

New Learning and the Classification of Learning Environments in Secondary Education

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This article presents a new classification scheme for learning environments in secondary education, based on a review of recent literature on new learning and a review of existing classification schemes. This new classification scheme emphasizes new forms of learning and is organized around three main aspects of learning environments that may be assumed to influence such learning: (a) learning goals, (b) the division of teacher and learner roles, and (c) the roles of the learners in relation to each other. It is then argued that teachers might use this classification scheme to design and evaluate their own learning environments. In addition, the scheme provides a clear framework for a next generation of process–product research.

KEYWORDS: classification, constructivism, educational objectives, learning environments, secondary education, teacher and learner roles.

Dutch secondary education faces large-scale changes aimed at the creation of learning environments intended to stimulate new forms of learning, based on the idea that learning is a social-interactive, contextual, constructive, self-regulated, and reflective process (Simons, 2000). The stimulation of these new forms of learning can be seen as a demand of modern society, and they are propagated for a variety of reasons (Bolhuis, 2003). First, there is an economic argument: The capacity for self-directed learning is needed because knowledge creation has become very important in Dutch society, in which knowledge productivity is at the core of economic development. A second argument is that Dutch society is part of a global village in which there is continually a “confrontation with other truths” (p. 328); individuals are called upon to deal with such confrontations. A third argument stresses that the stimulation of self-directed learning supports the development of a democratic society, in which all citizens have equal possibilities to function well. And fourth, there is an important internal educational argument, which stresses that students in Dutch secondary education have to be better prepared to function in higher education, which requires the development of competencies for self-directed learning. These four arguments form the main motor for the large-scale educational changes that are faced by Dutch secondary education.

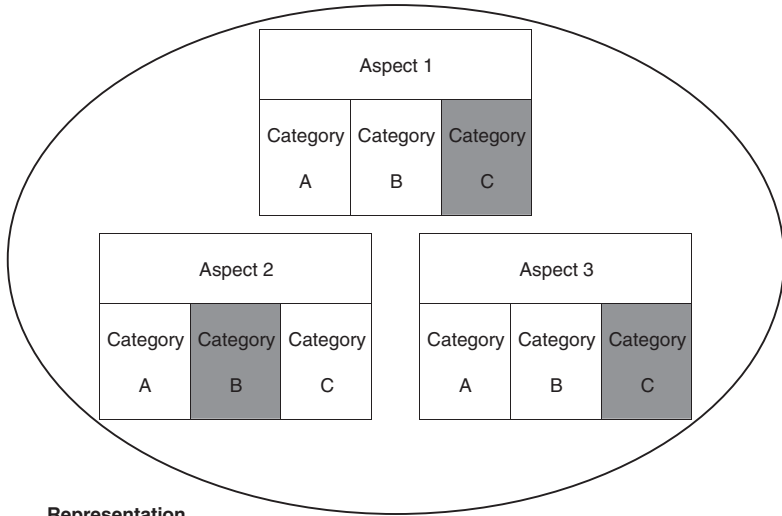
These changes are also inspired by new psychological and educational insights that stress a shift from learning environments based on a knowledge-transmission model toward learning environments based on a knowledge-construction model (Lowyck & Ellen, 1993). A concomitant shift in learning goals is also occurring. In addition to learning products (i.e., knowledge and skills), the functions of learning or “learning to learn” are coming to be valued as learning goals. This means that teachers in secondary schools must be not simply knowledge providers but also guides to the learning process. Students, moreover, must become more active and more independent learners. Finally, the new forms of learning call for an increase in cooperative learning and thus require students to learn new roles in relation to each other.

Learning goals, the division of teacher and learner roles, and the roles of learners in relation to each other are three aspects of the learning environment that clearly may influence the performance of students and stimulate new forms of learning. The purpose of this study was to use the Dutch case to take a first step toward a new classification scheme in which learning environments may be classified into a limited number of types. Our review integrates the literature on “new learning” with the literature about classification schemes directed at one or more of the three basic features just mentioned. Both traditional and modern learning environments are included in this review.

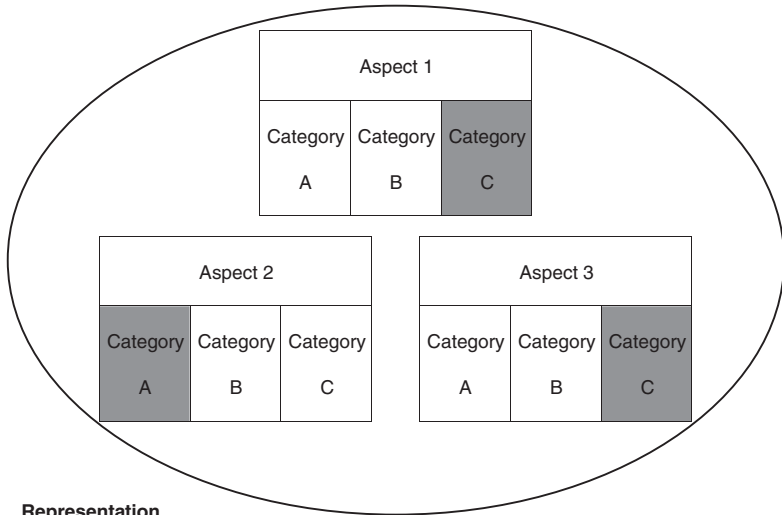
A classification scheme for learning environments is a descriptive scheme of types that covers existing and theoretically possible learning environments in schools (De Corte, Geerligs, Lagerweij, Peters, & Vandenberghe, 1981; Elshout-Mohr, Van Hout-Wolters, & Broekkamp, 1999). Over the past five decades, several classification systems have been constructed to characterize the learning environments of students. Most of them are based on just one aspect of the learning situation, namely the learning goals (e.g., see Bloom, 1956; Joyce & Weil, 1996). Understandably, these classification systems do not cover all of the learning goals targeted in modern learning environments, and additional aspects must be included in an adequate description. For example, we must describe the changing roles of teachers and learners if we are to characterize modern learning environments adequately and determine whether new forms of learning are being fostered. Similarly, we must explicitly connect learning goals with other aspects of the learning environment, including the roles of both teachers and learners (very few classification schemes make that connection).

In our terminology, a given *type* of learning environment has various *aspects*, which in turn contain various subsets or *categories*. Figure 1 shows schematic representations of two hypothetical types of learning environments (Representation A and Representation B), each type having three aspects and each aspect having three categories. To give concrete examples, two aspects of a learning environment are learning goals and learning materials (Joyce & Weil, 1996). Within the aspect of learning goals, a distinction may be made between learning-products goals (goals for the acquisition of content knowledge) and learning-process goals (goals for the acquisition of metacognitive learning functions). In this example, *content knowledge* and *learning functions* are considered to be categories of the aspect *learning goals*.

Teachers may arrange a learning environment in which they focus on the acquisition of content knowledge; they may, however, also choose to strive in particular to teach adequate metacognitive learning functions. For both Representation A and Representation B in Figure 1, the same three aspects of learning environments are shown—Aspects 1, 2, and 3. For each aspect, a teacher may select a particular cate-



**Representation
A**



**Representation
B**

FIGURE 1. Schematic representations of hypothetical types of learning environments.

category to concentrate on. The two representations in Figure 1 differ from each other only with respect to the category selection in Aspect 2. In Representation A, the teacher chooses to work on Category B of Aspect 2; in Representation B the teacher chooses to work on Category A of Aspect 2. Learning environments are grouped into one type if they share categories under the aspects specified as defining that type. For example, in Figure 1, Representations A and B belong to the same type of

learning environment if that type is defined by choices with respect to Aspects 1 and 3. If, however, a type is defined by choices with respect to Aspects 1 and 2, then the two representations belong to different types of learning environments.

Thus a learning environment can be described by identifying which category is met for each aspect. Classification schemes of learning environments may be based on one aspect or a combination of two or more aspects. The most relevant aspects of learning environments found in the literature include (a) the physical context in which learning and instruction occur; (b) the division of roles between teacher and learner; (c) the roles of learners in relation to each other; (d) learning goals; (e) the teacher's method of instruction; (f) the tasks to be performed by the students; and (g) the materials used and the roles they play (Anderson, 1989; Joyce & Weil, 1996; Reigeluth, 1983; Lowyck, 1995). In this article, we discuss the literature on new learning to establish which of the aspects listed here are the salient ones for stimulating new forms of learning. We then review the classification schemes on the basis of those aspects and construct a new classification scheme of learning environments.

In our terminology the concept of *learning environment* is restricted to school settings. It refers to all aspects in the school environment of the learner that influence the achievement of learning goals within a specific content or subject area (e.g., Boekaerts & Simons, 1995). We use the term *content* to refer to both information (e.g., a text, a video, or a lecture) and activities (e.g., writing an essay). In educational practice, the content or subject area is often used to distinguish different learning environments. For example, students in a history learning environment may read about World War II in a textbook and search for additional information in the library to learn more about the causes of the war. At the end of a period of study, they may have to make a presentation on the topic and thus apply their oral language skills. When a student deals with certain content in relation to another set of learning goals, his or her learning is said to occur in another learning environment. This means that the student reading a text on World War II as part of his English lessons is learning about it in another learning environment. Although the content is comparable (i.e., reading on World War II), the learning goals are very different (i.e., learning the causes of such a war as opposed to learning English reading skills). It is also possible for two situations with the same learning goals to constitute very different learning environments. For example, working on a German book presentation in a German-language class is very different from working on a presentation of the causes of the World War II based on the same book for a history class. Although the learning goals are fairly similar (i.e., adequate use of presentation skills), the content is very different. These two situations thus constitute different learning environments. Given our interest in the development of a general framework for the description and analysis of all kinds of secondary-education learning environments with respect to learning goals, the division of teacher and learner roles, and the roles of students in relation to each other, the focus here will nevertheless not be content specific.

As will be seen, the classification scheme for learning environments developed here provides a framework for future process-product research. A next generation of process-product research should examine the effects of multiple aspects of the learning environment on learning outcomes (Shuell, 1996). The classification scheme presented here should provide information on the most salient aspects of learning environments. Whereas process-product research has been primarily concerned with the effects of teacher behavior on the cognitive learning outcomes of students, a next generation of research should consider various metacognitive and

motivational outcomes as well (e.g., Jonassen & Grabowski, 1993). The new classification scheme should further help teachers to analyze their own practices and the current practices in their schools. More specifically, teachers may be helped to become more aware of the types of learning environments that predominate in their schools and to see whether those environments are in line with the characteristics of effective modern learning environments. Our classification scheme may also be used as a tool for the design of new secondary-education learning environments.

In the next section, we will review the literature on new learning. We will then consider already-existing classification systems in light of that literature and discuss the three salient aspects used to classify learning environments.

New Learning

The term *new learning* generally is “used to refer to the new learning outcomes, new kinds of learning processes, and new instructional methods both wanted by society and currently stressed in psychological and educational theory” (Simons, Van der Linden, & Duffy, 2000, p. vii). Although the societal desire for such learning is important, the focus of the present article is new learning from the psychological and educational points of view. From that perspective, the concept of new learning is based on three critical principles with regard to learning (see Jonassen & Land, 2000; Kanselaar, De Jong, Andriessen, & Goodyear, 2000; Perkins, 1992; Simons et al., 2000): (a) Learning is a constructive activity; (b) learning is a situated activity; and (c) learning is a social activity.

We will discuss these principles in detail, but first an aside on their “new” character. To what extent *are* they new, particularly in comparison with the core elements of progressive pedagogies? Learning as a constructive, situated, and social activity was reflected in the ideas of John Dewey at the beginning of the 20th century, for example. He stressed that education should provide students with opportunities to work in realistic, situated activities in which they could experiment and solve problems. In his view, the school should be a community in which students work together. Dewey’s colleague George Herbert Mead also stressed the importance of problem solving in situated activities and pleaded for an apprenticeship model of instruction and learning (see Mead, 1908). Barnes (2002) links Mead’s ideas to the current concept of *learning to learn*. In this article we will argue that the main ideas of contemporary constructivism in the context of education have already been elaborated in the social-learning and situated-learning perspectives—which were present in the work of Dewey and Mead. The similarities may be attributed to the fact that at the turn of the 20th century and again at the turn of the 21st century, major social and cultural changes have taken place in Western society. At the turn of the 20th century, major changes were connected with the process of industrialization and urbanization; at the turn of the 21st century, changes are connected with the process of globalization. Both industrialization and globalization have raised questions about how to arrange education, teaching, and learning to make young and developing members of society capable of dealing with the changing environment in which they live and work.

Nevertheless, Windschitl (2002) argues that, although the main elements of constructivism are the same as those found in progressive pedagogies, contemporary constructivism and the general character of schools today form a context for teaching that is unique and quite different, for example, from the context at the beginning of the 20th century. Windschitl’s first argument is that the research base of con-

structivism has grown significantly in the last three decades, offering more insights into the processes of teaching and learning. His second argument refers to conditions in schools and society that have changed dramatically, in particular the presence of information and communication technology (ICT), which affords numerous possibilities for information processing, stimulating learning processes, and communication, all of which are important conditions for new learning. Finally, in his third argument, Windschitl points to the particular social and economic background of present-day education, outlined at the start of our article. Thus we are not presenting a fundamentally new idea about learning in comparison with progressive pedagogies. Rather, we connect new learning with recent literature on constructivism, situated learning, and social learning. We also stress the importance of new learning in the context of contemporary education.

Learning Is a Constructive Activity

Whether “constructivism” is a theory or a philosophy is not at all clear (Lebow, 1993). Constructivism “has multiple roots in the psychology and philosophy of this century” (Driscoll, 2000, p. 375), and these roots are within the context of education mainly represented by the situated-learning and social-learning perspectives elaborated in the next subsections (see Land & Hannafin, 2000). Constructivism views learning as more than merely the reception or transmission of information; it is seen primarily as the active and personal construction of knowledge (see De Jong, 1995). The principle that learning is a constructive activity is based on the idea that everyday learning occurs during problem solving and working. Everyday learning has little to do with the transmission of knowledge, which is central to traditional school learning, and more to do with an active and personal construction of knowledge and skills and the development of competencies. Most constructivists therefore argue that the most important goals of learning in the school context are problem-solving, reasoning, and critical-thinking skills—the active and reflective use of knowledge, and self-regulation skills (e.g., De Jong, 1995; Driscoll, 2000). From such a perspective, moreover, the learning process itself is the most important learning goal and educational objective (Land & Hannafin, 2000; Simons et al., 2000).

The important conditions for learning based on constructivist assumptions are, according to Driscoll (2000, pp. 382–383), occurrence in complex, realistic, and relevant environments; provisions for social negotiation; support for multiple perspectives and multiple modes of representation; encouragement of student ownership in the learning process; and nurturing of self-awareness with respect to the knowledge construction process. The principle that learning is a constructive activity has implications, first and foremost, for the goals of learning, which, in constructivist theory, all have in common that they pertain to so-called learning to learn, or the process of learning constituted as a goal in itself. In this connection, Simons (2000) argues that the learning process revolves around the execution of three general learning functions: *cognitive*, *affective*, and *metacognitive*. Within each of the general functions, a distinction may be made among the more specific functions that constitute it: the *preparatory*, *executive*, and *closing* functions. For a more detailed view of Simons’s scheme, consider the following examples (pp. 158–159):

- *Types of cognitive learning functions.* Cognitive preparatory learning functions are, for example, “finding the missing prior knowledge” or “finding connections between prior knowledge and new information and skills.” An example

of a cognitive executive learning function is “practicing and applying.” Examples of cognitive closing learning functions are “summing up new knowledge and skills” or “thinking about future use and transfer categories.”

- *Types of affective learning functions.* Affective preparatory learning functions are, for instance, “finding challenges” or “coupling intentions and plans.” An example of an affective executive learning function is “upholding motivation and self-confidence.” Examples of affective closing learning functions are “rewarding” or “attribution of outcomes.”
- *Types of metacognitive learning functions.* Examples of metacognitive preparatory learning functions are “orientation toward learning goals” and “planning of time, sequence, and places for learning.” An example of an executive metacognitive learning function is “diagnosing causes of failures and problems,” and, finally, an example of a metacognitive closing learning function is “evaluating learning process and outcomes.”

The various learning functions concern the integrated use of a specific set of knowledge and learning skills. Whereas the specific knowledge and learning skills concern the product of learning, the execution of the learning functions refers to the process of learning. Learning environments that stimulate new forms of learning thus foster the execution of the various learning functions, as learning to learn is the central goal in such learning environments.

Learning Is a Situated Activity

The second principle stresses that knowing cannot be separated from doing, because otherwise knowledge would become decontextualized (Driscoll, 2000). Human thought is adapted to the environment (Clancey, 1997). “What people perceive, think, and do develops in a fundamentally social context” (Driscoll, pp. 155–156). The goals of learning, when construed as a situated activity, generally pertain to the process of “meaning making” or understanding particular concepts and skills through their use. Situated learning is best depicted in so-called “practice fields” or areas of study in which learners are required to practice the types of activities that they will need to engage in outside school, as well as those that are typically required in school (Barab & Duffy, 2000). The instructional design principles used in such practice fields include coaching and the modeling of thinking skills, and domain-related practices (pp. 31–33). Such domain-related practices are also central to the situated learning theory of Lave and Wenger (1991), who assume that “the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community” (p. 29).

The principle that learning is a situated activity has implications, first and foremost, for the division of roles between teachers and learners. In a traditional setting, the teacher regulates the learning process and the learner simply carries out instructions. Learning under such circumstances does not involve a practice field and is therefore decontextualized. Learners are not able to learn independently because of the lack of relevant context in which they can rely on their own learning practices. Learners are, therefore, to a great extent dependent on the instructions of the teacher. Such traditional settings are in contrast with modern learning environments, where the learning process tends to be more highly situated and where learners rely on their own learning practices to a greater extent and on their domain-related use of the relevant con-

cepts and skills. Responsibility for the learning process is shifted, step by step, from the teacher to the learner. Process-oriented instruction is based on such a model of teaching and learning (Simons et al., 2000; Vermunt, 1994, 1995). That is, the role of the teacher is to model processes and skills; to monitor student learning, thinking, and regulation of activities; to provide metacognitive guidance; and to stimulate students to reflect on their own learning (Simons et al., 2000). The role of the learner is one of self-regulation. This means that the external control over the learning process encountered in most traditional settings is replaced by internal control over the learning process, exercised by the learners themselves. For further discussion of process-oriented instruction, see Volet (1995) and Bolhuis and Voeten (2001).

The principle that learning is a situated activity has also clear implications for the goals of learning, in that the emphasis of such learning is on the actual use of the knowledge in question. The desired learning goals are also assumed to be more “durable, flexible, functional, meaningful, generalizable and application-oriented” (Simons et al., 2000, p. 1). In other words, greater emphasis on learning as a situated activity also promotes greater transferability of the outcomes of the learning.

Learning Is a Social Activity

The third principle is that learning is a social process. It implies that knowledge is a social construct created by a group of learners or a community (Van der Linden, Erkens, Schmidt, & Renshaw, 2000). Together, the principles that learning is a situated activity and that it is a social activity highlight the importance of the social context or “community.” The view of learning as a situated activity emphasizes the *actual use of the relevant knowledge or skills* within a specific context, and the view learning as a social activity emphasizes the *participation* of members in a community. Participation in a community requires interaction between members of the community, and, therefore, considerable attention is paid to the learning of social skills such as helping someone or negotiating, and it is assumed that such skills are needed to construct knowledge. That is, learners must work together to achieve shared learning goals.

The idea that learning is a social process is based on the work of the developmental psychologists Piaget (who represents the social-constructivist approach) and Vygotsky (who represents the sociocultural approach). In the social-constructivist approach, it is argued that learning is an individual process but nevertheless is influenced by participation in social activities. In the sociocultural approach, learning is viewed as socially situated and therefore is considered a social process (Roelofs, Van der Linden, & Erkens, 1999). Similarly, most social theories of learning construe learning as a largely social process; for example, Wenger’s (1998) theory involving communities of practice construes learning as a form of social participation.

The principle that learning is a social activity has implications, first and foremost, for the roles of learners in relation to each other. That is, in modern learning environments, learning is not approached merely as an individual activity but also as an activity that clearly calls for cooperation between learners. Johnson and Johnson (1999) described the roles that learners may play in relation to each other in three different kinds of learning settings: competitive, individual, and cooperative. In a competitive situation, a person’s learning clearly is beneficial to himself and not to his peers; learners actually compete with each other. In an individual learning situation, people’s learning clearly is beneficial to themselves alone and has no connection

with the learning of others; learners have single, individual roles. In a cooperative learning environment, each person's learning in one way or another benefits every member of the group; the learners cooperate as peers. In traditional learning environments, the learners have mostly individual and sometimes competitive roles. In modern learning environments, cooperative roles for the learners are emphasized.

In modern learning environments, learners may also have individual roles, but competitive roles are avoided. Learning in a competitive manner simply does not fit with the principle that learning is a social activity. This does not mean that there cannot be any competition in learning situations. Johnson and Johnson (1999) argue that intergroup competition in combination with intragroup cooperation, for example, can be very effective; but they stress, at the same time, that "the importance of spreading an umbrella of cooperation over the class before competition is initiated cannot be overemphasized" (p. 148). Therefore, for modern learning environments, cooperative learner roles are important because cooperation typically promotes the joint construction and sharing of knowledge, whereas competition without the so-called "umbrella of cooperation" could block their occurrence.

An instructional approach that reflects a social-learning perspective and, indeed, treats learners as cooperating peers is referred to as *cooperative learning*. Cooperative learning is based on the assumption that learning is a social activity. It refers to a variety of instructional strategies that stimulate students to work together in small groups and is therefore particularly well suited for the promotion of new forms of learning. While working on a joint or group task, students must depend on each other to achieve both common and personal goals (Abrami, Chambers, Poulsen, & Wade, 1995; Johnson & Johnson, 1989). The basic principles underlying the instructional strategies that cooperative learning calls for are (a) structuring positive interdependence; (b) structuring individual accountability; (c) stimulating direct interaction; (d) striving for the development of social and communicative skills; and (e) evaluation of the group product and learning process (Johnson & Johnson, 1999; Kagan & Kagan, 1992). The fourth principle highlights the importance of social learning skills. This particular type of learning goal is needed because social learning skills—for example, listening and explaining things to others—form the basis for an adequate collaboration among learners.

Of course, it has to be stressed that for cooperative learning to be preferable to individual learning, certain pitfalls, pointed out by research on teamwork and cooperative learning, must be avoided. The most important pitfalls are the "free rider effect," in which the more talented or more highly motivated group member does most of the work of a joint task; the "sucker effect," in which a group member who gets stuck doing all the work decides to decrease his activity to avoid being a "sucker"; and the "status differential effect," in which higher-status members dominate group activity and therefore have more opportunities for learning than lower status members do (Salomon & Globerson, 1989; Veenman, Van Benthum, Bootsma, Van Dieren, & Van der Kemp, 2002).

Important Aspects of Learning Environments From the Perspective of New Learning

From the perspective of new learning, three basic principles of learning may be distinguished and seen to point to three aspects of the learning environment as important from the perspective of new learning. These are the principles that

(a) learning is a constructive activity, which has foremost implications for the learning goals that are set; (b) learning is a situated activity, which has foremost implications for the division of roles between teachers and learners in the learning environment; and (c) learning is a social activity, which has foremost implications for the roles of the learners in relation to each other. In the next section, we take as the basis for our review of classification schemes for learning environments the following three aspects: the learning goals that are set, the division of roles between teachers and learners, and the roles of the learners in relation to each other. Thereafter, a new classification system based on these three aspects will be presented.

Review of Published Classification Schemes of Learning Environments

The following review is based on all published works with a classification of learning environments in terms of at least one of the three aspects considered relevant for the promotion of new learning: (a) learning goals, (b) division of roles between teachers and learners, and (c) the roles of learners in relation to each other.

The literature was initially searched with the following keywords: *classification of learning*, *didactic model*, *learning environment*, *learning model*, *taxonomy of learning*, and *teaching model*. These particular keywords, with an accent on the models, taxonomies, and classifications, were selected because the chances of finding literature containing a classification of one or more aspects of the learning environment were great. The terms for specific aspects of the learning environment (e.g., learning goals, teacher roles) were not selected as keywords for the search, as they were found to produce too many irrelevant hits. In addition, a combination of the term for a particular aspect of the learning environment with, for example, the term “classification” (e.g., classification of learning goals) was not used because it produced hits that were too restricted. We used the following search engines and databases: PsycINFO (1967–July 2001), ERIC (1966–March 2001), and Web of Science (Science Citation Index Expanded, 1988–July 2001; Social Sciences Citation Index, 1988–July 2001).

The list of possibly relevant publications produced by the aforementioned search strategy was next screened on the basis of the information in the abstracts or, when the abstracts did not provide sufficient information, the publications themselves. Many publications were indeed excluded from further review as they did not contain a classification of the learning environment using one or more of the aspects identified as relevant for the possible promotion of new learning. The reference lists accompanying the relevant publications were also screened for any additional publications with possible relevance. During the period in which the literature search was conducted, several of the findings were mentioned on international electronic mailing lists to make sure that no important publications were missed. Some additional publications were indeed suggested, and some of them proved relevant. With respect to the learning goals aspect of the search, the focus was placed on classifications of cognitive and affective learning goals. Classification schemes concerned with only the psychomotor domain of learning were excluded.

The classification scheme of Anderson and Krathwohl (2001), one of the most recent, was published when the present review was already at a very advanced stage. That scheme is a revision of Bloom’s original taxonomy of educational

objectives in the cognitive domain. Anderson and Krathwohl review 19 other revisions of Bloom's taxonomy. Many of those 19 were included in our review and, for those publications not included in our review, Anderson and Krathwohl's discussion was carefully considered and—when necessary—the original publication consulted as well. It could be concluded that those classification schemes that were not included in our review did not provide any additional information; they were therefore not examined further.

In the end, 15 publications were selected for the review process. In the case of classification schemes with more than one published edition, only the latest version was included in the review process. Next, the 15 chosen publications were coded by using the coding sheet that is shown in Figure 2 (adapted from Cooper, 1998). The coding focused on two main questions:

1. Which of the three aspects of the learning environment were addressed by a particular classification scheme (and which categories were further distinguished for each of these aspects)?
2. To what extent were features that are known to promote new learning involved in the classification scheme?

The answers to these two basic questions were then used to construct the new classification scheme for learning environments.

In Table 1, an overview is presented for each publication, including the form in which it was published (e.g., as book, book chapter, or journal article); the other

<p>General</p> <ul style="list-style-type: none">• Reference• Publication form <p>Background</p> <ul style="list-style-type: none">• Are other classification schemes referred to?• If yes, why is a new classification scheme created?• What is the purpose of the classification scheme?• What part of the educational system is the classification scheme aimed at? <p>Content of the classification scheme</p> <ul style="list-style-type: none">• On which literature and studies is the classification scheme based?• On which aspects of the learning environment is the classification scheme based?• Which domain does the classification scheme concern?• A description of the classification scheme (including the categories for each aspect): <p>Further information</p> <ul style="list-style-type: none">• Additional relevant information
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FIGURE 2. *Coding sheet.*

TABLE 1
Characteristics of reviewed publications on classification schemes, by year of publication

Author(s)	Publication form	Classifications referred to	Other studies referred to	Educational context	Aspect(s) of learning environment	Learning domain(s)
Bloom (1956)	Book		Discussions of a group of examiners	(U.S.) education in general	Learning goals	Cognitive
Krathwohl et al. (1956)	Book		Discussions of a group of examiners	(U.S.) education in general	Learning goals	Affective
Menges & McGaghie (1974)	Article	Bloom (1956) Krathwohl et al. (1956) Harlow (1972)		Education in general	Learning goals	Cognitive Affective Psychomotor
De Block (1975)	Book	Bloom (1956) Krathwohl et al. (1956) Simpson (1966)	(De Block, 1973) Discussions with students, teachers and academic staff	Education in general within the context of systematic and intentional learning processes	Learning goals	Cognitive Affective Psychomotor
De Corte et al. (1981)	Book chapter	Bloom (1956) De Block (1975)	Guilford's intelligence model	(Dutch) education in general	Learning goals	Cognitive
Romiszowski (1981, 1984)	Book	Bloom (1956) Gagné (1965/1985)		Education in general within the context of individualized instruction	Learning goals	Cognitive Affective Psychomotor
Merrill (1983)	Book chapter	Bloom (1956) Gagné (1965/1985)	Investigators, especially those involved in programmed instruction, instructional-systems design, and task analysis	Education in general	Learning goals	Cognitive

Carter (1985)	Article	Bloom (1956) Krathwohl et al. (1956) Simpson (1966) Romiszowski (1981, 1984)	(U.K.) higher education	Learning goals	Cognitive Affective Psychomotor
Gagné (1985)	Book	Information-processing theories	Education in general within the context of planned and intentional learning	Learning goals	Cognitive Affective Psychomotor
Barrows (1986)	Article	Some literature on problem-based learning	Medical education within the context of problem-based learning	Division of teacher and learner roles Method and phasing of teacher's instruction	Cognitive Affective Psychomotor
Hertz-Lazarowitz (1992)	Book chapter	Opinions and experiences of teachers	Educational in general	Division of teacher and learner roles Method and phasing of instruction Tasks, activities, instructions Learner's roles in relation to each other	Cognitive Affective Psychomotor

(continued)

TABLE 1 (Continued)

Author(s)	Publication form	Classifications referred to	Other studies referred to	Educational context	Aspect(s) of learning environment	Learning domain(s)
Farnham-Diggory (1994)	Article		Literature reviews Psychologists (Thorndike, Piaget) Authors with a situated cognition perspective (e.g., Collins, Brown, & Newnan, 1989) Literature with a cognitive science perspective Literature with an experimental psychology perspective	Education in general	Learning goals Division of teacher and learner roles	Cognitive
Elshout-Mohr et al. (1999)	Article	Bloom (1956) Merrill (1983) Gagné (1984)	Several psychologists and literature on education (e.g., Ausubel, Van Parreren, Doyle, Reigeluth, Glaser)	(Dutch) secondary education	Learning goals	Cognitive
Anderson & Krathwohl (2001)	Book	Bloom (1956) Romiszowski (1981, 1984) Merrill (1983) Gagné (1985) Bloom (1956) Gagné (1985)	Discussions of a group of examiners	(U.S.) education in general	Learning goals	Cognitive
Marzano (2001)	Book			Education in general	Learning goals	Cognitive Affective

classification schemes and important studies to which it refers; the educational context to which the classification scheme applies (e.g., elementary school, high school, education in general); the aspects of the learning environment on which the classification scheme is based; and the domains of learning addressed by the classification scheme (e.g., cognitive, affective, and/or psychomotor). A brief inspection of the 15 classification schemes presented in the table shows considerable variation with respect to the aspects of the learning environment considered, but most classification schemes were based on learning goals.

The earliest classification scheme referred to is Bloom's taxonomy of educational objectives (Bloom, 1956). Although Smith and Tyler presented a taxonomy of educational objectives in 1942 (see Taba, 1962), Bloom's taxonomy is commonly taken to be the starting point for the literature on educational classification systems. In the same year that Bloom's taxonomy came out, Krathwohl, Bloom, and Masia (1956) published a second taxonomy of educational objectives for the affective domain. These earliest classification schemes (and also those of Gagné and Romiszowski) have in common that they are concerned *only* with the goals of learning. In the 1980s and 1990s, several other classification schemes emerged with attention to more than one aspect of the learning environment. In addition to the goals of learning, the division of roles between teachers and learners, learners' roles in relation to each other, the form of instruction were also taken into account. Recent classification schemes include Elshout-Mohr et al. (1999), Anderson and Krathwohl (2001), and Marzano (2001).

In the following, we will first examine the categorization of the goals of learning within the cognitive and affective domains. Thereafter, we will examine the categorizations of the roles of teachers and learners, and then those concerning the roles that learners may play in relation to each other. Finally, we will undertake a comparison between these categorizations and the three aspects of learning environments most relevant to new learning.

Classification of Learning Goals in the Cognitive Domain

The learning goals in the cognitive domain generally relate to knowledge and learning skills. Knowledge is information stored in memory for later recall. Several authors distinguish kinds of knowledge, such as facts, structures, procedures, concepts, principles, methods, and relations. An important distinction to be made is between declarative knowledge (knowing that) and procedural knowledge (knowing how) (see, e.g., Gagné, 1985).

Learning skills are the mental or intellectual activities by means of which the learner processes information and knowledge. Remembering is thus a learning skill. In addition to remembering, there are the learning skills of comprehending information and applying knowledge. Most authors distinguish such learning skills (often called "procedures") as comprehension, application, analysis, synthesis, and evaluation. Romiszowski (1981, 1984) distinguished reproductive from productive learning skills. Reproductive learning skills involve the imitation or application of certain rules (e.g., writing grammatically). Productive learning skills require a personal contribution and creativity, such as essay writing and problem solving (e.g., Gagné, 1985). Anderson and Krathwohl (2001) included problem solving in their classification scheme but placed it under the term "create" to refer to the formulation

of hypotheses, the invention of a solution method, and the formulation of a plan for the solution of the problem.

Transfer skills refer to the transfer of knowledge and learning skills. Transfer skills involve the application of knowledge and learning skills acquired in the past in a new context and are present only in the classification scheme of Elshout-Mohr et al. (1999). Social learning skills make up a more special type, found only in the classification scheme of Menges and McGaghie (1974), who argued that social learning skills contain not only cognitive, affective, and psychomotor aspects but also an interpersonal aspect: “[I]nterpersonal learning has some characteristics that learning in noninterpersonal settings cannot have” (p. 56).

Elshout-Mohr et al. (1999) mentioned metacognition as an important learning goal in their classification scheme. The recent classification put forth by Anderson and Krathwohl (2001) is the only one that explicitly considers “metacognitive knowledge,” which they refer to as “awareness and knowledge of one’s own cognition” (p. 29). As examples, the authors mention “knowledge of outlining as a means of capturing the structure of a unit of subject matter in a textbook” (p. 29) or “knowledge that critiquing essays [well] is a personal strength, whereas writing essays [poorly] is a personal weakness” (p. 29). In addition, Marzano (2001) distinguishes metacognitive learning skills. Marzano describes four categories of metacognitive processes: (a) goal setting, (b) process monitoring, (c) monitoring clarity, and (d) monitoring accuracy.

Classification of Learning Goals in the Affective Domain

The learning goals in the affective domain generally refer to attitudes and affective learning skills. An attitude is a consistent, stable, and personally motivated reaction to certain phenomena, stimuli, objects, situations, or states of affairs (Krathwohl et al., 1956). Gagné (1985) described an attitude as follows: “A learner acquires mental states that *influence the choices of personal actions*. . . . Such ‘tendencies,’ which are seen as *choices* to the learner rather than as specific performances, are called *attitudes*” (p. 48).

Learning skills in the affective domain are mental or intellectual activities that the learner can apply to both his own attitudes and the attitudes of others. The most important learning skills in the affective domain concern the application of attitudes (De Block, 1975) and the development of value systems (Krathwohl et al., 1956; Romiszowski, 1981, 1984). Developing a value system involves learning objectives that “require the learner to bring together a complex of values, possibly disparate values, and to bring these into an ordered relationship with one another” (Krathwohl et al., 1956, p. 183). Both Krathwohl et al. (1956) and Romiszowski (1981, 1984) addressed the development of values and attitudes, in general, in their classification schemes; De Block (1975) placed greater emphasis on values and attitudes in relation to the learning process.

Marzano (2001) recently described self-system thinking in terms of a specific set of learning goals and argued that the “self-system consists of an interrelated system of attitudes, beliefs, and emotions” (Marzano, 2001, p. 50). Four categories of self-system thinking are described: (a) examining importance, (b) examining efficacy, (c) examining emotional response, and (d) examining motivation. And although Marzano did not explicitly refer to the affective domain of learning, the latter two categories of self-system thinking are clear examples of affective learning skills.

The Division of Teacher and Learner Roles

The various possible roles of the teacher and learner are basic to the classification scheme of Farnham-Diggory (1994), who also distinguished three instructional paradigms based on alternative role distributions for the achievement of learning goals: (a) a behavioral paradigm reflecting a social system in which the expert is high in status and the novice is low in status but expected to acquire more of the expert's expertise; (b) a developmental paradigm reflecting a social system in which the novice learns by developing his or her own personal theories with the support of the expert, who may question, contradict, and challenge those theories; and (c) an apprenticeship paradigm reflecting a social system in which the learner must clearly participate in the expert's world to learn (through acculturation).

Hertz-Lazarowitz (1992) similarly placed learning environments along a continuum, ranging from a centralized role for the teacher with an emphasis on control of the learner's responses to a decentralized role for the teacher with an emphasis on facilitation of the learner's learning. The range of alternative teacher roles has obvious implications for the possible learner roles, which are elaborated in the classification scheme of problem-based learning methods set forth by Barrows (1986). At one end of the continuum, learners are guided to understand the information that the teacher provides and are construed as knowledge consumers; at the other end, they are regarded as self-directed learners who evaluate their own knowledge, skills, and learning and are thus construed as knowledge producers.

The Roles of Learners in Relation to Each Other

As was pointed out earlier, the differing roles that learners may play in relation to each other also constitute an important aspect of the learning environment. That is, the learning situation can be arranged to enhance either individual learning or cooperative learning, alternatives that have obvious consequences for the roles that of learners play in relation to each other. The classification schemes of Hertz-Lazarowitz (1992) and Menges and McGaghie (1974) emphasize cooperative learning. Hertz-Lazarowitz argued that, although learning goals may clearly be achieved through individual learning based on individual tasks, they may also be achieved through social interaction and negotiation with peers to complete various tasks or subtasks in cooperation. Beyond Hertz-Lazarowitz (1992) and Menges and McGaghie (1974), no other classification scheme has taken into consideration the different roles that learners may play in relation to each other.

Conclusion

With respect to the first question posed in the literature review, namely which aspects of the learning environment form the basis of the various classification schemes, it can be concluded that most of the classification schemes are based on learning goals. Very few consider the division of teacher and learner roles or the roles of learners in relation to each other. And none of the schemes is based on all three aspects of the learning environment considered together.

The fact that learning goals are central to most of the classification schemes reviewed is clearly in keeping with a transmission model of learning. The basic assumption underlying such a model is that the necessary knowledge and skills must be transmitted from the teacher to the learners. As targeted products of learning, the necessary knowledge and skills also constitute the starting point for the

design of most learning environments. The basic question from such a perspective, then, is, How should the learning environment be organized to achieve such knowledge and skills?

A knowledge-construction model of learning, in contrast, assumes that knowledge and skills need not be transmitted but are constructed in a learning environment that clearly stimulates learning to learn. This model makes the process of learning (e.g., the execution of various learning functions), rather than the product, the central goal to be achieved. Furthermore, from a constructivist perspective, the basis for the design of learning environments is not learning goals but, rather, the roles that teachers and learners play in the learning situation.

The shift toward new learning means a shift from learning environments based on a knowledge-transmission model to learning environments based on a knowledge-construction model (Lowyck & Ellen, 1993). To classify learning environments with respect to a knowledge-construction model, however, it is necessary to consider not only the learning goals but also other important information, including the division of teacher and learner roles and the roles of the learners in relation with each other. But our review shows that few classification schemes have made the transition from a knowledge-transmission model to a knowledge-construction model. Learning goals that play an important role in the enhancement of forms of new learning appear across the range of classification schemes. Metacognitive learning goals are mentioned by Anderson and Krathwohl (2001), Marzano (2001), and Elshout-Mohr et al. (1999). Transfer skills are pointed out only by Elshout-Mohr et al. (1999), and collaboration skills are considered only in the classification scheme of Menges and McGaghie (1974). Learning goals with respect to the *process* of learning, that is, the execution of learning functions, are rare. Only the category of “self-system thinking,” contained in the classification scheme of Marzano (2001), resembles the affective learning functions, whereas the four categories of metacognitive processes parallel the metacognitive learning functions. We conclude that most of the learning goals in existing classification schemes refer to the product of learning. Only the execution of learning functions as a learning goal refers to the process of learning.

With respect to the division of teacher and learner roles, Farnham-Diggory (1994) provides a useful classification into behavioral, developmental, and apprenticeship models. In more traditional learning environments the division of teacher and learner roles reflects a behavioral model; in more modern learning environments it reflects developmental and apprenticeship models. According to Johnson and Johnson (1999), the roles of the learners in relation to each other can be distinguished as competitive, individual, and/or cooperative. Only in the classification scheme of Hertz-Lazarowitz (1992) was the distinction between the individual and cooperative roles found. The implications of these findings will be considered further in the next section, where a new classification scheme for learning environments will be presented.

A New Classification Scheme for Learning Environments

The new classification scheme is based on the three aspects of the learning environment listed in Figure 3: learning goals, division of teacher and learner roles, and roles of learners in relation to each other. For the aspect of *learning goals*, a distinction is made between learning goals pertaining mainly to the products of learning

1. Learning goals

Learning products

Knowledge of learning content
Knowledge of learning process
Attitude toward learning content
Attitude toward learning process
Cognitive learning skills
Affective learning skills
Social learning skills
Transfer skills

Learning process

Preparatory learning functions	Cognitive	Affective	Metacognitive
Executive learning functions	Cognitive	Affective	Metacognitive
Closing learning functions	Cognitive	Affective	Metacognitive

2. Division of teacher and learner roles

Behavioral model Developmental model Apprenticeship model

3. Roles of learners in relation to each other

Competitive Individual Cooperative

FIGURE 3. *Three basic aspects of the learning environment and related categories considered for classification.*

and learning goals pertaining mainly to the process of learning—a distinction commonly encountered in our review of the existing classification schemes. The “division of teacher and learner roles” is based on the three instructional paradigms and concomitant models of learning distinguished by Farnham-Diggory (1994): the behavioral, developmental, and apprenticeship models. The “learner roles with respect to each other” typically are described as competitive, individual, or cooperative, as proposed by Johnson and Johnson (1999).

Learning products are classified into knowledge, attitudes, and specific learning skills. Knowledge of learning content is knowing the relevant facts and principles; knowledge of the learning process is knowing what learning styles exist, which learning style is suited for oneself, and which styles are best in specific situations. In the opening section of this article, we mentioned motivational outcomes as important output factors of new learning environments. With respect to these motivational outcomes we include two types of attitudes in the learning products: Attitudes toward learning content include, for example, the degree of pleasure one derives from a specific subject; attitudes toward the learning process include one’s willingness to attempt to understand a specific matter. The attention given to attitudes as learning goals reflects a shift in present-day education from a performance orientation, stimulating the learner to achieve high test scores for example, toward a learning orientation, focused on developing learning strategies for mastering specific content and the enjoyment of the task (see, e.g., Boekaerts & Simons, 1995). This shift also is highlighted in the distinction between cognitive and affective learning skills.

An example of a cognitive learning skill is knowing how to apply already-learned knowledge or skills. An example of an affective learning skill is knowing how to motivate oneself to comprehend something that is not yet understood. Finally, an example of social learning skills is listening to or explaining something to another student. Of course, social learning skills lean heavily on knowledge of the learning process. Explaining some matter to another student means, in fact, helping that person to *learn*. As was said earlier, however, social learning skills also have interpersonal aspects (see Menges & McGaghie, 1974), for example, the processes playing between the sender and the recipient of a message or an explanation. Social learning skills are therefore mentioned separately. Transfer skills imply the ability to apply knowledge, learning skills, and attitudes in situations that are often unfamiliar or at least different in some way from the original learning situation. The emphasis on unfamiliar or different contexts makes transfer of skills different from simple “applying” of skills, which also may refer to familiar learning situations.

Whereas knowledge, attitudes and learning skills are related to the product of learning, learning functions are related to the *learning process* itself. The execution of learning functions as a learning goal is also represented by the notion of “learning to learn.” It is true, however, that learning functions can also be considered as the product of learning, because learning functions will continually be refined and optimized during learning processes. The execution of learning functions involves integrated use of specific knowledge, learning skills, or attitudes. A distinction may be made between preparatory, executive, and closing learning functions and between the cognitive, affective, and metacognitive aspects of these different learning functions (Simons, 2000). Examples of preparatory learning functions are “finding missing prior knowledge” (cognitive), “finding challenges” (affective), and “orientation

toward learning goals” (metacognitive). Examples of executive learning functions are “practicing and applying” (cognitive), “maintaining motivation and self-confidence” (affective), and “diagnosing causes of failures and problems” (metacognitive). Examples of closing learning functions are “thinking about future use and transfer categories” (cognitive), “attribution of outcomes” (affective), and “evaluating learning process and outcomes” (metacognitive).

With regard to the *division of teacher and learner roles*, three divisions are distinguished. The first division reflects a behavioral model. The teacher instructs the learner to become better in a specific subject. This means that the teacher instructs the learner regarding what should be learned and how, and the learner applies the instructions with the aim of acquiring more of the teacher’s expertise. In this model of role division, reinforcement of student activities plays an important role. The reinforcement component is typical for performance-oriented learning environments in which a behavioral model of role division is reflected. We noted earlier that in present-day education, there is a shift from a performance orientation toward a learning orientation. Learning environments in which a learning orientation is central tend more to reflect the second division of roles, which is in line with a developmental model. In that model the learner learns from the teacher who is questioning, contradicting, or even challenging the learner’s personal theories. The learner regulates his or her own learning with the teacher or expert serving as a coach. The third division of roles reflects an apprenticeship model of learning. The learner and teacher participate in a shared world with respect to a particular subject. The teacher has considerable expertise in that world and tries to model his or her expertise. The learner, in turn, masters a number of domain-related practices by participating in that world and imitating the activities of the teacher.

Finally, as was mentioned earlier, three categories of *roles of learners in relation to each other* are distinguished. A competitive role means that learners’ learning benefits only themselves and not others. An individual role means that learners’ learning benefits themselves and is simply not relevant for others. And a cooperative role means that learners’ learning is directed toward a shared learning goal or set of goals that may benefit each and every member of the group.

The three aspects of the learning environment considered in the present classification scheme are of equal importance. In Table 2, an overview of the 18 possible combinations of learning goals (product vs. process), division of teacher and learner roles (in keeping with a behavioral, developmental, or apprenticeship model of learning), and roles of the learners toward each other (competitive, individual, or cooperative) is presented. Each of the 18 combinations may be seen as a different type of learning environment. This classification scheme may therefore be useful for evaluating a wide variety of learning situations.

The new classification scheme can describe both relatively traditional learning environments and more progressive learning environments that clearly stimulate new forms of learning. Relative to traditional learning environments, modern learning environments appear to strive more toward learning goals that involve learning to learn. In addition, modern learning environments appear to be based on a developmental or apprenticeship model rather than a behavioral model. And the learners in such modern learning environments are also stimulated to learn in a more cooperative manner than the learners in traditional learning environments. Types 15 and 18 in Table 2 meet all of the requirements for stimulating new forms of learning

TABLE 2
The new classification scheme for learning environments

Goals	T-L roles	L-L roles	18 types of learning environments
Prod	Behav	Comp	1 Learning is aimed mainly at learning products. Teacher controls learning process most of the time with learners following instructions of teacher. Learners learn predominantly in a competitive manner.
Prod	Behav	Indiv	2 Learning is aimed mainly at learning products. Teacher controls learning process most of the time with learners following instructions of teacher. Learners learn predominantly in an individual manner.
Prod	Behav	Coop	3 Learning is aimed mainly at learning products. Teacher controls the learning process most of the time with the learners following instructions of teacher. Learners learn predominantly in a cooperative manner.
Prod	Devel	Comp	4 Learning is aimed mainly at learning products. Teacher serves as coach of learning process with learners regulating own learning process as much as possible. Learners learn predominantly in a competitive manner.
Prod	Devel	Indiv	5 Learning is aimed mainly at learning products. Teacher serves as coach of learning process with learners regulating own learning process as much as possible. Learners learn predominantly in an individual manner.
Prod	Devel	Coop	6 Learning is aimed mainly at learning products. Teacher serves as coach of learning process with learners regulating own learning process as much as possible. Learners learn predominantly in a cooperative manner.
Prod	Appren	Comp	7 Learning is aimed mainly at learning products. Teacher models expertise with learners participating in teacher's world and trying to imitate activities. Learners learn predominantly in a competitive manner.
Prod	Appren	Indiv	8 Learning is aimed mainly at learning products. Teacher models expertise with learners participating in teacher's world and trying to imitate activities. Learners learn predominantly in an individual manner.
Prod	Appren	Coop	9 Learning is aimed mainly at learning products. Teacher models expertise with learners participating in teacher's world and trying to imitate activities. Learners learn predominantly in a cooperative manner.

Proc	Behav	Comp	10 Learning is aimed mainly at learning to learn. Teacher controls learning process most of the time with learners following instructions of teacher. Learners learn predominantly in a competitive manner.
Proc	Behav	Indiv	11 Learning is aimed mainly at learning to learn. Teacher controls learning process most of the time with learners following instructions of teacher. Learners learn predominantly in an individual manner.
Proc	Behav	Coop	12 Learning is aimed mainly at learning to learn. Teacher controls learning process most of the time with learners following instructions of teacher. Learners learn predominantly in a cooperative manner.
Proc	Devel	Comp	13 Learning is aimed mainly at learning to learn. Teacher serves as coach of learning process with learners regulating own learning process as much as possible. Learners learn predominantly in a competitive manner.
Proc	Devel	Indiv	14 Learning is aimed mainly at learning to learn. Teacher serves as coach of learning process with learners regulating own learning process as much as possible. Learners learn predominantly in an individual manner.
Proc	Devel	Coop	15 Learning is aimed mainly at learning to learn. Teacher serves as coach of learning process with learners regulating own learning process as much as possible. Learners learn predominantly in a cooperative manner.
Proc	Appren	Comp	16 Learning is aimed mainly at learning to learn. Teacher models expertise with learners participating in teacher's world and trying to imitate activities. Learners learn in a competitive manner.
Proc	Appren	Indiv	17 Learning is aimed mainly at learning to learn. Teacher models expertise with learners participating in teacher's world and trying to imitate activities. Learners learn predominantly in an individual manner.
Proc	Appren	Coop	18 Learning is aimed mainly at learning to learn. Teacher models expertise with learners participating in teacher's world and trying to imitate activities. Learners learn predominantly in a cooperative manner.

Note. T = teacher, L = learner, Prod = learning products, Behav = behavioral model, Comp = competitive learning, Indiv = individual learning, Coop = cooperative learning (see Figure 3), Devel = developmental model, Appren = apprenticeship model, Proc = learning process. Shaded rows represent types of learning environments that probably are not feasible.

(at least in terms of our review of the relevant literature and the classification scheme developed on the basis of it). Types 1 and 2 represent clear-cut traditional learning environments. Between these extreme types of learning environments are many “mixed” types. For example, Type 14 involves learners who do not learn cooperatively but who clearly self-regulate their learning.

Four “mixed” types of learning environments seem rather infeasible: Types 7, 10, 13, and 16 (shaded in the table). It is difficult to imagine a learning environment that reflects Type 7, in which learners would strive toward learning products (and not the learning process) in a competitive manner by participating and imitating the activities of the teacher (i.e., on the basis of an apprenticeship model of learning). In reality, this combination of competition with participation typically leads to a dysfunctional situation. Types 10, 13, and 16 show a similar problem with a competitive role for the learners. As already mentioned, most modern learning environments clearly avoid situations requiring learners to compete because the sharing of knowledge is obviously avoided under competitive circumstances and the construction of knowledge is hindered as well. Striving toward the construction of knowledge implies attention to the process of learning; the combination of competition with the principle of learning to learn is therefore problematic. Furthermore, learning in competitive circumstances requires assessment and comparison of learners; it is hard to imagine how a teacher can assess and compare the execution of learning functions by learners.

In light of the above considerations, 14 of the 18 theoretically possible types of learning environments can be considered empirically feasible. An important question, then, is which of the 14 types are actually encountered in school practice. The classification scheme presented here provides a framework for examining the occurrence of various types of learning environments, and therefore further research along these lines is called for, to validate the 14 types of empirically feasible learning environments distinguished here.

Discussion

In this article, a new classification scheme of learning environments in secondary education was presented. The scheme is based on three aspects of the learning environment: (a) learning goals, (b) the division of teacher and learner roles, and (c) the roles of learners in relation to each other. These aspects of the learning environment have been found to play a critical role in the stimulation of new forms of learning. One purpose of the classification scheme is to make it possible to analyze both traditional and modern secondary education environments. Therefore, new categories of learning goals were also included, such as metacognitive learning functions and social learning skills. Furthermore, the divisions of teacher and learner roles reflecting a developmental and/or apprenticeship model were included as important for the promotion of new forms of learning and modern learning environments. Finally, with regard to the roles that the learners may play in relation to each other, cooperative roles were included as characteristic of modern learning environments. Cooperative roles are in clear contrast to both competitive and individual learning roles, which are characteristic of more traditional learning environments.

The particular combination of aspects of the learning environment included in the scheme presented here was not encountered in any of the other classification schemes that we reviewed. The reason is that very few classification schemes have

made the shift to the adoption of a knowledge-construction perspective on the learning environment, which makes not only learning goals but also other aspects of the learning environment quite important. It is interesting to note that teachers who create a constructivist learning environment (e.g., with respect to the division of teacher and learner roles or by using modern rich technologies) often strive simultaneously to achieve more traditional goals, such as the mastery of basic learning skills or answers to specific questions identified well ahead of time (Land & Hannafin, 2000). This suggests that teachers in modern learning environments may still tend to think along the lines of a transmission model of learning and still give learning goals a central place in the process of learning. More research is needed to verify this possibility.

The seeming tenacity of the transmission model brings up another important issue, namely the implications of new learning for assessment. If teachers still think in terms of a transmission model, the reason may be that current assessment methods are still in line with the transmission model. Shepard (2001), for example, holds that much of present-day education, with constructivist curriculum and instruction and traditional testing, has a “sphere for instruction entirely separate from the sphere for assessment” (p. 1067). If assessment is not in line with the advocated new learning goals but continues to reflect some implicit traditional learning goals, then the implicit goals will strongly steer the process of learning. Thus, not only is learning assessed inaccurately, but academic engagement is also undermined. New learning environments need to replace traditional assessment methods, such as paper-and-pencil tests, with methods that can assess new learning goals such as the execution of learning functions. Examples of new assessment methods are (a) diagnostic and test instruments for assessing social, cognitive, and metacognitive learning skills; (b) performance assessments in which learners have to demonstrate what they have learned by executing a concrete task; (c) case studies in which data are collected, for example, by observation and interviews; and (d) portfolios through which students can show concrete products that reflect their development (Van Hout-Wolters, 2000).

The new classification scheme presented here produces 18 types of learning environments, with 14 of them considered feasible. From the perspective of the teacher, an interesting question is which aspect of the learning environment—if any—serves as the main organizing principle. Do teachers arrange their learning environments from the perspective of learning goals or the desired division of teacher and learner roles? It is likely that teachers are inclined to think in terms of teacher and learner roles as basically fixed by the content of the curriculum and/or by examination requirements, which set the learning goals. But even when the division of teacher and learner roles appears to serve as the main organizing principle for the learning environment, it remains to be seen just how constructivist the learning goals are. As Land and Hannafin (2000) have argued, for instance, the learning goals employed by teachers are not always as constructivist as might be expected from the ways that the teachers choose to divide teacher and learner roles.

The new classification scheme for learning environments may be used as a research framework for further process-product research. In the next generation of research, the effects of various aspects of the learning environment, considered jointly, on the learning outcomes of students should be considered. For this purpose, the present classification scheme provides information on three aspects of the learning environment that have been found to be critical for process-product

research. And with respect to the goals of learning, this scheme distinguishes new kinds of learning outcomes, such as metacognitive and motivational outcomes.

To determine which of the 14 feasible types of learning environments described in the classification scheme actually occur in secondary school practice, and to maximize the utility of the new classification scheme in the context of process–product research, it may be necessary for teachers to experiment with the classification scheme in their own classrooms. In such a manner, the theoretical constructs on which the classification scheme is based can become further grounded in actual school practice (see De Corte, 2000). Furthermore, the outcomes of process–product studies based on the new classification scheme can be better translated into actual school practice and thereby made more accessible. In addition to this inductive use of the outcomes of process–product research, the outcomes may also be used in a deductive way because they may support the instructional development efforts of teachers and schools (Cobb & Bowers, 1999).

The new classification scheme may also serve as a frame of reference for secondary school teachers to analyze their own practices and the current practices of their schools. By analyzing their own individual practices in using the classification scheme, teachers can determine which types of learning environments predominate in their classes. In addition, the scheme may help teachers to determine whether a learning environment has the characteristics known to promote new forms of learning. The classification scheme may also be used to design learning environments. Through discussion of the various types of potential learning environments, teachers may determine the *actual* types of learning environments within their school or classroom and the *desired* types of learning environments. Thereafter, steps may be taken to shift a number of the aspects or all aspects of the learning environment in the direction of the desired type of learning environment.

The design of new learning environments is also an important issue in the broader context of educational innovation. At the moment, Dutch secondary education faces major large-scale changes aimed at the creation of learning environments known to stimulate new forms of learning. Teachers nevertheless appear to have considerable difficulty with this shift toward new learning environments and thus have a clear need for support. As Slavin (1998) points out, one of the most promising models for innovations in education (as indicated by positive student achievement) is the comprehensive reform model. In this model, both teachers and schools provide the concrete support needed to facilitate the change process in the form of student materials, teacher manuals, and professional development training. An important pitfall of such an approach, however, is that it leans on a transmission model of professional learning or development, asking teachers to simply copy some blueprint of the needed change. In contrast, teachers' reflection on their knowledge, beliefs, and skills has to be stimulated, because such reflection is an important prerequisite for realizing change in teacher practices (e.g., Shepard, 2001). Teacher reflection is also required for realizing changes with respect to the three aspects of learning environments that are central in the new classification scheme.

The new classification scheme presented here is meant to provide both concrete and specific support for the development of teachers and schools along the lines of the educational innovations being implemented (see Cobb & Bowers, 1999). Use of the classification scheme may not only help teachers to contemplate their beliefs about educational goals, good teaching, and productive learning but also provide a more integrative approach for designing learning environments.

Note

This article is part of an ongoing doctoral project entitled “New Learning Environments and Their Outcomes in Secondary Education.” This project is being conducted under the auspices and with the financial support of KPC Group (’s-Hertogenbosch) in collaboration with the Radboud University Nijmegen.

We would like to thank Robert-Jan Simons (University of Utrecht, The Netherlands) for his involvement in the initial months of the project. We also wish to thank the anonymous reviewers for their constructive comments, which helped us to improve earlier versions of the manuscript. Needless to say, we alone are responsible for the final version.

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