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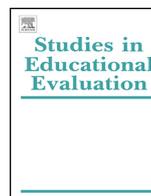
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Students' goal orientations and learning strategies in a powerful learning environment: A case study



Maaïke Koopman^{a,*}, Anouke Bakx^b, Douwe Beijaard^a

^a Eindhoven School of Education, Eindhoven University of Technology, Eindhoven, The Netherlands

^b Fontys University of Applied Sciences, Eindhoven, The Netherlands

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ABSTRACT

In Dutch secondary education, experiments with powerful social constructivist learning environments are conducted that aim to appeal to students' intrinsic goal orientations, use of deep cognitive learning strategies, and self-direction of meta-cognitive learning strategies. The aim of this study is to gain insight into the relation between learning environment characteristics and students' goal orientations and learning strategies, by means of a case study of one innovative school. Ten lesson observations were carried out. Students ($n = 138$) filled out questionnaires about their learning preferences. Results showed that characteristics of powerful learning environments were present. Students showed relatively strong preferences for mastery goals and had equal preferences for deep and surface cognitive learning strategies. Preferences for self-direction of meta-cognitive strategies were rather low.

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Introduction

This study focuses on the evaluation of an educational programme, with particular attention for the implemented characteristics of the learning environment and the manner in which students learn in this programme. In secondary education experiments with new types of learning environments are being conducted for the last two decades. Many of these learning environments are based on social constructivist views on learning (de Kock, Slegers, & Voeten, 2004; Murphy, 1997), in which learning is considered an active process with learners constructing knowledge while interacting with others (Philips, 1995). Reasons for these experiments often originate from intentions to improve student learning (Simons, van der Linden, & Duffy, 2000). In the study we present here, we investigate one of the experiments taking place in the Netherlands, paying attention to two important aspects: the design characteristics of powerful learning environments, based on social constructivist conceptions of knowledge and learning, and students' learning processes within this learning environment. In this manner, we evaluate whether the school succeeds in implementing social constructivist characteristics in

their learning environment and in eliciting the type of student learning they aim at.

With regard to students' learning processes in powerful learning environments (LEs), three aspects are expected to be relevant. First, the implemented characteristics are often aimed at increasing student engagement and motivation (Deci & Ryan, 2000; Levin, 2000) by making an appeal to students' intrinsic goal orientations underlying their comprehension of learning content (Koopman et al., 2008). Second, it is considered important that students are encouraged to construct their own knowledge in interaction with others (Kanselaar, 2002). When knowledge is constructed by students, deep cognitive learning strategies are carried out, such as structuring the learning content and making mental depictions of learning content (Marton & Säljö, 1976). Third, in powerful LEs an active role of students themselves is needed regarding regulation of their learning (Könings, Brand-Grüwel, & van Merriënboer, 2005). Students are made – partly – responsible for controlling their learning process. In order to do so they need meta-cognitive learning strategies such as orientating, planning, and evaluating (Vermunt & Verloop, 1999). Intrinsic goal orientations, as well as the execution of deep learning strategies, and student-direction of meta-cognitive learning strategies are assumed to have a positive effect on learning outcomes. The relation between LE characteristics and student learning, however, may be complicated by for example strong personal preferences for certain learning strategies students may hold and by the manner in which students interpret the LE they are

* Corresponding author. Tel.: +31402472707.

E-mail addresses: m.koopman@tue.nl, a.bakx@fontys.nl (M. Koopman).

confronted with (Segers, Nijhuis, & Gijsselaers, 2006; van Hout-Wolters, 2009).

Powerful LEs that are based on social constructivist views on learning vary, but often share some basic characteristics (Jonassen, 1994; Murphy, 1997). In order to make learning content more meaningful, the traditional subject areas are integrated. Active student learning, for example by having students conduct research, is frequently visible (Nie & Lau, 2010) and therefore project-based or problem-based education is often chosen as starting point for organizing tasks and learning content (Dochy, Segers, van den Bossche, & Gijbels, 2003; Levin, 2000). Little is known however about the effects of such characteristics in secondary education on student learning, as far as their goal orientations and learning strategies are concerned. Most research concentrates on different, rather isolated, aspects of LEs and its effects, such as effects of problem-based learning (Dochy et al., 2003), and effects of collaborative learning (Hattie, 2009). However, research that integrally investigates the relation between various characteristics of powerful LEs and student learning processes within these environments is needed (Richardson, 2003).

In the Netherlands, the first nationwide initiatives regarding LEs originating from social constructivism were taken in the nineties, but after a lack of success with their implementation only local initiatives remained (Roelofs & Terwel, 1999; Teurlings, van Wolput, & Vermeulen, 2006). Although some of these local practices exist for quite some years now, little evaluation research has been done on the degree to which the schools with such LEs succeed in encouraging effective learning processes. The aim of this study is to gain insight into relation between characteristics of the LE on the one hand and students' goal orientations and learning strategies on the other, by means of a case study of one school in the Netherlands. The school that was selected to participate in the study is considered as one of the schools at the forefront of innovative education in the Netherlands. The central question is: How can students' goal orientations and their preferences for cognitive and meta-cognitive learning strategies be characterized in a LE that is based on a social constructivist view on learning? As such, this research contributes to knowledge about the design of LEs for secondary education that aim to make an appeal to students' intrinsic goals, the execution of deep cognitive learning strategies and self-direction of meta-cognitive learning strategies by students. The results of this evaluation study may further help schools to properly translate the social constructivist theory about learning into classroom practices and teacher guidance that optimally support student learning (Nie & Lau, 2010).

Theoretical framework

Learning environments based on social constructivism

Recent developments in secondary education are often attached to social constructivism. Constructivism can be considered a theory about knowledge development in which learning is assumed to be a process of active construction of knowledge through experience (von Glasersfeld, 1989). The social constructivist version of the theory emphasizes the importance of social interaction (Simons, 2000). Constructivist ideas have had an impact on many educational reforms "that seek to create constructivist-based classroom environments and instructional practices to enhance students' deep understanding of knowledge" (Nie & Lau, 2010, 411). These reforms may take different forms in actual LEs but have some characteristics in common.

First, connections to real-world problems and situations are often the starting point for learning in order to emphasize the relevance and authenticity of learning content (Honebein, 1996; Nie & Lau, 2010). Realistic approaches to solve these real-world

problems are taught (Jonassen, 1994). Second, deep understanding of knowledge and knowledge building is strived for (Bolhuis & Voeten, 2001; Honebein, 1996; Nie & Lau, 2010). This mostly entails a rejection of the knowledge transmission model for education and the acceptance of a student-centred instructional approach. Within this student-centred approach, conceptual interrelatedness is stressed, for example by providing multiple representations of learning content (Jonassen, 1994; Murphy, 1997). Third, communication and interaction between students are emphasized (Honebein, 1996; Nie & Lau, 2010). Such collaborative learning is assumed to reflect outside school learning and is supposed to make students learn from each other. Fourth, student self-regulation of the learning process is ultimately strived for (Bolhuis & Voeten, 2001; Jonassen, 1994), which can prepare students to fulfil societal demands regarding lifelong learning. This needs to be supported by an environment in which tools are provided to students that help them to interpret and understand the learning content (Jonassen, 1994). Teacher guidance in powerful LEs involves coaching students' learning processes (Vermunt & Verloop, 1999), for example by analyzing and diagnosing the strategies used to solve the real-world problems (Jonassen, 1994), challenging the students to think of new strategies, and monitoring and evaluating the strategies used. Also, student learning can be encouraged through active teacher support, such as asking questions, providing assignments, and modelling learning strategies by demonstration (Vermunt & Verloop, 1999).

de Bruijn et al. (2005) created a model in which aspects of (a) the content and organization and (b) the type of guidance in these LEs were integrated. The content dimension can be divided into four components along which schools can differ; these pertain to:

- the actual subject matter and the manner in which it is presented (e.g. authenticity of the subject to be studied, integration of subject areas, tasks which resemble professional practice, a focus on learning-to-learn);
- the structure and range of the subject matter (e.g. the adoption of authentic situations as the starting point for the development of knowledge and practice of skills);
- the starting points regarding the delivery of the subject matter (e.g. use of a mixture of teaching methods, different sources of information, input from students, interaction with students);
- forms of processing the subject matter by students (e.g. active learning, explorative learning, reflective learning).

The guidance dimension concerns: characteristics of the systematic guidance provided by teachers and peers; the guidance, clarification and promotion of the student learning trajectory via a fixed programme framework; the provision of guidance aimed at the learning of skills; and the guidance of learning processes using 10 different forms of guidance (instruction, demonstration, thinking aloud, promoting understanding, allowing autonomous student work, active support, coaching, provision of help when necessary, evaluation, feedback). de Bruijn et al. (2005) assume that a teacher should carry out all 10 of these specific forms of guidance in order to provide complete assistance to students.

Student learning processes

The present study deals with the relation between characteristics of powerful LEs and students' learning processes in terms of their goal orientations and cognitive and meta-cognitive learning strategies.

Goal orientations

Research on achievement motivation has led to an achievement goal framework that integrates affective and cognitive aspects of learning goals (Ames, 1992). These goal orientations reflect the

goals students pursue when learning. Like motivation, goal orientations range from intrinsic to extrinsic. Several attempts have been made to categorize the types of goals of students (Duda & Nicholls, 1992; Elliot & McGregor, 2001). Usually mastery-oriented and performance-oriented goals are distinguished. Mastery-oriented goals originate from intrinsic motivation and lead students to strive for competence and understanding. Performance-oriented goals, on the other hand, are more extrinsic and typically related to social comparison (striving to be the best relative to others or avoiding demonstration of a lack of ability). In some studies work avoidance orientations are added as a third type of goal orientation (Duda & Nicholls, 1992; Seifert & O'Keefe, 2001). Work avoidance goals are extrinsic. Students preferring this orientation strive to perform well, but with as little effort as possible.

Goal orientations have been found to influence the learning activities students conduct and their learning results (Novak, 2002; Rozendaal, 2002). Generally, a mastery orientation is considered superior to other orientations when students' learning processes are concerned (Koopman et al., 2008). For example, a student that strives for competence in a certain field is more likely to show a predisposition to learn about this field in a more self-directed manner and to integrate new knowledge and existing knowledge more than a student who is primarily oriented towards achieving well. Though students' preferences for certain goal orientations are (at least) partly stable and personal, powerful LEs are supposed to contribute to eliciting mastery-oriented goals (Levin, 2000; Pintrich & Schunk, 2002). In the present study, students are assumed to have preferences for the aforementioned goal orientations: mastery, performance, and/or work avoidance. As the study is carried out in a LE that is expected to be based on social constructivist views on learning, mastery orientations are likely to be preferred quite strongly.

Learning strategies

Learning strategies are integrated wholes of learning activities that are carried out by students in order to attain learning goals (Vermunt, 1992). Regarding learning strategies a distinction can be made between cognitive, meta-cognitive and affective strategies (Vermunt & Verloop, 1999). Cognitive strategies refer to the processing of information; in this respect deep versus surface strategies can be distinguished (Chin & Brown, 2000; Marton & Säljö, 1976). Learners who adopt deep processing strategies perform learning activities as (a) relating and structuring of learning content, (b) critical processing of information, and (c) concrete processing, for instance, in the form of making mental depictions of the information supplied or linking information to outside school experiences. Conversely, learners who adopt surface processing strategies engage in mostly memorizing and repeating the learning content and analyzing learning tasks (dividing the learning content into smaller parts and performance of tasks in a more or less prescribed order). Deep cognitive strategies are often considered to be superior to surface strategies regarding their influence on learning results (Struyven, Dochy, Janssens, & Gielen, 2006). Students that prefer deep cognitive strategies show an interest in understanding the meaning of learning content and a focus on relating parts of learning content to each other and the linking of the new information to prior knowledge and experiences (Chin & Brown, 2000). Such learners are more effective than surface learners who tend to memorize separate facts and are merely able to reproduce as a result of rote learning. Like goal orientations, preferences for deep or surface strategies may be quite stable and they may already exist before students enter a specific LE (Vermunt & Vermetten, 2004). This might make it hard to change them. Friction might thus exist between students' personal

preferences and the demands and expectations of their teachers (Vermunt & Verloop, 1999). Also, students may adapt the strategies they use for different subject areas, thus diverging from their more general preferences. Deep cognitive strategies align well with social constructivist views on learning and the manner in which understanding of learning content is often tested in powerful LEs (Broekkamp & van Hout-Wolters, 2007). Based on their emphasis on meaningful and authentic learning, powerful LEs are likely to appeal to students' preferences for deep cognitive strategies (Nie & Lau, 2010).

Meta-cognitive strategies refer to the regulation of the learning process by conducting learning activities such as orienting, planning, monitoring, diagnosing, adjusting, reflecting, and evaluating. Meta-cognitive strategies "are those thinking activities students use to decide on learning contents, to exert control over their (cognitive) processing and affective activities and to steer the course and outcomes of their learning" (Vermunt & Verloop, 1999, 259). The manner in which the learning process is regulated can range from self-direction to teacher-direction of meta-cognitive strategies (Biggs, 1996; Hadwin, Järvelä, & Miller, 2011; Vermunt & Verloop, 1999). In case of self-direction, the student is responsible for exerting control over his/her own learning: he/she decides which meta-cognitive strategies are carried out when. In case of teacher direction, the responsibility is transferred to the teacher or teaching aids such as schoolbooks or other learning materials. A combination of both forms is also possible: in case of shared control both the student and the teacher are responsible for regulating the learning process (Boekaerts, 1999; Vermunt & Verloop, 1999). The relation between students' preferences for self-direction, teacher direction or shared direction and their learning results is mediated by the degree of compatibility of students' and teachers' strategies. In case of congruence between the two, teachers' and students' strategies are compatible which may lead to optimal learning results; in case of friction students' strategies are guided either too strongly or too weakly which may lead to too little or too much challenge respectively (Vermunt & Verloop, 1999; Heikkilä & Lonka, 2006). Finally, students' meta-cognitive strategies can sometimes be characterized as undirected, which is typical for a lack of regulation or control by either teacher or student (Vermunt & Vermetten, 2004). This type of regulation generally entails a negative relation with learning outcomes. Like goal orientations and cognitive learning strategies, directional preferences for meta-cognitive strategies are influenced not only by LE characteristics: they are also believed to be (in part) personal, more or less stable, and influenced by earlier experiences in education. However, powerful LEs are often supposed to make an appeal to self-direction of meta-cognitive strategies by the students (Loyens, Rikers, & Schmidt, 2009).

In the present study, students are assumed to have a preference for conducting deep or surface cognitive strategies and for either self-direction, shared direction, or teacher direction of meta-cognitive strategies (or a lack of direction). As the study is carried out in a LE that is expected to be based on social constructivist views on learning, deep cognitive strategies and self-direction of meta-cognitive strategies by the students are likely to be preferred the quite strongly¹.

¹ In this study, affective learning strategies are not investigated, as these are closely related to motivation. We decided to operationalize motivation using a goal orientations perspective. This perspective does justice to the role of different motivational preferences students may have, which may range from more intrinsic mastery goals to more extrinsic work avoidance goals.

Relation between learning environment characteristics and student learning

The abovementioned variables are studied using a case study approach. The research is carried out in a secondary school in which a social constructivist view on learning are explicitly strived for. Based on a study of the school's documents, the LE *intends* to have characteristics described in "Learning environments based on social constructivism" section.

More specific research questions were formulated:

1. To which degree are characteristics of powerful LEs, based on social constructivist conceptions of knowledge and learning, present in the case school?
2. What are students' preferences for goal orientations and learning strategies in the case school?
3. How do background variables, such as gender, grade level and programme level, relate to students' preferences for goal orientations and learning strategies?
4. Which LE characteristics may explain students' preferences for goal orientations and learning strategies found in the case school?

Method

Context of the study

The study was carried out at an innovative secondary school in the Netherlands. Based on information in documents from the school, it *intends* to provide education that is related to a social constructivist view on learning. The school reports three main starting points: (1) it aims at having students take their curiosity as point of departure for learning, (2) it strives to create learning communities in which collaborative student learning should take place, and (3) it emphasizes the importance of student reflection on their learning process. In the school, two types of lessons are provided: (1) mentor lessons in which students' competence development is aimed at and (2) expert lessons in which development of domain-specific knowledge and skills is strived for. In the mentor lessons, development of competencies such as 'doing research', 'giving presentations', and 'cooperating with others' is guided. The expert lessons are divided into four learning areas, that is science, humanities, arts, and languages, in which adjacent subject areas are combined. The type of education described here, demands from teachers that they cooperate in creating an integrated LE and have a shared vision on how to educate students. For example, students are supposed to work on assignments in which learning content of different subject areas are integrated; as a result they are guided by experts with different subject area expertises for one assignment and by a mentor that focuses on guiding students' competence development. The school in this study thus *aims* to create one LE for students, as opposed to different LEs created by individual teachers. A pilot study, in which several of the schools' teachers were interviewed, amongst others, about their vision about teaching and learning and about their cooperation with other teachers, confirmed these intentions (Koopman et al., 2011a).

Participants

To investigate the implemented characteristics of the LE 10 observations of lessons were carried out: five female and five male teachers were observed. Regarding the investigation of students' goal orientations and learning strategies all students of this school ($n = 382$) were invited to participate voluntarily. 138 students responded to this request (36.1%). These students were in different

programme levels of education (Pre-Vocational Secondary Education, response rate $n = 35$; Higher General Secondary Education, response rate $n = 51$; and Pre-University Education, response rate $n = 46$; missing $n = 6$)². The students were between 12 and 18 years old. 85 students were in the lower grades; 53 students were in the upper grades. 57% were female and 43% were male.

Data collection

Observation of characteristics of the learning environment

An observation scheme which was based on the characteristics described by de Bruijn et al. (2005) was developed. This scheme consisted of characteristics belonging to the content and guidance dimensions of LEs (see "Learning environments based on social constructivism" section). The four main characteristics of the content dimension were operationalized into 14 characteristics. For example, attention had to be paid to the degree to which the curriculum was arranged around themes in which subject areas were integrated, the degree to which students interacted, and the degree to which students had to think of solutions independently (see Table 3 for an overview). The guidance dimension was divided into 10 specific forms of guidance (instruction, demonstration, thinking aloud, allowing autonomous student work, active support, coaching, provision of help when necessary, evaluation, and feedback; see Table 5). As the content dimension concerned the characteristics of the LE that could be considered its starting points, these characteristics were observed time-based with a relatively long fragment size. The observer had to fill out every five minutes the degree to which that characteristic was visible on a scale from zero to three (0 = not observed; 1 = barely visible; 2 = sometimes visible; 3 = (almost) always visible) and some examples of situations in which the characteristic was visible³. From this, an overall lesson score was derived, which was used for the description of the results⁴. For the 10 forms of guidance of the guidance dimension a more precise analysis of the dimension was possible. As the guidance dimension pertained to specific teacher activities, the observer was able to fill out the frequency in which that characteristic was visible and some examples of situations in which the characteristic was visible. Supplementary, per form of guidance information was added about the type of situation in which the form of guidance mostly took place (individually, small groups, or whole-class).

Measuring student learning

Students' preferences for goal orientations and learning strategies were measured using questionnaires. It is generally assumed that such questionnaires investigate student learning on a general level (van Hout-Wolters, 2009). An obvious advantage of questionnaires is the easy access they provide to the preferences of relatively large groups of students. A possible disadvantage is related to the degree in which learning preferences need to be

² Dutch secondary education consists of three levels. Pre-Vocational Secondary Education (PVSE; in Dutch vmbo) prepares students for vocational education and training. Higher General Secondary Education (HGSE; in Dutch havo) prepares students for higher (vocational) education. Pre-University Education (PUE; in Dutch vwo) prepares students for higher (university level) education. In the case school, students of the three levels are in heterogeneous groups in the lower grades and in homogenous groups per level in the upper grades.

³ Some exceptions to this procedure were made. In case of the "use of different sources of information sources, teaching aids and places to work" and "a mix of teaching methods", variation on the level of the whole lesson was taken as a criterion; for "a fixed programme order", the structure of the whole lesson was taken into account.

⁴ A characteristic was judged as "barely visible" when it was present in approximately less than 25% of the lesson; it was judged as "sometimes visible" when it was present in between 25% and 75% of the lesson; it was judged as "(almost) always visible" when it was present more than 75% of the lesson.

measured on a task-specific level: students might have different approaches or preferences in different LEs (van Hout-Wolters, 2009; Schellings & van Hout-Wolters, 2011). As the school strives to create one integrated LE with similar characteristics in different teachers' lessons, it was decided to use questionnaires nonetheless. Students were instructed to respond with respect to their learning behaviour related to the specific learning in the school.

Goal orientations questionnaire

The preferences of the students for particular types of goal orientations while learning in school were investigated using a goal orientations questionnaire which consisted of 29 items rated along a five-point Likert scale (Duda & Nicholls, 1992; Koopman et al., 2008). For each item, the students had to indicate the extent to which they generally felt satisfied with that specific aspect of their education (see Table 1). Given that the goal orientations questionnaire was expected to distinguish between mastery, performance and work-avoidance orientations, the scales reflecting these orientations were tested for unidimensionality and overlap after administration of the questionnaire. For each scale, the Cronbach's alpha was determined which were .89 for mastery, .90 for performance and .88 for work avoidance. These were comparable to the alphas found in the original study using this questionnaire (Duda & Nicholls, 1992; .89 for mastery; .89 for performance; .73 for work avoidance).

Learning strategies questionnaire

The use of deep and surface cognitive learning strategies and the preferences for teacher direction, self-direction, or undirected use of meta-cognitive strategies were investigated with an adapted version of the Learning Styles Inventory from Vermunt, Bouhuijs, Piccarelli, Kicken, and Andree (2006). This questionnaire measured students' preferences on a general level: the items applied to student learning in a school setting. Of this questionnaire, only the scales on cognitive and meta-cognitive learning strategies were used, which meant that 38 items were rated along a five-point Likert scale. The students had to indicate the extent to which they preferred each of the learning strategies indicated by the items (see Table 1). The items about meta-cognitive learning strategies were used to gain insight into students' preferences about who directed the execution of those strategies. When the reliability of the learning strategies questionnaire was analyzed, it was decided to omit one item which was supposed to reflect the use of teacher direction of meta-cognitive strategies in order to improve the quality of that scale. The Cronbach's alphas were .81 for deep processing, .75 for surface processing, .51 for teacher direction, .71 for self-direction, and .73 for undirected meta-cognitive strategies. In another study using the questionnaire within secondary education (Piccarelli, Slaats, Bouhuijs, & Vermunt, 2006), largely comparable alphas of .84 and .76 were found respectively for

cognitive learning strategies and of .64 for teacher direction, .73 for self-direction, and .66 for undirected use of meta-cognitive regulation strategies. As the reliability of the teacher direction scale remained rather low, it was omitted.

Design and procedure

Data collection was undertaken across a period of one month in 2011. All lessons were observed and video-taped by the first author. As the study aimed to link students' learning in the school's LE (as measured by means of the two questionnaires), it was chosen to observe 10 different teachers once in this study to establish a broad view on the LE characteristics in the school. The observations were therefore spread across the grade levels and types of lessons (see Table 2). Four mentor lessons and six expert lessons were observed, thus reflecting the number of these lessons in the school's timetable. For each of the four learning areas, at least one expert lesson was observed: one science lesson, one arts lesson, two humanities lessons and two languages lessons were selected. Each observed lesson lasted 45 min. The questionnaires were administered anonymously via a secured website. Students were invited to participate by e-mail. The students were asked to provide information about background variables via three multiple choice questions about their gender, grade level, and programme level (PVSE, HGSE, or PUE).

Data analysis

The video-tapes of the observations were analyzed using a matrix (Miles & Huberman, 1994). The columns of the matrix represented the observed lessons and the rows represented the characteristics of the content dimension and forms of guidance of the guidance dimension. In each box of the matrix the findings of each lesson were summarized, using the scale from 0 to 3 and the most typical examples for the characteristics of the content dimension and the frequencies and typical examples per form of guidance for the guidance dimension. Next, the content of the boxes were summarized per column and per row, resulting in a judgment about the presence of characteristics of LEs per observed lesson and per characteristic. Finally, using the summaries per column and row, a general conclusion could be drawn about the degree to which characteristics of powerful LEs were present in the school. This conclusion was further specified per type of grade level (upper vs. lower grades) and type of lesson (mentor lesson vs. expert lesson). An audit procedure was carried out by another researcher to establish if this analysis procedure was comprehensible and acceptable (Akkerman, Admiraal, Brekelmans, & Oost, 2006). In order to make that judgment, the auditor had all data, the observation scheme, the matrix, and a draft version of this article at her disposal. She was also provided with a process document in

Table 1
Questionnaires and content of the questionnaires.

Instrument	Length	Scale	Sample item	
Goal orientations questionnaire	29 items, 5-point Likert-scale	Mastery (10 items)	As a student, I feel satisfied when I learn something interesting	
		Performance (10 items)	As a student, I feel satisfied when I do better than other students	
		Work-avoidance (9 items)	As a student, I feel satisfied when I don't have to do much work but get a good mark anyway	
Learning strategies questionnaire	38 items, 5 point Likert-scale	Cognitive	Deep strategies (12 items)	When I read something I wonder if it's true or not
			Surface strategies (8 items)	I learn lists of important things by heart
		Meta-cognitive	Teacher direction (6 items)	I do everything exactly as the book or teacher prescribes
			Self-direction (8 items)	To assess if I learned enough, I formulate questions that I try to answer
	Undirected (4 items)	I feel that I find it difficult to learn large amounts of learning content		

Table 2
Sample of lessons for the observations.

Type of grade level	Type of lesson	Description	n Observations
Lower grades (1–2)	Mentor lesson	Lesson provided by a mentor; aimed at development of competencies	2
	Expert lesson	Lesson provided by an expert teacher; aimed at the development of knowledge and skills regarding subject areas or combinations of subject areas	3
Upper grades (3–6)	Mentor lesson	Lesson provided by a mentor; aimed at development of competencies	2
	Expert lesson	Lesson provided by an expert teacher; aimed at the development of knowledge and skills regarding subject areas or combinations of subject areas	3

which the whole procedure of data gathering and analysis was documented. The way the data had been gathered and analyzed was assessed as accurate and acceptable.

After the analysis of the reliability of the scales, the questionnaires were analyzed by calculating mean scores and standard deviations per scale. Next, the scale scores were compared using *t*-tests and correlations between scales were calculated. Also differences and similarities between groups of participants were explored (male vs. female students, students from lower vs. upper grades, and students from the levels PVSE, HGSE, and PUE⁵) by performing independent sample *t*-tests and one-way ANOVAs.

The findings of the observations and the questionnaires were then combined, searching for possible relations between LE characteristics and students' preferences for goal orientations and learning strategies. Explanations were sought for the results regarding student learning (goal orientations and learning strategies), using the results about common and less common LE characteristics in the school.

Results

Characteristics of the learning environment

The school's LE could indeed be characterized as social constructivist. The intentions of the school (as described in their internal documents) have resulted in the implementation of the related LE characteristics.

The content dimension

Regarding the content dimension, most characteristics appeared to be always or almost always visible in most of the observed lessons (see Tables 3 and 4). Especially the characteristics "Curriculum arranged around themes that exceed subject areas", "Explicit attention for learning and problem solving skills", "Students frequently use many different sources of information, teaching aids and places to work", "Much interaction between students which stimulates them to learn from each other", "A mix of teaching methods is used", and "An important striving of the teacher is to stimulate students to think up solutions on their own" were (almost) always visible in the vast majority of the lessons. As such the observed lessons showed quite many similarities to the model of de Bruijn et al. (2005). The teachers often explicated the relations between learning content and the world outside school. Sometimes real life problems formed the basis for particular learning tasks, in which adjacent subject areas were integrated. Teachers made sure different information sources and materials were available in order to allow students to work on the learning tasks on their own, in pairs, or in small groups. The students' laptops, allowing them to use the internet and an electronic LE, formed an important aid. The teachers used many teaching

methods, such as discussions, conferences, mind mapping, educational games, and student presentations on learning tasks. Learning and problem solving skills got attention, as teachers gave students hints while they were working on the learning tasks independently. Also, teachers paid explicit attention to the manner in which the task could best be approached in the short instructions before the students started to work independently. Some less visible characteristics were "An emphasis on reflective learning in which students always examine why something goes right or not" and "Students' portfolios play an important role in assessment". These characteristics showed up in a minority (or, in case of the portfolios, only one) of the observed lessons. In case of assessment, this might be caused by some bias in the selection of lessons: assessment may have been part of different lessons than the observed ones. Also teachers explicitly monitoring of the coverage of competencies in students' work was only visible in half of the lessons.

Some differences were visible between the lessons guided by mentors and lessons guided by experts (see Table 3). For example, an emphasis on authentic tasks was visible in all mentors lessons and only in a part of the experts' lessons. Similarly, zooming from these complex tasks to underlying knowledge and skills appeared to be a major component of all mentor lessons and in only a part of the expert lessons (or less prominent). In the lessons guided by mentors, more attention was paid to reflective learning. Also, in these lessons teaching aimed at stimulating students to think up solutions on their own always played a major role, whereas in some of the lessons guided by experts this activity was less visible. In the mentor lessons, for example, there was more room for students' own ideas and productions, whereas in the expert lessons teachers provided solutions to students in order for the students to make pace. Some smaller differences were visible between upper and lower grades. These differences mainly pertained to the lessons guided by experts. For example, teaching methods appeared to be slightly more diverse in the upper grades. Besides, in the upper grades there was a somewhat stronger focus on learning in an active and explorative manner. Also, the upper grade expert lessons showed a fixed programme order more clearly than the lower grade expert lessons. In the lower grades, a stronger emphasis on authentic tasks was visible.

Guidance dimension

Regarding the guidance dimension, some types of guidance were visible more frequently than others in the observed lessons (see Table 5). Types of guidance that were visible often were: promoting understanding, instruction, providing active support, and allowing autonomous student work. Types of guidance that were visible more scarcely were: provision of help when necessary, thinking aloud, feedback, demonstration, and evaluation. The frequency in which coaching was visible was somewhat in between. Teacher guidance could thus be characterized as rather proactive with teachers taking the initiative to aid students, while also making room for independent student work and leaving the initiative for seeking aid to students.

⁵ Gender: male was taken as baseline; grade level: lower grades (1–3) were taken as baseline; programme level: lowest level was taken as baseline

Table 3Scores on the content dimension per characteristic per lesson on a scale from 0 to 3^a.

Lesson (mentor or expert)	Lower grades					Upper grades				
	1 (M)	2 (M)	3 (E)	4 (E)	5 (E)	6 (M)	7 (M)	8 (E)	9 (E)	10 (E)
Emphasis on authentic tasks/real-world problems	3	3	2	3	1	3	3	2	1	0
Curriculum arranged around themes that exceed subject areas	3	3	3	3	2	3	3	1	3	3
Explicit attention for learning and problem solving skills	3	3	2	3	3	3	3	3	3	2
Zooming from complex tasks to underlying skills and knowledge	3	3	3	2	0	3	3	2	3	2
School monitors the coverage of competencies during the learning process	3	3	0	0	0	3	3	0	3	0
Students frequently use many different sources of information, teaching aids and places to work	3	3	2	3	2	2	3	3	3	3
Much interaction between students which stimulates them to learn from each other	3	3	1	3	3	3	2	3	2	3
For many assignments, input from fellow students is crucial	3	2	0	3	2	3	2	3	1	2
A mix of teaching methods is used	3	3	1	3	2	2	3	3	3	3
Students acquire knowledge and skills by working in an active and explorative manner	3	3	2	2	2	2	3	3	3	3
An important striving of the teacher is to stimulate students to think up solutions on their own	3	3	0	3	2	3	3	1	3	3
An emphasis on reflective learning in which students always examine why something goes right or not	3	3	0	2	0	3	2	0	0	2
Students' portfolios play an important role in assessment	0	0	0	0	0	0	0	2	0	0
A fixed programme order	3	0	3	1	0	3	3	3	3	2

^a M = mentor lesson; E = expert lesson.

Instruction, demonstration and thinking aloud typically were whole-class activities in the observed lessons. The promotion of understanding was often aimed at the whole class in the beginning of the lessons and aimed at individuals later on. The degree to which students were allowed to work autonomously varied per lesson. Especially in the lessons guided by mentors, many whole-class activities were planned. As a result, in these lessons, less 'help when necessary' was provided. When teachers did provide help when necessary, this was mainly aimed at individual students. Coaching and active support were aimed at both the whole class and individual students. The same was the case for evaluation and feedback.

There were some differences between the types of guidance mentors used and those used by experts. Compared to mentors, the experts generally guided the students more frequently. When looking at which types of guidance were used by mentors and experts in different grades, some more differences were visible. Regarding promoting understanding, instruction, and allowing

autonomous student work, for example, the experts were found to use these particular types of guidance more frequently than mentors. In case of promoting understanding and instruction, this was the case in both lower and upper grades; in case of allowing autonomous student work especially lower grade experts seemed to prefer this activity quite strongly. In general, in the upper grades both mentors and experts showed fewer activities than in the lower grades (501 versus 390 activities). Some of the more prominent differences between upper and lower grades were related to promoting understanding, coaching, thinking aloud, feedback, and evaluation: in the lower grades the teachers more often used these types of guidance. Thinking aloud, feedback, and evaluation were barely visible in upper grade expert lessons. Finally, within the observed lower grades lessons guidance often seemed to fade during the lessons: in the beginning, often more guidance was visible than in the latter part of these lessons. This was not the case in the observed upper grade lessons.

Table 4

Frequencies in which content dimension characteristics were barely/sometimes/(almost) always visible in the 10 lessons, derived from Table 3.

Lesson	f per score			
	Not observed	Barely visible	Sometimes visible	(Almost) always visible
Explicit attention for learning and problem solving skills	0	0	2	8
Curriculum arranged around themes that exceed subject areas	0	1	1	8
Students frequently use many different sources of information, teaching aids and places to work	0	0	3	7
Much interaction between students which stimulates them to learn from each other	0	1	2	7
A mix of teaching methods is used	0	1	2	7
An important striving of the teacher is to stimulate students to think up solutions on their own	1	1	1	7
Students acquire knowledge and skills by working in an active and explorative manner	0	0	4	6
Zooming from complex tasks to underlying skills and knowledge	1	0	3	6
A fixed programme order	2	1	1	6
Emphasis on authentic tasks/real-world problems	1	2	2	5
School monitors the coverage of competencies during the learning process	5	0	0	5
For many assignments, input from fellow students is crucial	1	1	4	4
An emphasis on reflective learning in which students always examine why something goes right or not	4	0	3	3
Students' portfolios play an important role in assessment	9	0	1	0
Total	24	8	29	79

Table 5
Frequencies per type of guidance of the guidance dimension per lesson.

Lesson (mentor or expert)	Lower grades					Upper grades					Total
	1 (M)	2 (M)	3 (E)	4 (E)	5 (E)	6 (M)	7 (M)	8 (E)	9 (E)	10 (E)	
Promoting understanding	11	29	40	40	13	22	4	16	52	20	247
Instruction	5	8	25	11	34	1	6	13	21	34	158
Active support	3	20	0	18	32	15	16	14	10	29	157
Allowing autonomous student work	1	2	0	40	40	0	1	2	10	50	146
Coaching	7	1	1	29	7	6	6	4	1	3	65
Provision of help when necessary	0	2	0	6	12	0	0	9	4	4	37
Thinking aloud	6	0	0	0	13	0	1	1	3	0	24
Feedback	4	0	0	5	12	0	0	3	0	0	24
Demonstration	1	0	2	0	5	0	0	0	5	4	17
Evaluation	1	0	0	15	0	0	0	0	0	0	16
Total	39	62	68	164	168	44	34	62	106	144	891

Students' goal orientations and learning strategies

Preferences for goal orientations and learning strategies

With regard to students' goal orientations, it can be concluded that students preferred a mastery orientation strongest with a mean score of 4.10, which was 78% of the maximal possible score (see Table 6). Trying to perform the best (i.e., a performance orientation) or attaining sufficient grades without much effort (i.e., a work avoidance orientation) showed relatively lower mean scores with 50% and 48% of the maximal possible score, respectively. With regard to the cognitive learning strategies of the students, deep and surface learning strategies were preferred almost equally with a mean score of 3.08 for surface strategies and of 3.14 for deep strategies, which was 52% and 53% of the maximal possible score. With regard to meta-cognitive strategies, self-direction of meta-cognitive strategies by the student and undirected use of meta-cognitive strategies showed relatively low mean scores with 51% and 42% of the maximal possible score respectively.

Relations between goal orientations and learning strategies

The significant correlations found between the questionnaire scales were generally rather low. Students' preferences for mastery goal orientations were related to their preferences for performance orientations (see Table 7; $r = .26$; $p = .00$). It appears as if students striving for learning or competence were also interested in striving to be the best. Preferences for work avoidance goal orientations, on the other hand, were also related to performance orientations ($r = .38$; $p = .00$). Students that strive to attain sufficient grades without putting in much effort were also interested in social comparison. Regarding students' learning strategies, a relatively strong relation was found between preferences for deep processing strategies and preferences for self-direction of meta-cognitive strategies ($r = .67$; $p = .00$). Preferences for surface processing strategies were also related to students' preferences for self-direction ($r = .38$; $p = .00$). Preferences for undirected meta-cognitive strategies seemed to have no substantial relation with students' preferences for

deep or surface processing strategies (DEEP: $r = -.12$; $p = .19$; SURF: $r = -.05$; $p = .60$).

Positive significant relations between preferences for mastery goal orientations and all preferences for cognitive and meta-cognitive strategies were found, except from undirected meta-cognitive strategies. Preferences for performance goal orientations were only related to preferences for deep processing strategies ($r = .20$; $p = .03$). Preferences for work avoidance goal orientations were negatively related to preferences for self-direction of meta-cognitive strategies ($r = -.29$; $p = .00$).

Background variables: Differences between types of students

Some differences between types of participating students were found. Regarding gender, there was only a difference between male and female students with respect to their preferences for work avoidance goal orientations. Boys appeared to prefer this type of goal to a larger degree than girls did ($t = 3.07$; $p = .00$). Regarding grade level, students from the upper grades appeared to have stronger preferences for performance goal orientations ($t = 2.26$; $p = .03$) than students from the lower grades. Upper grade students also showed stronger preferences for deep processing strategies ($t = 2.03$; $p = .05$). Students from the lower grades, on the other hand, showed stronger preferences for surface processing strategies ($t = -2.66$; $p = .01$). Regarding the level students were in, PVSE students seemed to have weaker preferences for deep processing strategies than their peers in HGSE and PUE; HGSE students had weaker preferences than PUE students ($F(2, 111) = 4.27$; $p = .02$). PUE students showed weaker preferences for undirected meta-cognitive strategies than their peers in PVSE and HGSE; HGSE students also showed weaker preferences than PVSE students ($F(2, 111) = 5.36$; $p = .01$).

The relation between the learning environment and students' goal orientations and learning strategies

Some of the ideas about student learning in powerful LEs described in the theoretical framework were also found within the context of this case study. Regarding students' preferences for certain types of goal orientations, for example, students within our sample had rather strong preferences for mastery goals. This is in line with the idea that certain characteristics of the participating school are likely to make an appeal to intrinsic motives which, in turn, can be related to a mastery orientation. The frequencies in which some of the LE characteristics were observed provide some indications about what might have contributed to mastery orientations in students. Characteristics that may have contributed to the relative strong mastery preferences are likely to pertain to the frequent use of authentic tasks that was quite often visible in most lessons (see Table 4). The fact that tasks often show

Table 6
Mean scores on the questionnaire scales.

Scale	N	Min	Max	Mean	Std. dev.
Mastery	138	1.00	4.90	4.10	.65
Performance	138	1.00	5.00	2.99	.83
Work avoidance	138	1.00	5.00	2.93	.82
Deep cognitive strategies	119	1.00	4.83	3.14	.67
Surface cognitive strategies	119	1.13	4.50	3.08	.58
Self-direction	119	1.13	4.88	3.03	.65
Undirected meta-cognitive strategies	119	1.25	5.00	2.68	.81

Table 7
Correlations between the questionnaire scales.

	MAST	PERF	WORKAV	DEEP	SURF	SELF	UNDIR
MAST	–						
PERF	.26**	–					
WORKAV	–.08	.38**	–				
DEEP	.45**	.20*	–.07	–			
SURF	.19*	.02	–.15	.17	–		
SELF	.49**	–.01	–.29**	.67**	.38**	–	
UNDIR	–.14	.18	.12	–.12	–.05	–.17	–

resemblance with real life situations, supported by the freedom of choice students have on how to work out these tasks, may have resulted in the intrinsic goal orientations. Also, the frequent emphasis on active and explorative learning may have resulted in students following their own interests and thus striving for learning or competence in that field.

Regarding cognitive learning strategies, students in our sample appeared to have almost equally strong preferences for deep and surface strategies. Based on the ideas described in the theoretical framework, one might have expected stronger preferences for deep cognitive strategies. Compared to mean scores found for this scale (and the surface strategies scale) in other research using the same instrument, however, the scores found in this study are relatively high (e.g. Koopman, 2011b; Picarelli et al., 2006). Characteristics that may have elicited preferences for deep strategies may pertain to the themes the school used that exceed the traditional subject areas and to the fact that teachers often tried to take complex tasks as a starting point for students to develop underlying knowledge and skills. Perhaps as a result of teachers frequently integrating learning content from adjacent subject areas into so-called learning areas, students may have been more focused on the relating and structuring of concepts from different subject areas. Also, as a result of learning tasks in which different subject areas play a role it could have been easier to make concrete depictions of learning content. Frequent teacher guidance aimed at promoting understanding may also have supported deep learning. The focus on the development of learning and problem solving skills that teachers show may have contributed to students' ability to use both types of information processing strategies. For example, the teachers often actively paid attention to which processing strategies could possibly have been used by students to solve a task.

In contrast to the aims of the school regarding the elicitation of certain meta-cognitive learning strategies, medium scores were found for self-direction of these strategies. Besides, the observations showed that teachers provided rather strong teacher directed and initiated guidance, which may have supported (or perhaps even elicited) their lower preferences for self-direction. Although guidance in the lower grades often appeared to fade while the observed lessons progressed, lower grade students did not show stronger preferences for self-direction of meta-cognitive strategies. Perhaps students in this school demand the relatively strong, externally regulated guidance they received.

Conclusions and discussion

The central question of this study concerned the characterization of students' goal orientations and their preferences for cognitive and meta-cognitive learning strategies in a LE that is based on a social constructivist view on learning. The results of the evaluation of this educational programme showed that the investigated LE demonstrated many characteristics related to social constructivism. As such, it can be concluded that the school succeeded in implementing social constructivist characteristics in

their LE. Regarding the content dimension of the LE, the school appeared to have implemented learning tasks in which connections to real-world problems and situations can be easily made. The school also succeeded in stressing conceptual interrelatedness, mainly by integrating learning content from adjacent subject areas. In the school, students were stimulated to work in pairs or small groups, by means of which interaction among students is enhanced. The school's LE could be considered supporting with respect to encouraging students to strive for understanding, and by having them learn in an active and explorative manner. Regarding the guidance dimension of the LE, teacher guidance in the school can be described as quite strong, with teachers mainly focusing on instruction, promoting understanding, allowing autonomous student work, providing active support, and sometimes on coaching.

Concerning student learning, the results of this evaluation study indicated that the school succeeded partly in eliciting the type of student learning they aimed at. Student learning in the LE could be characterized as predominantly mastery oriented. The students turned out to have approximately equally strong, medium preferences for deep and surface learning strategies. Regarding their preferences for meta-cognitive learning strategies, the students showed medium preferences for self-direction of the execution of these strategies. Undirected meta-cognitive strategies were preferred less, especially by students in the highest level of secondary education. The social constructivist LE the school created appeared to have some success factors regarding the encouragement of effective learning processes (cf. de Bruijn et al., 2005; Honebein, 1996). First, students' preferences for mastery goal orientations may be related to the authentic learning tasks that allow students' voice and give students opportunities to plunge into their own interests. Second, the integration of learning content into broad subject areas and teacher guidance aimed at both promoting understanding and development of students' learning and problem solving skills may have contributed to relatively high scores for deep processing, when compared to similar studies in other secondary schools (Koopman, 2011b). Thirdly, students' medium preferences for self-direction of meta-cognitive strategies are supported by the strong teacher guidance mentioned earlier (cf. Vermunt & Verloop, 1999).

Some of the assumptions made about the relation between characteristics of LEs based on a social constructivist view on learning and students' learning processes were confirmed. Regarding students' goal orientations and powerful LEs eliciting mastery orientations, our findings corroborated with findings of earlier research (Meece, Anderman, & Anderman, 2006). Besides LE characteristics, the fact that students chose this school because of its non-traditional form of education may also have contributed to their intrinsic motives. Regarding preferences for deep cognitive learning strategies that may be elicited in powerful LEs, the results were more ambiguous. Many studies focused on student learning in innovative LEs that strive to focus on student learning show comparable, or even less positive results (Gijbels, Segers, & Struyf, 2008; Hattie, 2009; Nijhuis, Segers, & Gijbels, 2005). It remains

rather unclear how preferences for deep processing strategies can be provoked to an even larger degree. The idea that such preferences are at least partly fixed, like a kind of natural inclination or habit that differs from student to student, may complicate the degree to which school and teachers can influence them (Eley, 1992; Hadwin, Winne, Stockley, Nesbit, & Wosczyzna, 2001). Moreover, the use of surface processing strategies can sometimes be useful, for example when students are learning a foreign language. Perhaps, in this school some more attention could be paid to reflective learning on the part of students and evaluating and providing feedback on the part of teachers in order to bring about deeper processing. The assumptions regarding preferences for self-direction of meta-cognitive strategies were not confirmed in this study. Contrary to our expectations, students in this school showed rather mediocre preferences for self-direction. Indeed, this may also be related to personal inclinations or perhaps the age and developmental stage the students are in. Also, the openness of the LE the students are confronted with may in fact require teachers to guide students in a rather strong manner. In that case, the teachers in the investigated LE provide exactly the type guidance the students need (Kirschner, Sweller, & Clark, 2006). However, their strong guidance may also form little challenge for students to carry out meta-cognitive learning strategies on their own (Vermunt & Verloop, 1999).

There are some limitations to this study. First, in the observations it was chosen to focus on the frequencies in which content and guidance dimension characteristics were visible in 10 lessons. It was assumed that (frequent) presence of these characteristics would make the LE powerful (cf. de Bruijn et al., 2005). However, the manner in which the characteristics were implemented was not investigated in a qualitative manner in this study. Also, some characteristics may have been less visible in the observed lessons, while they might have been present over a longer period. Second, in order to strive for a high response all students of the school were asked to complete the questionnaire (i.e. also students that were not present in the observed lessons). Though 10 lessons of 10 teachers were observed in a school in which teachers cooperate much and share many of the same ideas about teaching and learning, we cannot be completely sure that all students received equally powerful education. In further research, stronger claims about causal relations between student learning and LE characteristics could be made when only questionnaire data from the students in the observed lessons were used. The study was designed as a case study in a school that is innovative for Dutch education. However, the results can be used to provide evidence for hypotheses about student learning, especially in terms of goal orientations, in innovative LEs. Further research could contribute to comparing the effects of this type of education to other experiments or more traditional LEs. As many schools struggle when they attempt to make comparable changes to their LE, in further research attention to the implementation process of such innovations would be relevant. Also, in future research it might be relevant to study what happens if there is friction between students' personal preferences for goal orientations and learning strategies and the characteristics of the LE they are confronted with (Vermunt & Verloop, 1999). Given some of the disadvantages of general self-report questionnaires, it might be relevant then to use online, task-specific data collection methods regarding student learning instead (Richardson, 2004; van Hout-Wolters, 2009).

This study indicates that some of the factors that can be assumed to lead to effective learning (in terms of learning results) can indeed be present in social constructivist learning environments, such as rather strong preferences for intrinsic goal orientations and deep cognitive strategies. Not every school that experiments with social constructivism as a starting point for the

design of an educational programme succeeds. The school in this study did justice to their ambitions and can thus provide some examples for other schools striving at comparable aims. For example, indications found that mastery orientations can indeed be elicited in powerful LEs might be useful. LE characteristics such as working with authentic, real-world problems and freedom of choice for students might be considered by other schools. It is particularly important then to arrange the entire curriculum around these problems and to guide students actively while they are working on these problems. There are some possible explanations for the success factors of this school that might also be relevant for schools with comparable ambitions. First, the school had about six years of experience with this form of education. In these years, they deliberately experimented to find out what worked best for their students and made some adjustments to the curriculum. Second, in this school all teachers chose to participate in the development of this type of education. The school started to implement social constructivist education from the moment it was founded. In contrast to many other schools attempting to change their education, there was no resistance towards the innovations among the teachers in this school. Third and finally, the entire curriculum of the school is based on a social constructivism view on learning (every grade level and every subject area). This, perhaps, makes it easier to completely and unambiguously create an innovative learning environment.

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