our study, the 'text type' we aimed for pupils to develop was an interpretative description of a line graph (see Figure 1). During the first three stages of the teaching and learning cycle, especially in the modelling stage, instructional activities are designed so as to promote independence in speaking and writing. Gibbons (2009) refers to the use of such materials as 'designed scaffolding'.



In 1998 there are about 5,000 pigeons in Utrecht. Between 1998 and 2000, the number of pigeons rises considerably; the graph shows a steep increase. In 2000, the number of pigeons gets to its maximum: about 32,000. After that time, until 2002, the number of pigeons drops little by little. The graph descends gradually. After 2002 the number of pigeons drops further down; the graph shows a decrease. From 2004 onwards the number of pigeons stays more or less the same. You can tell because the graph is constant.

Figure 1. Line graph and accompanying text type

Table 1. Strategies for scaffolding language and examples for each strategy

1	Reformulate pupils' utterances (spoken or written) into more academic wording	[In response to <i>the graph goes higher and higher up:</i>] <i>Indeed, the graph rises steeply.</i>
2	Ask pupils to be more precise in spoken language or to improve their spoken language	<i>What do you mean by 'it'?</i>
3	Repeat correct pupil utterances	<i>The graph descends slowly indeed.</i>
4	Refer to features of the text type (interpretative description of a line graph)	<i>Into how many segments can we split the graph?</i>
5	Use gestures or drawings to support verbal reasoning	For example, gesturing a horizontal axis when discussing this concept
6	Remind pupils (by gesturing or verbally) to use a designed scaffold (i.e., word list or writing plan) as a supporting material	<i>Look, the word you are looking for is written down for you here.</i>
7	Ask pupils how written text can be produced or improved	<i>How can we rewrite this in more mathematical wording?</i>

Another means to promote whole-class scaffolding of language was the employment of a conceptual framework consisting of strategies for scaffolding language considered to be successful in the first two teaching experiments. This framework was used to promote and evaluate the teacher's scaffolding performance. For examples of such strategies see Table 1.

Data collection

Data collection included video-recordings of all lessons, pupils' written work, the teacher's weekly written reflections using a reflection format we gave her, and audio recordings of video-stimulated recall interviews (SRIs) the researchers held with the teacher between lessons (Smit & Van Eerde, 2011). The idea behind SRIs is to encourage the teacher to think out loud while observing videos of her own lessons, thus to stimulate the teacher to relive the lesson (Meijer *et al.*, 2002). The SRIs followed a set order of question types: (1) neutral questions (e.g., 'What happens in this fragment?'); and (2) scaffolding-related questions (e.g., 'Why did you respond the way you did?', 'What scaffolding strategy did you enact here?'). We always ended with discussing the reflection the teacher had written between lessons to return to her own diagnoses of pupils' written work and oral language, and to discuss scaffolding intentions for the next lesson.

Enactment of key characteristics

All three characteristics of whole-class scaffolding can in our view be promoted *during* whole-class interaction as well as *outside* classroom interaction (mostly implying between lessons). The former we have metaphorically named *online* and the latter *offline* enactment of key characteristics. The terms online and offline should therefore not be taken literally as being or not being connected to the Internet. We now describe online and offline enactment of all key characteristics.

Diagnosis

Part of the diagnosing process took place during classroom interaction. This *online diagnosing* pupils' actual levels of language development was often a tacit activity, as opposed to situations in which explicit diagnostic strategies might be needed to gain insight into pupils' thought processes (Van de Pol *et al.*, 2011). The SRIs served to make the teacher's tacit diagnoses explicit.

In our research setting, *offline diagnosing* was promoted by asking the teacher to read all pupils' written work between lessons and to make weekly notes on pupils' language development. The teacher also listened to audio-tapes of half the lessons. In addition, the teacher was asked to fill in a reflection form after each lesson, in which we posed her some diagnosing-promoting questions, for instance: What did you notice about the quality of pupils' linguistic utterances? Furthermore, the researchers diagnosed the pupils' level of language development by watching video recordings and by examining pupils' written work. We discussed our findings with the teacher in preparation for the next lesson. The teacher occasionally formulated 'new' diagnoses when watching video recordings as part of SRIs.

Responsiveness

Online responsiveness is seen in a teacher's utterances adapted to pupils' spoken and written utterances, in this case aiming for the development of language. A teacher's utterance can be a direct response to pupils' language, but can also be a response to pupils' language that stems from earlier classroom interaction (e.g., a previous lesson). To promote online responsiveness, the teacher was asked to build up a repertoire of strategies that we formulated in the conceptual framework for scaffolding language. In SRIs the teacher and the researchers evaluated classroom interaction by use of this framework to promote internalization of the repertoire.

Offline responsiveness was enacted by adjusting lesson designs between lessons, drawing on diagnoses during and after lessons formulated by the teacher and the researchers. Although the plan for the lesson series was designed before the start of the teaching experiment, the instructional activities for each specific lesson were responsive to these diagnoses. That is, when specific language-related difficulties were diagnosed during a lesson, in written work, or when viewing a lesson afterwards, these issues were addressed in a subsequent lesson.

Handover to independence

In an attempt to foster *online handover* we encouraged the teacher to discuss the use of subject-specific language at a meta-level ('Why are we actually trying to be precise here?') and to promote pupils' use of the language aimed to develop ('Now see if you can describe this first segment of the graph in mathematical language yourself'). In this way, we aimed to foster pupils' engagement concerning the use of precise, subject-specific language, as well as to promote their initiative to express themselves at the linguistic level that has just come within reach.

Offline handover was fostered by employing the teaching and learning cycle. In the first three stages of the teaching and learning cycle, the instructional activities are designed to gradually handover to independence in speaking and writing. An example from our teaching experiment includes the ‘growing word list’ which is used by the teacher to write down subject-specific words (e.g., horizontal axis, coordinate system) and to refer to subject-specific words during whole-class interaction. Pupils, in turn, can look up the words they need to express themselves mathematically and to ultimately internalize these subject-specific words. Another instructional activity fostering independence is a writing frame (or ‘cloze’ exercise), which supports the writing of subject-specific texts. Here, specific parts of a description of a graph are left out so that pupils get to discuss the meaning and form of the missing words, while still obtaining temporary textual support. This is in line with what Wood *et al.* (1976) called reducing the degrees of freedom. Once pupils demonstrate increased independence, the writing frames become more ‘open’ (more words are left out) and finally pupils are to verbalise or write the target text independently in new contexts.

Illustrations of whole-class scaffolding

We consider *diagnosis* the starting point for planning and realizing whole-class scaffolding. The scaffolding example given below will illustrate how diagnoses were recurring starting points for online and offline *responsiveness* but also how the process of *handover to independence* was taking place. The linguistic issue used in this whole-class scaffolding example concerns the use of temporal prepositions referring to a particular *moment* in time, represented by a *point* in the line graph (e.g., *at 6 o’clock*, see text below graph in Figure 1) and word combinations referring to a particular *period* in time, represented by a *segment* of the line graph (e.g., *between 6 and 8*, see text below graph in Figure 1). We want to emphasise that this focus on particular formulations serves well to illustrate our conceptualisation of whole-class scaffolding but is only a small part of the language scaffolded in the teaching experiment. Our main efforts were also directed towards supporting concepts such as coordinate system, axis, graph, rise and fall, constant, steeply and gradually, and towards the reasoning involved in explaining how graphical features relate to processes represented in the graph.

During the fourth lesson of the teaching experiment one of the researchers observed pupils’ difficulty with the use of temporal prepositions. Prepositions are particularly hard to master for second language learners due to their variability in usage (see Bitchener *et al.*, 2005; Chodorow *et al.*, 2010). The following pupil’s utterance, in which an incorrect preposition is used, illustrates this:

With 13 weeks the sunflower is growing less fast. [The correct formulation, translated from Dutch, would be: From 13 weeks...]

In the SRI following Lesson 4, the researcher shared her diagnosis with the teacher:

Pupils say with 13 weeks when they refer to a period, instead of from 13 weeks. They are probably not aware of the difference between words that describe moments in time and words that describe periods in time.

In response to this diagnosis the researchers designed an instructional activity in which pupils were to reformulate sentences containing mistakes in the use of temporal prepositions that pupils had made themselves in spoken language or written work. To not discourage them, these sentences were discussed anonymously in a PowerPoint presentation and attributed to an imaginary child, Piet Praatjens (Tom Talkative). We asked the teacher to discuss these sentences in a non-judgemental way ('How does that sound?' or 'How could we say that slightly more precisely?'). The teacher was asked to model the use of temporal prepositions we were aiming to develop during this activity, without explicitly explaining their use. At that time we presumed that implicitly focusing attention on words like these would be enough to activate linguistic knowledge we supposed pupils to have already.

In the SRI following Lesson 5, the teacher diagnosed:

Words like from and between belong to the language of schooling, right? I had never expected these words to be in need of so much attention. Pupils find it very hard to use these words correctly.

For Lesson 6, a writing frame exercise was designed to support the pupils in developing the text type aimed for. Surprisingly, when discussing the pupils' written answers in a whole-class discussion, the teacher did not notice pupils' mistakes in their use of temporal prepositions, even though this use was meant to be the focus of discussion in the instructional activity.

Imana: From November two thousand and seven and January two thousand and eight more birds perched along the Northern Coast. The graph shows an increase.

Teacher: OK. [Moving on to the next sentence without reformulating preceding utterance]

Drawing on pupils' written work in Lesson 6, the teacher diagnosed in her written reflection that many pupils did not perform well in the writing frame exercise. In the SRI following Lesson 6 she stated: 'Many pupils have not given the correct answer in the written work'. She also herself concluded that her own actions had not been optimal and formulated an intention for the subsequent lesson.

My own explanation for the use of from was confusing for pupils. I shouldn't have done it that way. Next time I will explain these words again, supported by drawings. Also, I will write down correct answers on the whiteboard.

When watching video fragments the teacher realized she had not listened carefully enough to the pupils and had thus missed chances for online responsiveness. She then declared the intention to listen very carefully to the form of their linguistic utterances in the subsequent lesson.

The interaction fragment from Lesson 7 presented below illustrates the teacher's increased online responsiveness related to the use of temporal prepositions. In this fragment the topic of discussion is a line graph presented on the whiteboard showing Uncle Kees' weight as changing throughout the years.

- Yassin: When he was 30 and 35 he just stayed at 76 kilograms (points at numbers along the axis).
- Teacher: Wait a minute. How can we formulate this in the proper wording? When he was 30 and 35? What you, Oussana?
- Oussana: 30 till 35, he just stayed the same.
- Teacher: Do we say 30 *till* 35?
- Abdul: From. [...]

During Lesson 7 the teacher stated: ‘So just use *from...to*. We do not say *from...towards*. You cannot say that. It is not what we call “proper Dutch”’. One of the pupils responded to this by saying: ‘But almost everybody says so’. At this point, the teacher initiated a discussion on why the precise use of words like these is actually important. After several pupils’ contributions, one boy explained: ‘Then people start talking good language with you. Then they talk “social language” to you or something like that’. In this quote the boy demonstrates awareness of the fact that specific language use is associated with specific communities. In the SRI following Lesson 7, the teacher stated that she thought it quite poignant to observe these pupils growing more conscious of the social disadvantage of not being able to express themselves adequately. At the same time, she was touched that this issue could be discussed in such an open way, and she was very convinced about all pupils sharing these thoughts and questions.

In the same SRI the teacher diagnosed:

We explain and practise the use of these words extensively, yet they still make mistakes. I had expected they would fill out the written exercise without experiencing any difficulties, as we explained them repeatedly. By myself, I would never have paid so much attention to words like these.

In response to this diagnosis, the researchers designed an activity for Lesson 8 in which the use of temporal prepositions was again topic of attention. Pupils then started to independently use these words correctly in spoken and written language. The teacher diagnosed after reading the written work carried out in this lesson:

They have performed much better in their written work, much better than last week. This written work made me really happy! The first part of the joint construction activity went well, but I think we can attribute this progress mainly to the first activity in Lesson 8.

From the next statement we can also derive her intention to take the next step in the process of handover to independence. ‘I will now only refer to the words by pointing at the supporting drawings on the white board, as we have discussed them before’.

Pupils’ pre- and post-tests indeed show an increase of (correct) use of temporal prepositions. Whereas none of the pupils used these words in the pre-test in a description of a line graph, in the post-test 8 out of 22 pupils did use them. Out of these eight pupils, four sometimes used these words correctly and four always used them correctly. For some other linguistic aspects scaffolded during the lessons, the process of handover to independence seemed to have reached a further stage. For instance, the post-test showed that 16 out of 22 pupils were familiar with the names of the axes (horizontal and vertical), compared to 1 out of 22 in the pre-test. These examples

illustrate that the handing over of seemingly simple linguistic issues can be a long-term process.

The nature of whole-class scaffolding

The enactment of whole-class scaffolding, as illustrated in the previous section, made us aware of three features that we think are typical of whole-class scaffolding: its *layered*, *distributed* and *cumulative* nature.

Layered nature

Although some scholars argue that scaffolding is an interactive process, the teaching experiment we draw on illustrates that all three characteristics operate on different levels: not only at the interactive level of whole-class discussion, but also outside whole-class interaction, often in between lessons. In Figure 2 these are represented as two different layers, online and offline.

Diagnosing (D in Figure 2), to start with, was often tacitly enacted by the teacher during lessons (online enactment), but was also carried out by the teacher and the researchers in between lessons (offline enactment), for instance when reading pupils' written work and when viewing video fragments.

Concerning responsiveness (R in Figure 2), we see a division between instructional materials and the teacher. That is, offline responsiveness comprises all responses to diagnoses that are 'outsourced' to instructional activities (that respond to diagnosed difficulties) and artefacts (e.g., word list, writing frame). This type of responsiveness was initiated in between lessons. To promote the teacher's online responsiveness we used a framework of scaffolding strategies (see Table 1). We conjecture that such a means of promoting scaffolding can foster the construction of an internalized repertoire that forms the basis for online responsiveness (cf. Stone's 1998 remark on a range of types of support).

Offline handover to independence (H in Figure 2) was realized by drawing on the principles of the teaching and learning cycle for the design of instructional activities and materials. The teacher's role towards online handing over was to invite pupils to

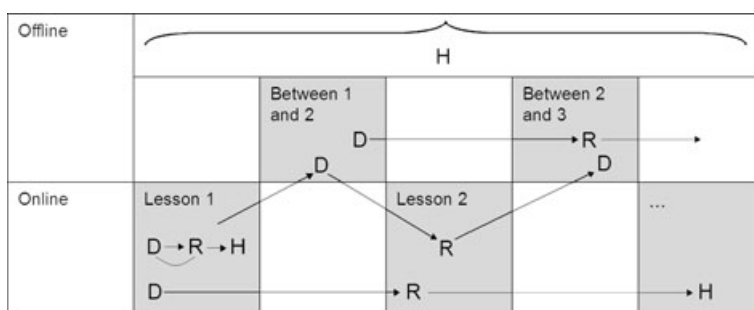


Figure 2. Schematic representation of whole-class scaffolding characteristics: diagnosis (D), responsiveness (R), handover to independence (H)

formulate independently. In the online row (Figure 2) H refers to the moment that pupils can indeed do so.

Distributed nature

A second feature of whole-class scaffolding is its *distributed* nature. Although we could identify all three key characteristics in our study, they mostly occurred in a scattered way, not within one episode but distributed over several episodes. For example, diagnoses of pupils' performance in written work were responded to in a lesson design for a subsequent lesson (see the arrow between D and R in the offline row). Or, diagnoses during a lesson could lead to increased responsiveness in the next lesson (see the arrow between D and R in the online row). We do realize that up to now responsiveness has mostly been studied at a micro-level of interaction episodes that occur within one lesson—hence the more common term 'contingency'. However, if we are to acknowledge the temporal dimension of classroom dialogue (Mercer, 2008), as well as the complex nature of some educational objectives (e.g., learning a subject-specific second language) we also advocate macro-perspectives. These are often related to the preparation for a subsequent lesson, for which the term 'contingency' seems less appropriate given the deliberate process of designing and the more reified nature of design.

Cumulative nature

In relation to this distributed nature, the *cumulative* nature as a third feature comes to the fore. The example of temporal prepositions tells us that repeated diagnosing as well as repeated offline and online responsiveness initiated and sustained the process of handing over to independence. This too implies that handing over to independence can often not be realized in one and the same lesson, and that pupils' learning processes cannot be attributed to instances of responsiveness. Instead, we would argue that pupils' learning processes represent the cumulative effect of scattered diagnoses, as well as online and offline responsiveness over time.

Discussion

The aim of this article was to provide a theoretically and empirically grounded conceptualisation of whole-class scaffolding. We intended to adhere to the spirit of the original concept of scaffolding in our conceptualisation for whole-class settings. Hence, we have chosen to distinguish three characteristics which stem from the literature on scaffolding and which in our teaching experiments also proved key in whole-class settings: diagnosis, responsiveness and handover to independence. In this respect, our conceptualisation remains close to the original spirit of what scaffolding is in one-to-one settings. The enactment of whole-class scaffolding, however, made us aware of three features that we think are typical of whole-class scaffolding: its *layered*, *distributed* and *cumulative* nature. We assume that these features hold for any whole-class scaffolding of learning that requires careful design and long-term learning processes.

For our conceptualisation of whole-class scaffolding we drew on a teaching experiment in the context of scaffolding *language*. Although, like any context, this context brings along its own specificities, we see no reason why the scaffolding characteristics would not apply the way they did here when more content-oriented whole-class scaffolding is investigated. However, the enactment of whole-class scaffolding may then need different means. For example, another approach to realise offline handover than the teaching and learning cycle may be needed, because this cycle is specifically aimed at language development. Future research on whole-class scaffolding in various settings is needed to test our assumption.

As to the research setting described in this article, one may wonder how realistic the enactment of whole-class scaffolding would be in naturalistic educational settings. Admittedly, the researchers played an active role in the offline enactment of the scaffolding characteristics, necessary to promote and investigate whole-class scaffolding. It is unrealistic to assume that teachers would do everything we did in this research setting, but this might not be necessary either now we have insight about what whole-class scaffolding is and how it can be enacted. Although SRIs, for instance, are not likely to happen without researchers or teacher trainers around, it is very well possible that teachers read student work in between lessons and discuss a video of their lesson with a colleague. It is also conceivable that once teachers, as part of their professional development, become more capable of enacting offline characteristics systematically and adequately, researchers or teacher trainers can fade away.

What we consider our main theoretical contribution to the field of scaffolding research is (1) the theoretical justification of whole-class scaffolding; (2) a distinction between online and offline enactment of its key characteristics; and (3) the identification of the layered, distributed and cumulative nature of whole-class scaffolding. The analysis of whole-class scaffolding poses methodological challenges: Singular teacher actions during whole-class teaching cannot be characterized as scaffolding since they will usually not have all three characteristics at the same time. Rather, whole-class scaffolding seems to consist of configurations of teacher actions, instructional means and the intention eventually to handover to pupils' independence across lessons. We are not claiming that short-term and one-to-one scaffolding in a problem-solving context cannot be layered, distributed and cumulative. In fact it may well be. But these features are much more apparent in whole-class scaffolding that is deliberately and explicitly employed to foster long-term learning processes.

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