Context framework for analysing situated knowledge transformation

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Chapter 4. Context framework for analysing situated knowledge transformation

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The claim that context can play a significant role in determining knowledge is inherent in the previous chapters’ discussions of the situativity of different knowledge forms and their possibilities of transfer to other contexts. This chapter aims to qualify this claim, to pave the way for the analyses to come in the book’s empirical chapters. We do not dispute that context is important for the actualization of knowledge, providing some form and content to it in each specific instance. The empirical studies presented in Parts 2 and 4 all illustrate this. However, as emphasized in Chapters 2 and 3, what this ‘some degree’ is will vary between knowledge forms and – we shall argue – also between contexts themselves: some aspects of some knowledge forms will sometimes stay the same across some contexts. This claim implies that knowledge has some degree of compositionality: knowledge is – to ‘some degree’ – composed of elements that can – to ‘some degree’ – be separated into elements that are – to ‘some degree’ – independent of one another and of context. On the face of it, compositionality and context-dependence contradict each other. Our aim is to show, however, that the two aspects can be balanced. In the first part of the chapter, we pursue this aim with a proof-by-exposition strategy, i.e. by providing concrete analyses which illustrate the balance. We do this by setting out a framework of context levels that makes it possible to analyse knowledge in specific situations in a way which takes both aspects into account (section one). We then illustrate the balance with two examples of how the framework can be used (section two). In the second part of the chapter, we pursue the aim by developing the philosophical underpinnings of the idea of balancing context-dependency and compositionality in our understanding of knowledge. We first provide a brief history of views on context-dependency (section three). The fourth section explores how influential discussions of context-dependency have relied on a comparison with language, and further, how the comparison can inform analyses of knowledge. We do this, because the need for balancing context-dependency and compositionality can most clearly be found in systematic studies of language.

1. Framework of context levels
The aim of this section is to provide a tool for accomplishing the balance between compositionality and context-dependency in specific analyses. To fulfil this aim, we follow Bateson’s idea that context can systematically be analysed into levels – a “hierarchy of contexts within contexts” (Bateson, 1972, p. 408). Arguing by way of language as comparison, he stated that “A phoneme exists as such only in combination with other phonemes which make up a word. The word is the
context of the phoneme. But the word only exists as such—only has “meaning”—in the larger context of the utterance, which again has meaning only in a relationship [between persons talking]” (Bateson, 1972, p. 408). He also claimed, however, that “the scientist [is driven] always to seek for explanation in the ever larger units [of the hierarchy]” (p. 408). We disagree with this claim, both as regards the contention that explanations must always be sought in the “larger units” (or ‘outer’ levels) of the hierarchy and as regards the postulate of a singular direction of influence. Characteristics of ‘outer’ levels will certainly frame characteristics of ‘inner’ levels, but often the direction of influence will be reversed, or there will be an interaction between characteristics at several levels at once. Importantly, characteristics are not pre-given or static, but develop in the interaction of agents in practice. We provide examples of this in the next section.

The “hierarchy of contexts” we wish to set forth has five context levels to which situational demands, possibilities and restrictions (henceforth ‘requirement characteristics’) pertain. The levels are analytical; in real empirical situations, requirement characteristics exist as an intermingled, interdependent and dynamically evolving unity of contextual demands and opportunities. The point of the framework is to allow an analysis of how this intermingling and interdependency plays out. Furthermore, people learn in attuning to and negotiating such unities of contextual demands and opportunities, and their competence in any given situation is gauged by the way they respond to, negotiate and cope with these unities. In this sense, the contextual demands and possibilities can be viewed as competence demands posed on people by the situation. We illustrate this below.

In the following, we first introduce our framework. It basically builds on the idea that our actions can always be analysed as: engaging with a domain, in an activity, within a life setting that takes place within a societal structure, making use of encompassing cultural practices. After presenting the framework, we explain its origin, relating it to other attempts at distinguishing context levels.

1. **The domain level**, concerned with the domain or content area. With reference to coming chapters, examples of domains are ethical theories (Chapter 6); protein chemistry (Chapter 7); energy optimization (Chapter 8); electromagnetism (Chapter 14) and narrative theory (Chapter 15). Examples of requirement characteristics at this level are: ethical theories provide ways of distinguishing good acts from bad ones; coupling resistances in parallel decreases the total resistance in the circuit, coupling them in series increases the total resistance; a story traditionally has a conflict, an escalation hereof, a climax and an ending.

2. **The activity level**, concerned with the activity itself; e.g. reading a book; individually or collaboratively solving a problem; attending a lecture; creating a model; performing a relay together with others. Requirement characteristics at this level include: all participants in group work should be allowed to speak; students sit relatively quietly whilst attending lectures, a relay involves taking turns in performing the required actions.

3. **The life setting level**, concerned with the life setting which frames the activity, e.g. participating in a class within an educational program; working as care-giver in an assisted living facility; teaching a class in primary school. Requirement characteristics at this level concern for instance acknowledging the teacher as an authority in the classroom; acting in accordance with
(negotiations of) accepted communication genres of the school or workplace; making do with the actual resources available in the situation.

4. The societal structure level, concerned with societal organizational structures and institutions which enable the life setting to exist and the activity to take place within it. Examples of societal structures are the organization of learning within a school system or within traditional family-centered apprenticeships with room and board provided; the organization of caretaking of elderly or disabled persons in assisted living facilities; and the organization of religious practices through church mediation. Requirement characteristics at this level concern e.g. state curriculum demands and national standards; formal qualification requirements for certain professional jobs; and existence and accessibility of a set of caretaking opportunities for the elderly or disabled.

5. The cultural practices level concerned with the cultural tools and ways of behaving which are prevalent in a culture across specific practices and societal structures. Examples of cultural practices are dominant communication forms (oral communication in earlier times, reading and writing in later historical epochs, arguably internet-based communication today); and the production of tools with certain materials (stone in the Stone Age, iron in the Iron Age, plastic in modern times). Examples of requirement characteristics at this level are: contemporary expectations of increased digitalization across societal institutions; preference of oral, written or digitalized communication in different historical societies.

By ‘domain’, we simply understand ‘the content area of the activity’. ‘Activity’, similarly, is ‘what participants are engaged in doing’. The scope of both will vary: at the level of higher education, narrative theory, energy optimization and protein chemistry are domains; at lower educational levels (if treated at all), they will be sub-topics treated within domains such as genre theory, force and energy and organic chemistry, respectively. Likewise, ‘group discussion’ will be part of the activity of ‘collaborative problem solving’ but may in other situations be an activity in itself.

In developing this framework, we have been inspired by Wedege’s distinction between “problem context” and “situation context” (Wedege, 1999) and by the distinction of Engle et al. between “content” and “social context” (Engle, Lam, Meyer, & Nix, 2012). More generally, we have been inspired by socio-cultural articulations such as those by Säljö, Dysthe, and Wertsch of how activities and settings are embedded in, configured by and conversely co-configuring of societal structures and historically developed cultural practices (Dysthe, 2001; Säljö, 2000; Wertsch, 1998).

Starting with Wedege’s distinction, “problem context” refers to the context delineated within a word problem in math (of the type “Petrus is in the supermarket to buy fruit for his family. His parents have given him €20 and instructed him to buy twice as many apples as pears, two oranges, and as many bananas as possible. The prices of apples, pears, oranges and bananas are etc…”). The “situation context”, in turn, is the life setting (our terminology) in which solving the problem takes place, typically a classroom or homework situation. This level frames the activity of e.g. solving word problems about supermarket buys. To make Wedege’s distinction useful beyond her focus on mathematics education research, we have replaced the term ‘problem context’ with ‘activity level’.
This broadens the reference of the term to the level of all requirement characteristics set by the activity itself. In Wedge’s case, the activity is solving a word problem, and the requirement characteristics will include, but not be restricted to, the ones set by the word problem. An example of another requirement characteristic at this level is (for most people at least) that complex calculations require tools such as pen and paper or a calculator.

As regards the distinction made by Engle et al. between “social context of learning” and “content” (Engle et al., 2012), our framework refines it by

a. distinguishing between “content” and “problem context” (or, in our terminology ‘domain level’ and activity level). Engle et al. explicitly refuse to distinguish the problem context from the content, because of their focus on the significance of the “social context”.

b. widening the focus of ‘social context of learning’ to the more neutrally formulated ‘life setting’. In contrast to Engle, this allows us to focus on other requirement characteristics in addition to socially determined ones, e.g. ones resulting from the material surroundings, such as the physical setup of the studios allocated to the Architecture and Design project work groups in Chapter 8.

c. adding two further context levels not discussed by Engle et al. which take broader socio-cultural aspects into account. These two levels, for their part, are inspired by socio-cultural theories like the ones of Dysthe, Säljö and Wertsch mentioned above.

As indicated, the framework is analytical. It makes it possible to analyse how the requirement characteristics at the different levels codetermine each other in concrete situations to form a unity of contextual demands and possibilities. It thus allows going beyond a mere reference to ‘practice’ as an explanation of why people act as they do (Schatzki, Knorr-Cetina, & von Savigny, 2001): it provides an analytical lens to articulate the norms and expectations implicit in these practices and examine the way they play out in interaction with other requirement characteristics of the situation, e.g. material surroundings. An example of an analysis is the criticism made by the first author of the operationalization of the Programme for International Student Assessment (PISA). With the framework, she demonstrated how the competence demands placed on students in the PISA test differed from the competence demands which most other life settings would place on them for similar domains and activities.

Our overall point in this chapter is that context-dependency needs to be balanced with compositionality, i.e. knowledge is not fully context-dependent; to some degree it is composed of elements independent of each other and of context. The framework makes it possible to take this abstract point into account for specific instances of knowledge actualization. In saying this, we emphasize that context-dependency is itself context-dependent: it differs from life setting to life setting to which extent the unity of situational demands and opportunities requires knowledge to be transformed and resituated to be put to use. For experienced teachers, their practical knowledge of utilizing different ICT tools for teaching may in some instances be transferred relatively untransformed from one classroom to another, even if projectors, whiteboards, desks etc. are placed somewhat differently, and the tools differ somewhat in functionality. Yet, in other life settings,
where for example only a few of the tools are in working order or students have very different attitudes towards ICT-mediated learning, more extensive transformation of the practical knowledge may be needed. The context level framework will allow pinpointing such differences between life settings, as well as enable an analysis of which aspects of knowledge stay unchanged (e.g. the procedurally realized routines of typing on the keyboard) and which aspects transform (e.g. the practical knowledge of interpreting student reactions). Differences in context-dependency may also exist between domains and between activities: chess playing is widely thought to be less context-dependent than the skill of reading, because the chess domain and activity are more well-defined and constrained than the domain and activity of reading.

In the following, we shall illustrate these general considerations through developing the latter two examples, chess playing and book reading. They have precisely been chosen because they demonstrate the usefulness of the framework for analysing context-dependency and compositionality both for knowledge within a seemingly well-defined and constrained domain (which might be expected to have a lesser degree of context-dependence) and for knowledge within a domain where context-dependency might be expected to be high. Between them, the examples therefore highlight, on the one hand, that all knowledge has some degree of context-dependence, but, on the other hand, that the context-dependency is not absolute. That is, they highlight that context-dependence and compositionality balance in each individual case – but balance differently.

2. Illustrating the framework’s usefulness for analysing context-dependency versus compositionality – two examples

2.1. Chess

The game of chess has been thought to be a game whose mastery will foster skills that transfer to “other domains” (Sala & Gobet, 2016, p. 46). In their metastudy of transfer in relation to chess instruction, Sala and Gobet emphasize the view that chess players’ skills are context bound; this, in turn, is thought to make far transfer difficult. Yet, Sala and Gorbet point to the hypothesis that “children train several context-independent skills”, and in virtue of that, there may be transfer to “the mathematical domain” (ibid., p. 48), reading skills or several, postulated, general cognitive skills. We see here the tendency to emphasize both context-dependence and context-independence (and with it, compositionality) when giving an account of transfer. The context level framework can help clarify what is at stake here; specifically, that some of the requirement characteristics at some of the levels are not very context dependent (and therefore constitute compositional elements) and that other requirement characteristics at other levels are.

The domain level constitutes a relatively fixed set of requirements. Historically, the rules for moving chess pieces and finishing a game has been subject to change (and in that sense they are dependent on historical context), but at any given instance, there is no negotiation of rules for moving pieces, taking turns and for what makes up a victory. This context-independency at the domain level is also suggested by the fact that Alan Turing wrote a program for playing chess before a computing machine had been devised that could run the program (Bringsjord &
In a relevant sense, the program exhibited knowledge of chess and this knowledge furthermore was compositional – consisting of information about rules and possible moves. What he did not program are some of the requirements that arise with the activity level, for actually engaging in a game of chess: terms of time allowed to make a move, selection of an opponent (a machine or a suitable human being) and whether it is required to sit through the game until it has reached a conclusion proper to the game; to what extent the requirements placed by chess considered at the activity-level were met has informed some of the debate surrounding Kasparov’s loss to IBM’s Deep Blue. For example, transparency vis-à-vis your opponent’s identity and history is arguably a requirement of chess at this level and was shown to be context-dependent in the case of the Kasparov-Deep Blue match (Bory, 2019). The life setting requirements concern the material and social setting in which one plays chess. They can vary greatly from context to context. Some examples of requirement characteristics at this level are: showing up on time to an extra-curricular chess class; maintaining software and internet-connection for an online game; a process of agreeing on rules concerning time for turn-taking; fitting game time to the time one needs to pass while waiting in an airport; exhibiting a modicum of sportsmanship in how you treat your opponent. The societal structure level involves demands placed by national and international societies of chess players with a view to competing or being ranked. Among relevant societal requirements in some countries is the widely perceived need for having some extra-curricular activities as a young person, or activities to complement a work life; finally, in many societies, requirements are placed on societies and clubs in so far as they are supported by a state. Context-dependency at this level is therefore also substantial. The cultural context of chess places the game in wider considerations of value and propriety and is also highly context-dependent. What is the value of competing and winning? What is the point of playing chess, and is it seen as particularly suited for certain classes or kinds of people (children learning patience, say, or nobility being trained in strategic modes of thought)? Is it a sport, itself largely a cultural construction, and consequently, might something transfer to other sports with similar requirements of attitude? It is an empirical question to which extent requirement characteristics at the societal structure level and the cultural context level interact with the requirement characteristics at the other levels to form specific knowledge demands on the chess player in any given situation. It is therefore also an empirical question precisely how compositional a chess player’s knowledge is. The idea of interacting with a computer has been shown to vary substantially between e.g. Western and Japanese cultures. Japanese chess players might draw on the indigenous Shinto religion when interacting with a robot, which has been suggested to influence their different attitudes to the integration of robots in society (Ito, 2018; Metzler & Lewis, 2008) and, consequently, playing chess with a computer.

2.2. Book reading

Our second example of an analysis that balances context-dependency and compositionality concerns book reading. On the face of it, book-reading might be expected to be more context-dependent than playing chess. Reading a book is an activity, the domain of which is the content of the book. The “content of the book” comprises both what the book is about (its subject) and the style in which it is written, as well as its material manifestation in print, digital media, podcast,
audio book etc. Reading may take place in many life settings, e.g. a first language class, homework preparation, leisure enjoyment at home, pastime whilst travelling, information seeking concerning another subject (for school or for leisure) to mention just a few. In the following, we shall analyse requirement characteristics in two life settings. One is leisure at home for which we provide a phenomenological analysis. The other is group reading in a primary school. We have chosen this life setting despite its focus on young learners which sets it apart from the book’s main concern with adults’ transfer. The reason for this is the availability of a detailed ethnographic study, namely Nolen’s longitudinal investigation of the development of reading motivation in two different schools, from Grades 1 to 3 (Nolen, 2007). Because of its richness in reported contextual detail, the study allows us to identify requirement characteristics at the different context levels and to compare them with the phenomenologically identified requirement characteristics of leisure reading. There are no similar studies for adults.

Starting at the most general level (rather than at the most concrete level, as was the case in the chess example), requirement characteristics at the cultural practices level are the same for both cases, given that they take place within the same culture (differences may exist between cultures as concerns the concept of leisure). Characteristics center around – indeed both cases are expressions of – the fact that writing, dissemination of writing, and reading exist as cultural practices which it is deemed significant to be able to partake in. At the societal structure level, they differ: classroom reading is structured by the schooling system which in America (where Nolen’s research was conducted) sets state standards for reading at different grade levels, with accompanying evaluation methods (including specific tests) to assess whether students meet the standards. This provides an overall framing to teaching reading in class, specifically in the form that students must develop reading skills corresponding to the standards. Leisure reading is not directly affected by these requirement characteristics (though there may be an indirect influence on student reading motivation, in particular if reading at home every day is a homework requirement from school). Leisure reading is more directly influenced by the societal structuring of time into working/schooling time and leisure time. This will frame expectations for leisure reading: it should be spent ‘well’, providing the right ‘balance to work/school time’, e.g. be relaxing, exciting, interest-driven, or devoted to personal development etc.

Significant for the life setting of the classroom reading in Nolen’s study is the teachers’ commitment (at both schools) to “developing a love of reading and writing” (Nolen, 2007, p. 219) as an important literacy goal for their students. This commitment quite generally delimits the content and activities which the children get to engage with, e.g. by modifying lessons to fit and capitalize on students’ domain-interests (the film Titanic, a funny story about animals in underwear etc.). Group reading in the one school was performed in shifting pairs, with lower-skilled students sometimes reading with students from the class below (Class 1). Students had been taught coaching strategies to help prevent them from over-helping (by, for instance, saying the word which another student was struggling to read). In the other school, the pair-reading with younger students was not a possibility (Class 2). In addition, in the beginning of the year, the teacher required students to finish group-reading before recess. Features such as these acted together in each setting to form
(differing) requirement characteristics at the life setting level concerning speed of reading, interest in reading, as well as expectations of relating texts to other interests. In contrast, at this level, requirement characteristics for leisure reading afford openness and choice on the part of the reader – “you do it for fun” – within the overall framing of leisure time reading as a valued thing to do stemming from the cultural practice and societal structure levels. This overall framing may, of course, itself be experienced as an obligation.

At the activity level, requirement characteristics for group reading in class will concern learning objectives such as: at first, putting letters together correctly to “sound out words” (Nolen, 2007, p. 242) – with the help of teacher and peers; later on, performance of literary analysis and interpretation in dialogue with other students and the teacher; and using specific reading strategies (Afflerbach, Pearson, & Paris, 2008) to facilitate analysis and interpretation. These requirement characteristics will, further, be intermingled with expectations concerning group interaction patterns, e.g. of “giving the word” (or not), letting all children have a chance to read (but in practice perhaps neglecting the slower readers (Nolen, 2007, p. 247)). Over time, other requirements arise from the fact that students will develop understandings of being skilled or not-skilled in reading and attitudes towards slow/fast readers, as well as perceptions of themselves in comparison to others - “ego concerns” (cf. Nolen, 2007, p. 243ff). This will lead to further restrictions and possibilities in their group reading sessions, in terms of who gets to read for how long. In comparison, requirement characteristics of leisure reading will also concern putting letters together to make sense; in this case without help (if family members are not available), but also without a definite commitment to get the correct words. Likewise, it is up to the reader to decide how much literary analysis and interpretation to perform (if any) and whether to engage in ‘dialogue with the text’ (Bakhtin, 1981) – or to simply sound out the words for the fun of it.

At the domain level, requirement characteristics in both types of settings concern understanding and acknowledging intra-textual features as well as managing the material manifestation of the text. Examples of intra-textual features are coherence and consistency of the text along with style and genre conventions and restrictions. Requirement characteristics at this level may vary between the settings, even for the same text: The textbook genre and style will for instance typically be expected and acceptable in class but may be found tedious in leisure reading. Conversely, students may find a fiction genre unengaging in class, but interesting in leisure reading, given less time pressure and less social negotiation of genre tastes.

This analysis shows that it is possible – and clarifying – to analytically distinguish requirement characteristics at the different levels in what on the face of it may seem highly situated phenomena. Furthermore, it demonstrates that the knowledge involved in reading is not the same in the classroom setting and the leisure reading setting, but also that there may be elements of the knowledge that are present in both settings. Thus, it illustrates how context-dependency and compositionality balance in this the outset which the context framework offers for analyses of transfer, transformation and resituation of knowledge (cf. Chapter 3). In particular, it opens for
empirical investigation of how specific readers’ reading knowledge transfers and transforms between the settings, in response to the changed unity of requirement characteristics.

As indicated, our aim in this chapter is to argue for the possibility of – and need for – balancing context-dependency and compositionality in our understanding of knowledge. In this and the following section, we take a step back to develop the philosophical underpinnings of the idea of attaining such a balance. This section provides a brief history of views on context-dependency, and looks at how more specific understandings of context appears to have been imported from other fields into educational research. Our initial inspiration from Bateson is an example of a long trend in educational research of understanding the concept of context through the discipline of philosophy of language. Both context-dependency and compositionality have been investigated thoroughly within these disciplines. In the next section, we explore the comparison between these disciplines and educational research further.

Different scientific practices and modes of explanation take quite different views of context-dependency. In some sciences, mention of context will suggest something that can unduly influence the object of study or the instruments used in studying it. A study of the effect of economic incentives on investment behaviour can differ in terms of the object of study, when the study is carried out in a Lutheran or Roman Catholic cultural environment. Both these contexts might influence the behaviour of those human beings that are studied and will likely influence data that might otherwise support one idealized, theoretical model of economic behaviour. Other scientific practices fundamentally question this view of context. This is perhaps most clearly expressed in the battle cry associated with anthropological method, “Context is everything!”, combined with the insistence that knowledge is always shaped locally (cf. Geertz, 1983; Roberge, 2016). In whatever way this methodological insistence is actualized in scientific practice, it suggests a generalized suspicion towards ignoring aspects of the environment of the researcher. Not just because one might miss factors that influence the object of study. More fundamentally, the suspicion concerns working with idealized theories and research agendas that display great confidence ahead of investigation in how to distinguish the object of study from its contextual surroundings.

Theoretical approaches to learning that emphasize situativity have been deeply influenced by anthropological methods. This is seen in the frequent appeals to context which emphasize the need for more contextual material (vaguely gestured at by use of the word “culture”) to be taken into account. Alternatively, the suggestion is made that previous theorists have misunderstood the relation between the focal object of study (the object, event etc. which the context is context for, cf. Dohn, Hansen, & Klausen, 2018), and its context (cf Bereiter, 1995; Van den Sanden, J. & Teurlings, 2003).

Approaches to learning that emphasize context have also been significantly inspired by the philosophy of language. One very influential example is found in the work of Brown, Collins & Duguid. They used the context-dependency of indexicals – such as “there” and “I” – to convey what
is meant by situativity in situated learning:

Indexicals are not merely context-sensitive; they are completely context-dependent... surprisingly, all words can be seen as at least partially indexical. All knowledge is, we believe, like language. Its constituent parts index the world and so are inextricably a product of the activity and situations in which they are produced (Brown, Collins & Duguid, 1989, p. 33).

Lave also relied on themes in philosophy of language in arguing for context-dependency of learning. More specifically, she questioned the idea that words in isolation have a literal meaning and pointed out that the specific meaning, which a word takes, is determined by context. Finally, Packer has used the later Wittgenstein’s notion of a language game to argue for context-dependence of learning and to question the concept of transfer (Packer, 2001).

These are only a few examples of the way philosophy of language has been imported into educational research in the service of understanding the concept of context. The positions are problematic when viewed as positions in the philosophy of language. Consider the exposition of indexicals: Brown et al. claim that the functioning of indexicals is “completely context-dependent” and that their existence is “a product of the activity and situations” where they are used. This suggests a view where the language user constantly makes up language in accordance with the context of the activity in which she finds herself. Brief reflection on the actual use of indexicals suggests a different picture: when using “I”, or “there”, I rely on words whose function is uniform across a range of very different contexts of use. When someone uses “I”, it picks out the same individual across written and social activities and contexts. When someone uses “there”, perhaps together with an act of pointing, the effect is, with great regularity, to direct attention of those in the vicinity to relevant states of affairs. The term “there” has been called a pure indexical (Kaplan, 1989) on account of the need for some act of ostension on behalf of the speaker in order to successfully refer to something. A similar act of ostension is not needed with the term “I” and for this reason it is not a pure indexical. For pure indexicals, aspects of the context are often involved in determining what is referred to, e.g. what the utterer is doing and/or where the utterer is. This is probably what have led educational researchers to explain context-dependency by comparing with indexicals. However, the comparison fully neglects the very predictable functioning that indexical expression has. A functioning which is readily mastered by children at an early age.

4. Balancing context-dependency and compositionality

As indicated, educational researchers have argued for context-dependency of knowledge and learning, utilizing points from philosophy of language. However, this is a rather one-sided use of philosophy of language, as other analyses from this discipline emphasize the compositionality of language. A view of knowledge drawing less one-sidedly on insights from philosophy of language will point, as we do, to the need for balancing context-dependency and compositionality. In this section, we indicate how this could be done.

The emphasis on context has been central in much 20th century thought about language and can be
traced back at least to Gottlob Frege’s treatment of language and logic. Frege (1884) had it as one of his three fundamental principles “never to ask for the meaning of a word in isolation, but only in the context of a proposition” (Frege, 1884/1968, p. X). The principle, called the “context-principle”, surfaced in different versions in the writings of Wittgenstein. In some of his late writings, we have a very general version: “Words have meaning only in the stream of life” (Wittgenstein, 1980, p. 687) and “we don’t start from certain words, but from certain occasions or activities” (Wittgenstein, 1982, p. 30). These remarks suggest an emphasis on both a practical setting and an everchanging, widely encompassing, cultural context. Notably, they are fully in line with the educational researchers’ use of philosophy of language discussed in the last section.

What is neglected in this use, however, is that Wittgenstein’s later writings were part of a movement away from considerations of compositionality in language. Compositionality was also regularly discussed by Frege and has actually been referred to as “his” principle (Janssen, 2001). One of Frege’s key contributions has been the comparison of a piece of language with a mathematical function. A mathematical function is a paradigmatic example of compositionality because it is an independent symbol that can be combined and completed in different ways. Frege’s comparison articulates the idea that the meaning of a complex expression – such as a sentence – is a function of the meaning of its parts and the syntactic rules according to which they are combined. Early Wittgenstein’s work (1922) also argued for an understanding of language where complex statements are shown to be the result of operations on simpler ones. This position is known as logical atomism. The principle of compositionality can be argued for by referring to the experience of composing sentences out of well-known things (words). The words seem akin to building blocks that we use to compose something novel, that in spite of its novelty has very predictable features: we immediately understand the meaning of any new, well-formed sentence. In other words, there are explanatory strengths of subscribing to the principle of compositionality: it offers the beginnings of a plausible account of how it is that humans can construct and immediately understand a vast range of sentences.

Whether the principle of compositionality can be upheld for all linguistic phenomena is a standing discussion. For example, some have thought that words sometimes have a particular metaphorical meaning. Davidson (1978) effectively dismantled this idea by pointing out that we lack a credible account of how we make and understand metaphors from words with a known meaning. Subsequent theories in philosophy of language have tended to accept Davidson’s argument. Others, amongst them cognitive linguists such as Lakoff (Lakoff, 1990; Lakoff & Johnson, 1980), have developed other views on metaphors which focus more on context-dependence and less on compositionality.

We would like to emphasize that it requires careful analysis to use insights from philosophy of language to make points about knowledge and learning. But in studies of language, we do have clear models of how something complex can be constructed out of something simpler. The comparison with the functioning of language can therefore be a rich source of theory construction, in particular for studies of learning and knowledge transfer that focus on cognitive aspects (cf Chapter 3, the cognitivist approach, and Chapter 12 on learning computational literacy).
A few final points should be made: first, compositionality can also be stressed directly within theories of learning, not only through pointing to philosophy of language. It has been suggested that compositionality is a central aspect of models (Woody, 1995). Models, in turn, feature centrally in the cognitivist approach to understanding learning and transfer (Seel, 2017, cf. also Chapter 3). Identifying the models that on different occasions are utilized by learners could exactly mean identifying things that remain identical across contexts (a case of this is discussed in chapter 7). Second, educational scientists, like any other scientists, should consider the possible explanatory strengths of both appeals to context-dependency and to compositionality. Approaches that emphasize situativity of learning have displayed a tendency to ignore the latter (Greiffenhagen & Sharrock, 2008; Reed, 2012). If a scientist can explain a phenomenon with fewer conceptual resources by relying on principles of compositionality and elements that are identical across contexts, then that would seem the best thing to do, scientifically speaking (Baker, 2016).

5. Concluding remarks
The focus of this chapter has been a development of the notion of context-dependence. The aim has been, on the one hand, to qualify the general claim inherent in previous chapters, i.e. that context can play a significant role in determining knowledge. We have argued that the degree to which knowledge is context-dependent is itself context-dependent and that, conversely, context-dependency is in each instance balanced by some degree of compositionality of knowledge. We have thus offered a balanced philosophical background on which to understand the book’s empirical chapters on situated knowledge and its transfer, transformation and resituation to other contexts. Further, we have articulated a framework for analysing context-dependency and compositionality (and how they balance) which will allow balanced analyses to be undertaken in subsequent chapters.

By way of concluding, we wish to point out that educational scientists have recently looked farther afield for inspiration than philosophy of language to understand the interplay between context-dependence and compositionality. In discussion of context, Sawyer & Greeno (2008) suggest that the issues involved in the “…situative approach are analogous to… debates within the philosophy of mind” (2008, p. 356). Jacobson, Kapur & Reimann (2016) have suggested that complex systems theory should serve as a meta-theory of learning. They briefly point to the nature of networks and to how complex systems have informed descriptions of various natural phenomena involving individual and collective behavior. Their examples include storms, foraging ants and flocking birds. They then map this approach onto examples of learning. This complexity theory approach emphasizes emergence, which is more rarely appealed to in studies of language. It would be premature to judge which scientific ideas will ultimately be fruitful when imported into educational science. However, before a cross-fertilization with other fields is attempted, we believe it is fundamental to attempt to analyse context-dependency and compositionality from within educational research itself. Our framework of context levels is an attempt to do just that.
References


