Student perspectives on education: Implications for instructional redesign

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Nederlandse Organisatie voor Wetenschappelijk Onderzoek
projectnummer 411-01-052

ico
Interuniversitair Centrum
voor Onderwijsonderzoek

ISBN 97890 358 1975 7

Omslag ontwerp
Jeroen Berkhout en Karen Könings

Illustratieverantwoording
Picture Alliance, Den Haag: omslagfoto

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PROEFSCHRIFT

ter verkrijging van de graad van doctor
aan de Open Universiteit Nederland
op gezag van de rector magnificus prof. dr. ir. F. Mulder

ten overstaan van een
door het College voor promoties
ingestelde commissie
in het openbaar te verdedigen

op vrijdag 15 juni 2007 te Heerlen om 15.30 uur precies

door
Karen Dominique Könings
geboren op 1 mei 1975 te Heerlen

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Vele keren per dag dringt tot me door
hoezeer mijn eigen uiterlijk en innerlijk leven is opgebouwd
op de krachtsinspanningen van mijn medemensen,
zowel zij die leven als zij die dood zijn,
en hoezeer ik me moet inspannen
om net zoveel terug te geven
als ik heb ontvangen.

Albert Einstein

Voorwoord

"Weet je wat", zei Pippi, "ik bedoel, weet je wat, juffrouw, het was erg leuk om hier eens te komen en te zien hoe het hier toegaat, maar ik geloof niet dat het me verder erg veel kan schelen om naar school te gaan.... Ik word er gewoon duizelig van. Ik hoop, juffrouw, dat je er niet boos om bent?" (Astrid Lindgren, 1983, p.44)

De manier waarop leerlingen tegen onderwijs aankijken en hoe ze het ervaren is van grote invloed op hun leergedrag. Bij het ontwerpen van onderwijs wordt echter zelden rekening gehouden met ervaringen en ideeën van leerlingen. Pippi Langkous kan gezien worden als een voorbeeld van een leerling waarbij het leerproces spaak loopt omdat het aangeboden onderwijs niet aansluit bij haar leerbehoeften, zij misschien andere verwachtingen van school had, of omdat haar ideeën over waardevol onderwijs erg verschillen van de ideeën van de onderwijsgevende. Een discussie tussen Pippi en haar "juffrouw" over de vormgeving van het onderwijs en het gezamenlijk herontwerpen hiervan zou de leeromgeving effectiever hebben gemaakt. Dit is in het kort de thematiek van het onderzoek dat beschreven is in dit proefschrift.

Het proefschrift is tot stand gekomen met medewerking, hulp en steun van een aantal mensen, dat ik hierbij graag wil bedanken. Allereerst bedank ik mijn promotor Jeroen van Merriënboer en co-promotor Saskia Brand-Gruwel heel hartelijk voor hun grote inzet. Beste Jeroen, je was een enthousiasmerende, behulpzame en zeer coöperatieve promotor. Ik heb veel geleerd van onze brainstormsessies, je manier van vragen stellen en je feedback op mijn teksten. Beste Saskia, je was een fijne dagelijks begeleider die daarbij steeds tijd vrijmaakte voor het becommentariëren van mijn werk en het opzetten van een boompje over analyses of onderzoeksideeën. Met je positieve instelling en relativeringsvermogen heb je ons onderzoeksproject een zonnig karakter gegeven: meedenkend, betrokken, altijd oplossingsgericht, maar ook afremmend als ik soms te veel wilde. Ik denk met veel plezier terug aan alle uurtjes die we met z'n drieën "gestoeid" hebben over het onderzoek. Bedankt!

Veel dank ben ik ook verschuldigd aan de scholen voor Voortgezet Onderwijs die meegewerkt hebben aan het onderzoeksproject (of delen ervan). Bedankt aan alle leerlingen en docenten die één of meerdere vragenlijsten invulden, meewerkten aan een interview of aan het experiment rond participatief herontwerpen. Een woord van dank wil ik ook richten aan de leidinggevenden van de verschillende scholen die mij de mogelijkheid gaven om gegevens te verzamelen binnen hun

_____

A. Lindgren (1983). *Pippi Langkous komt thuis.* Amsterdam: Ploegsma bv.

school: de heren Erfkemper en Hansen van het St.-Janscollege in Hoensbroek, mevrouw Beckers en de heren van Eeghem en Kuijpers van het Trevianum in Sittard, de heer Linders van het Bernardinuscollege in Heerlen, de heren Thewissen, Franssen en Jennekens van College Rolduc in Kerkrade, en de heer Golsteyn van Stella Maris in Meerssen.

Verder wil ik Nick Broers bedanken voor zijn statistische adviezen. Nick, bedankt voor de constructieve mailwisselingen en de prettige samenwerking tijdens het schrijven van hoofdstuk drie van dit proefschrift. Dankjewel ook aan Marjo van Zundert, die als stagiaire bijdroeg aan het onderzoeksproject. Marjo, bedankt voor je inzet en gedegen manier van werken. Het was leuk een stukje van het traject samen af te leggen en helemaal mooi dat het werd beloond met een gezamenlijke publicatie. Ik ben blij dat je me als paranimf terzijde zult staan. Bij het invoeren van de grote aantallen vragenlijsten heb ik veel hulp gehad van Roel Rutten, Ingrid Jonkman en Marieke Peeters. Jullie doorzettingsvermogen was groot, waarvoor veel dank! Tevens wil ik alle collegae van het Onderwijstechnologisch Expertisecentrum – in het bijzonder de collega-promovendi en de collegae van de masteropleiding Actief Leren – bedanken voor de fijne tijd en de goede samenwerking. Dank aan Ronald Gossieau voor zijn speurwerk naar de bron van de afbeelding op de kaft en voor het regelen van de rechtenverwerving.

Graag wil ik ook een aantal mensen bedanken die op een heel andere wijze hebben bijgedragen aan de totstandkoming van dit proefschrift. Beste Mat, bedankt voor je nimmer-aflatende interesse in mijn werk, je luisterend oor en je adviezen op alle terrein. Beste Birgit en Viviane, een lange historie bindt ons en ik ben erg dankbaar voor ons warm contact. Dankjulliewel ook voor het meedenken en de goede raad op belangrijke momenten in de afgelopen jaren. Viv, ik vind het heel fijn dat je mijn paranimf zult zijn. Beste Ursi en Peter, trotz der Distanz seit ihr oft sehr nah. Vielen Dank für alle schönen Momente und euere Freundschaft.

Tenslotte wil ik mijn ouders bedanken voor alles wat zij voor mij betekenen en betekend hebben. Lieve paps, met veel warmte en dankbaarheid denk ik terug aan de mooie jaren die we samen met z'n drieën hadden. Je bouwde mee aan de basis, waarop ik heb geprobeerd verder te bouwen. Je wekte mijn interesse voor onderzoek, maar veel meer nog gaf je me het voorbeeld om uitdagingen aan te gaan. Helaas moest je te vroeg heengaan, maar onze herinneringen blijven levend en je bent vaak in mijn gedachten. Lieve mama, de mijlpaal van dit proefschrift zou ik nooit hebben bereikt zonder jouw steun, betrokkenheid en liefde. Alles kan ik met je delen. Ik ervaar dit als een heel kostbaar geschenk. Bedankt dat je er altijd voor me bent. Als ik mijn zegeningen tel, tellen jullie dubbel!

Karen Könings, 01.05.2007

Contents

1

General introduction

Nowadays, much effort is invested in innovating and improving the quality of education. This proves to be a difficult process. Part of the problems is due to the extent to which different people involved in the educational process exchange experiences and ideas with each other. Communication between different stakeholders is often limited. A first point of consideration is that designers do seldom accept co-accountability for the translation of their ideas into practice (Staub, 2004). Implementation is likely to suffer from this. In addition, the design cannot be adapted and improved on the basis of teachers' experiences if communication between designers and teachers is so much limited. A second point is that students are mostly not involved in the design process of their learning environment (Cook-Sather, 2001, 2006). In fact, students are often seen as "consumers" of teaching practices others set up for them. However, human-factors engineering stresses that designers' and users' interpretation of any system or design have to be more or less the same to eventually reach the designers' intentions (Norman, 1986, 1988), otherwise a decline in effectiveness is to be expected (Bartholomew, Parcel, Kok, & Gottlieb, 2001). Thus, if communication with students about the learning environment is absent or suboptimal, their dissentient perceptions are likely to stay unnoticed but nevertheless undermine the effectiveness of the learning environment.

More congruence between perspectives of designers, teachers, and students is supposed to improve the effectiveness of the learning environment. Cooperation and providing feedback to each other are needed to account for the different viewpoints of stakeholders and to achieve better alignment between perspectives. The Second Phase is an innovative learning environment in Dutch secondary education that has suffered from incongruity between perspectives of different

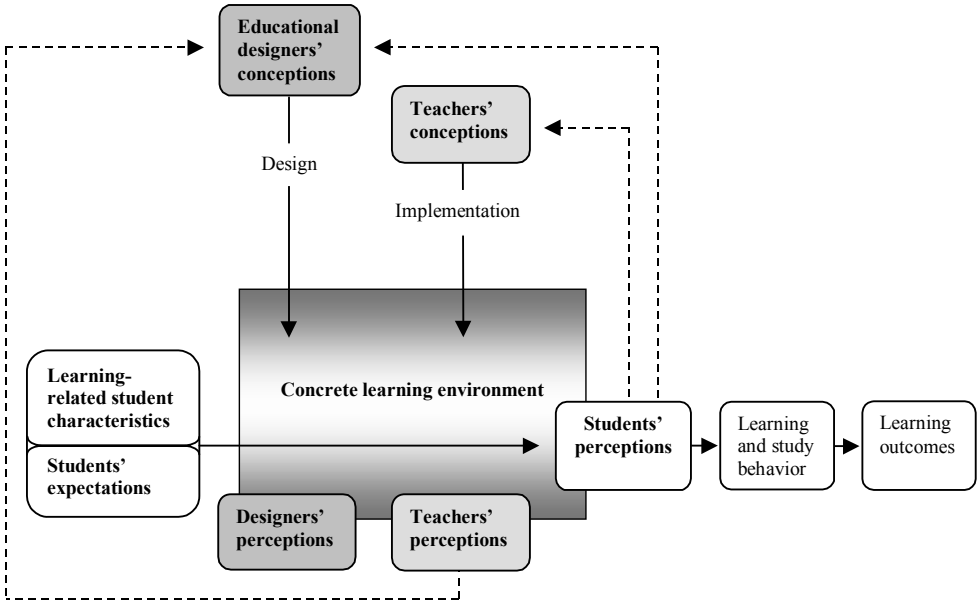

Figure 1.1 The COmbination-Of-Perspectives (COOP) model.

stakeholders and lack of communication or cooperation. Schools and teachers have experienced numerous problems with implementing this innovative educational design and students grumble about an overfilled curriculum and lesson program (Veugelers, de Jong, & Schellings, 2004). This learning environment is the educational context of the research project described in this thesis. The main goal of the reported project is twofold. First, it aims to gain insight in different perspectives of people involved in the educational process. Second, effects of participatory design are studied as a strategy to improve the congruence between the perspectives of teachers and students.

Chapter 2 presents the COmbination-Of-Perspectives (COOP) model (see Figure 1.1). It discusses findings reported in the literature about perspectives of different stakeholders on a learning environment, namely: educational designers, teachers, and students. The perspective of educational designers reflects the aims and characteristics of modern education (de Corte, 1990, 2003; Merrill, 2002; van Merriënboer & Paas, 2003; Vermunt, 2003), like student autonomy, interactive learning, and differentiation. Teachers have their own perspective on education, which is influenced by their conceptions of learning and teaching (Pratt, 1992; Trigwell, Prosser, & Waterhouse, 1999). They implement the designs of innovative learning environments produced by educational designers, but because

communication and cooperation between designers and teachers is often lacking (e.g., Keys & Bryan, 2001; Pedersen & Liu, 2003; Staub, 2004), it is likely that discrepancies exist between perspectives of teachers and designers. Therefore, the COOP model proposes a feedback loop from teachers' perceptions of a learning environment to designers.

Finally, students also have their own perspective on a learning environment. This perspective is the result of the interaction between the environment and the student who has certain learning-related characteristics (Luyten, Lowyck, & Tuerlinckx, 2001; Wierstra & Beerends, 1996), like a particular motivational orientation, conception of learning, and affective processing strategy. The student perspective on a learning environment is of crucial importance, because it directly influences learning and study behavior and thus the quality of learning (Entwistle & Tait, 1990). An environment per se does *not* directly influence student learning, and therefore the student perspective should have a far more prominent place in educational design processes than it currently has. The COOP-model visualizes this by the feedback loops from students' perceptions of the learning environment back to teachers' and educational designers' conceptions.

Building on the COOP-model described in Chapter 2, the further chapters focus on the perspectives of students in Dutch secondary education (Chapters 3-4), their teachers (Chapter 5), the differences between both (Chapter 6), and finding ways to diminish the differences in perspectives (Chapters 7-8). In all studies, three aspects of perspectives are considered, namely: perceptions, desires, and (dis)satisfaction.

Chapters 3 and 4 focus on the students' perspective on a learning environment, especially on the highlighted elements in Figure 1.2. Chapter 3 describes a large-scale longitudinal study on students' expectations and perceptions of a learning environment. Expectations are hypothesized to influence subsequent perceptions. Students were on the eve of entering an innovative learning environment in Dutch secondary education, called the Second Phase, when they filled out the questionnaire on their expectations. In the two subsequent years these students again filled out the questionnaire to report on their perceptions of the environment. The research questions are: (1) "Are students' expectations of the learning environment met, and how do desires and dissatisfaction develop over time?" (2) "do expectations positively relate to subsequent perceptions, and how do desires and dissatisfaction scores at different moments in time relate to each other?" and (3) "how do expectations, desires, and prospective dissatisfaction relate to learning-related student characteristics?" The results reveal that students are disappointed about most of the characteristics of the new environment and this relates to undesirable changes in learning-related student characteristics. The study underlines the importance of investigating expectations in educational context.

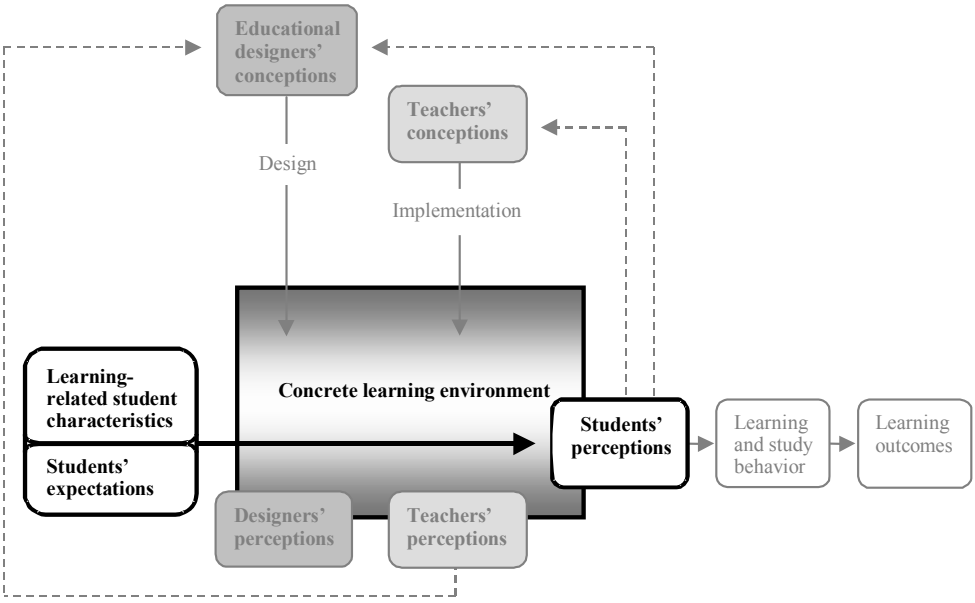

Figure 1.2 Elements of the COOP model studied in the Chapters 3 and 4.

Chapter 4 reports a study of students' perspectives on the Dutch Second Phase, while they are already learning in this environment. The research questions are: (1) "How do 10th grade students perceive the innovative learning environment, what do they desire from a learning environment, and with which elements of the perceived learning environment are they dissatisfied?" and (2) "how are perceptions, desires, and dissatisfaction scores related to learning-related student characteristics, in particular, cognitive processing strategies, regulation strategies, motivational orientations, conceptions about learning, and affective processing strategies?" It reveals that students perceive the environment as only partially powerful: they are dissatisfied and desire a much more powerful environment.

Chapter 5 describes a study focusing on teachers' perspectives (see Figure 1.3) on the same learning environment students reported on in the study described in Chapter 4. The following research questions are answered: (1) "How do teachers perceive the current innovative learning environment, what do they desire from an environment, and with which of its elements are they dissatisfied?" and (2) "how are perceptions, desires, and (dis)satisfaction related to approaches to teaching, amount of teaching experience, sex, and courses taught?" The findings of this study provide useful feedback for designers as well as a starting point to intensify their cooperation with teachers.

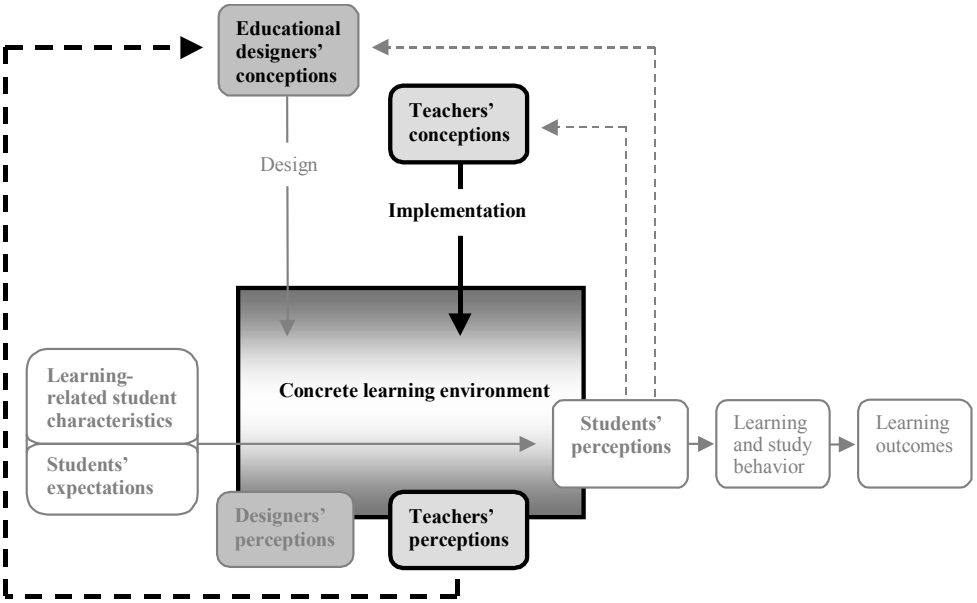

Figure 1.3 Elements of the COOP model studied in Chapter 5.

Chapters 6, 7, and 8 focus, in order, on differences between perspectives of students and teachers, exploring possibilities for an intervention to diminish these differences, and evaluating effects of this intervention. As can be seen in Figure 1.4, the combination of perspectives and the feedback loop between students and teachers are now emphasized.

Chapter 6 presents the results of a direct comparison between student and teacher perspectives on the learning environment in the 10th grade of Dutch secondary education (i.e., the first school year for students in the Second Phase). The main research question is: "How do students' and teachers' perspectives – specifically, their perceptions, desires, and dissatisfaction – on a learning environment differ?" Results show that teachers report predominantly higher perceptions and lower dissatisfaction than students. Implications for the differences between individual teachers and students are discussed, referring to the relations between their perspectives and personal background variables as found in Chapters 3 and 4. The findings stress the need for an intervention to decrease the difference in perspectives. An open discourse between teachers and students about the (re)design of their learning environment is proposed.

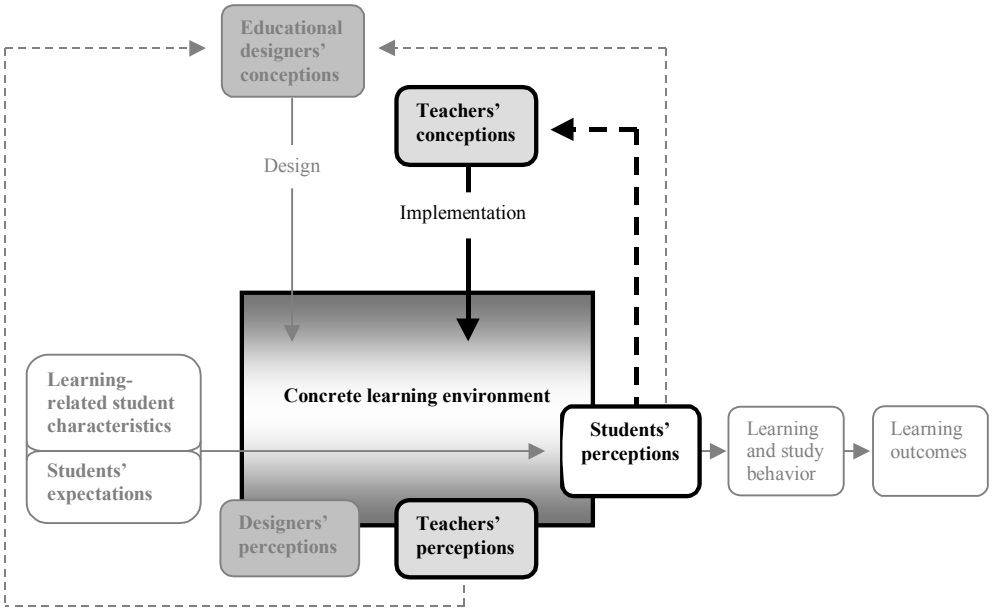

Figure 1.4 Elements of the COOP model studied in the Chapters 6, 7, and 8.

Chapter 7 describes a study exploring the possibility to implement participatory design in an educational context. Participatory design aims at the active participation of users in the design process and in making decisions that will affect them (Kensing & Blomberg, 1998; Mankin, Cohen, & Bikson, 1997). Participatory design is common practice in many areas outside the field of education. It might be a helpful strategy to reduce differences in perspectives. Students and teachers were asked about their opinions on the desirability and feasibility of possible uses of it. Furthermore, possible causes are explored for the differences between perspectives, as found in the study described in Chapter 6. The main goal of this study is to investigate if teachers and students are willing to engage in a participatory (re)design of their learning environment, and if so, in which ways they prefer to do so. Both students and teachers are quite positive toward participatory design, supporting its desirability and feasibility. The study also yields practical guidelines for implementation.

Chapter 8 describes a study evaluating the effects of a discourse between students and teachers, in the form of participatory redesign of their learning environment. Effects are measured on students' and teachers' perspectives on the environment and the magnitude of the discrepancy between both. Participatory design is implemented by six teachers with one of their tenth-grade classes. The

discourse between the teacher and seven students from her/his class resulted in collaboratively formulated action points, which the teacher tried to implement in subsequent lessons. The research questions are: (1) "How do co-designing students and teachers evaluate the participatory design meeting, and how does the rest of the class (i.e., non-co-designing students) evaluate the outcomes, such as the formulated action points?" (2a) "what are the effects of the participatory design meeting and subsequent redesign of the learning environment on students' (co-designers and rest of the class) and teachers' perspectives on the environment and the magnitude of the discrepancy between both?" and (2b) "what are in each experimental class the effects on students' and teachers' perspectives on various characteristics of the learning environment, and the discrepancy between both?" Results indicate that participatory design is a promising initiative for instructional (re)design.

Finally, Chapter 9 provides a general discussion of the findings of the conducted studies. It summarizes the main results and conclusions of Chapters 3 to 8, and in turn relates them to the COOP model presented in Chapter 2. Furthermore, it discusses implications for educational practice: How can different perspectives on a learning environment best be taken into account when innovations take place? The limitations of the presented research project are discussed and directions for future research are provided.

2

Towards more powerful learning environments through combining the perspectives of designers, teachers, and students

This chapter is published as:
Könings, K. D., Brand-Gruwel, S., & van Merriënboer, J. J. G. (2005).
Towards more powerful learning environments through combining
the perspectives of designers, teachers and students.
British Journal of Educational Psychology, 75, 645-660.

Abstract. In order to reach the main aims of modern education, powerful learning environments (PLEs) are designed. The characteristics of the design of PLEs are expected to have positive effects on student learning. Additionally, teachers' conceptions of learning and teaching do influence the implementation of a PLE. Moreover, students' perceptions of a learning environment affect their subsequent learning behavior and the quality of the learning outcomes. The different perspectives of educational designers, teachers, and students are summarized in the COmbination-Of-Perspectives (COOP) model. Combining these perspectives by mutual exchange of conceptions and perceptions is expected to have positive effects on the power of PLEs.

2.1 Introduction

Nowadays, a lot of attention is paid to the development of powerful learning environments (PLEs). Educationalists and teachers attempt to create learning environments for students that are supposed to be optimal for learning. Principles from cognitive psychology and constructivism are used to design and develop such learning environments. Mostly students themselves do not participate in the development of learning environments that are specifically intended for them. Although it is common practice not to involve students in the development process, this is not self-evident.

Research (Elen & Lowyck, 1998, 1999) has shown that students do not always experience a learning environment in the way it was intended by the designers. Rather than the learning environment itself, the students' perceptions of a learning environment determine how much they will learn and how effective a learning environment will be (Entwistle, 1991). The way students perceive and interpret a learning environment is influenced by their conceptions about learning, tasks, and environments, together called 'instructional metacognitive knowledge' (Elen & Lowyck, 1999). Discrepancies between designers' and students' interpretation of a learning environment will usually cause suboptimal use of a learning environment (Elen & Lowyck, 1999). In addition, there may be a discrepancy between designers' intentions with a learning environment, and teachers' conceptions of learning and teaching, which will lead to an implementation that differs from the intentions of the designers. These discrepancies are not an insoluble problem, however. Because students and teachers have their own perspective on the learning process, they should be involved in the design of the learning environment. What is really needed is a reciprocal relationship between designers, teachers, and students, so that there is exchange of ideas about learning and perceptions of learning environments. Only in this way, can more congruence be created between interpretations of learning environments by designers, teachers, and students, which will lead to the development of more effective learning environments and, eventually, more effective learning.

Underpinning this idea, the elements mentioned above are discussed in this paper. First, the main aims of modern education are described. Second, the characteristics of PLEs are explained in the light of those aims. Third, it is important to look at teachers' conceptions about learning and teaching, as mainly teachers implement learning environments into practice. Fourth, student conceptions and perceptions about learning and education are discussed. Fifth, the COmbination-Of-Perspectives (COOP) model summarizes the perspectives of the different participants involved in the educational process, making discrepancies

between them visible. In addition, the ultimate goal of creating more congruence between perceptions of learning environments by students, designers, and teachers is elaborated. Finally, the COOP model is discussed.

2.2.1 Aims of modern education

In the current view on learning, constructivism has a central position. Learning is seen as an active process of interpreting and constructing individual knowledge representations (Jonassen, 1991). Students have to process information actively and construct the knowledge through experience. Active knowledge construction in context contributes to advanced thinking and learning activities, resulting in high-quality knowledge acquisition (Spiro et al., 1991; Collins, Brown, & Newman, 1989; Brown, Collins, & Duguid, 1998). Instruction should provide tools and environments for helping students to achieve this.

Problem-solving skills are essential for living in a complex society. People are confronted with a variety of problems in daily life and at work. In order to effectively solve problems, three categories of skills are required (de Corte, 1990): (a) the flexible application of a well-organized domain-specific knowledge base, (b) systematic search strategies for problem analysis and transformation, and (c) metacognitive skills. Because real-life problems have a context that differs from the learning context, students should also be able to transfer knowledge and skills they learned at school to new situations. They have to become competent in applying the knowledge in their worlds, beyond the school walls (Dijkstra, 2001). In education, it is not a matter of reaching short-term goals, but of integrating acquired knowledge and skills with more general goals, such as understanding the surrounding reality, and adapting to changing circumstances (ibid).

Furthermore, people currently have at their disposal vast amounts of information, due to an increase in use of modern media, such as the Internet. In order to satisfy information needs, people have to find their way through what is available. This requires the ability to select, process, and organize information. Moreover, fast changes in work, technology, and society make it impossible to teach students everything at school, and during their youth. Individuals need to continuously update their knowledge, attitudes, and skills after graduation, however, without the support from teachers. They have to develop their professional competencies independently. An important goal of modern education is to prepare students for this lifelong process of learning (van Hout-Wolters, Simons, & Volet, 2000). Students should acquire a self-directed way of learning: they should mainly regulate their learning processes themselves, and should be able to work without the help of others, and learn in an experiential way.

In brief, education should be directed at reaching goals with regard to the acquisition of high quality knowledge, problem-solving skills, transfer of knowledge and skills, and self-directed learning skills. To catch these main aims of modern education, the term powerful learning environments is used, by which the current ideas about design and arrangement of learning environments are summarized.

2.2.2 Characteristics of powerful learning environments

There is a significant amount of information about the characteristics of PLEs. Specifically, de Corte (1990, 2003), Merrill (2002), van Merriënboer and Paas (2003), and Vermunt (2003) have all recently published work about designing such learning environments, and there is considerable agreement about the most important characteristics of PLEs. While different authors have also stressed different aspects of the design, all characteristics can be brought back to the general educational aims mentioned earlier.

In order to stimulate active knowledge construction and the acquisition of problem-solving skills, the learning environment should be problem-based, in that students are engaged in solving real-world problems (Merrill, 2002). Learning tasks or problems should be complex, realistic, and challenging in order to elicit an active and constructive learning process in students (van Merriënboer & Paas, 2003). Additionally, Merrill (2002) has described four other characteristics of PLEs that seem to be common in different current instructional theories. They can be seen as four phases of the learning process, which is directed to the acquisition of high quality knowledge and skills, problem-solving skills, and to transferability of learning outcomes. First, prior knowledge and experiences of the student must be activated, in order to build new knowledge on pre-existing knowledge. Second, new skills or knowledge must be demonstrated to the student through modeling. Third, the student should have the opportunity to apply their new knowledge and skills. Fourth, the newly acquired skills and knowledge must be integrated into real-world activities of the student. These features described by Merrill fit well with the ideas behind cognitive apprenticeship (Collins, Brown, & Newman, 1989). Van Merriënboer and Paas (2003) have stressed three basic principles for the design of a PLE. First, the learning environment must aim at integrated sets of learning goals, directed at the acquisition of knowledge, skills, and attitudes in an integrated way. By this integration, students become able to recombine acquired skills, knowledge, and attitudes effectively to solve problems in new situations (van Merriënboer, 1997). Second, in the design, variation in learning styles of students must be taken into account. For instance, well-designed environments must allow for deductive approaches (i.e. study general information, and then

examples) as well as inductive approaches (i.e. study examples, and then general information) to learning, and must also support both inquisitorial approaches (i.e. mainly study through discovery and asking questions), and expository approaches (i.e. mainly study through processing pre-structured information) to learning (van Merriënboer & Kirschner, 2001). Finally, the instructional design must be aligned with the human cognitive architecture, especially the limited processing capacity of the human mind, which is a prerequisite for being able to effectively construct your own knowledge (Sweller, van Merriënboer, & Paas, 1998).

Another way of stimulating active knowledge construction processes is the inclusion of small group, collaborative work, and ample opportunities for interaction, communication, and cooperation in the learning environment (van Merriënboer & Paas, 2003). This idea originates from Socrates, who stressed the importance of dialogue and discussion for knowledge construction a few thousand years ago. Recently, cooperation during knowledge construction, called collaborative learning, has received renewed interest. By a process of interaction and negotiation, students have an active and constructive role in the learning process.

A self-directed and independent way of learning and thinking can be stimulated by gradually transferring the responsibility for the learning processes from the instructional agent to the students themselves (Vermunt, 2003). Starting with explicit external regulation and support, the teaching process is directed to teach students how they can obtain control over their own learning processes. As students acquire self-directed learning skills, external support is gradually withdrawn. Teaching methods gradually change, dependent on, and complementary to, the growing competencies of the students, defined as process-oriented teaching (Vermunt & Verschaffel, 2000). The acquisition of self-regulation skills can be improved by stimulating students to articulate and reflect upon their learning and problem-solving processes (de Corte, 1990). Articulation helps students 'to spell out and make explicit their knowledge and problem-solving procedures. Reflection leads students to compare their cognitive strategies and solution processes with those of experts or other students' (p. 13).

Figure 2.1 summarizes the described characteristics of PLEs which have a supportive role in reaching the modern aims of education. They all contribute to one or more of the educational goals, which are pursued in current education systems. There is a considerable amount of evidence that these characteristics lead to better student learning (see e.g. Bolhuis, 2003; Johnson & Johnson, 1994; Schmidt, de Volder, de Grave, Moust, et al., 1989; Spires & Donley, 1998; Vermunt, 1995).

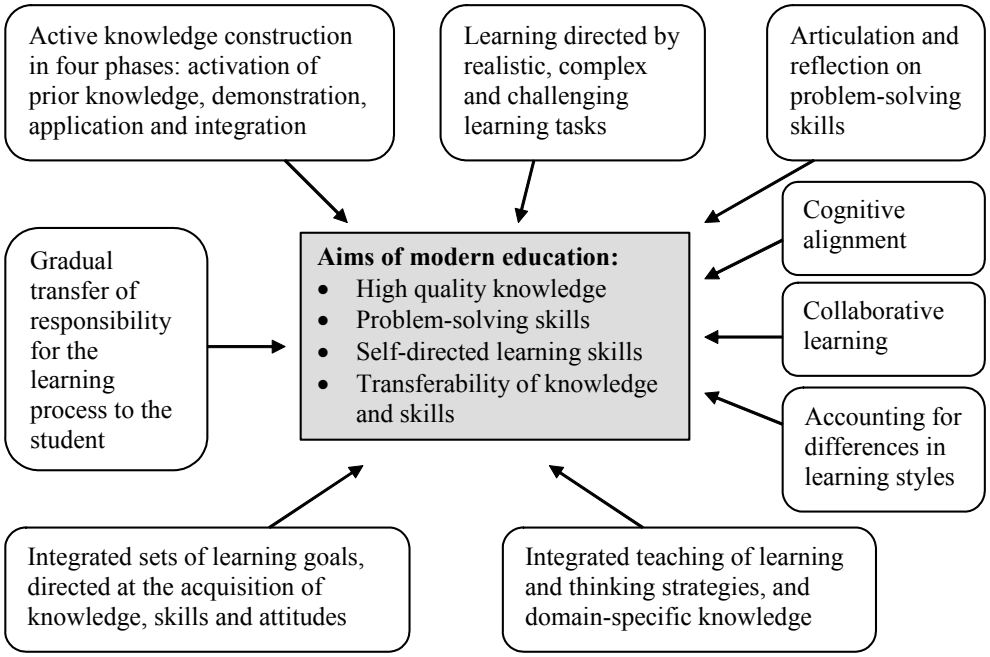

Figure 2.1 Characteristics of powerful learning environments that contribute to reaching the main aims of modern education.

Educationalists use these characteristics to design blueprints of PLEs, ranging from classroom-based courses and electronic learning environments, to complete educational approaches, like problem-based learning and competence-based education. However, a design of a learning environment that is well suited to reach the modern aims of education does not give the guarantee of practical success. Implementation is crucial in determining the factual characteristics of a learning environment, which influence student learning. Because teachers, instead of designers, often implement already designed learning environments into practice, it is worth examining the conceptions teachers have about learning and teaching. These conceptions strongly influence the implementation, and consequently the impact of the PLE on student learning.

2.2.3 Teachers' conceptions of learning and teaching

Having conceptions is inherent in human beings, because they attach meanings to their surrounding world. Conceptions can be seen as lenses through which people perceive and interpret the world (Pratt, 1992). Consequently, conceptions influence the way people act and react to their environment, which is in accordance with these perceptions. For teachers, a considerable part of their surrounding world is the teaching context, and they have formed specific conceptions of learning and teaching. Because of this, it is impossible that teachers implement PLEs into practice exactly as intended by the designer. Teachers perceive the learning environment through the lenses of their own conceptions, and will act and react accordingly.

There exists a large body of research on teachers' conceptions of teaching and learning. Kember (1997) reviewed 13 of these studies, and developed a model that synthesizes all the findings. According to him, all conceptions can be placed on a continuum between a teacher-centered/content-oriented pole, and a student-centered/learning-oriented pole, linked by an intermediate conception. Kember's synthetic model contains five conceptions of teaching: (1) imparting knowledge, (2) transmitting structured knowledge, (3) student-teacher interaction, (4) facilitating understanding, and (5) conceptual change and intellectual development. According to the conception of imparting knowledge, teaching is seen as presenting information to students, who only have to passively receive this information. The focus is on the lecturer and his/her knowledge, which gets transmitted by lecturing. According to the conception of teaching as transmitting structured knowledge, the focus is still on the transmission of knowledge, but there is more attention for the student. The teacher structures and arranges the presented information in a way that students have more chance of receiving the information. The conception of student-teacher interaction is the intermediate conception and forms the transition between the teacher-centered/content-oriented orientation, and the student-centered/learning-oriented orientation. The interaction between the teacher and the students is seen as important now, because of the recognition that student understanding and discovery are essential, manifesting itself in a degree of interaction. With regard to facilitating understanding, teachers who have the student-centered conception of teaching see teaching as a process of helping students to learn and develop deep understanding. Desirable learning outcomes are no longer limited to the intake of information, but include understanding and the ability to apply the acquired knowledge. According to the conception of conceptual change and intellectual development, a learning environment focuses on students' prior knowledge and tries to change pre-existing conceptions by arguing, applying

ideas, and focusing on conflicts between conceptions, in a sympathetic and supportive environment.

Recently, Samuelowicz and Bain (2001) have shown that there is no intermediate conception between the teaching-centered orientation and the learning-centered orientation, as Kember described. It is not the teacher-student interaction per se that differentiated the orientations, but the purpose and the nature of the interaction. Interaction is either focused on improving the transmission process (for example maintaining students' attention), or it is used to help students construct appropriate understandings. Thus, there are relatively hard boundaries between teaching-centered and learning-centered orientations. What is important with regard to the implementation of PLEs is that a clear distinction can be made between both dimensions. The orientation of teachers' conceptions determines the compatibility of teachers' perceptions of the environment with the design of the PLE.

Research has shown that teachers' conceptions of learning and teaching do influence the factual organization and implementation of a learning environment, and by consequence the quality of student learning. Teachers' conceptions influence students' approaches to learning, mediated by the teachers' approaches to teaching (Trigwell, Prosser, & Waterhouse, 1999). A teaching orientation of learning facilitation is significantly correlated with desirable and meaningful student learning approaches (Gow & Kember, 1993). Moreover, there is also a clear relationship between a knowledge transmission orientation of teaching, and surface or less desirable student learning approaches (Gow & Kember, 1993). For example, teachers who think about teaching as transfer of knowledge from the teacher to the students depress students' intrinsic interests, and their use of a deep learning approach.

In short, teachers seem to have different conceptions of teaching and learning that can be described as teacher-centered/content-oriented, or student-centered/learning-oriented. The conceptions within the student-centered/learning-oriented orientation are compatible with the ideas of constructivism and PLEs, and it is expected that teachers having one ore more of these conceptions are well able to bring a PLE into practice. In light of the aims of modern education and the characteristics of PLEs, the teacher-centered/content-oriented conceptions of teachers are problematic for implementing PLEs. Aims that are pursued by designers of a learning environment will probably not be reached. This clearly indicates that the influence of teachers' conceptions of learning and teaching should not be underestimated, while looking at the effects of realizing a PLE.

2.2.4 The perspective of the student

It has been shown that in practice it is not the concrete learning environment that influences learning processes of students, however, students' perceptions of the learning environment are crucial. It is the perception of the characteristics of the learning environment that affect students' approaches to learning and the quality of the learning outcomes (Entwistle & Tait, 1990). This position fits within the cognitive mediational tradition (Doyle, 1977), which stresses that instructional interventions do not directly influence student learning. The learning effects are mediated by students' perceptions and interpretations of the learning environment. In other words, students' perceptions of a PLE determine their subsequent learning and the learning outcomes. The characteristics of the learning environment themselves do not have direct influence on student learning. For this reason, student perceptions should have a central position in our thinking about PLEs and reaching the aims of modern education. Although a learning environment can be designed to be very powerful and be well implemented, students' perceptions of that learning environment will determine what kind of learning activities will be employed, and of what quality the learning outcomes will be.

In order to get a grasp on the content of students' perceptions, the origin of the perceptions is important. A study of Tsai (2000) showed clear relations between secondary school students' epistemological beliefs and their perceptions of a constructivist learning environment. Students' perceptions of a learning environment can be seen as the result of the interaction between the student with the learning-related characteristics (internal variable), and the learning environment (external variable; e.g. Luyten, Lowyck, & Tuerlinckx, 2001; Wierstra & Beerends, 1996). As described earlier, conceptions play a central role in perceiving and interpreting the environment, and in the way of reacting to it (Pratt, 1992). Students, more specifically, have conceptions about 'the way in which instructional features may help or hinder them to learn or to realize (instructional or learning) tasks' (Elen & Lowyck, 1999, p. 149). Part of this metacognitive instructional knowledge is students' knowledge about learning: conceptions about the self with respect to learning, motivational strategies, control strategies, and conceptions about cognitive strategies. These four kinds of conceptions, although differently labeled, are in accordance with the dimensions of the construct 'learning style' (Vermunt, 1996); conceptions of learning, motivational orientations, regulation strategies, and cognitive processing strategies. Because these characteristics are likely to influence students' perceptions, they will be described in more detail.

First, students have conceptions of learning. Marton, Dall'Alba, and Beaty (1993) have described six qualitatively different conceptions of learning, building on five conceptions described by Säljö (1979). In the most primitive conception,

learning is seen as *increasing one's knowledge* by collection, consumption, and storing of information. According to the second conception, learning is equal to *memorizing and reproducing* information. These are thought to be the core activities in the learning process. The conception of learning as *applying* stresses the acquisition of the ability to apply knowledge or skills. Common in these first three (quantitative) conceptions, is that knowledge is seen as something external to the student, which must be taken in and stored. On the other hand, meaning is fundamental in the next three (qualitative) conceptions of learning. The conception of learning as *understanding* stresses gaining meaning during the learning process. Learning is seen as grasping new ideas, gaining more insight, and developing a conception of something. According to the conception of learning as *seeing something in a different way*, the change of already existing conceptions is crucial. The student sees learning as changing his way of thinking about the subject matter. Finally, the conception of learning as *changing as a person* closely relates to the former conception. Differing the way of thinking and seeing the surrounding implies that you change as a person.

Second, students differ in their motivational orientations and their goals of learning. Several types of motivational orientations have been described. Beaty, Gibbs, and Morgan (1997) mentioned four different motivational orientations: personal, vocational, academic, and social. Students having a personal orientation are focused on their personal development as a goal of learning and studying. Students can also be motivated for learning by the goal of getting a job after graduation, called vocational orientation. Academic orientation refers to students' goals concerning the academic side of university or school life, such as intellectual interest and educational progression. Finally, students' goals can be directed to the social side of school or university life, termed social orientation. These motivational orientations can be further classified by making a distinction between intrinsic and extrinsic interest in learning (Beaty et al., 1997). All motivational orientations, minus the social one, have to be further specified by the locus of students' interest: interest in the learning content or studying as a means to an end. For instance, a student with a personal motivational orientation and an intrinsic interest in learning prefers challenging learning materials for self-improvement and broadening. In contrast, a student having a personal orientation with extrinsic interest is fixated on getting feedback and passing the course, aimed at compensation or proof of capability. The distinction between intrinsic and extrinsic interest parallels, respectively, with Dweck's learning and performance goals (1986). The former refers to the primary focus on gaining new skills and knowledge; the latter refers to the emphasis on positive evaluations from others. Taken together, the balance between the motives for learning and the extent to

which students are intrinsically or extrinsically interested in learning, forms an important student characteristic.

The third relevant learning-related student characteristic is regulation, concerning the way of regulating the learning processes. Self-regulated learning includes metacognitive strategies (such as planning, orienting, steering, and testing) and effort management strategies that reflect students' persistence at difficult and boring tasks and working diligently (Pintrich & de Groot, 1990). Students differ in their locus of control: external regulation or self-regulation (Vermunt, 1998). Externally regulated students largely depend on the teacher and the learning environment for the regulation of their learning processes. The environment determines what must be learned and how it must be done. On the contrary, self-regulated students take the initiative for learning in their own hands. They are able to regulate the learning-processes themselves, and even are actively involved in the choice of the learning content.

The use of different kinds of cognitive processing strategies is the fourth student characteristic. Students differ in their preferences for using different kinds of cognitive processing activities. There has been five important activities described (Vermunt, 1998; Vermunt & Verloop, 1999). Students' thinking activities can be directed to relating to and structuring the learning materials, for example, by linking new knowledge to prior knowledge and structuring parts of knowledge into organized wholes. Critical processing refers to examining facts, arguments and conclusion, rather than just accepting any information that is presented. Students using a memorizing and rehearsing strategy do not perform deep processing activities, as in the former strategies. They memorize and rehearse the subject matter, in order to be able to reproduce it. Focusing on analyzing during learning means that larger wholes get broken down into parts, and details are emphasized. Finally, students using a concrete strategy try to form tangible images of the subject matter, by thinking of examples and relating it to personal experiences.

Taken together, these four learning-related student characteristics are intended to influence how students perceive a concrete learning environment. The perception of a learning environment is shown to be central in determining the effects of a learning environment on student learning.

In addition to the learning-related student characteristics, students' expectations of a learning environment play an important role with respect to students' perceptions. Students form expectations about a learning environment, based on information they get about the main activities and goals of a learning environment. Relating the features of a learning environment with students' own characteristics will convince students that they can or cannot successfully execute the learning behavior that is required to reach the goals of the learning environment. According

to Bandura's self-efficacy theory (1977), students form outcome expectations, referring to expectations about the usefulness of certain learning activities for reaching the goals. Additionally, they have efficacy expectations: beliefs about their own ability to perform those learning activities. Both outcome expectations and efficacy expectancies must be positive, before a student will put forth effort to reach the educational goals. Another type of expectation of a learning environment is the anticipation of the consequences of goal achievement and the value of these consequences (Driscoll, 1993). If a student does not assign any value to the learning outcomes that are pursued by a learning environment, their expectations will be negative. This may be due to incongruence between the learning environment and the student's motivational orientation. In short, expectations of a learning environment seem to play a role in students' anticipation on a learning environment and their perceptions of it, and originate from the comparison of the features of a learning environment and their personal learning-related characteristics.

2.2.5 Combining the different perspectives

Research has shown that students prefer congruence between their learning habits and the characteristics of a learning environment (Vermetten, Vermunt, & Lodewijks, 2002). Students show a clear preference for learning environments that even promote their habitual approaches to learning (Entwistle & Tait, 1990). Small differences between students' learning strategies and teaching strategies in a learning environment may represent a challenge for students to increase their learning and thinking skills (Vermunt & Verloop, 1999). These constructive frictions, however, evolve into destructive frictions if the differences between student characteristics and the learning environment get so large that they may cause decrease in students' learning and thinking skills. Negative effects of characteristics of a learning environment on students' learning processes are also called mathemathantic effects (e.g. Lohman, 1986). Clark (2001) has explained these mathemathantic effects by referring to levels of self-efficacy of the student. Self-efficacy judgments tend to be low when students perceive the required mental effort for performing a learning task as being high. Much mental effort is required, for example, for learning novel and difficult tasks. When the task requirements are perceived extremely high or even impossible to obtain, the self-efficacy reaches such a low level that the 'efficacy threshold' will be reached. At the efficacy threshold, mental effort stops and attention will be automatically directed at different or novel goals. Thus, the intended learning process is cancelled, because the student perceives not to be able to meet the requirements of the learning

environment. It becomes clear that it is not a superfluous luxury to look seriously at the interaction of students with a PLE.

The COmbination-Of-Perspectives (COOP) model depicts the variables that have been mentioned in this paper (see Figure 2.2). It combines the perspectives of educational designers, teachers, and students. In education, the design-process is often executed by two participants. Designers develop blueprints for a learning environment, based on their ideas about constructivism and characteristics of PLEs. Designing in such a context can be seen as developing study books or educational approaches that form the building-blocks of a learning environment. The educational designer can be seen as a 'distal' designer. Often teachers implement such designs into the classroom. They can be seen as 'proximal' designers. It is often the role of the teachers to use these blocks of the distal designer to build or create a concrete learning environment for students. In doing so, teachers rely on their practical experiences, condensed in their conceptions of teaching and learning. Students participate in this learning environment, bringing along their learning-related characteristics and expectations of a learning environment. These variables are likely to influence the way students perceive the learning environment (e.g. Tsai, 2000). In general, conceptions appear to influence perception-processes (Pratt, 1992). Conceptions of designers and teachers therefore influence the way they perceive the learning environment. Furthermore, the COOP model illustrates that designers and teachers do not have a direct influence on student learning. In contrast, students' perceptions of a learning environment do influence student learning and the quality of learning outcomes (Entwistle & Tait, 1990), and whether the goals of a PLE will be reached or not.

Thus far, the model is quite straightforward. The added value of the COOP model lies in the feedback loops, depicted as dotted arrows in Figure 2.2. These loops promote involvement of students in the design and development of a learning environment. Additionally, feedback from teachers' perceptions to designers' conceptions is proposed. Teachers' perceptions can be valuable information for designers. Bringing together the expertise of the designer and the teacher can contribute to optimization of the design of a learning environment (The Design-based Research Collective, 2003). The mechanisms that are depicted by the feedback loops show a parallel with human factors engineering. Norman (1986, 1988) used a three-conceptual-models approach for optimizing man-machine interaction: the designer's model, the user's model, and the system image. The designer uses his model to create a system. The designer's model and the user's model can differ, which causes a gap between the way the user interprets the system and the way the designer intended it. Research in the field of educational psychology shows the existence of discrepancies between designers'/teachers'

intentions or conceptual model, and users' perceptions, as well (see e.g. Winne & Marx, 1982). Recently, studies of Broekkamp (2003) showed inconsistencies between teachers' and students' perceptions of task demands. Students generally did not have an accurate perception of their teachers' intended task demands.

In order to look for possibilities for creating optimal congruence between designers and teachers on the one hand, and students on the other hand, the first step is to use students' perceptions as feedback or input for both teachers and designers. The COOP model can be seen as an aid for identifying any possible discrepancy between perceptions of designers, teachers, and students. The second step is to reduce these differences. For man-machine interaction, Norman (1986) describes two possible solutions to bridge the gap between the system image (created by the designer) and the user's model. First, designers can adapt the system, moving closer to the user by making better matches to the needs of the user. Second, the user can bridge the gap by creating plans, action sequences, and interpretations, moving his goals and intentions closer to the description of the system. The same two kinds of solutions can be proposed in education, in order to create more congruence between designers' and teachers' conceptual models of a learning environment and students' perceptions of it. Either designers or teachers can adapt the learning environment to students' perceptions, or students can be stimulated to adapt to the learning environment. Which option is chosen depends on the kind of the discrepancy.

For example, if students perceive a high amount of emphasis on the reproduction of knowledge in a non-reproduction-oriented learning environment, then this is an undesirable situation. It is possible that the learning environment gives unintended signals to students that reproduction is a good learning strategy. It seems meaningful, therefore, to examine and observe the educational practice, the behavior of the teacher, and to analyze the tests students have to make. As a result, the design of the learning environment has to be altered. Another example is that students perceive little differentiation in a learning environment. All students do the same things. Excellent students do not perform extra assignments and students getting bad marks do not perform extra exercises. It is conceivable that the learning environment gives opportunities for differentiation, but students do not use them. In this case, a way to stimulate and motivate students to use these opportunities has to be found. Taken together, these examples illustrate that it is situation dependent whether the learning environment has to be adapted, or the perceptions of students have to be redirected. The ultimate goal is to optimize the power of a learning environment, and this should be the basis for which one of the two options for creating optimal congruence is chosen.

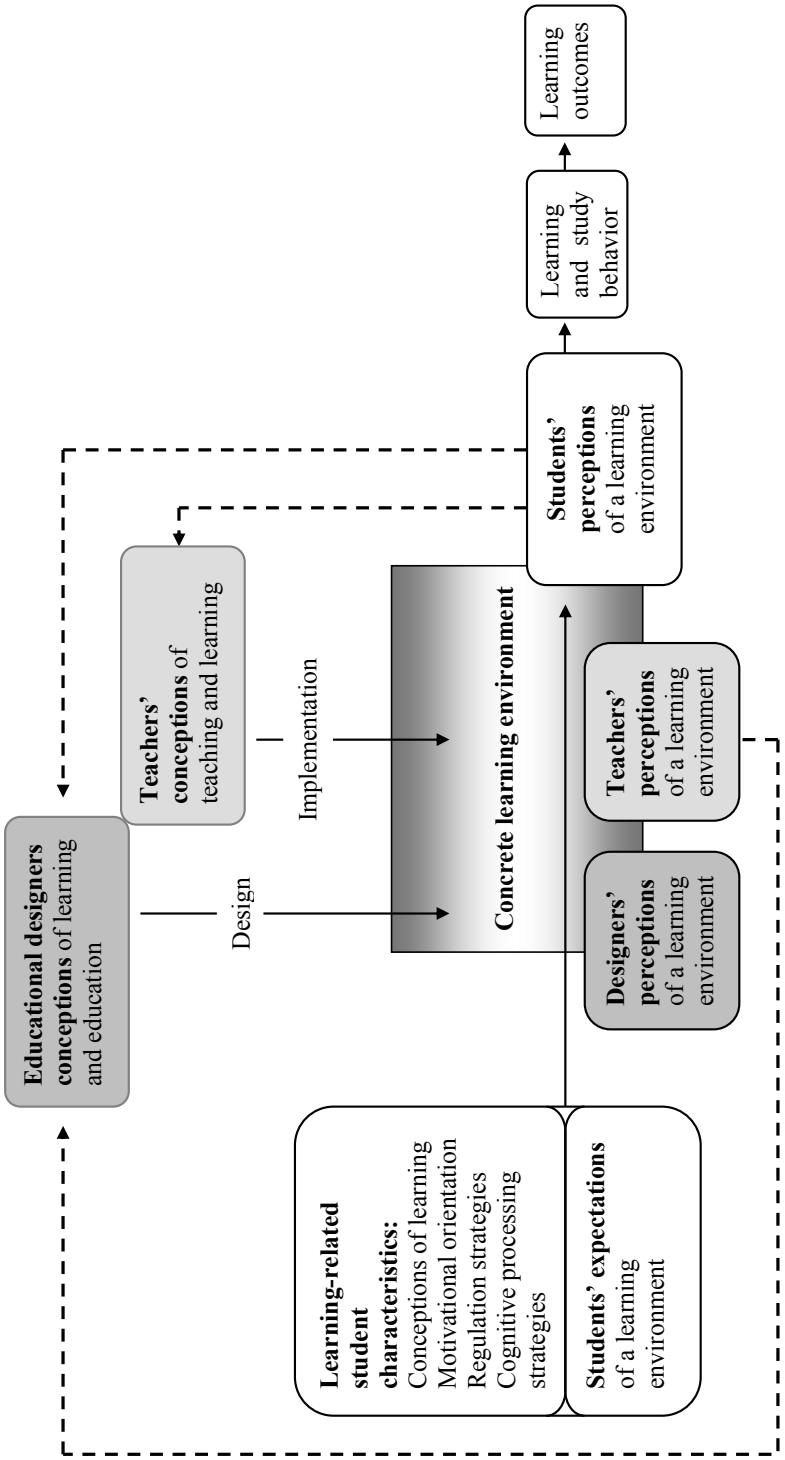

Figure 2.2 The COmbination-Of-Perspectives (COOP) model.

2.3 Discussion

Based on the literature referred to in this paper, the COOP model has been described, summarizing the different perspectives of the participants involved with the creation and realization of a learning environment. Educational designers use their knowledge about characteristics of PLEs to design learning materials and select instructional strategies for a PLE. Teachers' conceptions of learning and teaching influence the way they implement a learning environment. However, students' perceptions of a learning environment determine their subsequent learning behavior, and, consequently, the quality of the learning outcomes. Students' perceptions are thus central in exploring the effects of PLEs on student learning. Perceptions are the result of the interaction of the student, with his/her learning-related characteristics, and the learning environment. Students' perceptions may be mediated by their expectations of the learning environment.

In order to optimize PLEs, a reciprocal relationship between designers, teachers, and students is proposed. According to the COOP model, students' perceptions of a learning environment should provide input in the design process of PLEs as carried out by educational designers and teachers. In order to fine-tune the learning environment, designers and teachers have to take the perspective of the students into account. Discrepancies between the educational aims of designers and teachers on the one hand, and students on the other hand, are suboptimal for students' learning. In the case of appearing discrepancies, there should be an attempt to reach more congruence between the different perspectives. Designers and teachers can adapt to the perspective of students, in order to optimize their learning. However, if students' perspective is incompatible with the characteristics of PLEs, designing compensating learning activities for students can help bridge the gap between different perspectives. The aim of such compensating activities is that students gain skills and acquire attitudes they need to make best use of the PLE, to get the most favorable profit from, and see the value of, the learning environment. In addition to the feedback loop from students' perceptions to teachers' and designers' conceptions, a loop from teachers' perceptions to designers' conceptions is proposed. Mutual exchange of ideas and experiences of both can optimize the design.

The COOP model is a general model that is well applicable to a wide range of educational practices. A source of variation for the COOP model may be the factual presence or absence of all participants involved. In the design and implementation process, the educational designer and the teacher are not necessarily both involved. In nursery school teachers themselves design the learning environment and educate the pupils, without the intervention of a

designer. Often they even develop the learning materials themselves. In electronic learning environments the role of the teacher mostly disappears. The educational designer develops the electronic learning environment that is directly offered to the students. In university class the professor designs and implements the learning environment, in that he/she prepares, develops, and teaches the lesson. The model can easily be adapted to such variation in the presence of all participants involved by deleting either the designers' blocks in the model or the teachers' blocks. Always present are the students and the teacher and/or the designer. The ultimate goal of the COOP model is to make any possible discrepancy between the participants visible and, eventually, to promote fine-tuning between them. The nursery school teacher, the designer of an electronic learning environment, and the professor all have to take into account the students' perceptions of the learning environment. In all cases there has to be a fine-tuning of the perspectives of the participants involved, as proposed in the COOP model.

Although the COOP model and the need for a reciprocal relationship between designers, teachers, and students seems quite clear, comment is required. First, the idea of learning-related student characteristics on learning behavior is not new. For example, Van Rossum and Schenk (1984) have demonstrated the relations between students' views on learning, their learning approaches and the quality of their learning outcomes. Also, the influence of students' conceptions of learning and their approaches to learning has been established (Dart et al., 2000). Students having qualitative conceptions are likely to use deep approaches to learning, characterized by elaborating the materials and actively constructing knowledge. What is particularly important in the COOP model, however, is the emphasis on students' perceptions of a learning environment, which is expected to mediate this relationship.

Second, student characteristics are not stable personality traits, but are the reflection of students' learning experiences. It has been shown that the same students use different learning strategies in different learning contexts, and that these differences are rather large (Vermetten, Lodewijks, & Vermunt, 1999). In that sense, perceptions of a learning environment therefore also influence students' learning-related characteristics. Moreover, in this study, high correlations were found between reported learning strategies among different learning contexts, indicating the existence of individual consistency in the use of a learning style. Although students adapt their learning strategies to the characteristics of a learning environment, they do have habitual ways of learning.

Third, there seems to be a tension between what students consider as important for learning (conceptions of learning), and what they consider as important in a concrete learning environment (Elen & Lowyck, 1999). According to students'

conceptions, they prefer to learn in an active and constructive way and to participate in discussions. However, while functioning in a concrete learning environment, students often want to hand over the responsibility for learning to the teacher, and prefer clear learning goals and description of the learning content. It is hypothesized that prior experiences with learning environments have caused students' different views on the demands of functioning in education, compared with their own conceptions of learning which reflect their preferred way of learning (Elen & Lowyck, 1999).

From a practical viewpoint, the COOP model can be helpful in exploring the different perspectives of designers, teachers, and students, and in identifying discrepancies between them. Next, the identified discrepancies will hopefully yield concrete suggestions for the optimization of a learning environment and harmonization between participants involved. As in the tradition of human factors engineering, congruence between the different participants creates a situation where students use a learning environment as it is intended by teachers and designers. Future research is intended to deliver tools that can help to create *more powerful* learning environments, by stimulating a reciprocal relationship between educational designers, teachers, and students during the development-process.

From a theoretical point of view, the COOP model can contribute to the search for ways to optimize learning processes and learning outcomes. According to this literature based model, close cooperation between designers, teachers, and students is expected to influence the effects of PLEs. Investigating this model could give insight in ways to optimize learning environments and learning processes. Future research will explore the different variables, as described in our model, in order to validate the model, and make possible discrepancies between the three perspectives visible and, eventually, investigate the effects of creating more congruence on the quality of student learning.

3

Does a new learning environment come up to students' expectations? A longitudinal study

This chapter is submitted as:
Könings, K. D., Brand-Gruwel, S., van Merriënboer, J. J. G., & Broers, N. (2006). *Does a new learning environment come up to students' expectations? A longitudinal study.* Submitted for publication.

Abstract. School transitions and educational innovations confront students with changes in their learning environment. Though it is known that expectations influence perceptions and motivation, which, in turn influence the effectiveness of any situation, students' expectations for a new learning environment has received little attention. This longitudinal survey (N = 1335 high school students with an average age of 15 years) studies students' expectations and subsequent perceptions of eight characteristics of a new environment, their desires, and their (prospective) dissatisfaction. The investigated characteristics (fascinating contents, productive learning, integration, student autonomy, interaction, differentiation, clarity of goals, and personalization) cover elements considered important in powerful learning environments. Results show that students were disappointed about most of the characteristics of the new environment. This was related to undesirable changes in learning-related student characteristics, such as increased fear of failure. Also, expectations related positively to later perceptions. Desires at different measurement moments related to each other; the same holds for dissatisfaction. The research also studied relations between prospective reports and student characteristics (i.e., motivational orientations, conceptions of learning, regulation strategies, information processing strategies, and affective processing strategies). Motivational problems and fear of failure were found to be risk factors for educational innovations. The findings stress the importance of a good preparation of students for curricular changes and the need to provide extra support for students with particular characteristics.

3.1 Introduction

Students' learning environments change several times during their school career: after kindergarten they enter primary school, followed by secondary school and, possibly, higher professional education or university. Besides this school change, students are also often confronted with educational innovations in school curricula, which cause changes in school practices. Before entering a learning environment, students form expectations and build ideas about how it will be to study in there and it is known that these expectations influence subsequent perceptions (e.g., Olson, Roese, & Zanna, 1996). This is highly relevant for education, because it has been shown that students' perceptions of a learning environment are of central importance for its effects on learning (Entwistle, 1991; Entwistle & Tait, 1990). However, the role of expectations in this context has received little attention. This is a serious omission since students' development and their pleasure in school are likely to be disturbed when their expectations of a subsequent learning environment do not match with the perceptions thereof. The current study focuses on students' expectations of a new learning environment and the longitudinal effects of this on their subsequent perceptions of this environment while in it. In addition to expectations and perceptions, students' desires with regard to the design of the learning environment and their satisfaction or dissatisfaction with the expected and perceived environment are also examined. Finally, relations between students' prospective reports and their learning-related characteristics are explored.

The literature on expectations in educational contexts is broad and concerns many aspects not dealing specifically with the expectations of a learning environment. Examples include teachers' expectations of student performances (Weinstein, 1998); students' expectations of their own performances (i.e., self-efficacy, Bandura, 1977; Lopez, Lent, Brown, & Gore, 1997); students' expectations about connections between effort and performance in relation to a positive or negative mood state (Erez & Isen, 2002); students' expectations of success in relation to task-avoidance behavior, low achievement, and dissatisfaction (Nurmi, Aunola, Salmela-Aro, & Lindroos, 2003), and students' expectations of utility of what they are learning for their future in relation to their learning motivation (future-time perspective theory; Kauffman & Hasman, 2004). In each of these studies, clear relationships have been found between expectations and the other variables being studied.

Very little research, however, has been conducted on students' expectations with regard to the characteristics of a forthcoming course or learning environment. Twenty years ago, Rosinski and Hill (1986) pointed to the importance of investigating students' expectations of the content of a course and the degree to

which the course met these expectations, because these expectations determine the way students enter a course or learning environment. It has also been found that students' expectations with respect to the objectives of a course influence their perceptions of this course, even independent of what they actually encounter (Kirschner, Meester, Middelbeek, & Hermans, 1993). In spite of these results, research on students' expectations of a learning environment has laid fallow. More general psychological literature about expectations, however, indicates two reasons for taking the role of expectations in education more seriously: (1) expectations affect the subsequent perception of a learning environment and so determine its effectiveness, and (2) expectations affect students' motivation, engagement, and investment of effort in learning.

3.1.1 Expectations and perceptions

The influence of expectations on students' perceptions of a learning environment is highly relevant because perceptions determine their study behavior and, consequently, how much they will learn and how effective the learning environment will be (Entwistle, 1991).

Expectations can bias perceptions in three different ways. First, expectations bias information-gathering processes because they direct the learner's attention to information that is either consistent or clearly inconsistent with the expectations themselves. Both consistent and inconsistent information is more likely to be noticed and processed, which leads to selective perception (Olson, Roese, & Zanna, 1996). Second, expectations bias the interpretation of information in that information is likely to be interpreted in a way that is consistent rather than inconsistent with expectations (ibid). A classical experiment (Chapman & Chapman, 1967) showed that people notice instances that confirm expectancies and interpret information in agreement with these expectations. In that experiment, participants viewed drawings that were randomly coupled to descriptions of particular mental illnesses of the drawers. Results showed that participants identified relations between drawing characteristics and symptoms of the mental illnesses, while no such relations actually existed. The expectations relating to the symptoms of mental illness heightened their attention for illusory congruent characteristics in the drawings and guided the interpretation of the drawings.

Finally, expectations bias subsequent behavior. People are likely to behave consistent with their expectations (Olson, Roese, & Zanna, 1996). A well-documented example of this phenomenon is learned helplessness where Seligman and Mayer (1967) found that dogs relinquish certain behaviors (i.e., trying to avoid painful shocks) when they experience a lack of control over their environment. The dogs did not expect that their behavior would have effect and consequently adapted

their behavior to this expectation. This has also been shown in educational contexts where students displayed symptoms of learned helplessness and gave up trying to perform, when they did not see themselves as capable of success (Craske, 1988). In addition to this direct effect on behavior, expectations may even shape the environment. People tend to behave in such a way that their behavior optimally matches their expectations and, thus, *create* what they expect; a phenomenon known as a self-fulfilling prophecy (Merton, 1948). Research has shown that teachers, told that a class was highly intelligent, consequently expected higher performances, which subsequently resulted in higher student performances (Pygmalion in the classroom experiment, Rosenthal & Jacobson, 1968).

Applied to education, adequate or inadequate expectations could have far reaching effects. A student entering a learning environment with high expectations to find certain characteristics there (for example, student autonomy) will look for information consistent with that expectation, interpret this information in such a way that it supports the expectations, and behave in a way that is consistent with these expectations. This student is likely to have more positive perceptions than another student entering the same environment with low expectations of autonomy, because this student will mainly attend to stimuli supporting the low expectations, and interpret stimuli and behave in a way consistent with low expectations. The student with low expectations for student autonomy, consequently, will display less autonomic behavior and a more passive attitude. In contrast, the student with higher expectations is more likely to find stimuli for autonomous behavior and will tend to be more pro-active. In short, students in the same learning environment are likely to perceive it different, depending on their a priori expectations of it.

3.1.2 Expectations and motivation

Investigating students' expectations is also relevant because research shows that expectations affect engagement, motivation, and investment of effort. The relation between high expectations, or optimism, and engagement is best described as a non-linear dynamical model (Carver & Scheier, 2001), taking the form of an S-shaped curve in which the behavior of the system depends on its recent history (Barton, 1994; Thagard, 1996). Figure 3.1 shows the discontinuities in the model. The level of engagement (*y*-axis) depends on the recent history of the system. At a certain range of optimism (i.e., on the *x*-axis) there are more possible values of engagement (called *hysteresis*). Starting with high optimism and high engagement (upper right part of Figure 3.1), and experiencing situations that temper this optimism, engagement slowly decreases for a while. But at some point, a small decrease in the level of optimism produces an abrupt drop in the level of engagement. This is called a *phase transition*. If starting with low optimism and

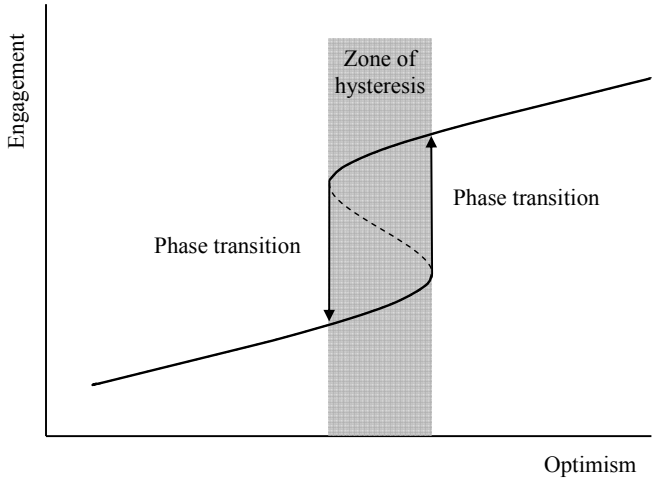

Figure 3.1 Example of a non-linear dynamical model (Carver & Scheier, 2001).

low engagement (lower left part of Figure 3.1), and experiencing situations that endorse optimism, engagement slowly increases. At a certain point, a small further increase in the level of optimism produces an abrupt rise in the level of engagement. In the region of hysteresis, students who have been optimistic from the beginning will be highly engaged, while originally less optimistic students may still show a low level of engagement.

This non-linear dynamical model might imply that students who are with high and positive expectations about a new, forthcoming learning environment are, in the case of disappointments, likely to invest more effort and to remain motivated for a longer period of time than students with lower or more negative expectations. Students with more prospectively negative or lower expectations about the new learning environment would be likely to be less engaged and need more positive cues to get engaged.

Another model on the role of expectations is the expectancy-value model, stating that expectations and values together influence performance, effort, and persistence (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). People have personal values and ideas about what is desirable. For example, they may have values pertaining to the relevance, enjoyment, and utility of engaging in a particular task. The expectancy-element refers to the sense of confidence or doubt about the attainability of those values. In this model, "expectations" refer solely to "expectations of success", but it seems defensible to broaden this concept to include more general expectations of education. According to the expectancy-value model, both expectations and personal values influence learning-related choices and different aspects of behavior, such as effort, persistence, and performance.

Carver and Scheier (2001) extended the expectancy-value model by adding feedback-control processes. In a feedback loop, expectations serve as inputs and are continuously compared to reference values. The magnitude of the discrepancies between expectations and reference values influences the output of the feedback loop, namely, behavior. People try to reduce or eliminate discrepancies between input and their personal values and desires. A high rate of the discrepancy-reduction induces positive feelings and confidence, while a low rate induces negative thinking and doubt. A sense of doubt and negativism can impair motivation to act – both before and during acting. It can also cause overt disengagement or covert, mental disengagement such as off-task thinking (Carver & Scheier, 2001).

The expectancy-value model with feedback-control implies that students expecting a learning environment that corresponds with their desired environment feel relatively confident and in a good mood, causing higher learning motivation in the future environment. In contrast, students expecting a learning environment that is very different from their desired environment experience doubt and are in a bad mood, especially because they – usually – do not have control over the learning environment and thus have no possibilities to reduce the discrepancy. This causes low motivation and engagement. This is in line with cognitive dissonance theory (Festinger, 1957) which states that inconsistency between people's cognitions, feelings, and behavior evokes a negative internal state which people try to reduce whenever possible. Cognitive dissonance is a fundamentally motivational state (Elliot & Devine, 1994). Since students do not have control over the possible dissonance they experience in education, it is likely that this will have motivational effects. The lower the motivation, the worse the emotional functioning and the more symptoms of psychological distress, like anger, sadness, and hopelessness will be exhibited (Roeser, Eccles, & Sameroff, 1998). Together, these principles emphasize the relevance of research on expectations in an educational context.

The current study investigates both aspects of expectations discussed, namely expectations which bias perceptions and expectations which influence student characteristics, such as motivation and engagement. Three research questions will be addressed in the rest of this article, namely:

- Are students' expectations of the learning environment met, and how do desires and dissatisfaction develop over time?
- Do expectations positively relate to subsequent perceptions, and how do desires and dissatisfaction scores at different moments in time relate to each other?
- How do expectations, desires, and prospective dissatisfaction relate to learning-related student characteristics?

For focusing on expectations of a learning environment, eight characteristics of powerful learning environments (PLEs) are considered as starting point. Students' expectations with respect to these characteristics of a learning environment are studied. There is considerable agreement about the most important characteristics of a powerful learning environment to promote acquiring high quality knowledge, problem-solving skills, self-directed learning skills, and transferability of knowledge and skills (see de Corte, Verschaffel, Entwistle, & van Merriënboer, 2003, and Könings, Brand-Gruwel, & van Merriënboer, 2005, for an overview).

First, PLEs should contain complex, realistic, and challenging learning tasks (van Merriënboer & Paas, 2003). Second, learning in a PLE is not directed towards reproduction of knowledge, but to an active process of sense-making of the subject matter and creating mental models, that can be reused in new problem situations (Collis & Winnips, 2002; Moreno & Mayer, 1999). Third, new knowledge in PLEs is integrated with students' prior knowledge and experiences (Merrill, 2002) and is aimed at integrated sets of learning goals for acquiring knowledge, skills, and attitudes in an integrated way (van Merriënboer & Paas, 2003). Fourth, a self-directed and independent way of learning and thinking is stimulated by gradually transferring the responsibility for the learning processes from the instructional agent to the students themselves (Vermunt, 2003). Fifth, by inclusion of small group, collaborative work, and ample opportunities for interaction, PLEs give students an active and constructive role in the learning process (van Merriënboer & Paas, 2003). Sixth, PLEs take variation between students into account. For instance, allowing for both deductive as well as inductive approaches to learning, and supporting both inquisitory and expository approaches to learning (van Merriënboer & Kirschner, 2001). Seventh, learning goals and task demands are clear as they direct learning strategies (Broekkamp, van Hout-Wolters, Rijlaarsdam, & van den Bergh, 2002). Eighth and last, in PLEs teachers are available for help and support. Starting with explicit external regulation and support, the teaching process is directed to teach students how they can obtain control over their own learning processes (Vermunt & Verschaffel, 2000). These eight characteristics all contribute to achieving the educational goals being pursued in current educational systems (i.e., high quality knowledge acquisition, problem-solving skills, self-directed learning skills, transferability of knowledge and skills). There is a considerable amount of evidence that these characteristics, indeed, lead to better student learning (see, e.g., Bolhuis, 2003; Johnson & Johnson, 1994; Schmidt, de Volder, de Grave, Moust et al., 1989; Spires & Donley, 1998; Vermunt, 1995).

With regard to the first research question, students' expectations about characteristics of a new learning environment are examined in the light of their

later perceptions of this environment. For educational designers and teachers, it is important to know what students expect of a learning environment and if their expectations are met when they are working in it. Programs for preparing students for impending changes can be improved, based on such information. Also, from the perspective of the students it is highly relevant to explore the extent to which they are well prepared for new learning environments and have built realistic expectations that are met in their later perceptions. As indicated by Carver and Scheier's (2001) non-linear dynamical model, large differences between expectations and subsequent perceptions can have large effects on motivation and engagement. The study will also gather information on students' desires with regard to the design of the new learning environment and, especially, the longitudinal development of their desires. Comparing the desires with the expectations makes clear the extent to which students expect an environment that is in agreement with their desires. The expectancy-value model predicts affective and motivational consequences if large discrepancies exist between these desires and expectations. The study, further, longitudinally explores whether the difference between expectations and desires (i.e., prospective dissatisfaction) corresponds with later differences between perceptions and desires (i.e., perceived dissatisfaction).

With regard to the second research question, longitudinal relations between expectations and perceptions are investigated. Expectations bias perception-processes in such a way that consistency between expectations and perceptions is promoted. This would imply that prospectively optimistic students with high expectations of the new learning environment report relatively high perceptions of it later on, and that prospectively pessimistic students with low expectations report relatively low perceptions later on. We expect that prospective dissatisfaction relates to later perceived dissatisfaction in the same way.

With regard to the third and final research question, the current study investigates the relationship between expectations of a learning environment and motivation and other student characteristics. As discussed previously, the literature on expectations indicates the existence of a relationship between expectations and motivation. More specifically, there are – at least – some characteristics of the learning environment that can be hypothesized to be related to motivation. Research has shown, for example, that contextualization and meaningful subject matter result in gains in motivation and involvement when compared to abstract and decontextualized learning contents (Cordova & Lepper, 1996). Recognizing the utility of course contents leads to higher intrinsic motivation and better study habits (Simons, Dewitte, & Lens, 2004). Also, learning goals serve a directive function, can lead to greater effort investment, positively affect persistence, and

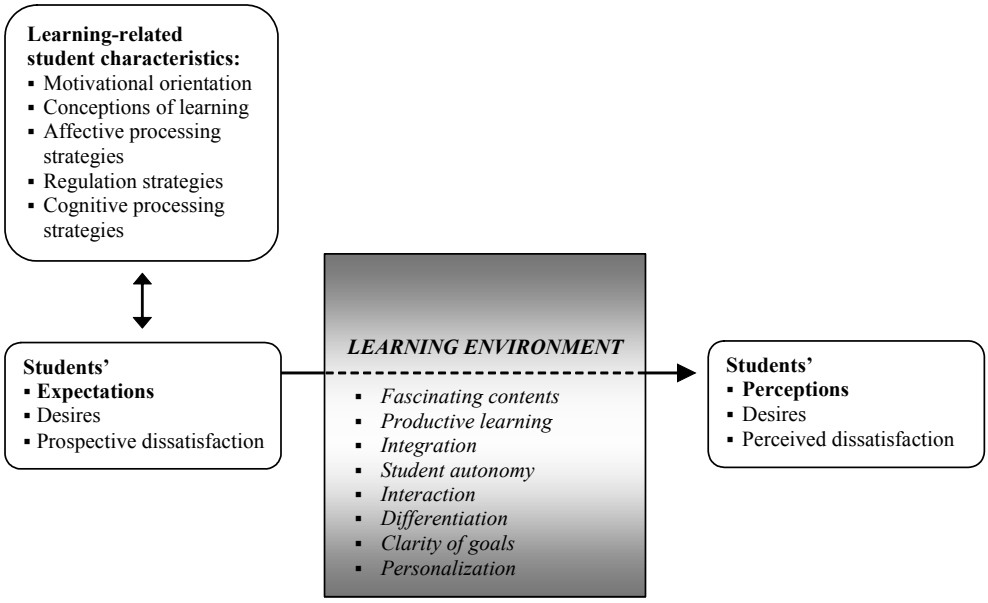

Figure 3.2 Visualization of the variables involved in the study.

motivate the learner as a reference point to be attained (Locke & Latham, 2002). Thus, clarity of learning goals is likely to improve motivation. Finally, support of the relationships with the teacher has been shown to be positively related to both the academic aspects of motivation (i.e., interest in academic activities) and the social aspects of it (i.e., social responsibility in class) (Wentzel, 1998).

Along with its relation with motivation, students' perceptions of a learning environment also relate to several other learning-related student characteristics (e.g., Luyten, Lowyck, & Tuerlinckx, 2001; Wierstra & Beerends, 1996), and especially with conceptions of learning (Tsai, 2000) and affective processing strategies (Könings, Brand-Gruwel, & van Merriënboer, 2007a). Motivation is only one aspect of a broader range of student characteristics that might be related to expectations. Vermunt (1996, 2004) defined five clusters of components of student learning: motivational orientations, conceptions of learning, affective processing strategies, information processing strategies, and regulation strategies. The current study explores how students' expectations relate to all components of these five clusters of learning-related characteristics. As perceptions have been shown to be related to more student characteristics than solely motivation, this may also be true for expectation. No earlier research has focused on this. This study will clarify which student characteristics are related to either higher or lower expectations of

the new learning environment, and are related to particular desires concerning the design of this learning environment. Finally, the relationship between student characteristics and prospective dissatisfaction with the new learning environment is studied to try to explain why different students approach a new learning environment in different ways.

The proposed concepts involved in the current study are depicted in a scheme in Figure 3.2.

3.2 Method

3.2.1 Participants

At the first measurement (T1), the sample consisted of 842 ninth graders (mean age = 15.27 years, *SD* = .52) at five schools for secondary education in the Netherlands, attending either senior general education (i.e., a five year program, preparing for higher professional education) or pre-university education (i.e., a six year program, preparing for university education). They were on the eve of participating in an innovative learning environment in Dutch secondary education, called the Second Phase, which is based on the principle of guided independent study. About one year later (T2), the sample consisted of 1.146 tenth graders, of whom 727 students already participated at T1. At T2 students had been working in the innovative learning environment for about one year. At T3 the sample consisted of 704 eleventh graders at four schools: 433 students participated at all three measurement moments; 181 students participated at T2 and T3; 16 students participated at T1 and T3, and 74 students participated at T3 only. At T3, the eleventh graders had worked and studied for about two years in the learning environment. In total, 1.335 students participated in the study (50.6% girls, 49.4% boys).

The increase in the number of participants at T2 was partly due to one big school, of which the management decided at T1 to participate in this study with only half of the students (i.e., classes). One year later (T2), however, it was difficult to track those students who participated at T1, because class composition had changed. Therefore, all tenth graders of this school participated in the second measurement, which resulted in an increase of the sample with 189 students. Furthermore, about 200 of the newly included participants at T2 were repeaters from an earlier cohort (i.e., year). They were tenth graders for the second time. Additionally, about 20 students were added to the sample at T2 who had been absent during data collection at T1. The attrition at T2 is likely to be due to incidental absence of students and non-promotion from ninth to tenth grade.

The decrease in the number of participants at T3 was partly due to non-promoted students who left the study. As at T2, about 200 non-promoted students from an earlier cohort were included, it seems reasonable to assume that about an equal number of students was also lost from the sample. Because at each measurement the non-promoted students of an earlier cohort were added to the sample, there is prevented for unwanted shifts or biases in the sample. Also, part of the attrition at T3 resulted from the fact that one of the schools posed serious problems for the organization of the data collection process. After deliberation with the school authorities it was decided to refrain from further data collection at this school, which caused a loss of 157 participants. The management of the large school at T3 decided to partly select those students who already participated twice and brought them together for the third measurement, and partly let participants participate in complete classes (including students who did not participate at T1).

The achievement level of the general exam of the participating schools indicates that they are representative for schools in the Netherlands with one school at the senior general education level scoring largely above the national average and two schools at the pre-university level scoring slightly above the average (Onderwijsinspectie [Dutch Inspection of Education], 2006). The percentage of students from cultural minorities at the participating schools ranged from 0.00% to 1.33% (national average is 2.55%; W.Wieldraaijer, Centraal Financiële Instellingen [Central Financial Institution], personal communication, January 8, 2007).

3.2.2 Materials

3.2.2.1 The learning environment

The context of this study is a nationwide innovation in Dutch secondary education, called the Second Phase (Ministerie van OCW, 2005; Stuurgroep Profiel Tweede Fase Voortgezet Onderwijs, 1995; Veugelers, de Jong, & Schellings, 2004). All schools in the Netherlands had to participate in this innovation. The Second Phase requires students to independently acquire skills and knowledge to better prepare them for higher professional education and university. Students learn in a self-directed way with possibilities for collaborative learning. There is more room for individual differences than in the traditional education situation and teachers have to take these differences into account. The teacher's role is more like a coach and less like an instructor, which creates more possibilities for interaction between students and the teacher. The learning process is not only directed to knowledge acquisition, but also to the selection and processing of the vast amounts of information available today. Furthermore, learning contents are actualized and broadened, because building a broad general knowledge base is an important goal

of the Second Phase. The integration of different subjects is also emphasized. Courses are clustered in profiles of closely interconnected topics (e.g., science and health, economics and society) which are meant to enable better integration of the subjects and lead to a better preparation for higher professional education and university. In addition to better integration of subjects, the coherence between knowledge and skills and the application of knowledge in subject-matter domains are also emphasized.

The objective characteristics of the implementation of the Second Phase on the schools participating in this study is beyond the scope of this research. However, research has shown that – in general – its implementation with respect to stimulating student autonomy and differentiation are not convincingly perceived as being achieved by teachers (Könings, Brand-Gruwel, & van Merriënboer, in press). Teachers also do not perceive that they have sufficient freedom to deviate from lesson programs and regret it (Veugelers, de Jong & Schellings, 2004). Furthermore, they regret having fewer opportunities to give explanations and presentations to their classes, which however indicates that the implementation of the Second Phase succeeded in breaking through traditional forms of education.

3.2.2.2 Inventory of Perceived Study Environment Extended (IPSEE)

The aim of the IPSEE- is to measure students' perceptions of a particular learning environment and their desires with regard to the design of the environment. A combination of these measures gives insight into students' satisfaction with a learning environment by looking at the differences between perception scores and desire scores. For the purpose of the current study, a parallel version of this questionnaire was constructed, measuring students' expectations of a forthcoming learning environment: the Inventory of Expected Study Environment Extended (IESEE), which will be described in the next section.

The IPSEE consists of 67 items. Thirty-one of these items originate from the Inventory of Perceived Study Environment (IPSE; Wierstra, Kanselaar, van der Linden, & Lodewijks, 1999), translated into Dutch by the Expertise Center Active Learning of Maastricht University (Picarelli, Slaats, Bouhuijs, & Vermunt, 2006). We constructed another 36 items in order to be able to measure the characteristics of powerful learning environments more completely. Such learning environments, based on principles of cognitive psychology and constructivism, are aimed to reach the main goals of modern education, namely the acquisition of high-quality knowledge, problem-solving skills, self-directed learning skills, and transferability of knowledge and skills. The literature describes several characteristics of the design of a powerful learning environment, including active knowledge construction, gradual transfer of responsibility, and the use of complex and realistic

learning tasks (see de Corte, Verschaffel, Entwistle, & van Merriënboer, 2003, and Könings, Brand-Gruwel, & van Merriënboer, 2005, for an overview).

The IPSEE items are ordered in eight scales (see Table 3.1) that can be seen as characteristics of powerful learning environments. The first scale is *fascinating contents* and contains items about the extent to which the learning contents are considered to be interesting, challenging and personally relevant for students. The second scale is *productive learning*, what can be considered as little emphasis on sole reproduction of learning contents, but to an active process of sense-making of the subject matter and creating mental models. The third scale is *integration* and includes items about the integration of new knowledge with prior knowledge, the integration of different knowledge domains and the integration of knowledge and skills. The fourth scale is *student autonomy* and is intended to measure attention to student self-directed learning with regard to contents, instructional methods, and planning. The fifth scale is *interaction*, which incorporates both collaboration with peers and interaction with the teacher. The sixth scale is *differentiation*, which inquires about opportunities for students to choose and carry out different tasks, solve problems in different ways, and use different learning materials to solve problems. The seventh scale is *clarity of goals* and includes items about the clarity of instructional goals and task demands. The eighth and final scale is *personalization*, which relates to the availability of individual support from teachers.

Each of the items of the IPSEE contains a statement about one of the characteristics of a learning environment and two statements; one related to its presence and one related to its desirability. For example:

All students do the same work at the same moment.

A. This happens
B. I would like this to happen

The statements are rated on a six-point scale, ranging from totally disagree (1) to totally agree (6). Scores on statement A give a measure of the student's perception of learning environment. Scores on statement B show what the student desires from the learning environment. The difference between the scores on statements B and A is defined as a measure of the satisfaction or dissatisfaction with the learning environment. Increasing differences between perceptions and desires indicate increasing dissatisfaction. Small differences between perceptions and desires indicate low dissatisfaction. It should be noted that low dissatisfaction could be interpreted as high satisfaction, but only the term dissatisfaction will be used in this article so as to interpret and present the results in an univocal way.

Table 3.1 Internal consistencies of the scales of the IESEE at T1, and the IPSEE at T2 and T3

		Cronbach's alpha coefficient					
		T1		T2		T3	
Scale	Number of items	Expectation	Desire	Perception	Desire	Perception	Desire
Fascinating contents	9	.82	.69	.85	.77	.85	.80
Productive learning	5	.80	.76	.83	.81	.79	.76
Integration	11	.78	.73	.81	.78	.81	.78
Student autonomy	15	.81	.78	.85	.84	.84	.81
Interaction	11	.68	.68	.73	.73	.68	.71
Differentiation	6	.67	.72	.66	.72	.67	.73
Clarity of goals	4	.75	.65	.81	.72	.83	.72
Personalization	6	.75	.65	.80	.70	.78	.68

Internal consistency was computed for all eight scales for the perception items and the desire items separately at T2 and T3 (see Table 3.1, columns 3 to 6; note that at T1, students were not yet in the Second Phase). For the scale fascinating contents the coefficients ranged between .77 and .85; for productive learning between .76 and .83; for integration between .78 and .81; for student autonomy between .81 and .85; for interaction between .71 and .73; for differentiation between .66 and .73; for clarity of goals between .72 and .83, and for personalization between .68 and .80. In total, four of thirty-two Cronbach's alpha coefficients were between .60 and .70; fourteen between .70 and .80, and another fourteen above .80.

To examine whether the eight scales are sufficiently independent to warrant separate consideration, all pairwise correlations between the scales were computed, for T2 and T3 separately. Per time point, correlations between the scales could be computed over perception data, desire data and dissatisfaction data. This yielded 84 (i.e., 3 x 28) correlation coefficients for each time point. At T2, 65 of these correlations were below .50, implying that – in those cases – less than 25% of the variation on that scale can be explained by variation on the other scale, 16 were between .50 and .60, and only 3 were slightly above .60. In addition to considering the pairwise correlations between the scales, the tolerance was computed for each scale as a check for possible collinearity between the scales. The tolerance measure, which has a range from 0 to 1, is usually considered to indicate serious collinearity if the values are below .10. The tolerance was computed separately for each of the eight scales for perception, desire and dissatisfaction data, resulting in 24 tolerance values. The lowest tolerance value found at T2 was .45. Of the

remaining 23 tolerance values, 11 were above .60. For T3, a similar exercise yielded 67 correlations below .50, 13 between .50 and .60, and 4 slightly above .60. The lowest tolerance value was .45, with 11 of the tolerance values having a value above .60. In other words, there are no statistical reservations that would seriously invalidate considering the eight scales separately.

3.2.2.3 Inventory of Expected Study Environment Extended (IESEE)

The IESEE is a parallel version of the IPSEE and measures students' expectations of a forthcoming learning environment and their desires with regard to that environment. Differences between expectation scores and desire scores indicate prospective satisfaction with the forthcoming learning environment. The IESEE contains the same 67 items as the IPSEE, but statement A now related to students' expectations instead of perceptions: "I expect this to happen (in the 10th grade)". Internal consistency of the IESEE is illustrated in Table 3.1 (columns 1 and 2). The coefficients for the expectation scales ranged from .67 for the scale differentiation to .82 for the scale fascinating contents. In respect to desire scores, the alpha coefficients ranged from .65 for the scales clarity of goals and personalization to .78 for the scale student autonomy. In total, 6 of 16 Cronbach's alpha coefficients were above .60; 7 were above .70, and 3 were above .80.

As was done for the IPSEE-scales, the independence of the 8 IESEE-scales was checked. Of the 84 correlations (28 over expectation data, 28 over desire data and 28 over prospective dissatisfaction data), 83 were below .50, and one correlation was between .50 and .60. The lowest tolerance value was .56, with 19 of the tolerance values having a value above .60. Again, there is no statistical objection to consider the eight IESEE-scales separately.

3.2.2.4 Inventory of Learning Styles for Secondary Education (ILS-SE)

This ILS questionnaire was originally developed by Vermunt (1992) and was adapted to students in secondary education by Vermunt, Bouhuijs, and Picarelli (2003). The questionnaire measures learning-related characteristics of students, based on their usual way of learning. The ILS-SE consists of 100 items. Based on results of factor analyses, we decided to exclude a single item, because of a small factor loading (< .40). The remaining 99 items are divided in five clusters: processing strategies, regulation strategies, motivational orientations, conceptions of learning, and affective processing strategies. Each of the five clusters contains several scales (see Table 3.2).

Table 3.2 Internal consistencies of the scales of the ILS-SE, at T1 and T2

Cluster	Scale	Number of items	Cronbach's alpha coefficient	
			T1	T2
Information processing strategies	Deep processing	12	.84	.84
	Stepwise processing	8	.81	.80
Regulation strategies	Self-regulation	8	.71	.71
	External regulation	6	.68	.66
	Lack of regulation	4	.66	.71
Motivational orientations	Personally interested	4	.58	.67
	Certificate-oriented	5	.58	.63
	Vocation-oriented	4	.73	.77
	Ambivalent	5	.75	.74
Conceptions of learning	Construction and use of knowledge	8	.82	.81
	Intake of knowledge	4	.64	.64
	Cooperative learning	3	.70	.76
	Stimulating education	5	.78	.79
Affective processing strategies	Problems with motivation and concentration	7	.87	.86
	Fear of failure	8	.87	.87
	Keeping a good state of mind	8	.72	.71

Processing strategies pertain to cognitive activities that students use to process learning contents. This first cluster contains two scales: *deep processing* which includes relating and structuring knowledge elements and critical processing of information, and *stepwise processing* which entails memorizing, rehearsing, and studying information in detail. The second cluster, regulation strategies, refers to the way students regulate and steer their own learning process. This cluster falls apart in three scales, namely, *self-regulation* which is the regulation of one's own learning process through planning, monitoring, reflecting and own initiatives with respect to learning contents; *external regulation* which pertains to learning processes to be regulated by external sources, such as books or the teacher, and *lack of regulation* which are difficulties encountered regulating learning and processing learning contents effectively. The third cluster, motivational orientations, contains scales covering different personal goals or motives students can have for learning and going to school. The four scales are: *personally interested* which entails learning out of interest in the learning contents and to develop oneself; *certificate-oriented* which is learning for passing tests, high achievements, and obtaining certificates; *vocation-oriented* which pertains to learning for future study and vocation, and *ambivalent* which entails a doubtful, uncertain attitude toward own capacities and chosen subjects. The fourth cluster is about students' conceptions of learning and contains four scales, namely, *construction and use of knowledge* which is learning as constructing one's own

knowledge and using it by means of concretizing and applying; *intake of knowledge* which pertains to learning as taking in information provided by education and reproducing it; *cooperative learning* which is preferring learning in cooperation with peer students, and *stimulating education* which entails continuous stimulation of learning by teachers or textbooks. The fifth cluster, affective processing strategies, concerns emotional aspects of learning. It contains three scales, namely, *problems with motivation and concentration* which is problems with staying concentrated and motivated during learning, easily being distracted, and showing postponing-behavior; *fear of failure* which pertains to experiencing stress during learning, especially in testing situations and having a negative self-image, and *keeping a good state of mind* which is having a positive idea about own capacities, being self-confident and performing activities to stay motivated and concentrated.

For each item in the ILS-SE, students rate the degree to which a statement corresponds to their own learning behavior, ideas about learning, motivational orientations, or affective strategies on a 5-point scale. Information about internal consistencies of the scales at T1 and T2 is included in Table 3.2. At T1 Cronbach's alpha ranged from .58 for the scales personally interested and certificate-oriented, to .87 for the scales problems with motivation and concentration and fear of failure. At T2 the coefficients ranged from .63 for the scale certificate-oriented to .87 for the scale fear of failure. In total, two of 32 Cronbach's alpha coefficients were .58; 7 were above .60; 13 were above .70, and 10 were above .80, all of which are acceptable.

As was the case for the IPSEE-scales, the independence of the 16 ILS-SE-scales was tested. Table 3.3 shows the correlations between the scales. It can be seen that 116 of the correlations were below .50, 3 between .50 and .60, and only 1 slightly above .60. The lowest tolerance value was .40, with 12 values above .60. Thus, there was no statistical objection to considering the 16 ILS-SE-scales separately.

3.2.3 Procedure

At T1, the participants filled out the IESEE and the ILS-SE. At T2, they filled out the IPSEE and the ILS-SE. At T3, they only filled out the IPSEE. Preceding the completion of a questionnaire, students received a short oral instruction about the goal and content of the questionnaire and about the way items had to be scored. This was repeated on the first page of each questionnaire. Participants had to fill in their name, age, class (i.e., year group), and school. The IESEE/IPSEE took between 30 and 40 minutes to complete; the ILS-SE took between 20 and 30 minutes. The participants filled out the questionnaires during regular school hours.

Table 3.3 Pearson's correlations between the scales of the ILS-SE (at T1)

Scale	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Deep processing															
(2) Stepwise processing	.35**														
(3) Self-regulation	.68**	.53**													
(4) External regulation	.28**	.54**	.39**												
(5) Lack of regulation	.14**	.16**	.16**	.16**											
(6) Personally interested	.37**	.27**	.39**	.18**	-.06										
(7) Certificate-oriented	.04	.35**	.14**	.33**	.07*	.05									
(8) Vocation-oriented	.17**	.21**	.22**	.22**	.03	.24**	.33**								
(9) Ambivalent	.01	-.05	.02	-.08*	.41**	-.19**	-.11**	-.23**							
(10) Construction and use of knowledge	.54**	.31**	.46**	.30**	-.03	.41**	.18**	.42**	-.13**						
(11) Intake of knowledge	.01	.27**	.09**	.32**	.31**	-.01	.28**	.16**	.17**	.07					
(12) Cooperative learning	.19**	.12**	.22**	.16**	.16**	.08*	.07	.16**	.13**	.29**	.25**				
(13) Stimulating education	.24**	.08*	.17**	.12**	.31**	.08*	.04	.10**	.20**	.31**	.30**	.30**			
(14) Problems with motivation and concentration	-.10**	-.35**	-.29**	-.19**	.19**	-.18**	-.17**	-.15**	.23**	-.23**	.00	-.05	.12**		
(15) Fear of failure	.22**	.19**	.31**	.09*	.48**	.09**	.03	-.01	.38**	.04	.22**	.20**	.20**	.06	
(16) Keeping a good state of mind	.37**	.32**	.37**	.33**	-.09**	.30**	.20**	.20**	-.21**	.39**	.02	.09*	.07	-.14**	-.06

Note. ** $p < .01$, * $p < .05$

3.2.4 Data analysis

A maximum of 25% of missing values was accepted to compute the mean scores for each scale of the IESEE, IPSEE, and ILS-SE. If at least 75% of the items of a scale were filled out, these items were used to compute the mean score of that scale. For each scale, a mean score could be calculated using at least 95% of the participants. Dissatisfaction scores of the IESEE/IPSEE were computed as the difference between the desire score and the expectation/perception score. Students who desire a particular characteristic of a learning environment to be *more* strongly implemented than they expected or perceive are called *"lovers"* of this characteristic, for example, differentiation-lovers. Students who desire a particular characteristic of a learning environment to be *less* strongly implemented than they

expected or perceive are called *"rejecters"* of this characteristic, for example, differentiation-rejecters. One student can thus be a lover for one scale and be a rejecter for another scale. To interpret the results of lovers and rejecters in a univocal way, dissatisfaction scores of rejecters were transformed to absolute values. If rejecters made up less than 15% of the whole sample, their data were not further analyzed.

Since the longitudinal design had a nested data structure, with participants nested in classes (i.e., year groups) and classes nested in schools, we expected both serial correlations due to repeated measurements and intraclass correlations due to the multilevel structure. Data are analyzed with a longitudinal mixed model: repeated measures are considered to be nested in participants and participants are considered to be nested in classes. Although classes are further nested within schools, schools are not included as an additional random factor in the model because their number is too small to permit inference to the population of schools. Instead, school was included as a fixed factor in the model to correct for correlations in the data due to nesting within schools. Thus it is assumed that the five schools are representative for the wider population of schools. School and/or class were only included in the model if their effects were significant at a level of $p < .10$.

Apart from accounting for the multilevel structure of the data, the longitudinal mixed model analysis has two other advantages over traditional repeated measures ANOVA. First, repeated measures ANOVA assumes that the residual variation can be described by a covariance structure known as sphericity. This is a highly restrictive assumption that is seldom realistic in the case of repeated measures. The longitudinal mixed model permits the specification of more realistic covariance structures. We opted for an unstructured covariance matrix, posing no restrictions on the values of residual variances and covariances. Second, repeated measures ANOVA discards each participant with a missing value on any of the three measurements. In contrast, the longitudinal mixed model makes use of maximum likelihood estimation. Under the assumption that cases are missing at random (MAR), participants with missing data on one or two measurements can still be used for estimation purposes. The MAR assumption is plausible in our case, so that mixed model analysis allows for a more efficient use of the available data whilst still yielding unbiased estimates of effects.

A specific problem requiring further consideration is correction for class effects. Class composition changed over the time periods so that the same pupil could belong to three differently composed classes. This problem was circumvented by trying out – a maximum of – three different class corrections for each separate model. Class was first tried out as a random factor by using the classes as

composed at T1, then tried out as a random factor by using the classes as composed at T2, and finally tried out as a random factor by using the classes as composed at T3. In principle, this procedure might end up with more significant class effects, yielding a problem of choice: Which model should be reported? But in practice, this did not pose a problem because the estimates of the fixed effects were unbiased and the standard errors only marginally changed under the different class corrections. In the Results section, the Tables only report standard errors corrected for school effects (if relevant). If a significant class effect changed a parameter estimate from significant to non-significant, or vice versa, this will be explicitly discussed in the text. If a class effect is not described in the text, correction for class had only minor effects on reported standard errors and did not change the significance of the result. In the following section only results significant at a level of $p < .01$ are reported.

3.3 Results

3.3.1 Development in students' reports about the learning environment

To answer the first research question – are students' expectations of a learning environment met and how do desires and dissatisfaction develop over time? – a longitudinal mixed model analysis was used. For testing longitudinal effects over time, F values were computed, and for identifying the exact differences between the three times of measurement, pairwise comparisons with Bonferroni correction were conducted. Cohen's d effect size was computed by dividing the difference between two measurements by the weighted average of their corresponding standard deviations. Only differences with an effect size above .20 will be described in the text.

Longitudinal analyses on dissatisfaction scores were limited to participants who were "lovers" on a particular scale consistently over time (i.e., they were never a "rejecter" on the other measure(s) for this scale). It is impossible to include lovers and rejecters in the same analysis. Mathematically, a dissatisfaction score of -3 is always lower than a score of +3, and conceptually, both scores may indicate the same degree of dissatisfaction but yet in another direction (lover or rejecter). It is not possible to account for this difference in the same analysis, because the use of absolute dissatisfaction scores would deny the important distinction between students who desire a weaker implementation of a particular characteristic of a powerful learning environment and students who on the contrary desire a stronger implementation of the same characteristic. Therefore, data of lovers and rejecters are separately analyzed for each scale. Consistent lovers were dominant in the

sample (see Table 3.4). Rejecters were very scarce (less then 15% of the sample). Only differentiation-rejecters consisted of more than 15% of the students on each measurement; these data are analyzed and presented separately.

3.3.1.1 Expectation and perception scores

Table 3.4 presents the means and standard deviations of expectation scores (T1), perception scores (T2 and T3), desire scores (T1, T2, and T3), and dissatisfaction scores (T1, T2, and T3). Table 3.5 shows the results of the mixed model longitudinal analyses on expectation and perception data. The results of the *F* tests showed that significant longitudinal effects existed on all scales of the IPSEE ($p < .01$).

Table 3.4 Means and standard deviations of expectation scores (T1) and perception scores (T2 & T3), desire scores and dissatisfaction scores, separately for lovers (L) and rejecters (R) on a scale

Scale	Expectations and perceptions			Desires			Dissatisfaction								
	T1	T2	T3	T1	T2	T3	T1			T2			T3		
							L	%L	R	L	%L	R	L	%L	R
Fascinating contents	3.46 (.82)	3.10 (.85)	3.12 (.86)	4.76 (.65)	4.87 (.63)	4.92 (.63)	1.35 (.80)	97	-	1.77 (.96)	99	-	1.82 (.96)	99	-
Productive learning	2.76 (.97)	2.89 (1.01)	3.32 (.93)	4.10 (.94)	3.85 (.99)	3.95 (.94)	1.53 (1.02)	92	-	1.29 (1.00)	85	-.93 (.92)	.93 (.81)	82	-.76 (.73)
Integration	4.27 (.64)	3.74 (.69)	3.77 (.72)	4.58 (.55)	4.60 (.55)	4.67 (.55)	.58 (.56)	73	-.44 (.41)	.95 (.72)	93	-	.96 (.75)	96	-
Student autonomy	3.88 (.70)	3.29 (.71)	3.38 (.69)	4.88 (.51)	4.56 (.59)	4.65 (.53)	1.11 (.74)	93	-	1.37 (.88)	95	-	1.32 (.86)	97	-
Interaction	3.98 (.64)	3.70 (.65)	3.74 (.62)	4.59 (.58)	4.56 (.58)	4.60 (.56)	.77 (.57)	86	-	.94 (.64)	94	-	.92 (.64)	95	-
Differentiation	3.54 (.86)	3.10 (.76)	3.15 (.78)	3.39 (.94)	3.22 (.85)	3.25 (.86)	.51 (.57)	51	-.77 (.60)	.63 (.71)	60	-.66 (.53)	.59 (.66)	61	-.67 (.57)
Clarity of goals	4.12 (.94)	3.82 (.96)	3.88 (1.00)	5.37 (.53)	5.32 (.55)	5.33 (.52)	1.32 (.95)	96	-	1.56 (1.04)	97	-	1.47 (1.10)	99	-
Personalization	3.95 (.86)	3.95 (.86)	4.12 (.78)	4.97 (.61)	4.99 (.59)	4.99 (.55)	1.11 (.80)	94	-	1.10 (.85)	96	-	.92 (.77)	96	-

Note. - indicates < 15% of the sample in this category

The differences between expectation scores (T1) and perception scores (T2) show that the scores decreased on seven of the eight scales, indicating disappointing perceptions compared to the expectations. The effect sizes were large for integration, student autonomy, and differentiation (in order, .79, .84, and .53). No significant difference between expectation and perception scores was found for personalization.

Table 3.5 Results of mixed model analyses on longitudinal data of expectations (T1) and perceptions (T2 & T3), data of desires (T1, T2, & T3), and data of prospective dissatisfaction (T1) and perceived dissatisfaction (T2 & T3) for consistent lovers on a scale

			T2 – T1			T3 – T2		
Scale	***F***	***df***	**Δ**	***SE***	***d***	**Δ**	***SE***	***d***
Expectations and perceptions								
Fascinating contents	76.38**	2, 368.59	-.36**	.03	.43	-.02	.03	.02
Productive learning	98.72**	2, 618.65	.13**	.04	.13	.41**	.04	.42
Integration	242.13**	2, 451.50	-.53**	.03	.79	.01	.03	.01
Student autonomy	243.21**	2, 582.42	-.59**	.03	.84	.07*	.03	.10
Interaction	65.90**	2, 501.33	-.28**	.03	.44	.05	.02	.08
Differentiation	88.28**	2, 835.36	-.42**	.03	.53	.00	.03	.00
Clarity of goals	45.80**	2, 428.35	-.33**	.04	.35	.02	.04	.02
Personalization	12.91**	2, 459.72	-.01	.03	.01	.15**	.03	.18
Desires								
Fascinating contents	26.94**	2, 357.85	.12**	.02	.19	.07**	.02	.11
Productive learning	27.12**	2, 391.90	-.24**	.03	.25	.05	.03	.05
Integration	12.64**	2, 388.82	.02	.02	.04	-.09**	.02	.16
Student autonomy	115.65**	2, 490.25	-.31**	.02	.56	.08**	.02	.14
Interaction	3.46*	2, 327.57	-.01	.02	.02	.05*	.02	.09
Differentiation	13.18**	2, 477.97	-.16**	.03	.18	-.01	.03	.01
Clarity of goals	3.14*	2, 608.02	-.05	.02	.09	.00	.02	.00
Personalization	.44	2, 374.00	.02	.02	.03	-.02	.02	.03
Dissatisfaction								
Fascinating contents	115.80**	2, 359.08	.46**	.03	.51	.05	.03	.05
Productive learning	80.71**	2, 544.29	-.27**	.04	.27	-.36**	.04	.39
Integration	114.35**	2, 315.48	.40**	.03	.61	.02	.03	.03
Student autonomy	34.21**	2, 454.27	.27**	.03	.33	-.04	.03	.05
Interaction	26.60**	2, 493.06	.19**	.03	.31	.00	.03	.00
Differentiation	5.21**	2, 211.47	.14**	.04	.21	-.06	.05	.08
Clarity of goals	26.43**	2, 403.30	.26**	.04	.26	-.04	.04	.04
Personalization	18.26**	2, 505.00	.01	.03	.01	.18**	.03	.22

Note. Standard errors are based on estimation of fixed effects without correction for class effects, but with correction for school effects (if $p_{school} < .10$). Additional correction for class effects did not change the significance of the result, unless stated in text. ** $p < .01$, * $p < .05$

For most scales, the differences between perception scores at T2 and T3 showed no significance. An increase of perception scores from T2 to T3 was only found for the scales productive learning and personalization. Apparently, students perceived these elements of the learning environment as being present more strongly at T3 than at T2. Scores on productive learning, notably, increased year after year (from T1 to T2, and from T2 to T3). The most striking result is the large decline of expectation scores at T1 and perception scores at T2, on the majority of the scales. Apparently, the perceived learning environment did not meet students' expectations. This raises additional questions because the non-linear dynamical model of Carver and Scheier (2001) predicts possible strong declines in

engagement when optimism decreases to a level where a phase transition occurs (see Figure 3.1). Thus, given our results, effects of dissatisfaction on the development of students' learning-related characteristics become interesting. Therefore, for all scales we additionally explored the relations between the size of the mismatch between expectation scores (T1) and perception scores (T2) and the development of learning-related student characteristics in the same period. The mismatch scores (T2 minus T1) ranged from -5, indicating a large decrease in scores from T1 to T2 and strong disappointment, to +5, indicating a large increase in scores from T1 to T2 and thus much higher perceptions than previously expected. For analyzing these data, mixed model regression analyses were conducted. In the first step of the analyses, the changes in each learning-related student characteristic (T2 minus T1) as well as a school and a class variable were included in the model. By using a backward procedure, a model was built that only contained variables that were significant at $p < .01$ ($p_{school/class} < .10$).

Results show that a decrease from expectation scores (T1) to perception scores (T2) on the scale fascinating contents related to a decrease in personally interested motivational orientation ($B = .24$; $SE\ B = .05$; $\beta = .20$), a decrease in reported use of deep processing strategies ($B = .20$; $SE\ B = .05$; $\beta = .13$), and an increase in fear of failure ($B = -.21$; $SE\ B = .04$; $\beta = -.18$) from T1 to T2. Thus, the larger the disappointment, the more personal interest and the use of deep processing strategies decreased, and the more fear of failure increased. For the scale integration, a decrease from T1 to T2 (i.e., disappointment) was related to a decrease in vocation-oriented motivational orientation ($B = .12$; $SE\ B = .04$; $\beta = .13$). For the scale student autonomy, a decrease was related to an increase in fear of failure ($B = -.15$; $SE\ B = .04$; $\beta = -.14$) and a decrease in deep processing ($B = .16$; $SE\ B = .05$; $\beta = .11$). For the scale interaction, a decrease was related to a decrease in deep processing strategies ($B = .16$; $SE\ B = .05$; $\beta = .13$), a decrease in considering learning as a cooperative activity ($B = .08$; $SE\ B = .03$; $\beta = -.11$), and an increase in the ambivalent motivational orientation ($B = -.10$; $SE\ B = .04$; $\beta = .10$). For the scale clarity of goals, a decrease was related to a decrease in personally interested motivational orientation ($B = .18$; $SE\ B = .05$; $\beta = .13$), and a decrease in keeping a good state of mind ($B = .20$; $SE\ B = .06$; $\beta = .13$). For the scale personalization, a decrease was related to a decrease in the personally interested motivational orientation ($B = .15$; $SE\ B = .05$; $\beta = .12$), and an increase in fear of failure ($B = -.18$; $SE\ B = .05$; $\beta = -.15$). Productive learning was the only scale showing an increase in scores from T1 to T2. An increase in productive learning was related to a decrease in the conception of learning as intake of knowledge ($B = -.15$; $SE\ B = .05$; $\beta = -.10$), and a decrease in fear of failure ($B = -.15$; $SE\ B = .06$; $\beta = -.10$).

It appears that perceptions, which do not meet the expectations, are related to undesirable changes in learning-related student characteristics, especially to an increase in fear of failure, a decrease in deep processing, and a decrease in personally interested motivational orientation. Thus, besides negative effects of disappointing perceptions on motivation, negative effects on affective processing strategies and information strategies are found.

3.3.1.2 Desire scores

Table 3.5 presents the results of mixed model longitudinal analyses on desire scores. The analyses test whether or not desire scores are stable over time. *F* tests showed significant longitudinal effects on five of the eight scales. For the scales interaction and personalization, desire scores did not show any changes over time. For the scale clarity of goals, desire scores showed no significant longitudinal effect when corrected for school. However, when corrected for class composition at T3 as well as school, they did show a significant effect ($F = 7.09$; T2 – T1 = -.10 ($SE = .03$; $d = .19$); T3 – T2 = -.08 ($SD = .03$; $d = .16$)).

As can be seen from Table 3.5, the differences between desire scores at the three times of measurement are rather small. Desire scores on the scales productive learning and student autonomy decreased from T1 to T2. In particular, students considered student autonomy as more desirable before entering the new learning environment than after one year of experiencing the environment ($d = .56$). There were no large changes in the desire scores from T2 to T3. Desire scores on the scale fascinating contents showed small increases with each measurement (both from T1 to T2, and from T2 to T3).

So, the results for the longitudinal data of desire scores showed significant effects on several scales, although the changes over time were rather small. Desire scores for productive learning and student autonomy decreased, and desire scores for fascinating contents increased.

3.3.1.3 Dissatisfaction scores

Table 3.4 presents means and standard deviations of dissatisfaction scores at T1, T2, and T3, separately for lovers and rejecters. The mixed model longitudinal analyses were limited to students consistently classified (i.e., at T1, T2 and T3) as "lovers" on a particular scale. In addition, data of students consistently classified as differentiation-rejecters were analyzed, because they made up more than 15% of the sample at the three times of measurement. Table 3.5 presents the results of the lovers on each scale; the results for the differentiation-rejecters are described in the text.

The results show significant longitudinal effects on all scales of the IESEE/IPSEE; all *F* tests yield significant effects. Dissatisfaction scores increased from T1 to T2 on six scales: fascinating contents, integration, student autonomy, interaction, differentiation, and clarity of goals. Thus, students' prospective dissatisfaction, before they started to work in the new learning environment, is lower than their dissatisfaction after they perceived the learning environment for about one year. The increase in dissatisfaction is particularly large for the scales fascinating contents and integration (respectively d = .51 and d = .61). The dissatisfaction scores only decreased for the scale productive learning.

Between T2 and T3, dissatisfaction scores changed for only two scales. The dissatisfaction scores for productive learning further decreased, and the dissatisfaction scores for personalization showed a decrease from the second to the third measurement. The dissatisfaction scores of differentiation-rejecters showed no significant longitudinal effects, neither from T1 to T2 nor from T2 to T3.

The results for dissatisfaction scores predominantly showed increases from T1 to T2, except for productive learning which showed a decrease. From T2 to T3, dissatisfaction scores changed for only a few scales. Most remarkable was a continuing decrease of dissatisfaction scores for productive learning.

Summarizing, results for the first research question showed that students' perceptions of the new learning environment did not meet their expectations. Productive learning was the only aspect of the learning environment that was perceived as being present more strongly than expected. Desires with respect to the design of the learning environment showed longitudinal changes, although those changes were mostly small. The desirability of student autonomy clearly decreased from T1 to T2. Dissatisfaction increased on almost all scales, especially from T1 to T2. However, dissatisfaction with productive learning decreased.

3.3.2 Relationships between students' reports on different measurement moments

To answer the second research question – are expectations related to subsequent perceptions, and are desires and dissatisfaction scores at different times of measurement related to each other? – mixed model regression analyses were conducted to investigate mutual relations between expectation scores at T1, perception scores at T2, and perception scores at T3. To investigate the relation between expectation scores at T1 and perception scores at T2, a model was tested with the perception score at T2 as a dependent variable and the expectation score at T1 as an independent variable. The relations between expectation scores (at T1) and perception scores at T2 and T3 were examined by building a model in which the perception score at T3 for a particular scale of the IPSEE was specified as a

dependent variable, and expectation scores at T1 and perception scores at T2 as independent variables. Testing this model provides insight in the relation between scores at T1 and T3, and between scores at T2 and T3. Because perception scores at both T2 and T3 were included in the model, the regression coefficient of the score at T2 is corrected for the score at T3, and vice versa. The regression coefficients represent the size of the unique part of the relation between the dependent and independent variable.

In the first step of the analyses the independent variable(s) was/were added to the model, as well as the school variable (covariate) and a class variable (random intercept). As for the first research question, analyses were done threefold: once using the class composition at T1, once at T2, and once at T3. The analyses for investigating the relation between scores at T1 and T2 were done only twice: once using the class composition at T1 and once at T2. In the second step of the analyses, school and/or class were sequentially removed if $p > .10$ and, thus, relations between dependent and independent variables were not significantly influenced by school or class. This strategy was used to investigate the relations between the expectation score (T1) and the perception scores at T2 and T3, separately for the eight scales of the IPSEE. Relations between desire scores at the different times of measurement were analyzed in the same way. Analyses of the relations between dissatisfaction scores were, again, limited to those participants who were consistently classified as lovers for a particular scale and to participants who were consistently classified as differentiation-rejecters.

3.3.2.1 Expectation and perception scores

Table 3.6 presents the results of analyzing the mutual relations between expectation scores at T1, and perception scores at T2 and T3. The expectation scores at T1 had a significant positive effect on perception scores at T2 for all scales (Table 3.6: results on line 1 for each scale). Thus, the higher the expectation scores, the higher the perception scores at T2. Perception scores at T2 also had a significant positive effect on perception scores at T3. But as can be seen from Table 3.6 (line 2 for each scale), the direct effect of expectation scores (T1) on perception scores at T3 was non-significant for three scales and relatively small for the other scales. This is likely due to the mediating role of the perception scores at T2. By including perception scores at T2 in the analyses, results are corrected for this potential mediator and show the size of the unique relation between scores at T1 and T3.

Table 3.6 Regression coefficients ($p < .01$) of mixed regression of expectations at T1 on perceptions at T2 and perceptions at T3, and of perceptions at T2 on perceptions at T3

	Expectations at T1			Perceptions at T2		
Scale	***B***	***SE B***	**β**	***B***	***SE B***	**β**
Fascinating contents						
perceptions at T2	.46	.03	.44			
perceptions at T3	.21	.05	.20	.48	.05	.48
Productive learning						
perceptions at T2[a]	.36	.04	.34			
perceptions at T3[a]	.23	.04	.24	.34	.04	.37
Integration						
perceptions at T2[a]	.47	.04	.43			
perceptions at T3	n.s.			.53	.05	.51
Student autonomy						
perceptions at T2[a]	.36	.04	.36			
perceptions at T3[a]	n.s.			.45	.05	.45
Interaction						
perceptions at T2[a]	.39	.04	.38			
perceptions at T3	n.s.			.52	.04	.55
Differentiation						
perceptions at T2[a]	.21	.03	.24			
perceptions at T3	.15	.04	.16	.41	.05	.39
Clarity of goals						
perceptions at T2[a]	.43	.03	.42			
perceptions at T3	.13	.05	.12	.56	.05	.54
Personalization						
perceptions at T2	.45	.03	.45			
perceptions at T3	.15	.04	.16	.50	.05	.55

Note. Standard errors are based on estimation of fixed effects without correction for class effects, but with correction for school effects (if $p_{school} < .10$). Additional correction for class effects did not change the significance of the result, unless stated in text. [a] corrected for school effects

3.3.2.2 Desire scores

Table 3.7 presents the results of mixed model regression analyses on the desire scores, showing relations between the different measurements. Desire scores at T1 had a significant positive effect on desire scores at T2 and on desire scores at T3 for all scales. Likewise, desire scores at T2 had a significant positive effect on desire scores at T3. Thus, the higher, for example, the desire score for fascinating contents at T1, the higher the desire score for fascinating contents at T2 and T3, and the higher the desire score for fascinating contents at T2, the higher the desire score for fascinating contents at T3.

Table 3.7 Regression coefficients ($p < .01$) of mixed regression of desires at T1 on desires at T2 and desires at T3, and of desires at T2 on desires at T3

	Desires at T1			Desires at T2		
Scale	***B***	***SE B***	**β**	***B***	***SE B***	**β**
Fascinating contents						
desires at T2[a]	.47	.03	.48			
desires at T3[a]	.19	.04	.20	.48	.04	.48
Productive learning						
desires at T2[a]	.54	.03	.51			
desires at T3[a]	.19	.05	.19	.44	.05	.46
Integration						
desires at T2[a]	.46	.03	.46			
desires at T3	.24	.05	.24	.42	.05	.43
Student autonomy						
desires at T2	.49	.04	.42			
desires at T3[a]	.12	.04	.11	.46	.04	.52
Interaction						
desires at T2	.48	.03	.48			
desires at T3[a]	.26	.04	.28	.46	.04	.48
Differentiation						
desires at T2[a]	.42	.03	.46			
desires at T3	.19	.04	.21	.45	.05	.45
Clarity of goals						
desires at T2[a]	.36	.04	.35			
desires at T3[a]	.20	.05	.21	.44	.04	.46
Personalization						
desires at T2[a]	.36	.03	.38			
desires at T3	.24	.04	.27	.47	.04	.51

Note. Standard errors are based on estimation of fixed effects without correction for class effects, but with correction for school effects (if $p_{school} < .10$). Additional correction for class effects did not change the significance of the result, unless stated in text. [a] corrected for school effects

3.3.2.3 Dissatisfaction scores

Table 3.8 presents the analysis results for relations between dissatisfaction scores at T1, T2, and T3, for students consistently classified as lovers for a particular scale. For all scales, prospective dissatisfaction at T1 had a positive effect on dissatisfaction at T2, and dissatisfaction at T2 had a positive effect on dissatisfaction at T3. Prospective dissatisfaction at T1 had a direct positive effect on dissatisfaction scores at T3 on half of the scales, indicating a unique relation between the dissatisfaction scores at T1 and T3 for fascinating contents, integration, differentiation, and clarity of goals.

Table 3.8 Regression coefficients ($p < .01$) of mixed regression of prospective dissatisfaction at T1 on dissatisfaction at T2 and dissatisfaction at T3, and of dissatisfaction at T2 on dissatisfaction at T3 for consistent lovers on a scale

	Prospective dissatisfaction at T1			Dissatisfaction at T2		
Scale	***B***	***SE B***	**β**	***B***	***SE B***	**β**
Fascinating contents						
dissatisfaction at T2	.57	.06	.40			
dissatisfaction at T3[a]	.18	.06	.15	.54	.05	.54
Productive learning						
dissatisfaction at T2	.47	.06	.40			
dissatisfaction at T3	n.s.			.31	.05	.38
Integration						
dissatisfaction at T2	.57	.08	.49			
dissatisfaction at T3	.30	.08	.26	.57	.06	.55
Student autonomy						
dissatisfaction at T2[a]	.40	.06	.38			
dissatisfaction at T3[a]	n.s.			.56	.05	.59
Interaction						
dissatisfaction at T2[a]	.34	.06	.36			
dissatisfaction at T3[a]	n.s.			.52	.05	.53
Differentiation						
dissatisfaction at T2	.57	.14	.51			
dissatisfaction at T3	.35	.13	.34	.38	.08	.39
Clarity of goals						
dissatisfaction at T2[a]	.48	.05	.41			
dissatisfaction at T3	.21	.05	.19	.55	.05	.54
Personalization						
dissatisfaction at T2	.36	.05	.38			
dissatisfaction at T3	n.s.			.49	.05	.54

Note. Standard errors are based on estimation of fixed effects without correction for class effects, but with correction for school effects (if $p_{school} < .10$). Additional correction for class effects did not change the significance of the result, unless stated in text. [a] corrected for school effects

For students consistently classified as differentiation-rejecters, analyses also showed a positive effect of prospective dissatisfaction at T1 on dissatisfaction at T2 ($B = .24$; $SE\ B = .07$; $\beta = .27$), and a positive effect of dissatisfaction at T2 on dissatisfaction at T3 ($B = .56$; $SE\ B = .15$; $\beta = .51$). The more prospective dissatisfied students were at T1, the more dissatisfied they were one year later (from T1 to T2), and the same holds for the next year (from T2 to T3). There was also a small but significant direct effect of prospective dissatisfaction at T1 on dissatisfaction at T3 ($B = -.01$; $SE\ B = .12$; $\beta = -.02$).

In summary, the results for the second research question showed robust relations between expectations and later perceptions. The higher students' expectations before entering the new learning environment, the higher their subsequent perceptions were. Additionally, the higher their perceptions at T2, the higher their

perceptions at T3. Desire scores also showed to be longitudinally related. Finally, prospective dissatisfaction scores were positively related to subsequent dissatisfaction scores with the perceived learning environment.

3.3.3 Relationships between students' reports at T1 and learning-related student characteristics

To answer the third research question – how are expectations, desires, and prospective dissatisfaction scores related to learning-related student characteristics? – mixed model regression analyses were used to examine the relations between expectation scores at T1 and learning-related student characteristics at T1. Analyses were corrected for possible school effects as well as interdependency of data within classes by including these variables, together with the learning-related student characteristics, in the first step of the mixed model regression analyses. A backward procedure was used, removing the less significant variables one by one. Variables were excluded until all variables in the model were significant at a level of $p < .01$. Class and school effects were retained in the model if $p < .10$.

The same analyses were used to investigate the relations between desire scores and learning-related student characteristics. For analyzing the relations between dissatisfaction scores and learning-related student characteristics, data of students classified as lovers and rejecters were analyzed separately for each scale, as described in the previous sections. Dissatisfaction scores of rejecters were transformed to absolute values, to make univocal interpretation of results of lovers and rejecters possible. If rejecters made up less than 15% of the sample, their data were not analyzed.

3.3.3.1 Expectation scores and learning-related student characteristics

Table 3.9 presents the results of mixed model regression analyses, investigating the relations between expectation scores and learning-related student characteristics. Expectation scores for the different scales of the IPSEE were all significantly related to at least two and at most five learning-related student characteristics. As can be seen from the Table, some student characteristics were more often related to expectation scores than others. Learning-related student characteristics related to expectation scores on at least half of the scales of the IPSEE are described below.

A personally interested motivational orientation was positively related to expectation scores for five scales: fascinating contents, student autonomy, interaction, clarity of goals, and personalization. The conception of learning as the construction and use of knowledge was also frequently related to high expectation scores: the stronger this conception, the higher the expectation scores for

Table 3.9 Significant results ($p < .01$) of mixed model analyses, showing relations between expectations and learning-related student characteristics

Dependent variable	Independent variable(s)	*B*	*SE B*	β
Fascinating contents	Personally interested	.39	.04	.31
	Construction and use of knowledge	.31	.04	.27
	Problems with motivation and concentration	-.12	.03	-.14
Productive learning[a]	Intake of knowledge	-.22	.04	-.16
	Problems with motivation and concentration	-.12	.04	-.12
	Stepwise processing	-.16	.05	-.13
	Deep processing	.15	.06	.10
Integration[a]	Construction and use of knowledge	.20	.04	.22
	External regulation	.13	.04	.10
	Fear of failure	-.10	.03	-.12
Student autonomy[a]	Construction and use of knowledge	.18	.04	.20
	Fear of failure	-.11	.03	-.11
	Personally interested	.11	.04	.10
Interaction[a]	External regulation	.16	.03	.18
	Personally interested	.14	.03	.15
Differentiation[a]	Intake of knowledge	-.11	.04	-.11
	Construction and use of knowledge	.12	.05	.08
	Stepwise processing	-.11	.04	-.10
Clarity of goals[a]	Ambivalent	-.19	.05	-.17
	External regulation	.18	.05	.14
	Personally interested	.18	.05	.12
	Fear of failure	-.13	.05	-.09
Personalization[a]	Ambivalent	-.19	.04	-.20
	Intake of knowledge	.16	.04	.13
	Personally interested	.18	.05	.15
	Fear of failure	-.15	.04	-.11
	Construction and use of knowledge	.13	.05	.10

Note. Standard errors are based on estimation of fixed effects without correction for class effects, but with correction for school effects (if $p_{school} < .10$). Additional correction for class effects did not change the significance of the result, unless stated in text. [a] corrected for school effects

fascinating contents, integration, student autonomy, differentiation, and personalization. The conception of learning as intake of knowledge was related to expectation scores too, but predominantly negative: the stronger this conception, the lower the expectation scores for the scales differentiation and productive learning (i.e., a higher expectation of reproduction of knowledge). The conception of learning as intake of knowledge was positively related to expectation scores for personalization (i.e., availability of support from the teacher). Furthermore, the use of external regulation strategies was positively related to expectation scores for the scales integration, interaction, and clarity of goals. Finally, the report of fear of failure was negatively related to expectation scores for half of the scales: integration, student autonomy, clarity of goals, and personalization.

With respect to the formulated hypotheses about the relation between motivation and expectations for the scales fascinating contents, clarity of goals, and personalization, the results show that motivational orientations were indeed related to expectations for those scales. For all three scales the personally interested motivational orientation was related to higher expectations. Expectations for fascinating contents were negatively related to problems with motivation and concentration, while especially the ambivalent motivational orientation was negatively related with the scales clarity of goals and personalization. As can be seen from Table 3.9, expectation scores for these scales were also related to some other learning-related student characteristics.

In summary, the results presented in Table 3.9 show that learning-related student characteristics were related to expectations and, mostly, in a consistent fashion related to either higher or lower expectation scores. Especially, students reporting fear of failure tended to expect a less powerful learning environment, while students with a personally interested motivational orientation and a constructivist conception of learning tended to expect a more powerful learning environment.

3.3.3.2 Desire scores and learning-related student characteristics

Table 3.10 presents the results of mixed model regression analyses, which give insight in relations between desire scores and learning-related student characteristics, both measured at T1. Several learning-related student characteristics were frequently related (i.e., three times or more) to desire scores for different scales of the IPSEE.

Reporting a conception of learning as the construction and use of knowledge was positively related to desire scores for three scales: fascinating contents, integration, and personalization. The conception of learning as the intake of knowledge was also related to desire scores, but the direction of the observed relations was equivocal: the stronger this conception, the lower the desire scores for the scale differentiation and the higher the desire scores for the scales clarity of goals and personalization. The more students' motivational orientation was certificate-oriented, the higher their desire scores for the scales fascinating contents, student-autonomy, clarity of goals, and personalization. Reporting deep information-processing strategies related to higher desire scores for the scales fascinating contents, productive learning, and integration. The affective processing strategy of keeping a good state of mind was positively related to desire scores for half of the scales: productive learning, student autonomy, interaction, and clarity of goals. A positive relation between this affective processing strategy and desire scores was also found for the scale personalization, when class composition at T1 was included in the mixed model regression analysis. The results of this analysis,

Table 3.10 Significant results ($p < .01$) of mixed model analyses, showing relations between desires and learning-related student characteristics

Dependent variable	Independent variable(s)	*B*	*SE B*	β
Fascinating contents[a]	Construction and use of knowledge	.27	.04	.28
	Certificate-oriented	.15	.04	.12
	Deep processing	.15	.04	.13
Productive learning[a]	Stepwise processing	-.35	.05	-.27
	Personally interested	-.24	.05	-.17
	Keeping good state of mind	.18	.05	.12
	Self-regulation	-.23	.07	-.15
	Deep processing	.17	.07	.10
Integration[a]	Construction and use of knowledge	.28	.03	.32
	Deep processing	.14	.03	.16
	Stimulating education	.08	.02	.13
	Ambivalent	-.08	.02	-.12
Student autonomy[a]	Problems with motivation and concentration	.10	.02	.18
	Keeping good state of mind	.10	.03	.15
	Lack of regulation	-.08	.02	-.13
	Certificate-oriented	.10	.03	.11
	Vocation-oriented	.08	.03	.10
Interaction	Cooperative learning	.29	.02	.51
	Keeping good state of mind	.11	.03	.18
	Personally interested	.08	.03	.12
	External regulation	.08	.03	.13
Differentiation[a]	Intake of knowledge	-.27	.04	-.22
	Stepwise processing	-.15	.04	-.09
Clarity of goals[a]	Certificate-oriented	.20	.03	.21
	External regulation	.12	.03	.17
	Intake of knowledge	.10	.02	.11
	Keeping good state of mind	.08	.03	.19
	Cooperative learning	-.06	.02	-.09
Personalization[a]	Construction and use of knowledge	.20	.03	.21
	Intake of knowledge	.13	.03	.15
	Certificate-oriented	.14	.04	.13

Note. Standard errors are based on estimation of fixed effects without correction for class effects, but with correction for school effects (if $p_{school} < .10$). Additional correction for class effects did not change the significance of the result, unless stated in text. [a] corrected for school effects

which was corrected for both class and school effects, showed personalization to be significantly related to a conception of learning as the construction and use of knowledge, a conception of learning as the intake of knowledge, and a certificate-oriented motivation, and, additionally, to keeping a good state of mind ($B = .08$; $SE\ B = .03$; $\beta = .10$). This last variable is not presented in Table 3.10 because the *p*-value was just above .01 (namely, .015).

In summary, the results presented in Table 3.10 show many relations between learning-related student characteristics and desires with respect to the design of a future learning environment. A certificate-oriented motivational orientation and

affective strategies for keeping a good state of mind are most frequently related to high desire scores.

3.3.3.3 Prospective dissatisfaction scores and learning-related student characteristics

Table 3.11 presents results of mixed model regression analyses on the prospective dissatisfaction data. For the scales integration and differentiation, the Table presents the data of both lovers and rejecters. Only the results of lovers are reported for the other scales.

Five learning-related student characteristics were related to prospective dissatisfaction scores on at least half of the scales. First, a personally interested motivational orientation was negatively related to prospective dissatisfaction scores for six scales. The stronger students' personally interested motivational orientation was, the lower their prospective dissatisfaction scores for the scales fascinating contents, productive learning, student autonomy, differentiation, clarity of goals, and personalization (all for lovers). In addition, a stronger personally interested motivational orientation was related to lower prospective dissatisfaction scores for integration-rejecters.

Second, an ambivalent motivational orientation was related to high prospective dissatisfaction scores. The stronger the ambivalent motivational orientation of students, the higher their prospective dissatisfaction scores for the scales fascinating content, integration, interaction, clarity of goals, and personalization (all for lovers).

Third, problems with motivation and concentration were positively related to prospective dissatisfaction scores. The more severe the problems with motivation and concentration reported by lovers, the higher their prospective dissatisfaction scores for the scales fascinating contents, productive learning, and student autonomy. The more severe the problems with motivation and concentration reported by differentiation-rejecters, the higher their prospective dissatisfaction scores for the scale differentiation. Thus, differentiation-rejecters who report problems with motivation and concentration desire less differentiation than they expect.

Fourth, a stronger conception of learning as intake of knowledge was related to higher prospective dissatisfaction scores for productive learning and clarity of goals (for lovers). Thus, lovers of productive learning and clarity of goals desired more productive learning and clearer goals than they expected. For integration-rejecters and differentiation-rejecters, a stronger conception of learning as intake of knowledge was also related to higher prospective dissatisfaction scores: these students desired less integration and differentiation than they expected.

Table 3.11 Significant results ($p < .01$) of mixed model analyses, showing relations between dissatisfaction and learning-related student characteristics, separately for lovers (L) and rejecters (R) on a scale

Dependent variable	L / R (% of *N*)	Independent variable(s)	*B*	*SE B*	β
Fascinating contents[a]	L (97)	Personally interested	-.28	.04	-.23
		Certificate-oriented	.23	.05	.16
		Problems with motivation and concentration	.15	.03	.16
		Ambivalent	.14	.04	.13
Productive learning	L (92)	Problems with motivation and concentration	.21	.04	.15
		Personally interested	-.21	.06	-.12
		Construction and use of knowledge	-.22	.06	-.12
		Intake of knowledge	.13	.05	.08
		Keeping good state of mind	.15	.06	.09
Integration	L (73)	Ambivalent	.12	.03	.13
		Deep processing	.10	.04	.11
	R (27)	Personally interested	.13	.04	.12
		Intake of knowledge	-.11	.04	-.12
Student autonomy	L (93)	Problems with motivation and concentration	.12	.03	.13
		Certificate-oriented	.15	.05	.10
		Personally interested	-.11	.04	-.09
Interaction[a]	L (86)	Cooperative learning	.13	.03	.16
		Construction and use of knowledge	-.19	.04	-.19
		Deep processing	.14	.04	.13
		Ambivalent	.09	.03	.10
		Keeping good state of mind	.10	.03	.10
Differentiation	L (49)	Personally interested	-.13	.05	-.09
		Deep processing	.13	.03	.09
	R (51)	Intake of knowledge	-.13	.04	-.12
		Problems with motivation and concentration	-.12	.04	-.12
Clarity of goals	L (96)	Personally interested	-.20	.05	-.14
		Fear of failure	.15	.05	.13
		Ambivalent	.14	.05	.12
		Intake of knowledge	.12	.04	.09
Personalization[a]	L (94)	Personally interested	-.19	.05	-.15
		Fear of failure	.16	.04	.14
		Deep processing	.18	.05	.14
		Ambivalent	.13	.04	.11

Note. Standard errors are based on estimation of fixed effects without correction for class effects, but with correction for school effects (if $p_{school} < .10$). Additional correction for class effects did not change the significance of the result, unless stated in text. [a] corrected for school effects

Fifth, the use of deep information-processing strategies was related to higher prospective dissatisfaction scores. The stronger the use of deep processing strategies by students, the higher were their prospective dissatisfaction scores for

the scales integration, interaction, differentiation, and personalization (all for lovers).

At first sight, it is counter-intuitive that both students with an ambivalent motivational orientation or with problems with motivation and concentration, and students with deep processing strategies were more prospectively dissatisfied with the future learning environment. On the one hand, Tables 3.8 and 3.9 indicate that problems with motivation and concentration are related to lower expectation scores for the scales fascinating contents and productive learning, while there were no significant relations with desire scores for those scales. Significant relations between prospective dissatisfaction scores and problems with motivation and concentration seem to be due to the lower expectation scores, which increased the difference between expectation scores and desire scores, and consequently, increased prospective dissatisfaction scores. On the other hand, Tables 3.8 and 3.9 show that deep processing strategies are related to high desire scores for the scales fascinating contents and integration, while there were no significant relations with expectation scores for those scales. The fact that deep processing strategies were related to high prospective dissatisfaction scores is likely the result of higher desire scores, which caused an increase in the difference between expectation and desire scores (i.e., prospective dissatisfaction scores).

The analyses of prospective dissatisfaction scores and learning-related student characteristics show that some student characteristics, and especially, the personally interested motivational orientation are related to low prospective dissatisfaction scores. Other student characteristics, such as an ambivalent motivational orientation, problems with motivation and concentration, and deep processing strategies are related to high prospective dissatisfaction scores. The origins of the prospective dissatisfaction scores, however, seem to be different for different student characteristics.

Summarizing, results for the third research question show that learning-related student characteristics are related to expectations. Fear of failure was frequently related to lower expectations, whereas a personally interested motivational orientation and a conception of learning as the construction and use of knowledge were related to higher expectations. A certificate-oriented motivational orientation and affective strategies for keeping a good state of mind were most strongly related to high desire scores for the design of a future learning environment. Prospective dissatisfaction scores were related to an ambivalent motivational orientation, problems with motivation and concentration, and the use of deep processing strategies. A personally interested motivational orientation was related to low prospective dissatisfaction.

3.4 Conclusions and discussion

The current study aimed to shed light on the role of expectations in education, especially expectations students have of a future learning environment. Because students move to new learning environments several times during their school career, it is relevant to gain more insight in their expectations and subsequent perceptions of these new environments, and to investigate how learning-related student characteristics affect expectations.

The first research question concerned possible discrepancies between expectations of the new learning environment and later perceptions of it. More specifically, it focused on the sub questions whether students' expectations of an innovative learning environment in Dutch secondary education are met (first part of the research question), and how desires and dissatisfaction with regard to this environment develop over time (in order, the second and third part of the research question). Our results clearly show that students' perceptions of the new learning environment fall short of their expectations. Expectations are higher than the perceptions after one year with respect to fascinating contents, integration, student autonomy, interaction, differentiation, and clarity of goals.

Productive learning is the only aspect for which perceptions exceed the expectations after one year, and for which perceptions even further increase in the second year (i.e., from T2 to T3). This is a positive finding, because the innovative learning environment indeed aimed to stimulate active processing and use of knowledge, rather than reproductive learning. However, the disappointing perceptions of the other aspects of the learning environment are worrying. Apparently, the Second Phase is implemented in such a way that students do not perceive its valuable aspects as much as they expected them beforehand. This is problematic because perceptions direct learning behaviors (Entwistle, 1991): students are likely to perform suboptimal learning activities and may consequently not – fully – reach the educational goals. In addition, the disappointment with the new learning environment is likely to have negative effects on motivation and engagement, as described in the non-linear dynamical model of Carver and Scheier (2001) and the expectancy-value model of Eccles and Wigfield (2002). This is supported by the results from the extra analyses, indicating that a mismatch between expectations and perceptions is related to negative changes in learning-related student characteristics. Disappointing perceptions were related to higher fear of failure, a lower personally interested motivational orientation, and less use of deep processing strategies. So, the fact that students' expectations are not fulfilled is problematic for both the effectiveness of the learning environment and the development of students' learning-related characteristics.

The second part of the first research question focused on longitudinal effects on students' desires with respect to the learning environment. Changes in desires were absent or relatively small. Desires decreased between the first and second measurement for productive learning, differentiation, and student autonomy. The decrease was strongest for student autonomy. Possibly, students had unfavorable experiences with autonomous learning in this period: they considered student autonomy as more desirable before entering the new learning environment than after one year of experiencing it.

The third part of the first research question focused on changes in dissatisfaction with the learning environment. Dissatisfaction increases between the first and the second measurement on the majority of the scales. The prospective dissatisfaction with the new learning environment is smaller than the perceived dissatisfaction one year later. This is especially true for integration, fascinating contents, student autonomy, interaction, clarity of goals, and differentiation. The increase of dissatisfaction is mostly due to the disappointing perceptions after one year, compared to the expectations beforehand. With regard to fascinating contents, dissatisfaction also increases because of an increase in its desirability. Productive learning is the only aspect deviating from the tendency of increasing dissatisfaction over time: students become more and more satisfied with it. This is due to perceptions of productive learning after one year being higher than expectations beforehand as well as a decrease in desirability from the first to the second measurement.

Taking the results for the first research question together, it is clear that the new learning environment does not meet the expectations students had beforehand. Students' desires are fairly stable and show only small changes, except for a clear decrease in the desirability of student autonomy. Dissatisfaction with the learning environment increases, especially between the first and second measurement. Students are disappointed with the new environment. The only exception is the aspect of productive learning: students perceive more productive learning than they expected and over time it becomes more and more congruent with their desires.

For the second research question, relations were investigated between expectations and perceptions, and between desires and dissatisfaction scores measured at different times. Expectations are positively related to subsequent perceptions of the learning environment for all scales. Thus, the higher the expectations for one particular aspect beforehand, the higher the perceptions for this aspect later on, and the lower the expectations beforehand, the lower the perceptions later on. Perceptions measured at the second and third time of measurement are also clearly related. Furthermore, desires at all three times of measurement are also related to each other. Thus, a student who has high desires

about a particular aspect of the learning environment beforehand also has relatively high desires for this aspect after one and after two years. Additionally, prospective dissatisfaction with the new environment is related to dissatisfaction after one year, and dissatisfaction after one year of working in the new environment is again related to dissatisfaction after two years.

The relations between expectations/perceptions and dissatisfaction over time may well be explained by the cognitive biases described in the Introduction (see, e.g., Olson, Roese, & Zanna, 1996). People tend to pay selective attention to information consistent with their expectations, and also interpret this information in such a way that their expectations are confirmed. Additionally, people create self-fulfilling prophecies because they behave in agreement with their expectations.

The findings for the first two research questions show that students' prospective ideas about the new learning environment do not match their later experiences. At the same time, measures at different moments in time are positively related to each other. In general, students' expectations of the learning environment are higher than their later perceptions. Their dreams do not come true.

The third research question focused on the relations between expectations and learning-related student characteristics, and the way desires and prospective dissatisfaction are related to those characteristics. Having a personally interested motivational orientation and conceiving learning as the construction and use of knowledge are both related to higher expectations for at least half of the investigated aspects of the new learning environment. Reporting fear of failure frequently relates to low expectations, thus, students who report to have a strong fear of failure are more reserved in their expectations of the future environment. These findings confirm the assumed relation between motivation and expectations, but also show that expectations are influenced by conceptions of learning and affective processing strategies. Furthermore, the use of affective strategies for keeping a good state of mind, a certificate-oriented motivational orientation, a conception of learning as the construction and use of knowledge, and the use of deep processing strategies are all positively related to high desires.

Prospective dissatisfaction with the new learning environment is frequently related with learning-related student characteristics. A personally interested motivational orientation is strongly related with low prospective dissatisfaction, that is, students think they will be satisfied with the new environment. On the contrary, problems with motivation and concentration are strongly related with high prospective dissatisfaction, that is, students think they will be unhappy with the new environment. High prospective dissatisfaction is also found for the ambivalent motivational orientation, the conception of learning as intake of knowledge, and the use of deep processing strategies. The origin of the prospective

dissatisfaction, however, seems to be different for different learning-related student characteristics. For example, prospective dissatisfaction increases in the case of deep processing strategies because of higher desires, but it increases in the case of problems with motivation and concentration because of lower expectations.

The finding that students' prospective reports are related to their learning-related characteristics is in agreement with the literature on optimism/pessimism and discrepancies between expectations and personal values. First, high expectations of the learning environment are related to high personal interest and an active view on learning, which is in agreement with the concept of "engagement" in the non-linear dynamical model of Carver and Scheier (2001). Low expectations are especially related to fear of failure. It would be an oversimplification to consider fear of failure as a form of "low engagement". As shown by the work of Hermans (1975), students having a high fear of failure prefer a high degree of structure, clearness, stability, and continuity in their learning environment. They are averse to unexpected and unfamiliar situations. Low expectations of the new and thus unfamiliar learning environment are better understandable in this context.

Second, high prospective dissatisfaction with the new learning environment is, among other things, related to problems with motivation and concentration and an ambivalent motivational orientation. This is in agreement with the ideas of Eccles and Wigfield (2002), and Carver and Scheier (2001), who claim that a discrepancy between expectations and personal values influences important aspects of learning behavior, such as persistence and the amount of effort invested in learning. A slow rate of reduction of this discrepancy, which is likely to occur because students cannot directly influence the learning environment, induces either a sense of doubt or negative thinking. An ambivalent motivational orientation and problems with motivation and concentration are clear signals of doubt and negativism, and may thus indicate a lack of persistence and an unwillingness to invest effort. Prospective dissatisfaction with the learning environment is – in the current study – also positively related to conceiving learning as intake of knowledge and using deep processing strategies, which fits less well in the theoretical framework. But the relation between low prospective dissatisfaction and a personally interested motivational orientation, indicating that students who are more personally interested expect to be happy in the new learning environment, is in turn clearly in agreement with positive thinking and a sense of confidence, as described in the literature.

A first theoretical implication of our findings is that principles from general psychological research on expectations, optimism, and pessimism are also applicable to an educational setting, in particular, a setting in which students are confronted with the implementation of a new learning environment. A second

implication is that the concept of expectations deserves a much more prominent place in educational research than it has today. As shown in our study, students do not automatically construct realistic expectations of a new learning environment and, even more important, their expectations strongly influence the way they perceive the learning environment after it has been implemented. Perceptions are likely to determine their learning behaviors and, consequently, the effectiveness of the learning environment. Gaining more insight in the role of students' expectations is thus of utmost importance to develop guidelines for the design of powerful learning environments, preferably in such a way that students' expectations are taken into account.

A practical implication of our findings is that schools and teachers should carefully prepare their students on curricular changes or innovations of the learning environment. The quality and quantity of information students receive on the characteristics of a new learning environment before they start to work in it should be carefully determined in order to help them build realistic expectations. If possible at all, disappointing perceptions should be prevented. Students with a high fear of failure are extra vulnerable in situations of change: they should be given extra support and structure in the period before and during the implementation of a new learning environment.

A limitation of the current study is that students were always required to report their expectations of the new learning environment in the questionnaire, regardless of the clearness of their expectations. Students may have had vague or, on the contrary, fairly pronounced expectations. In future studies, more detailed information on the clearness/vagueness of expectations would provide valuable additional information. Furthermore, it is unknown how students formed their expectations and which sources of information they used for this. Possibly, expectations are built on stereotypes about this educational innovation, circulating, for instance, in the press or their peer group. A limitation with respect to reported relations between expectations and learning-related student characteristics (i.e., research question 3) is that the direction remains unclear. Student characteristics are likely to influence the formation of expectations and prospective dissatisfaction, expectations might influence the learning-related characteristics of students, or the relation may be bi-directional.

To gain more insight in the processes yielding the expectations which students reported in this study, future research should focus on the *origin* of the expectations, including the sources students use to form them (e.g., press, brothers and sisters, peers, parents etc.). Such research provides better insight in the nature of expectations in an educational setting, and might help to develop a theory of how they can best be dealt with in educational design. Furthermore, knowledge

about the origin of expectations would provide schools with valuable information they can use to optimize their preparation of students on curricular changes and innovations. In line with this, future research should also address the question how the process of forming expectations could be influenced in such a way that it results in more realistic expectations, that is, expectations that match later perceptions.

To conclude, this study showed that expectations of a learning environment deserve a prominent role in educational research and praxis. Students do not automatically form realistic expectations of a new learning environment such as the Second Phase in Dutch secondary education. Although unrealistic, these expectations yet influence their perceptions of the new environment. Disappointing perceptions are likely to decrease the effectiveness of the learning environment and are also related to undesirable changes in learning-related student characteristics. More effective approaches are needed to prepare students for large educational changes. Such approaches should take differences in individual learning characteristics and related prospective ideas into account. For educational design, it would be highly beneficial if future research develops guidelines to account for students' expectations in case of curricular changes or innovations.

4

Students' perceptions and desires of an innovative learning environment: "Can it be a bit more powerful please!"

This chapter is submitted as:
Könings, K. D., Brand-Gruwel, S., & van Merriënboer, J. J. G (2006).
Students' perceptions and desires of an innovative learning environment: "Can it be a bit more powerful please!"
Manuscript submitted for publication.

Abstract. It is known that students' perspectives on a learning environment influence their learning processes. Although, it is important to take these perspectives into account, students mostly do not participate in the (re)design of a learning environment. A first step to increase the involvement of students in the design process is to determine their perceptions of an innovative learning environment, their desires, and their (dis)satisfaction. This is the focus of the present study. The participants were 1146 tenth graders of five schools for secondary education in the Netherlands. Data about students' perceptions, desires, and dissatisfaction, as well as learning-related student characteristics were collected using two questionnaires. The results show that students perceive the new learning environment they are working in as only partially powerful: they are dissatisfied and desire a much more powerful environment. Furthermore, perceptions as well as desires and dissatisfaction scores relate to student characteristics. The relation between low perception/high dissatisfaction and motivational problems is prominent. A discourse with students about the design of the learning environment is proposed as a first step to overcome dissatisfaction and improve the quality of the learning environment.

4.1 Introduction

At schools and universities, students should be given optimal opportunities to develop themselves, and all efforts should be focused on student learning. Educational designers and teachers develop learning environments, intending to foster students' learning processes. Students, however, are mostly not involved in the design of an educational innovation or the development of a new learning environment. Consequently, teachers and designers have limited insight in students' perspectives on the environment. This is rather problematic, because it is known that students' perceptions and appreciation of a learning environment are crucial for the effectiveness of the environment in terms of learning results. Human-factors engineering also stresses that, for good functioning of any system, the designer's and the user's interpretation have to be more or less the same (Norman, 1986, 1988). Applied to education, this means that teachers and designers should account for students' views on the environment when trying to deliver an optimal learning environment. Therefore, they should primarily know how students experience the environment.

The current study focuses on the perspectives of students who experience a new innovative learning environment in Dutch secondary education. According to the initiators of this innovation, the environment can be considered as a powerful learning environment. In a powerful environment principles of cognitive psychology and constructivism are incorporated, resulting in characteristics like active knowledge construction by the learners, gradual transfer of responsibility from the teacher to the learner, complex and realistic learning tasks, and ample opportunities for collaborative learning (see de Corte, Verschaffel, Entwistle, & van Merriënboer, 2003, and Könings, Brand-Gruwel, & van Merriënboer, 2005, for an overview). The main goal of the current study is to investigate how students perceive this learning environment, what they desire with respect to its design, and how the perceived environment differs from their desires (i.e., dissatisfaction). Because students' perceptions, desires, and dissatisfaction are likely to vary between students, in addition, the relations between students' perspectives and their learning-related student characteristics are explored.

All learning environments aim at fostering students learning processes and students are in fact the most important actors in this environment. They are the "users" of it and directly experience how it affects learning. However, they are often not questioned about these experiences. Students and their perceptions mostly do not play a role in the (re)design of the environment that is in fact developed for them. This is far from self-evident, and it might be argued that students' perspectives should, in contrast, have a prominent role for the design of the

environment. If student perceptions are neglected, they might perceive the learning environment differently as intended by teachers and designers, follow their own learning preferences, and perceive the environment as badly fitting their needs and desires. This is likely to have negative effects on the effectiveness of the learning environment.

Research pointed out that not the characteristics of the learning environment itself, but foremost students' perceptions of it determine the nature and quality of their learning processes. These perceptions influence the learning and study behavior and, eventually, the learning outcomes and thus the effectiveness of the learning environment (Elen & Lowyck, 1999; Entwistle & Tait, 1990). If students' perceptions do not match with the original intentions of teachers and designers, the learning environment does not reach its goals. Especially, because students' interpretations of the environment are not easily predictable for teachers and designers, it is of great value to explicitly determine students' perspectives (Donaldson, 1978; Kershner & Pointon, 2000). As Oldfather (1995a) states, "students' insider views of schooling are likely to differ from those of outsiders" (p. 86). Listening to students and sharing their perspectives could help teachers and designers to rethink learning processes and the design of learning environments (Cook-Sather, 2003).

The impact of students' preferences with respect to the design of the learning environment should not be underestimated. It has been shown that students tend to learn in a way that is congruent with their learning preferences and their own learning habits (Vermetten, Vermunt, & Lodewijks, 2002). Students use only those elements of the learning environment that are suitable for them and fit well in their habitual way of learning. Students' approach to learning is even stronger related to their preferred learning environment than to the actual environment (Yuen-Yee & Watkins, 1994). So, students' desires may threaten the original set up of the learning environment and the intentions of its designers, if they are not properly accounted for.

Congruence between the learning environment and students' needs and desires is thus important, also because an environment offering learning arrangements fitting badly students' needs is likely to have negative consequences on student motivation and engagement (see, e.g., Eccles et al., 1993). Students' engagement in learning depends on "whether they feel able to meet the challenges presented to them, whether they see purpose and value in classroom activities, and whether they feel safe and cared for by others in the setting" (Roeser, Eccles, & Sameroff, 2000, p. 454). Perceiving a learning environment that fits badly to personal developmental needs relates to multiple problems, like poor motivation to learn, poor grades, misconduct, and poor mental health (ibid). Thus, both students and the

educational setting benefit from an optimal fit between students' needs and their perceptions of the offered learning environment. As an implication, students' criticisms and points of (dis)satisfaction have to be taken very seriously.

Concluding, students' perspectives on a learning environment should not be taken for granted because they strongly influence the eventual effects of an educational design. Designers and teachers must be aware of the limited effects of the "objective" learning environment as well as the importance of the "subjective" environment. Exploring students' perspectives on the environment could offer insight and feedback about what is really going on in the environment. Asking students for their perceptions, their desires, and their criticisms should be a first step when thinking about (re)designing education.

But, when listening to students and investigating their perspectives it should be noticed that their reports are highly personal and vary greatly among students, even in the same learning environment or year group. This variation might be due to differences in (teacher) treatment, students' varying needs and expectations of the learning environment, and dissimilar values and norms used by students to reflect on the environment (Levy, den Brok, Wubbels, & Brekelmans, 2003). Another source of systematic variation in students' reports about a learning environment is the individual characteristics of students (ibid). Students' perceptions of a learning environment can be seen as the result of an interaction between internal, learning-related characteristics and external, environment-related characteristics (Luyten, Lowyck, & Tuerlinckx, 2001). With respect to individual student characteristics, relevant variables include: (1) cognitive processing strategies, (2) regulation strategies, (3) motivational orientations, (4) conceptions about learning, and (5) affective processing strategies.

First, students differ in their habits for using different kinds of *cognitive processing strategies*, which are likely to be related to perceptions of the learning environment (see, e.g. Entwisle & Ramsden, 1983; Entwistle & Tait, 1990; Trigwell & Prosser, 1991). For instance, in a study of Dart et al. (1999) students using deep processing strategies perceived the learning environment as being more personalized, encouraging more active learning, and requiring the use of more inquiry skills than students using stepwise processing strategies. Cognitive processing strategies are also related to preferences or desires with regard to the learning environment: students prefer an environment that supports their habitual way of learning (Entwistle & Tait, 1990).

Second, the use of *regulation strategies* is another characteristic that varies among students. Students may, predominantly, regulate and manage their own learning process, largely depend on the teacher or the environment for regulation, or even experience a complete lack of regulation during learning (Vermunt, 1998).

Students who use self-regulatory strategies, actively manage their environment, adapt to it, and change the environment to better fit their desires and needs (Pintrich & Schauben, 1992). It is likely that such regulation strategies are reflected in students' perceptions of a learning environment.

Third, students' *motivational orientations* are related to perceptions of an environment: changing perceptions of a learning environment during a school year explain changes in motivation (Bong, 2005). Perceived challenge and perceived positive general feedback contribute to intrinsic motivation for learning, as well as low perceived threat to sense of self (Koka & Hein, 2003).

Fourth, students' *conceptions about learning* and what constitutes learning relate to their perceptions of a learning environment (see, e.g., Dart et al., 2000). In general, conceptions influence perceptions: conceptions can be seen as lenses through which people perceive and interpret the world (Pratt, 1992). A study of Tsai (2000) has shown relationships between secondary school students' epistemological beliefs and their perceptions as well as their desires of the learning environment.

Fifth and last, *affective processing strategies* might also be related to students' perspectives on learning (Vermunt & Vermetten, 2004). Affect refers to emotions and affective states, which may influence student learning processes. Students' perceptions of teaching are related to the affective value of school: positive perceptions contribute to liking school and enthusiasm to participate in learning (Ireson & Hallam, 2005). Especially students' perceptions of the availability of support and given help for learning have shown to be important (ibid). Also, students' perceptions of meaningfulness of the subject matter and the perceived control over their learning process seems to be crucial: low perceived meaning and externality (i.e., little responsibility) may lead to work avoidance (Seifert & O'Keefe, 2001).

In short, the learning-related student characteristics discussed above have show to be related in some way to students' perspectives on education. However, they have been studied separately, not in coherence with each other. It is yet unknown which characteristics are most strongly related to students' perceptions, desires, and (dis)satisfaction. Therefore, in addition to answering the question how students perceive, desire, and appreciate the learning environment, a second aim of the current study is to gain more insight in the relations between students' perceptions, desires, and dissatisfaction and their learning-related characteristics. This may give additional information to teachers and designers, because it may offer explanations for variation of students' responses to the learning environment.

In summary, the current study will answer the following research questions:

- How do students perceive an innovative learning environment (in Dutch secondary education), what do they prefer in a learning environment, and with which elements of the perceived learning environment are they dissatisfied?
- How are perceptions, desires, and dissatisfaction scores related to learning-related student characteristics, in particular, cognitive processing strategies, regulation strategies, motivational orientations, conceptions about learning, and affective processing strategies?

4.2 Method

4.2.1 Participants

The participants in this study were 1146 students of five schools for secondary education in the South of the Netherlands. They were all 10th graders, following either senior general secondary education (47.2%) or pre-university education (52.8%). The mean age of the participants was 16.32 years (*SD* = .60). All students took part in an innovative learning environment in Dutch Secondary Education, called Second Phase.

4.2.2 Materials

4.2.2.1 The learning environment

The context of this study is a nation-wide innovation in Dutch secondary education, called Second Phase (Ministerie van OCW, 2005; Stuurgroep Profiel Tweede Fase Voortgezet Onderwijs, 1995; Veugelers, de Jong, & Schellings, 2004). This learning environment requires students to acquire knowledge and skills in an independent way, better preparing them for higher professional education and university. Students learn in a self-directed way, with ample opportunities for collaborative learning. There is more room for teachers to take individual differences between students into account than in the traditional classroom situation. The teacher also serves more like a coach and less like an instructor, which creates better opportunities for contact between students and teachers. The learning process is not only directed to knowledge acquisition, but also to the selection and processing of the vast amounts of information available today. Furthermore, learning contents are actualized and broadened, because building a broad general knowledge base is an important educational goal of the Second Phase. The thematic integration of different subject matter domains is emphasized.

Courses are clustered in so-called 'profiles', such as Nature and Technology, Culture and Society, and so forth. According to the educational designers of the learning environment this enables more integration of subject matter domains and leads to a better preparation for higher professional education and university. In addition to better integration between subject matter domains, the coherence between knowledge and skills is emphasized too and the practical application of knowledge and skills is stressed.

4.2.2.2 Inventory of Perceived Study Environment Extended (IPSEE)

The aim of the IPSEE is to measure students' perceptions of an existing learning environment and their desires with regard to the design of a learning environment. These measures together give insight in students' satisfaction with a learning environment, by looking at the differences between perception scores and desire scores.

The IPSEE consists of 67 items. Thirty-one of these items originate from the Inventory of Perceived Study Environment (IPSE; Wierstra, Kanselaar, van der Linden, & Lodewijks, 1999), translated into Dutch by the Expertise Centre Active Learning of Maastricht University (Picarelli, Slaats, Bouhuijs, & Vermunt, 2006). We constructed another 36 items, in order to be able to measure more completely the characteristics of powerful learning environments. Such learning environments, designed by principles based on cognitive psychology and constructivism, aim to reach the main goals of modern education: acquisition of applicable and transferable knowledge, general problem-solving skills, and self-directed learning skills. In the literature several characteristics of a powerful learning environment are described, like active knowledge construction by the learners, gradual transfer of responsibility from the teacher to the learners, and the use of complex and realistic learning tasks (see de Corte, Verschaffel, Entwistle, & van Merriënboer, 2003, and Könings, Brand-Gruwel, & van Merriënboer, 2005, for an overview).

The items of the IPSEE are covering eight scales (see Table 4.1) that can be considered as characteristics of powerful learning environments. The first scale is *fascinating contents* and contains items about the extent to which the learning contents are interesting, challenging and personally relevant for students. The second scale is *productive learning*, which can be considered as little emphasis on the sole reproduction of learning contents. The third scale is *integration* and includes items about the integration of newly acquired knowledge with prior knowledge, the integration of different subject matter domains, and the integration of knowledge and skills. The fourth scale is *student autonomy* and measures the attention devoted to student's self-directedness with regard to the content of learning, the way of learning, and the planning of time. The fifth scale is

interaction, which incorporates collaboration with peers and interaction with the teacher. The sixth scale is *differentiation*, which inquires after opportunities for students to choose and perform different learning tasks, solve problems in different ways, and use different learning materials. The seventh scale is *clarity of goals* and includes items about the clarity of instructional goals and task demands. The eighth and last scale is *personalization*, which inquires the availability of support of teachers.

Each of the items of the IPSEE contains a statement about one of the characteristics of a learning environment and two questions. For example:

All students do the same work at the same moment.

A. This happens
B. I would like this to happen

The questions are rated on a six-point scale, ranging from totally disagree (score = 1) to totally agree (score = 6). Scores on question A give a measure of perceptions of the student's learning environment. Scores on question B show how the desired learning environment of the student would look like. The difference between the scores on question B and question A is defined as the measure of the (dis)satisfaction with the learning environment. Increasing differences between perceptions and desires indicate increasing dissatisfaction. Small differences between perceptions and desires indicate low dissatisfaction. It should be noted that low dissatisfaction can also be interpreted as high satisfaction, but only the term dissatisfaction is used to enable the interpretation of the results in an univocal way.

Internal consistencies are computed for all eight scales, separately for the perception items and the desire items (see Table 4.1). All Cronbach's alpha coefficients were above .70, except one coefficient, which was above .60. They were all acceptable.

Table 4.1 Internal consistencies of the scales of the IPSEE

Scale	Number of items	Cronbach's alpha coefficient	
		Perception	Desire
Fascinating contents	9	.85	.77
Productive learning	5	.83	.81
Integration	11	.81	.78
Student autonomy	15	.85	.84
Interaction	11	.73	.73
Differentiation	6	.66	.72
Clarity of goals	4	.81	.72
Personalization	6	.80	.70

4.2.2.3 Inventory of Learning Styles for Secondary Education (ILS-SE)

This questionnaire was initially developed by Vermunt (1992) and adapted to students in secondary education by Vermunt, Bouhuijs, and Picarelli (2003). The questionnaire measures learning-related characteristics of students, based on their usual way of learning. The ILS-SE consists of 99 items divided in five clusters: processing strategies, regulation strategies, motivational orientations, conceptions of learning, and affective processing strategies. Each cluster contains several scales (see Table 4.2).

Processing strategies concern cognitive activities that students use to process learning contents. This first cluster contains two scales: *deep processing* (relating and structuring knowledge elements and critical processing of information) and *stepwise processing* (memorizing, rehearsing, studying information in detail). Second, regulation strategies refer to the way students regulate and steer their own learning process. This cluster falls apart in three scales: *self-regulation* (regulation of the own learning process through activities like planning, monitoring, reflecting and own initiatives with respect to learning contents), *external regulation* (learning processes to be regulated by external sources, like books or the teacher), and *lack of regulation* (difficulties with regulating learning and processing learning contents effectively). Third, the cluster motivational orientations contains scales covering different personal goals or motives students can have for learning and going to school: *personally interested* (learning because of interest in the learning contents and the desire to develop oneself), *certificate-oriented* (learning for passing tests, gaining high grades, and obtaining certificates), *vocation-oriented* (learning for future study and professions), and *ambivalent* (a doubtful, uncertain attitude toward own capacities and chosen courses). The fourth cluster is about students' conceptions of learning and contains the following scales: *construction and use of knowledge* (learning as constructing one's own knowledge and using it by means of concretizing and applying), *intake of knowledge* (learning as taking in information, provided by education and memorizing/reproducing it), *cooperative learning* (preferring learning in cooperation with fellow students), and *stimulating education* (learning as a process that is continuously driven by teachers and/or textbooks). Fifth, the cluster affective processing strategies concerns emotional aspects of learning: *problems with motivation and concentration* (problems with staying concentrated and motivated during learning, easily being distracted and sometimes showing postponing-behavior), *fear of failure* (experiencing stress during learning, especially in testing situations and having a negative self-image), and *keeping a good state of mind* (having a positive idea about own capacities, being self-confident and performing activities to stay motivated and concentrated).

Table 4.2 Internal consistencies of the scales of the ILS-SE

Cluster	Scale	Number of items	Cronbach's alpha coefficient
Processing strategies	Deep processing	12	.84
	Stepwise processing	8	.80
Regulation strategies	Self-regulation	8	.71
	External regulation	6	.66
	Lack of regulation	4	.71
Learning orientations	Personally interested	4	.67
	Certificate-oriented	5	.63
	Vocation-oriented	4	.77
	Ambivalent	5	.74
Mental models of learning	Construction and use of knowledge	8	.81
	Intake of knowledge	4	.64
	Cooperative learning	3	.76
	Stimulating education	5	.79
Affective processing strategies	Problems with motivation and concentration	8	.86
	Fear of failure	8	.87
	Keeping a good state of mind	8	.71

For each item, students rate on a five-point scale the degree to which that particular statement corresponds to their own learning behavior, ideas about learning, motivational orientations, or affective strategies. Information about internal consistencies of the scales is included in Table 4.2; all Cronbach's alpha coefficients were acceptable. For four scales the coefficients were above .60; for the other scales the coefficients were above .70.

4.2.3 Procedure

The participants filled out the two questionnaires, first the IPSEE and then the ILS-SE. Preceding the completion of a questionnaire, students received an oral instruction about the goal and contents of the questionnaire and about the way items had to be scored, which was also described at the first page of each questionnaire. Participants had to fill out their name, age, year group, and school. The IPSEE takes 30 - 40 minutes to complete. The completion of the ILS-SE lasts about 20 - 30 minutes. The participants filled out the questionnaires during regular school time.

4.2.4 Data analysis

For computing mean scores for each scale of the IPSEE and the ILS-SE, maximally 25% of missing values was accepted. So, if at least 75% of the items at scale level were filled out, these items were used to compute the mean score of the scale. Looking at the mean scores, it showed that on each scale a mean score could be

calculated for at least 95% of the students. Dissatisfaction scores of the IPSEE were computed as the difference between desire scores and perception scores. Students, who desire a characteristic of a powerful learning environment to be more strongly implemented than they actually perceive, are called *"lovers"* of this characteristic, for example differentiation-lovers. Students, who desire a characteristic of a powerful learning environment to be less strongly implemented than they perceive, are called *"rejecters"* of this characteristic, for example differentiation-rejecters. A very small part of the sample consisted of perfectly satisfied students (i.e., dissatisfaction = 0 on a scale). Because on all scales these participants made up a negligible part of the total sample (< 15%), these data will not be analyzed and reported.

For analyzing the data of this study, mixed model analyses were conducted. By using this type of analyses it is possible to account for the nested nature of the data. Students were grouped in classes of about 25 students, which can cause interdependency in the data of students from the same class. In mixed model analyses the participants can be considered as nested in classes by including *class* as a random factor. Although classes are further nested within schools, *school* is not included as an additional random factor in the model, since the number of schools sampled is too small to permit inference to the population of schools. Instead, *school* is included in the model as a fixed factor. In this way, a correction takes place for the correlation in the data due to the nesting within schools. *School* and *class* were only included in the model if their effect was significant at a level of $p < .10$.

With respect to the first research question – how do students perceive the learning environment, what do they desire in it, and with which elements are they dissatisfied? – descriptive statistics and mixed model analyses were conducted. In order to investigate whether perception scores and desire scores differ from the neutral score of 3.5 (i.e., the middle of the scale), differences were computed between each particular score and 3.5. To test whether the difference score deviates from zero, simple models were built that include an intercept, class, and school. School and/or class were subsequently removed if $p > .10$. The significance of the intercept, now, indicates whether perception or desire scores significantly differ from the score of 3.5.

To test students' dissatisfaction with the different aspects of the learning environment, it is investigated whether the difference between perception scores and desire scores deviate significantly from zero. Differences were computed and tested in mixed model analyses in the same way as described above. The significance of the intercept shows whether perception or desire scores significantly differ from each other.

With respect to the second research question – how do perceptions, desires, and prospective dissatisfaction relate to learning-related student characteristics? – mixed model analyses were used to examine the relations between perception scores and learning-related student characteristics. Analyses were corrected for possible school effects and interdependency of data within classes by including these variables, together with the learning-related student characteristics, in the first step of the mixed model analyses. A backward procedure was used, removing the less significant variables one by one. Variables were excluded until all variables in the model were significant at a level of $p < .01$. Class and school effects remained in the model if $p < .10$.

The same analyses were used to investigate the relations between desire scores and learning-related student characteristics. For analyzing the relations between dissatisfaction scores and learning-related student characteristics, the sample is for each scale divided into lovers and rejecters. Data of these participants were analyzed separately, in the way described above. Dissatisfaction scores of rejecters were transformed to absolute values, to make an univocal interpretation of results of lovers and rejecters possible. If rejecters on a scale consisted of less than 15% of the total sample, these data were not analyzed.

In the following section only results are reported which are significant at a level of $p < .01$.

4.3 Results

To answer the research questions, results are presented concerning students' reports about their perceptions of the current environment, their desires with respect to the design of an innovative learning environment, and their dissatisfaction with the current environment. Furthermore, the results of the mixed model analyses on students' reports and learning-related characteristics are described, showing relations between (1) perception scores and (learning-related) student characteristics, (2) desire scores and student characteristics, and (3) dissatisfaction scores and student characteristics.

4.3.1 Perceptions, desires, and dissatisfaction

Table 4.3 presents the descriptive results for the perception scores, desire scores, and dissatisfaction scores of the different scales of the IPSEE (see also Figure 4.1). Students perceived the innovative environment partly as a powerful learning environment, since mixed model analyses showed that on four out of eight scales the perception scores were significantly higher than the neutral score of 3.5

Table 4.3 Means and standard deviations of perception scores, desire scores, and dissatisfaction scores, separately for lovers (L) and rejecters (R)

	Perception		Desire		Dissatisfaction					
					Lovers			Rejecters		
Scale	***M***	***SD***	***M***	***SD***	***M***	***SD***	**%L**	***M***	***SD***	**%R**
Fascinating contents	3.10	.85	4.87	.63	1.79	.95	99	-		<1
Productive learning	2.87	1.00	3.85	.99	1.39	.97	79	-.93	.92	15
Integration	3.74	.69	4.60	.55	.97	.71	90	-		7
Student autonomy	3.29	.71	4.56	.59	1.38	.88	95	-		5
Interaction	3.70	.65	4.56	.58	.95	.64	93	-		6
Differentiation	3.10	.76	3.22	.85	.78	.72	48	-.67	.53	40
Clarity of goals	3.82	.96	5.32	.55	1.65	.99	92	-		3
Personalization	3.95	.86	4.99	.59	1.16	.83	91	-		4

Note. - indicates < 15% of the sample in this category

($p < .01$). Students perceived integration in the learning contents, interaction during the learning process, clarity of learning goals, and personalization as significantly higher than neutral. However, on half of the measured aspects of the learning environment they did not perceive the environment to be in agreement with the principles of powerful learning, because perception scores for these aspects were significantly lower than 3.5. Students did not perceive the learning contents as fascinating, they did not perceive an emphasis on productive learning, they perceived limited opportunities for student autonomy, and they did not perceive much differentiation. The mixed model analyses to test the difference between the mean score and the neutral score of 3.5 were corrected for school effects on the scales fascinating contents, integration, interaction, differentiation, and clarity of goals; analyses on the scales productive learning and personalization were corrected for class and school, and the analysis on student autonomy was only corrected for class.

The desire scores of the IPSEE give insight in the ideal learning environment of the students (see Table 4.3 and Figure 4.1). Results of the mixed model analyses showed that on seven of the eight scales desire scores were significantly higher than 3.5 ($p < .01$ for all tests), which means that students clearly preferred most of the characteristics of a powerful learning environment. Only the desire for differentiation was significantly lower than the neutral score. The analyses were corrected for school effects on the scales fascinating contents, integration and personalization, and they were corrected for class effects on the scales productive learning and differentiation.

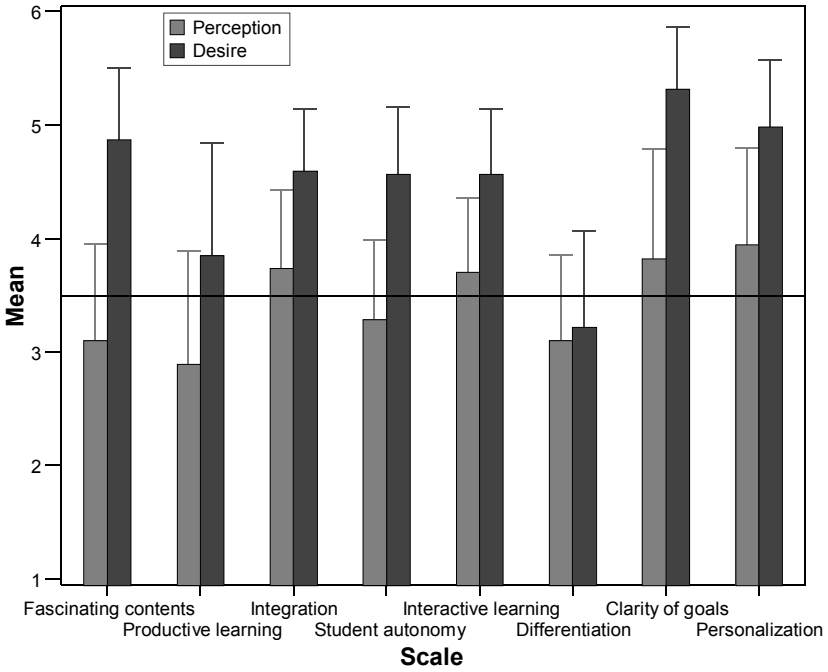

Figure 4.1 Mean scores and standard deviations of the perceived and desired learning environment.

The difference between perception scores and desire scores is used as a measure of dissatisfaction with the current learning environment. By looking at the differences between the perception bars and the desire bars in Figure 4.1, the dissatisfaction can be deduced. The more both bars differ, the higher the dissatisfaction (see, e.g., fascinating contents). The more both bars match, the lower the dissatisfaction (see, e.g., differentiation). Although the size of the differences differs among scales, mixed model analyses showed that on seven out of the eight scales the perception scores differed from the desire scores at a level of $p < .01$. The difference between perception scores and desire scores with respect to differentiation was significant at a level of .025. Thus, the mean perception scores were lower than the mean desire scores for all scales (corrected for school on the scales fascinating contents, productive learning, interaction, differentiation, and clarity of goals). This is a remarkable result: although the aim of the Second Phase

is to provide students with an innovative and powerful learning environment, they yet prefer an even more powerful environment.

Because all differences between perception and desire scores were significant, it is valuable to use the measure of dissatisfaction as an independent variable in further analyses. Table 4.3 presents the means and standard deviations of the dissatisfaction scores. Two groups of students are distinguished for each scale: lovers and rejecters. On most scales, the vast majority of students were lovers, desiring the particular characteristic of a powerful learning environment more than perceived. On six out of eight scales only a small, non-substantial part of the sample was classified as rejecter. Only for productive learning and differentiation more than 15% of the students was rejecter, indicating that they desired these characteristics of the learning environment to be less manifest than currently perceived. As can be seen from Table 4.3, students were most dissatisfied with the clarity of learning goals, emphasis on productive learning, fascinating contents, student autonomy, and personalization.

4.3.2 Perception scores and learning-related student characteristics

Table 4.4 presents the results of the mixed model analyses investigating the relations between students' perceptions and learning-related characteristics. The results show that perception scores on the different scales of the IPSEE relate to at least two and at most six learning-related student characteristics. As can be seen from the Table, several student characteristics were frequently related to different perception scores (i.e., on at least three scales of the IPSEE). These student characteristics will be described in more detail.

Reporting problems with motivation and concentration related to lower perception scores on seven out of the eight scales: all scales except clarity of goals. It showed that this student characteristic related to perceiving many aspects of the learning environment as less powerful. Lack of regulation strategies was also related to lower perception scores, namely, for interaction during the learning process, clarity of goals, and personalization.

A personally interested learning orientation positively related to perception scores. The more students reported to study out of personal interest, the higher their perception scores for the scales fascinating contents, student autonomy, clarity of goals, and personalization – but the lower their scores on differentiation. The conception of learning as the construction and use of knowledge related to higher perception scores for fascinating contents, integration, and personalization. The use of external regulation strategies related to higher perception scores for the scales interaction, clarity of goals, and personalization – but to lower perception scores on differentiation.

Table 4.4 Significant results ($p < .01$) of mixed model analyses, showing relations between perceptions and learning-related student characteristics, corrected for class and school effects (if $p < .10$)

Dependent variable	Independent variable(s)	*B*	*SE B*	β
Fascinating contents[s]	Personally interested	.34	.03	.28
	Problems with motivation and concentration	-.25	.03	-.25
	Construction and use of knowledge	.29	.04	.22
Productive learning[cs]	Stepwise processing	-.24	.04	-.17
	Problems with motivation and concentration	-.15	.03	-.13
Integration[s]	Construction and use of knowledge	.21	.03	.19
	Vocation-oriented	.13	.03	.14
	Problems with motivation and concentration	-.09	.02	-.11
Student autonomy[c]	Personally interested	.15	.03	.15
	Problems with motivation and concentration	-.09	.03	-.11
	Cooperative learning	.07	.02	.09
Interaction[s]	Cooperative learning	.20	.02	.27
	Problems with motivation and concentration	-.12	.02	-.15
	Vocation-oriented	.09	.02	.11
	External regulation	.10	.03	.10
	Lack of regulation	-.06	.02	-.08
	Deep processing	.09	.03	.08
Differentiation[s]	External regulation	-.12	.04	-.10
	Personally interested	-.09	.03	-.08
	Problems with motivation and concentration	-.07	.03	-.08
Clarity of goals[s]	Personally interested	.20	.04	.15
	Lack of regulation	-.14	.04	-.13
	Ambivalent	-.16	.04	-.13
	External regulation	.14	.04	.09
Personalization[s]	Lack of regulation	-.13	.03	-.13
	External regulation	.18	.04	.13
	Personally interested	.13	.04	.11
	Problems with motivation and concentration	-.08	.03	-.08
	Construction and use of knowledge	.12	.04	.09

Note. [c] corrected for class effects. [s] corrected for school effects.

4.3.3 Desire scores and learning-related student characteristics

The results of the mixed model analyses in Table 4.5 give insight in the relations between desire scores and learning-related student characteristics. Eight student characteristics related frequently and mostly positive to desire scores.

The more a conception of learning as the construction and use of knowledge was reported by the students, the higher their desire scores for fascinating contents, integration, differentiation, clarity of goals, and personalization. The more they considered learning as a cooperative activity, the higher their desire scores for integration, student autonomy, interaction, and personalization. The conception of learning as initiated and stimulated by teachers or the textbook (i.e., the scale "stimulating education") related to higher desire scores for integration, interaction, and personalization. The conception of learning as the intake of knowledge, however, related to lower desire scores for the scales productive learning, student autonomy, and differentiation. So, three out of four conceptions of learning (construction of knowledge, cooperative learning, and stimulating education) related to higher desire scores for particular powerful characteristics of the learning environment. Not surprisingly, the conception of learning as intake of knowledge did not.

Reporting a certificate-oriented motivational orientation related to high desire scores for the scales fascinating contents, student autonomy, clarity of goals, and personalization. The more a vocation-oriented motivation was reported by the students, the higher their desire scores for integration, student autonomy, and interaction – but the lower their scores for differentiation. Overall, both certificate-oriented and vocation-oriented students preferred a predominantly powerful learning environment.

Deep processing strategies related to higher desire scores for fascinating contents, integration, and interaction. Finally, being able to keep a good state of mind related to higher desire scores for fascinating contents, integration, and personalization.

Table 4.5 Significant results ($p < .01$) of mixed model analyses, showing relations between desires and learning-related student characteristics, corrected for class and school effects (if $p < .10$)

Dependent variable	Independent variable(s)	*B*	*SE B*	β
Fascinating contents[s]	Construction and use of knowledge	.27	.03	.27
	Deep processing	.14	.03	.14
	Lack of regulation	.08	.02	.10
	Certificate-oriented	.11	.03	.10
	Keeping a good state of mind	.08	.03	.08
Productive learning[s]	Stepwise processing	-.56	.04	-.40
	Intake of knowledge	-.20	.04	-.15
	Personally interested	-.13	.04	-.09
	Ambivalent	-.11	.04	-.08
	External regulation	.14	.05	.09
Integration[s]	Construction and use of knowledge	.23	.03	.27
	Deep processing	.14	.03	.15
	Stimulating education	.07	.02	.10
	Vocation-oriented	.07	.02	.10
	Keeping a good state of mind	.06	.02	.08
	Cooperative learning	.05	.02	.07
Student autonomy	Certificate-oriented	.15	.03	.15
	Intake of knowledge	-.11	.02	-.14
	Problems with motivation and concentration	.09	.02	.12
	Vocation-oriented	.09	.02	.12
	Cooperative learning	.08	.02	.11
	Fear of failure	-.07	.03	-.08
Interaction[c]	Cooperative learning	.33	.02	.49
	Vocation-oriented	.09	.02	.12
	Deep processing	.09	.02	.10
	Stimulating education	.06	.02	.07
	Stepwise processing	.06	.02	.07
Differentiation[s]	Intake of knowledge	-.23	.03	-.21
	Stepwise processing	-.18	.04	-.15
	Construction and use of knowledge	.14	.04	.11
	Vocation-oriented	-.09	.03	-.08
Clarity of goals[c]	Certificate-oriented	.18	.03	.18
	External regulation	.11	.03	.13
	Construction and use of knowledge	.09	.03	.11
Personalization[s]	Construction and use of knowledge	.16	.03	.18
	Certificate-oriented	.13	.03	.13
	Keeping a good state of mind	.10	.03	.11
	Stimulating education	.08	.02	.10
	Cooperative learning	.06	.02	.09

Note. [c] corrected for class effects. [s] corrected for school effects.

4.3.4 Dissatisfaction scores and learning-related student characteristics

Table 4.6 presents the results of the analyses on the dissatisfaction data, per scale divided into lovers and rejecters. Results for rejecters are only reported for the scale productive learning and differentiation, because these were the only scales on which a substantial part of the participants was rejecter (> 15% of the sample).

Results show that problems with motivation and concentration are related to higher dissatisfaction scores for six out of eight scales. The more these problems were reported by students, the more they were dissatisfied with respect to fascinating contents, productive learning (for lovers), student autonomy, interaction, differentiation (both for lovers and rejecters), and personalization. The lack of regulation strategies was related to higher dissatisfaction scores on the scales integration, interaction, clarity of goals, and personalization. In contrast, reporting personal interest in learning was related to lower dissatisfaction scores (i.e., higher satisfaction) for five scales: fascinating contents, productive learning (both for lovers and rejecters), student autonomy, clarity of goals, and personalization.

The results with respect to the second research question – how are perceptions, desires, and dissatisfaction scores related to learning-related student characteristics? – are visualized in Figure 4.2. From an educational perspective, increasing perceptions are favorable (bright shading) and indicate that students perceive the learning environment as more powerful. Decreasing perceptions indicate a learning environment that is perceived as less powerful, which is suboptimal and therefore visualized with dark shading. The same holds for the increasing and decreasing dimension of desires with respect to the design of the environment. However, increasing dissatisfaction indicates that students perceive a learning environment as not fitting their desires. As mentioned in the Introduction, this is likely to have negative effects on student motivation and engagement. Thus, in the Figure an increasing dissatisfaction goes together with the shading growing darker, whereas a decreasing dissatisfaction indicates a better fit and is visualized with brighter shading. The boxes include those learning-related student characteristics that, on at least three of the IPSEE scales, are either positively or negatively related to perceptions, desires, and dissatisfaction scores.

Table 4.6 Significant results ($p < .01$) of mixed model analyses, showing relations between dissatisfaction and learning-related student characteristics, separately for lovers (L) and rejecters (R), corrected for class and school effects (if $p < .10$)

Dependent variable	L /R (% of *N*)	Independent variable(s)	*B*	*SE B*	β
Fascinating contents[s]	L (99)	Problems with motivation and concentration	.30	.03	.26
		Personally interested	-.29	.04	-.21
Productive learning[s]	L (79)	Problems with motivation and concentration	.23	.04	.15
		Personally interested	-.20	.05	-.11
	R (15)	Stepwise processing	.39	.09	.22
		Personally interested	-.27	.09	-.15
Integration	L (90)	Lack of regulation	.11	.03	.13
		Deep processing	.11	.04	.09
		External regulation	-.10	.04	-.08
Student autonomy	L (95)	Problems with motivation and concentration	.17	.03	.15
		Certificate-oriented	.20	.05	.12
		Personally interested	-.14	.04	-.10
		Intake of knowledge	-.11	.04	-.08
Interaction[s]	L (93)	Problems with motivation and concentration	.10	.02	.12
		Lack of regulation	.09	.02	.11
Differentiation[s]	L (48)	Deep processing	.17	.05	.11
		Problems with motivation and concentration	.11	.04	.10
	R (40)	Problems with motivation and concentration	.11	.03	.11
		Self-regulation	.11	.04	.07
Clarity of goals[s]	L (92)	Personally interested	-.20	.05	-.13
		Lack of regulation	.13	.04	.10
		Ambivalent	.14	.05	.10
Personalization	L (91)	Lack of regulation	.15	.03	.14
		Personally interested	-.15	.04	-.12
		Problems with motivation and concentration	.11	.03	.10
		Self-regulation	.14	.05	.10

Note. [c] corrected for class effects. [s] corrected for school effects.

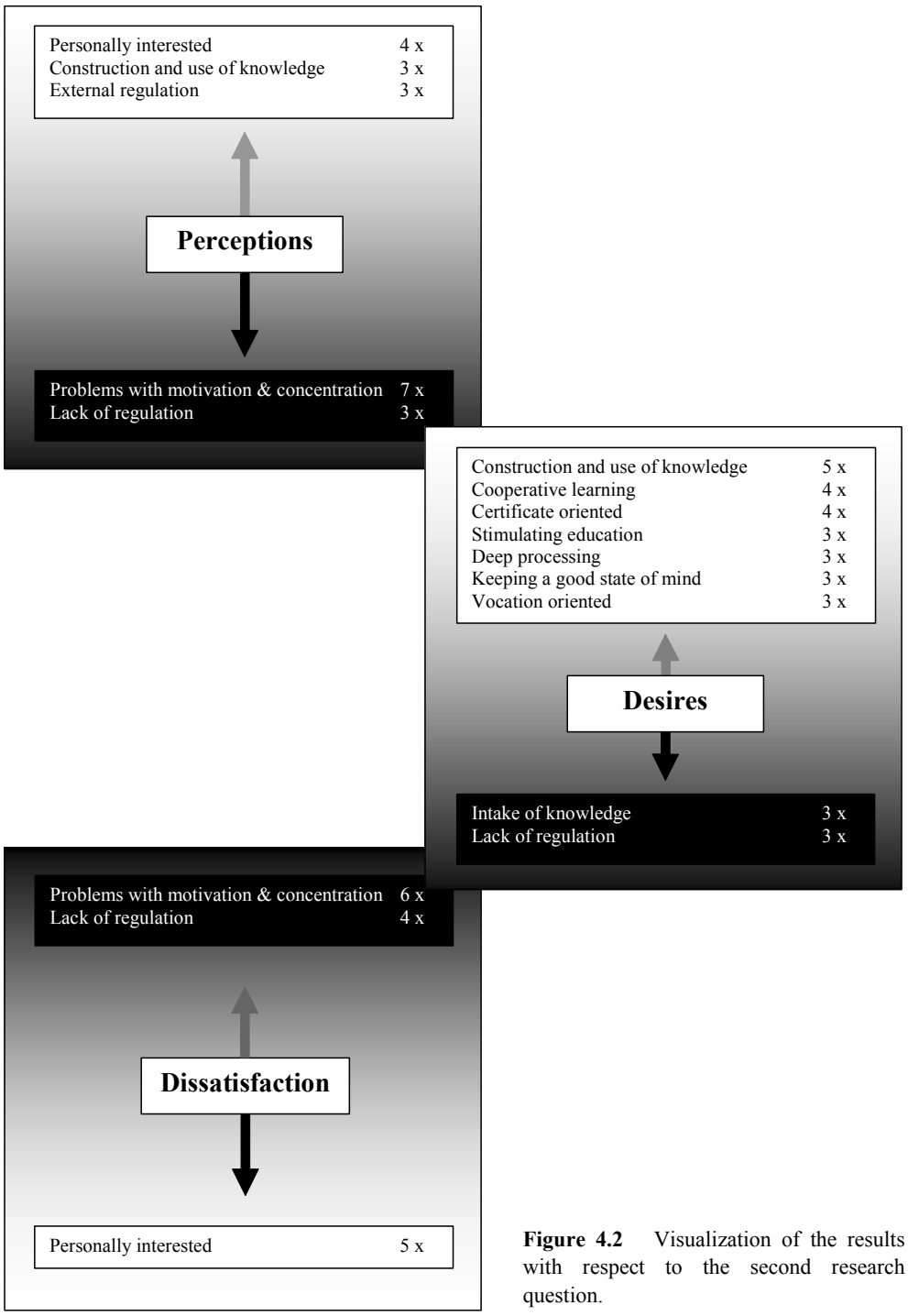

Figure 4.2 Visualization of the results with respect to the second research question.

4.4 Discussion

The current study provides insight in students' perceptions, desires, and measures of dissatisfaction with the Second Phase, which is the new innovative learning environment in Dutch secondary education, as well as the relations of these variables with learning-related student characteristics.

The first research question focused on the students' perspective on the innovative learning environment. The results show that students perceive the learning environment as powerful with respect to integration of learning contents, interactions with other students and the teacher during learning, clarity of goals, and personalization (i.e., individual support from teachers). However, on the other half of the scales, the results show that students do not perceive the environment as yet sufficiently powerful. They do not find the learning contents very fascinating; they recognize little emphasis on productive learning, they experience limited possibilities for student autonomy during learning, and they perceive little differentiation. These results show that the learning environment is only partially perceived as powerful as intended by the designers of this innovation. Especially, the low scores on student autonomy are remarkable in the context of the Second Phase, as the development of self-directed learning is formulated as one of the main goals of it.

With regard to students' desires, the results show that students are very positive about all specified characteristics of powerful learning environments, except for differentiation among students. Apparently, students largely agree with today's educationalists about the desirable features of a learning environment, but they do not feel the need to differentiate between individual students in the same environment.

Overall, students desire a more powerful and innovative learning environment than they currently perceive: they are dissatisfied and want more! This holds for all measured characteristics of the environment, including a trend to wish for more differentiation. The results on dissatisfaction indicate that students desire more fascinating learning contents than perceived, as well as learning goals that are more clear, more opportunities for autonomy, a stronger emphasis on productive learning, and a higher level of personalization.

So, it shows that – in the eyes of students – the Second Phase is a powerful learning environment to only a limited degree. Students would prefer a more powerful one and see ample room for improvement of the learning environment. A possible explanation for perceiving only a partially powerful learning environment could be that students do not always have an accurate perception of teachers' intentions in education (Broekkamp, 2003). For instance, a teacher might have the

intention to promote productive learning, but if students do not pick up the relevant signals of the teacher they stay working in their conventional way. Another explanation could be that the educational design of the Second Phase is not yet fully implemented by the teachers (Könings, Brand-Gruwel, & van Merriënboer, in press). On the one hand, an incomplete implementation may be due to the fact that teachers experience problems such as limited lesson time, which makes it difficult to use new instructional methods, and missing discipline and skills in students, which makes it difficult to give them more autonomy. On the other hand, teachers' approaches to teaching are persistent and may also hinder a complete implementation of the design (ibid).

The second research question focused on how perceptions, desires, and dissatisfaction scores relate to learning-related student characteristics. First, the results with respect to students' *perceptions* show that if students report a more personally interested learning orientation, they perceive the learning environment as powerful on more aspects. The same is true for holding the conception of learning as the construction and use of knowledge, and for the use of external regulation strategies. It indicates that reporting problems with motivation and concentration frequently relate to lower perceptions of the environment. Also, lack of regulation strategies is repeatedly related to lower perception scores. Thus, there seems to be a clear distinction between student characteristics that either positively or negatively relate to perceptions. Student characteristics related to high perceptions could be seen as educationally favorable features, whereas characteristics related to low perceptions could be seen as rather unfavorable features.

Second, the results with respect to students' *desires* show many relations with learning-related student characteristics. Whereas for perceptions only three student characteristics had frequent positive relations, for desires seven student characteristics had such positive relations. More specifically, three conceptions of learning, namely, construction and use of knowledge, cooperative learning, and stimulating education, as well as two motivational orientations, namely, a certificate orientation and a vocational orientation, relate to higher desires. Deep information processing strategies and well-developed strategies for keeping a good state of mind are also related to a higher desire for powerful aspects in the learning environment. Negatively related to desires are the conception of learning as intake of knowledge and a lack of regulation strategies: the more these learning-related characteristics are reported by students, the less they desire the aspects that are assumed to make the learning environment more powerful.

Third, results for the relation between *dissatisfaction* and learning-related student characteristics show that problems with motivation and concentration as

well as lack of regulation strategies frequently relate to high dissatisfaction. In contrast, a personally interested learning orientation relates to low dissatisfaction (i.e., high satisfaction). In line with the results for perceptions, there is thus a clear distinction between student characteristics that relate either positively or negatively to dissatisfaction. The characteristics that relate to high dissatisfaction are educationally unfavorable, while personal interest in learning is a highly favorable student characteristic.

In summary, the results with respect to the second research question show several student characteristics that clearly relate to perceptions, desires, and measure of dissatisfaction. Highly remarkable is the pattern found for the results on perceptions and dissatisfaction scores: educationally favorable student characteristics, such as personal interest in learning, are related to perceiving the learning environment as more powerful and to lower dissatisfaction with the learning environment. Educationally unfavorable student characteristics, such as problems with motivation and concentration, are related to perceiving the learning environment as less powerful and to higher dissatisfaction with it. The questions are now how to explain these results and how to interpret them in order to learn lessons for educational practice?

With regard to the explanation of results, it should be noted that the current study provides insight in relations between variables but does not allow for any conclusions about the causal direction of effects. Thus, do students become frustrated and loose motivation because of the learning environment? Or are they unhappy and attribute their negative feelings to school and the learning environment? In daily life, a popular explanation is that because of puberty, many students do not value school because other things are more important for them. It would be difficult or even impossible to satisfy these students by adapting the learning environment. The current study cannot offer the definite answer but offers some interesting viewpoints.

Roeser, Eccles, and Sameroff (2000) clearly distinguish between students for whom a low valuing of school is a marker for complex problems (e.g., poor motivation to learn, poor mental health, poor grades, affiliation with negative peers), and students who are just bored with their schooling. The “popular” viewpoint would imply that students’ criticisms on education originate from complex problems and are not related to the quality of their education. This, however, would only provide a partial explanation because it does not take the second category of students, who are just bored with their schooling, into account. Indeed, other studies (Eccles et al., 1993) have shown negative motivational consequences when the environment does not fit well to the developmental needs

and does not foster enough developmental growth. This means that students may loose their motivation because of a suboptimal learning environment.

From the domain of cybernetics, there is also support for the idea that low perceptions and a high level of dissatisfaction might cause motivational problems. Comparing perceptions with the own standards (i.e., desired states) yields a discrepancy, comparable to dissatisfaction in the current study. A large discrepancy causes negative affect, especially if the tempo of discrepancy reduction is low (Carver & Scheier, 1998). By changing their behavior, people try to adapt the environment in such a way that perceptions will better fit their desires (i.e., discrepancy reduction). However, in common educational practice students have very little or no influence on the environment they are learning in, thus the tempo of discrepancy reduction is likely to be nil or very low. This might cause disengagement and withdrawal (ibid). When attribution theory is linked to the idea of discrepancy reduction, it might be predicted that people internally attribute the cause of the discrepancy, and attempt to change their own behavior, when they see good opportunities for rapid discrepancy reduction. However, if they do not see opportunities for discrepancy reduction, they will attribute the cause of the discrepancy externally, which promotes avoidance and withdrawal (Silvia & Duval, 2001).

If this line of reasoning is applied to the current findings, highly dissatisfied students possibly developed negative affects like disengagement because they do not possess any means to reduce the discrepancy between the perceived and the desired learning environment. This may, additionally, cause external attribution of the discrepancy and cognitive withdrawal, which is exactly our main finding in this context: problems with motivation and concentration and a lack of regulation in case of high dissatisfaction with the learning environment.

It is certainly not the case that learning-related student characteristics have an unidirectional effect on perceptions and dissatisfaction, or that the causality is the other way round. Instead, there are reciprocal causal relationships. As mentioned by Roeser et al. (2000), the processes will differ between students. But in addition, both processes are also likely to happen within the same student. Learning-related student characteristics are the result of the interaction between a student and his/her environment and are not unchangeable (Vermunt, 2005).

Concluding, there is a real possibility that – at least part of – the students report problems with motivation, concentration and regulation because of characteristics of their current learning environment. This underlines the claim that learning environments should be further improved and that a closer look at students' perceptions, desires and dissatisfaction should be taken. Also, because students prefer a much more powerful environment than the currently perceived one, their

perceptions and criticisms should be given a much more prominent place in the design of a new learning environment or the redesign of the existing one.

In our opinion, it is not sufficient to use only students' written evaluations of a learning environment as input for the (re)design process, as this would at best result in a modest increase in appreciation of the environment (van Os, 2000). Moreover, students would then still have no opportunities to reduce the discrepancy between their perceptions and desires, which is crucial for engagement in the learning environment. What is really needed, is *communicating* with students: listening to their experiences and to their suggestions for improving the learning environment (Cook-Sather, 2002; Papatheodorou, 2002). This requires a shift in thinking, trusting that students have relevant knowledge, overcoming established patterns of hierarchy, and creating an empathic and sensitive climate in order to start a fruitful discussion about the (re)design of the learning environment. Given the major findings of the current study, it is important to include a representative sample of the student population in such a discussion. That is, both satisfied, positively perceiving students, and dissatisfied, negatively perceiving students have to be invited. Before starting such an initiative to intensify the conversation between teachers and students about (re)design and improvement of the learning environment, further research should clarify whether students (both satisfied and dissatisfied) are willing to participate. It would also be beneficial to know beforehand whether teachers are willing to discuss (re)design issues with their students, including dissatisfied students. Further research will explore the willingness of students and teachers to participate.

A practical implication of this study is that students should be more involved in the (re)design process of a learning environment. Students desire a highly powerful learning environment and designers and teachers should profit from this. In addition, students greatly vary in perceptions, desires, and dissatisfaction, which is related to learning-related characteristics. Therefore, the benefits of discourse and cooperation between teachers and students during (re)design will be highest when both satisfied and dissatisfied students participate. Dissatisfied students should certainly not be excluded from such a discourse because their criticisms are unwelcome. Probably, these students will benefit most from the opportunity to contribute to the (re)design of the learning environment.

A theoretical implication of this study is that once again the importance of students' perspectives on a learning environment are underlined, as it shows large discrepancies between perceptions and desires. Additionally, this study examined relations with different learning-related student characteristics, like motivational and regulation strategies, which were studied separately in the past. Now, we were able to identify which student characteristics are most important in relation to

students' perceptions, desires, and dissatisfaction. Furthermore, students' dissatisfaction was introduced as an independent variable for examining students' perspectives on a learning environment. Wierstra, Kanselaar, van der Linden, and Lodewijks (1999) already described dissatisfaction as the difference between perceptions and desires. However, it was not used before as an independent variable, and the current study clearly shows that it is an important and informative addition, when focusing on students' perspectives on a learning environment.

To conclude, this study showed the importance of exploring the perspectives of students on a learning environment. Students did not perceive the learning environment as powerful as originally intended by the designers, but preferred a much more powerful environment. They were dissatisfied with their current learning environment. Perceptions, desires, and dissatisfaction related to learning-related student characteristics in different ways. Unfavorable student characteristics, like motivational problems, are likely to be at least partly the result of the disappointing learning environment and the limited influence students have on it. There is a clear need to give students a more important role in the (re)design process of a learning environment. By discourse and discussion between teachers and students, the learning environment might be improved and better fit the students' desires, namely a more powerful environment for learning.

5

Teachers' perspectives on innovations: Implications for educational design

This chapter is published as:
Könings, K. D., Brand-Gruwel, S., & van Merriënboer, J. J. G. (in press). Teachers' perspective on innovations: Implications for educational design. *Teaching and Teacher Education.*

Abstract. Educational designers often develop a 'powerful learning environment' that is subsequently implemented by teachers. Due to a lack of cooperation with teachers they may receive limited feedback on the quality of their design and the way it is implemented. This study focuses on teachers' perceptions of a Dutch innovative learning environment called the Second Phase, as well as their desires and their (dis)satisfaction with this environment. The results show that teachers are reserved about student autonomy and productive learning. Perceptions and desires are related to their individual approaches to teaching. The findings provide useful feedback for designers and a starting point to intensify their cooperation with teachers.

5.1 Introduction

During the last decade, many initiatives to modernize education and to optimize student learning have been taken in Dutch schools. Principles of cognitive psychology and constructivism are the basis for such innovations, which should eventually lead to 'powerful learning environments'. Such learning environments are aimed to reach the main goals of modern education: acquisition of high-quality knowledge, problem-solving skills, self-directed learning skills, and transferability of knowledge and skills. In the literature several characteristics of a design of a powerful learning environment are described, like active knowledge construction, gradual transfer of responsibility, and complex and realistic learning tasks (see Könings, Brand-Gruwel, & van Merriënboer, 2005, for an overview)

It is a general risk of large-scale innovations that educational designers develop a design or blueprint for a powerful learning environment that teachers subsequently do not or cannot fully implement in their teaching. This seems to have happened also in the innovation of Dutch secondary education (Veugelers, de Jong, & Schellings, 2004). A nation-wide innovation in the higher grades of Dutch secondary education started in 1998, aiming to develop a powerful learning environment that should predominantly promote students' acquisition of self-directed learning skills. Teachers play a crucial role in the interpretation of an innovative design and its translation to educational practice. Therefore, the main goal of the current study is to find out how teachers think about the new powerful learning environment and which factors influence their perspective. Related aims are to investigate whether teachers in Dutch secondary education perceive the current learning environment as a powerful one, what they desire in this learning environment, and with which elements of the perceived learning environment they are (dis)satisfied.

Investigating teachers' perceptions of the learning environment gives insight in the extent to which the educational design has been successfully implemented. First of all, teachers are able to give information about successfully or unsuccessfully implemented aspects of the original design in the factual learning environment, for example, the degree to which productive learning and self-directed learning take place. This provides information about the current state of the implementation and its agreement with the original design. Secondly, teachers are an important source of feedback for educational designers, because *not* implementing particular aspects of the original design could also mean that it is not workable or feasible in practice. The design may not contain sufficient guidelines for good implementation or may simply not be suitable for realization in educational practice.

When trying to implement a new educational design, teachers may experience failing preconditions at four levels: (1) the educational design itself, (2) the school, (3) the students, and (4) their own competencies. First, designers do not always take co-accountability for the translation of their ideas into practice (Staub, 2004). Too often, there is a lack of interaction between designers and teachers. Teachers are expected to autonomously transfer and apply educational systems and results of educational research. This, however, is an extremely complex task and may result in limited or inadequate implementation of the innovative design. Secondly, at the school level teachers work under particular conditions that may hamper the good implementation of an innovative design. For instance, smooth implementation may be hampered by a lack of time, large group sizes, inappropriate textbooks and media, and available classrooms that do not allow for individual work or work in small groups (Roelofs & Terwel, 1999; Verloop & Lowyck, 2003). Third, teachers' perceptions of student characteristics influence the choice and realization of a learning environment. For example, if teachers perceive that less able students are overcharged in the learning environment, then they are likely to change or adapt it (Roelofs & Terwel, 1999). Moreover, the perceived lack of passion in today's students may also negatively affect the implementation of new teaching practices (Simplicio, 2004). Fourth, teachers need to believe that they have the skills for implementing the innovation and thus have a positive expectancy of success with regard to the implementation in the specific context they are working in (Abrami, Poulsen, & Chambers, 2004).

Apart from the aspects that teachers report as obstacles for innovating their educational practice, innovations may also suffer from teachers' unintended failure to incorporate new ways of teaching. Teachers' perceptions, desires and dissatisfaction (jointly called the "teacher's perspective") do not only reflect limiting preconditions from the outside world but also from the teachers' realm of thought. In the literature, four possible causes are described for teachers' resistance to innovations: (1) willingness to learn, (2) lack of consciousness of teaching behavior, (3) incomplete reflection, and (4) dominant conceptions of teaching and learning.

First, teachers' willingness to learn is a crucial factor for implementing educational innovations. Teachers can be divided into three groups having different patterns of behavior indicating their willingness to learn (van Eekelen, 2005). Teachers who do not see why there is a need to learn hold on to old teaching habits, do not have an open mind for others, are not very critical of their own role in education, and seldom reflect or ask themselves questions. Teachers who wonder how to learn want to improve their teaching practices but do not know how to accomplish this. They are mostly critical of their own role and are a bit more open

to others. Teachers who are eager to learn want to improve their performances and undertake action in order to learn. They are alert to classroom processes, have an open mind for others, and are critical towards their own role.

Second, a lack of consciousness of own teaching behavior can make traditional teaching practices highly persistent. Only part of teachers' teaching behavior is conscious and reflective (Tigchelaar & Korthagen, 2004). Routines and spontaneous, immediate reactions determine much of a teacher's classroom behavior. Teachers have to react very quickly to things happening in the classroom when educating about 25 to 30 students. Because these unconscious behaviors and routines are based on earlier and often more traditional educational experiences, they may interfere with the implementation of educational innovations that expect new teaching behaviors from teachers.

Third, teachers reflect only on a part of the whole educational process. They mainly reflect on the desired manifestation of their teaching, which means that they focus on the educational methods and strategies they plan to use in their lessons (Ponte, Ax, Beijaard, & Wubbels, 2004). They rarely reflect on the current educational reality and the effects of their teaching behaviors (ibid). This one-sided way of reflecting on education is likely to hamper the implementation of educational innovations.

Finally, teachers differ in their conceptions of teaching and learning. It has been shown that conceptions influence perceptions. Conceptions can be seen as lenses through which people perceive and interpret the world (Pratt, 1992). Conceptions of teaching and learning can be placed on a continuum between a teacher-centered/content-oriented pole and a student-centered/learning-oriented pole (Kember, 1997). Conceptions on the latter side of the continuum are most compatible with educational innovations based on constructivism and ideas behind powerful learning environments. Teachers' conceptions of teaching and learning are influencing teachers' approaches to teaching (Trigwell, Prosser, & Waterhouse, 1999) and their way of acting and reacting in the learning environment (Pratt, 1992). This implies that conceptions may influence the way teachers implement an educational design through their approaches to teaching, which can be seen as an operationalization of their conceptions. This influence could be reflected in teachers' perceptions of the learning environment, desires, and dissatisfaction with the current learning environment.

Practical experiences at the level of design, school, students, and teachers' own competencies and self-efficacy, as well as teachers' individual characteristics, are reflected in teachers' perceptions of the learning environment, the way they would like the learning environment to be (i.e., desires), and their dissatisfaction with elements of the current learning environment. So, teachers are able to give

important feedback to those who designed the educational innovation (see also Könings, Brand-Gruwel, & van Merriënboer, 2005; West & Staub, 2003). The perspective of teachers provides information about the practical side of the design, which is in fact indispensable for designers.

Only informing designers about teachers' experiences with the designed learning environment, would be the weakest form of cooperation between designers and teachers (i.e., implementers) (Kensing & Blomberg, 1998). A stronger form of cooperation is participatory design, aiming at an active participation of users in the design process and in decisions that will affect them (Kensing & Blomberg, 1998; Mankin, Cohen, & Bikson, 1997). Participatory design is already used in business (Mumford, 1997) and in developing technology (Mankin, Cohen, & Bikson, 1997), and more specific in the design process of computer applications (Bødker, 1996). The participatory design process constitutes analysis of needs and possibilities, generation of visions for change, project management and planning for implementation (Kensing, Simonsen, & Bødker, (1998). Some important benefits of participatory design are: (1) an improved quality and usability of the design, (2) easier acceptance of innovations by its users, (3) a better understanding of innovations by the users resulting in a more effective implementation, and (4) less investments in innovations that users do not want or cannot use in practice (Damodaran, 1996).

For good functioning of participatory design it is important to be well-informed on teachers' perspective in implementing a new educational design, and how this is related to teachers' individual characteristics. The current study answers the question of how teachers perceive, desire, and appreciate an innovative learning environment, and examines the relation between teachers' perspectives and their approaches to teaching. Additionally, possible relations with the amount of teaching experience, sex, and courses teachers are teaching will be explored. Shortly, the current study answers the following research questions:

- How do teachers perceive the current innovative learning environment (in Dutch secondary education), what do they desire in a learning environment and with which elements of the perceived learning environment are they dissatisfied?
- How are perceptions, desires, and (dis)satisfaction related to approaches to teaching, amount of teaching experience, sex, and courses teachers are teaching?

5.2 Method

5.2.1 Participants

The sample consisted of 142 teachers of five schools for secondary education in the south of the Netherlands. They were all teaching 10th grade students (about 16 years old) in senior general secondary education and/or pre-university education and were expected to implement the innovative learning environment, called Second Phase. The teachers' mean age was 44.40 years (*SD* = 9.77), having on average 18.40 years (*SD* = 10.21) of teaching experience. The sample consisted of 47 female teachers (33.8%) and 92 male teachers (66.2%) Three teachers did not indicate their sex. The participants were teaching different kinds of courses (see Table 5.1). Four teachers did not specify which courses they were teaching.

Table 5.1 Frequencies of the different kind of courses the participants were teaching

	Absolute frequency	Percentage
Teaching languages courses[1]	52	37.7%
Teaching science courses[2]	36	26.1%
Teaching general education courses[3]	31	22.5%
Teaching creative courses[4]	12	8.5%
Teaching a combination of courses[5]	7	4.9%

[1] Dutch, German, English, French, classical languages
[2] General science, biology, chemistry, physics, mathematics, computer technology
[3] History, geography, economics, social studies, philosophy of life
[4] Cultural and artistic appreciation, drawing, handicrafts, music, physical education
[5] Teaching courses in more than one of the above categories

5.2.2 Materials

5.2.2.1 The learning environment

The context of this study is a nation-wide innovation in Dutch secondary education, called Second Phase (Ministerie van OCW, 2005; Stuurgroep Profiel Tweede Fase Voortgezet Onderwijs, 1995; Veugelers, de Jong, & Schellings, 2004). This learning environment requires students to acquire skills and knowledge in an independent way, better preparing them for higher professional education and university. Students learn in a self-directed way, with opportunities for collaborative learning. In this learning environment there is more room to account for individual differences than in the traditional class situation. The teacher has to be sensitive to student's individual progress and problems. The learning process is not only directed to knowledge acquisition, but also to the selection and processing of the vast amounts of information available today. In this learning environment

the teacher serves more as a coach and less as an instructor. This creates more possibilities for contact between students and the teacher. Furthermore, learning contents are actualized and broadened. Building a broad general knowledge base is an important educational goal of the Second Phase. The integration of different subject matter domains is emphasized. Courses are clustered in profiles or "themes" of closely interconnected subject matters. According to the educational designers of the learning environment, this enables more integration between subjects and leads to a better preparation for higher professional education and university. In addition to more integration between subjects, the coherence between knowledge and skills is emphasized and the application of acquired knowledge is stressed.

5.2.2.2 Background questionnaire

This short questionnaire is aimed to get insight in teachers' individual background characteristics. It contained four open questions about the teacher's age, the number of years of teaching experience, sex, and the courses taught.

5.2.2.3 Inventory of Perceived Study Environment Extended-Teacher (IPSEE-T)

The aim of the IPSEE-T is to measure teacher's perceptions of a particular learning environment and their desires with regard to the design of a learning environment. These measures together give insight in teachers' (dis)satisfaction with the learning environment, by looking at the discrepancies between perceptions and desires.

The IPSEE-T consists of 67 items. Thirty-one of these items originate from the Inventory of Perceived Study Environment (IPSE; Wierstra, Kanselaar, van der Linden, & Lodewijks, 1999), translated into Dutch by the Expertise Centre Active Learning of Maastricht University (Picarelli, Bouhuijs, & Vermunt, 2006). To measure the characteristics of powerful learning environments more completely, as described by Könings, Brand-Gruwel, and van Merriënboer (2005), another 36 items were constructed. The original version of the IPSE is intended for completion by students. For the current study the IPSEE-T has been adapted for administration to teachers.

The items of the IPSEE-T cover eight scales (see Table 5.2) that are considered as central characteristics of powerful learning environments. The first scale is *fascinating contents* and contains items about the extent to which the learning contents are interesting, challenging, and personally relevant for students. The second scale is *productive learning*. The less emphasis on sole reproduction of learning contents, the higher the score on this scale. Thus, scores on this scale are reversed in order to express productive learning. The third scale is *integration* and

includes items about the integration of newly acquired knowledge with prior knowledge, the integration of different knowledge domains, and the integration of knowledge and skills. The fourth scale is *student autonomy* and intends to measure the attention to student's self-steering with regard to the content of learning, the way of learning, and time planning. The fifth scale is *interaction*, which incorporates both collaboration with peers and interaction with the teacher. The sixth scale is *differentiation*, which inquires after opportunities for students to choose and make different tasks, solve problems in different ways, and use different learning materials. The seventh scale is *clarity of goals* and includes items about the clarity of instructional goals and task demands. The eighth and last scale is *personalization*, which inquires after the availability of tailored teacher support.

All students do the same work at the same moment.	No, totally disagree	Disagree	A bit disagree	A bit agree	Agree	Yes, totally agree
A. This happens (in the 10th grade)	☐	☐	☐	☐	☐	☐
B. I would like this to happen	☐	☐	☐	☐	☐	☐

Figure 5.1 Sample item of the IPSEE-T.

Each of the items of the IPSEE-T contains a statement about one of the characteristics of a learning environment and two questions, as illustrated in Figure 5.1. The questions are rated on a six-point scale, ranging from totally disagree to totally agree. Scores on question A measure the perceptions of the teacher's learning environment. Scores on question B indicate what the desired learning environment of the teacher would look like. The discrepancy (i.e., absolute difference) between the scores on question A and question B is defined as the measure of dissatisfaction with the particular learning environment. Increasing discrepancies between perceptions and desires indicate increasing dissatisfaction. Small discrepancies between perceptions and desires indicate low dissatisfaction. It should be noted that low dissatisfaction can also be seen as high satisfaction, but only the term dissatisfaction is used to interpret the results in an univocal way.

Internal consistency is computed for all eight scales, separately for the perception items and the desire items (see Table 5.2). All Cronbach's alpha coefficients were above .70, except for two coefficients that were between .60 and .70. Thus, the internal consistencies of all scales were acceptable.

Table 5.2 Internal consistencies of the scales of the IPSEE-T

		Cronbach's alpha coefficient	
Scale	**Number of items**	**Perception**	**Desire**
Fascinating contents	9	.78	.80
Productive learning	5	.74	.80
Integration	11	.77	.76
Student autonomy	15	.87	.87
Interaction	11	.75	.64
Differentiation	6	.79	.72
Clarity of goals	4	.77	.80
Personalization	6	.68	.70

5.2.2.4 Approaches to Teaching Inventory (ATI)

The aim of the ATI (Prosser & Trigwell, 1997) is to measure teaching approaches. The questionnaire contains two scales: *information-transmission/teacher-focused* (ITTF) and *conceptual-change/student-focused* (CCSF). These scales represent the extreme teaching approaches on a scientifically well known continuum of approaches between a teacher-centered/content-oriented pole and a student-centered/learning-oriented pole (see Kember, 1997; Prosser & Trigwell, 1993). The ATI has been translated in Dutch and now contains 11 items. The scale ITTF consists of 5 items ($\alpha = .66$) and the scale CCSF consists of 6 items ($\alpha = .72$). All items are rated on a six-point scale, ranging from totally disagree to totally agree.

5.2.3 Procedure

The participants received an invitation to take part in the study accompanied by the questionnaires and a description of the goal of the study. The first page of each questionnaire contained a description of the aim and the contents of the questionnaire and instructions for scoring the items. Participant first had to fill out the background questionnaire, followed by the IPSEE-T, and the ATI. They could fill out the questionnaires at any moment and place they wanted. In total 142 of the 246 teachers returned the questionnaires (i.e., 57.7%).

5.2.4 Data analysis

For computing mean scores for each scale of the IPSEE-T, maximally 25% of missing values is accepted. So, if at least 75% of the items at scale level were filled out, these items were used to compute the mean score. Looking at the mean scores, it showed that on each scale for at least 85% of the teachers a mean score could be calculated, except for the scale integration (11 items). For this scale a mean score was calculated for only 63% of teachers. The missing-value procedure was adapted for the integration-scale, because it appeared that three items were not applicable to all teachers. These three items referred to integration of theory lessons and practicals. Not all courses included practicals, with the consequence that part of the teachers could not answers these particular items. Therefore, the procedure for this scale was adapted as follows: if 75% of the eight remaining items of the scale were filled out, then the mean of all answered items (including the three particular items) was computed.

One-sample *t* tests were used to investigate whether perception scores and desire scores differ from the neutral score of 3.5. Paired-samples *t* tests were used in order to test whether discrepancies between perceptions and desires, indicating dissatisfaction, were significant. Multiple regression analyses were used to investigate relations between perceptions on the one hand, and teaching approaches, years of teaching experience, sex, and courses taught on the other hand. In the first step of the regression analysis dummies for the school variable were entered in the regression model to correct for possible school effects. In the second step, the independent variables were added using a stepwise forward procedure. The same analyses were used to investigate relations of desires and dissatisfaction with teachers' individual characteristics. Only independent variables explaining at least 10% of the variance are reported in the text.

5.3 Results

For answering the first research question teachers' perception scores will be reported, as well as the desire scores and the dissatisfaction scores. In relation to the second research question, statistics of the Approaches to Teaching Inventory will be described. Besides, the results of multiple regression analyses will be reported, showing relations (1) between teachers' perception scores and their individual characteristics, (2) between desire scores and individual characteristics, and (3) between dissatisfaction scores and individual characteristics.

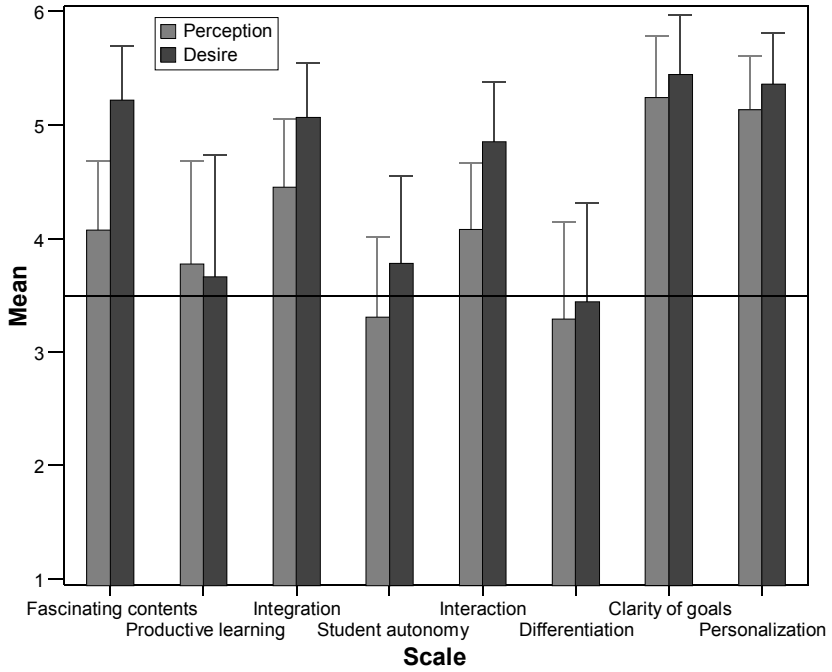

Figure 5.2 Mean scores and standard deviations of the perceived and desired learning environment

5.3.1 Perceptions, desires, and dissatisfaction

The eight mean scores of the different scales of the IPSEE-T (see Figure 5.2) showed that teachers perceived the learning environment predominantly as a powerful learning environment. One-sample *t* tests showed that on six of the eight scales the perception scores were significantly higher than the neutral score of 3.5 ($p < .01$ for all tests). Teachers perceived fascinating contents, emphasis on productive learning, integration in the learning contents, interaction during the learning process, clarity of goals, and personalization as significantly higher than neutral. On two scales the perception scores were significantly below 3.5 ($p < .01$ for both tests). Teachers perceived differentiation and student autonomy significantly lower than neutral, although they were still scored higher than 3.0 (i.e., above 'a bit disagree').

The desire scores of the IPSEE-T give insight in the ideal learning environment of the teachers. One-sample *t* tests showed that on six of the eight scales the desire scores were significantly above 3.5 ($p < .01$ for all tests), which means that teachers clearly desired most of the characteristics of the learning environment, as measured by the IPSEE-T. Only the desires of productive learning and differentiation did not significantly differ from the neutral score.

The discrepancy between perception scores and desire scores is interpreted as a measure of the dissatisfaction with the perceived learning environment. By looking at the difference between the perception bar and the desire bar in Figure 5.2, the dissatisfaction can be deduced. The more both bars differ, the higher the dissatisfaction (e.g., see fascinating contents). The more both bars match, the lower the dissatisfaction (e.g., see differentiation). Although the size of the discrepancies differs among scales, paired *t* tests showed that for all scales the perception scores differed significantly from the desire scores ($p < .01$). For seven of the eight scales the perception scores were lower than the desire scores. Productive learning was the only scale that showed higher perception scores than desire scores ($p < .01$). Surprisingly, teachers preferred more reproductive learning in the learning environment than they actually experienced.

Because all discrepancies between perceptions and desires were significant, it is valuable to compute our measure of dissatisfaction with the perceived learning environment and to use it in further analyses. The means and standard deviations of the dissatisfaction scores are presented in Table 5.3, together with the means and standard deviations of the perception scores and the desire scores. It can be seen from Table 5.3 that teachers were especially dissatisfied with the extent to which the learning contents are fascinating for students, the room for interaction during the lessons, the integration in the learning contents, and the possibility for student autonomy.

Table 5.3 Means and standard deviations of dissatisfaction scores (ordered from high to low), perception scores, and desire scores

	Dissatisfaction		**Perceptions**		**Desires**	
Scale	***M***	***SD***	***M***	***SD***	***M***	***SD***
Fascinating contents	1.14	.62	4.06	.64	5.20	.46
Interaction	.79	.54	4.05	.57	4.84	.52
Integration	.64	.46	4.43	.60	5.07	.49
Student autonomy	.52	.54	3.26	.69	3.79	.76
Personalization	.24	.36	5.12	.48	5.37	.45
Differentiation	.21	.58	3.23	.84	3.44	.87
Clarity of goals	.19	.36	5.25	.55	5.45	.53
Productive learning[a]	.12	.48	3.78	.92	3.66	1.07

Note. [a] For this scale perception scores were higher than desire scores.

5.3.2 Approaches to teaching

Teachers reported both the ITTF approach (M = 4.22; SD = .70) and the CCSF approach to teaching (M = 3.91; SD = .73). A one-sample t test on the scores of the ATI showed that on both scales the means were significantly higher than the neutral score of 3.5 ($p < .01$). A paired t test showed that the scores on the ITTF scale were significantly higher than the scores on the CCSF scale, $t(133) = 3.57$, $p < .01$. So, teachers considered teaching primarily as information transmission in a teacher focused educational context.

5.3.3 Perception scores and teachers' individual characteristics

Table 5.4 presents the results of the multiple regression analyses of teachers' individual characteristics on the perception scores of the scales of the IPSEE-T. The independent variables included in the analyses are: approaches to teaching, sex, years of teaching experience, and courses taught. The results in Table 5.4 are corrected for possible school effects, by including the variable school in all models. The analyses showed that part of the variance of the perception scores on different scales was explained by the teaching approach. The more teachers reported a CCSF approach to teaching, the higher the perception scores of integration. For the scales student autonomy and interaction, the CCSF approach also contributed to high perception scores. The perception scores of differentiation were negatively related to the ITTF approach. The more teachers reported this teaching approach, the lower their perception scores of differentiation. The perception of clarity of goals was related to the course teachers were teaching: teachers teaching language courses

Table 5.4 Significant regression weights ($p < .05$) of variables predicting perceptions

Dependent variable	R^2	ΔR^2	Independent variable(s)	*B*	*SE B*	β
Fascinating contents	.17	.08	CCSF approach	.25	.08	.29
Productive learning	.21	.06	ITTF approach	-.34	.12	-.26
		.04	Creative courses	.73	.30	.21
Integration	.26	.18	CCSF approach	.36	.07	.44
Student autonomy	.27	.12	CCSF approach	.33	.08	.35
		.06	ITTF approach	-.24	.08	-.26
Interaction	.29	.15	CCSF approach	.31	.07	.38
		.06	ITTF approach	-.21	.07	-.25
Differentiation	.19	.15	ITTF approach	-.45	.10	-.39
Clarity of goals	.13	.11	Language courses	.37	.10	.33
Personalization	.16	.04	Sex	-.20	.09	-.20

Note. All multiple regression models are corrected for school effects. R^2 is the total amount of explained variance of the model, including school effects. ΔR^2 is the change in R^2 after adding the particular independent variable in the model.

perceived more clarity of goals than others. Sex hardly related to perception scores, and years of teaching experience did not relate to perception scores on any scale.

In short, the regression models reported in Table 5.4 show that approaches to teaching are often related to perception scores. Teachers reporting a CCSF approach perceive a *more* powerful learning environment on half of the scales of the IPSEE-T. Teachers reporting an ITTF approach perceive a *less* powerful learning environment on half of the scales.

5.3.4 Desire scores and teachers' individual characteristics

The results of the multiple regression analyses of teachers' individual characteristics on desire scores of the IPSEE-T (see Table 5.5) showed that the more teachers reported a CCSF approach, the higher their desire scores on integration, student autonomy, and interaction. On the scale differentiation the ITTF approach contributed to low desire scores. Overall, the results in Table 5.5 show that approaches to teaching explain part of the variance of the desire scores on seven of the eight scales. The CCSF approach was related to high desires. The ITTF approach is two times related to low desires and two times to high desires. The courses the teachers were teaching related to their desire scores on three scales. The number of years of teaching experience and sex show no relation with desire scores.

Table 5.5 Significant regression weights ($p < .05$) of variables predicting desires

Dependent variable	R^2	ΔR^2	Independent variable(s)	*B*	*SE B*	β
Fascinating contents	.01					
Productive learning	.17	.05	ITTF approach	-.33	.14	-.22
		.03	Language courses	-.42	.21	-.19
Integration	.19	.17	CCSF approach	.28	.06	.43
Student autonomy	.18	.14	CCSF approach	.40	.10	.38
Interaction	.20	.17	CCSF approach	.31	.07	.42
Differentiation	.16	.15	ITTF approach	-.46	.11	-.40
Clarity of goals	.13	.08	Language courses	.29	.11	.27
		.04	ITTF approach	.14	.07	.19
Personalization	.21	.04	ITTF approach	.14	.06	.23
		.04	General education courses	-.22	.10	-.21

Note. All multiple regression models are corrected for school effects. R^2 is the total amount of explained variance of the model, including school effects. ΔR^2 is the change in R^2 after adding a particular significant independent variable to the model. If there is no independent variable significantly predicting a dependent variable, only R^2 is reported.

5.3.5 Dissatisfaction scores and teachers' individual characteristics

There was only one significant regression weight in all multiple regression analyses of teachers' individual characteristics on dissatisfaction scores. Teachers teaching creative courses were more dissatisfied about the clarity of goals (R^2 = .61; ΔR^2 = .04; B = .33; $SE\ B$ = .11; β= .20) than teachers teaching other courses. The lack of significant findings in the multiple regression analyses of the dissatisfaction scores indicate that teachers, independent from their individual characteristics, are all equally dissatisfied with the perceived learning environment. There was no influence of teaching approaches on dissatisfaction. There were also no relations between dissatisfaction scores and sex, years of teaching experience, and courses taught.

5.4 Conclusions and discussion

The current study gives insight in teachers' perceptions, their desires, and their dissatisfaction with the Second Phase in Dutch secondary education, as well as the relation of these variables with teachers' individual characteristics.

The first research question focused on the teacher's perspective of the current innovation in Dutch secondary education. The results show that teachers perceive a predominantly powerful learning environment, except for student autonomy and differentiation. It is particularly remarkable that student autonomy is not perceived as pronouncedly present in the learning environment, because this is one of the elementary characteristics of its underlying educational design.

The desires show that teachers positively value almost all measured elements of a powerful learning environment, including student autonomy. Teachers are neutral about the desirability of differentiation and productive learning. In the light of educational trends such as education-on-demand and adaptive teaching it is striking that differentiation is not an important issue for teachers: they do not recognize it in their own environment and they do not value it very highly. This might be explained by the fact that students are already grouped together in two levels (at school level), based on their capacities: senior general secondary education and pre-university education. However, at class level one might still expect that variation between students in capabilities and interests would give further reason for differentiation.

Except for productive learning, the results of dissatisfaction scores show that teachers desire a more powerful learning environment than they perceive at the moment. Teachers are especially dissatisfied with the lack of challenging and fascinating contents, the low amount of interaction during the learning process, the

inadequate integration of subject matter, and the amount of student autonomy. Teachers are also dissatisfied with respect to productive learning, but the desire scores are lower than the perception score. Apparently, teachers prefer *less* emphasis on productive learning than they currently experience in the learning environment, formulated otherwise, they prefer more reproduction of knowledge than they perceive. This is clearly not in line with constructivist ideas, which stress the importance of the construction of knowledge by learners themselves (Jonassen, 1991).

The second research question focused on the relations between teachers' perceptions, desires, and dissatisfaction on the one hand, and their approaches to teaching, amount of teaching experience, sex, and courses taught on the other hand. Results show that teachers' perceptions are related to their approaches to teaching. Teachers reporting the CCSF approach perceive a more powerful learning environment, while teachers reporting the ITTF approach perceive a less powerful learning environment. Teachers' perceptions are sometimes related to the courses taught, hardly related to sex, and never related to years of teaching experience.

A possible explanation for the found relation between perceptions and approaches to teaching (i.e. operationalized conceptions) is that the conceptions influenced the perception process. Conceptions operate as lenses through which one looks (Pratt, 1992). Another plausible explanation is that teachers perceive different educational practices. Teachers all have their own way of teaching and usually only perceive their own lessons. Thus, the object of the perception may have differed, which itself was out of the scope of this study. If teachers teach according to their own approach to teaching, they are likely to perceive a learning environment that is in line with their approaches to teaching. However, this means that they have the freedom to do so because the educational design is not highly prescriptive.

Teachers reporting a CCSF approach desire a more powerful learning environment. The direction of the relation between desires and the ITTF approach is equivocal. The stronger the ITTF approach, the lower the desires for productive learning and differentiation, and the higher the desires for clarity of goals and personalization. Productive learning and differentiation are less desirable elements of the learning environment if the teacher considers information transmission as the goal of education, doing so in a teacher-focused manner. The clarity of goals and personalization as characteristics of powerful learning environments, however, can also fit well in the more traditional ITTF approach to teaching.

Dissatisfaction is hardly related to teachers' individual characteristics. There is a single relation with the courses taught, but no relation with sex and years of teaching experience. Dissatisfaction is totally independent from approaches to

teaching: teachers with a CCSF approach and an ITTF approach are equally dissatisfied with the learning environment. This is remarkable, because the design characteristics of the Second Phase fit better to the CCSF approach than to the ITTF approach. A likely conclusion is that all teachers can constitute their educational practices according to their own approaches to teaching to the same extent. If this is true, the educational design of the Dutch innovation in secondary education is only implemented as far as it is in agreement with teachers' approaches to teaching.

Remarkably, there is a lack of a relation between years of teaching experience and the teachers' perspective. It indicates that teachers who just graduated and enter practice (mostly young teachers) do not perceive a more powerful learning environment, or are more dissatisfied with the perceived learning environment, than more experienced teachers. This means that young teachers are not more inclined to innovate than their experienced colleagues, which could be explained by quick socialization and adaptation to the current school practices (Pugh & Zhao, 2003).

What causes can be identified for the hampering implementation of the design of the learning environment? The study showed several aspects that are in contrast with the original design. Teachers perceive the current learning environment as a powerful one, with the exception of differentiation and student autonomy. The autonomy of students is not seen as highly desirable and a productive way of learning is even less desired than perceived. Furthermore, teachers seem to design their education according to their own approaches to teaching. What may cause this incomplete implementation of the learning environments? From the comments teachers wrote at the end of the questionnaire, it became clear that they experience problems with the feasibility of the design. The following comments may explain the conservative attitude with respect to student autonomy. Teachers stated that the connection between students' prior education and the Second Phase is missing and students are not prepared to learn in a self-directed way. Teachers also remarked that high-ability students function well in the innovative learning environment, but students with less learning capabilities tend to get lost. Additionally, they mentioned that it costs a lot of discipline and skills for young students to work seriously in an environment that offers much freedom. Part of the students has motivational problems. "Students do not have a clear goal yet." Teachers' preferences for more reproductive learning are better understandable in the context of the following remarks. Teachers commented that students are overloaded with too many courses in the new learning environment and that (too) limited lesson time can be spend on different subjects. Additionally, skills are stressed in the new learning environment and students have to write many papers and conduct many

projects. According to the teachers, these characteristics of the design of the learning environment may lead to superficiality and little deepening of the subject matter. Additionally, a few teachers reported difficulties with the innovative learning environment, because they did not feel well prepared to implement the Second Phase. So, teachers mention failing preconditions at the level of the educational design, the school, the students and their own competencies.

Next to these reflective information about the current implementation of the learning environment, this study shows influences of teachers' conceptions on the implementation. From the literature it is known that it is difficult to change conceptions and beliefs (e.g., Chinn & Brewer, 1993). Teachers have built their conceptions and beliefs about teaching from their own experiences as students in primary, secondary, and tertiary education and from their – sometimes lengthy – teaching experiences in the period before starting the innovation. Conceptions are heavily resistant to change. And, according to cognitive dissonance theory (Festinger, 1957), people prefer congruence between cognitions (i.e., beliefs) and behavior. If a limited prescriptive educational design places few constraints on teaching behaviors, it is easier to stick to existing behaviors than to change the cognitions. The results of the current study may indicate the design of the learning environment is not well-defined enough.

A limitation of the current study is that the relation between conceptions (operationalized as approaches to teaching) and perceptions cannot be separated from the relation between approaches to teaching and the way in which teachers constitute the learning environment. In order to get more grasp on this, one has to focus, additionally, on the "objective" learning environment, for example with video observations in the classroom. This is an important line for future research. Another limitation of the study is that teachers may have answered the questionnaire in a socially desirable manner. However, if this effect played a role at all, it seems to be small, because the responses on the different scales of the IPSEE-T clearly differentiated and many answers were not in agreement with the design of the innovative learning environment or today's educational insights.

A practical implication of our study is that an innovative educational design should offer teachers much guidance for how to implement it in practice, because our results indicate that teachers otherwise tend to implement the innovation in accordance with their own approaches to teaching, which are not always in line with the intended design. Therefore, the design needs to be explicit about the teaching behaviors expected from the teachers. However, it is highly necessary that such a design is workable and feasible for teachers. Therefore, a second practical implication is that cooperation between educational designers and teachers should be promoted and become common practice. Because teachers experience problems

in the feasibility of the design, they themselves adapt the design to a practical form. These feasibility problems provide important feedback for designers and a starting point for cooperating with teachers more closely in order to develop a more workable design. The principles of participatory design can give practical guidance for this cooperation. By more intensive cooperation between designers and teachers, the scope of the innovative design can be enhanced because it makes it easier for teachers to teach according to the design rather than according to their own approaches to teaching. This is especially relevant for reaching "traditional" teachers when implementing innovations.

To conclude, this study showed the importance of exploring the perspective of teachers who are involved in an educational innovation. It showed that the implementation of the innovative learning environment only partly succeeded and that more cooperation between educational designers and teachers is needed to create more congruence between the educational design and the factual learning environment in the classroom. Such a cooperatively developed design will contribute more to promoting good educational practices than a design developed without acknowledgment of the teacher's perspective. Furthermore, such a design will be more workable for teachers and, eventually, better able to assist teachers in innovating their education. Making the design more specific and concrete could help more traditional teachers to successfully implement an innovation.

6

Students' and teachers' perspectives on an innovative learning environment: Do they see through the same glasses?

This chapter is submitted as:
Könings, K. D., Brand-Gruwel, S., & van Merriënboer, J. J. G. (2007).
Students' and teachers' perceptions of an innovative learning environment: Do they see through the same glasses?
Manuscript submitted for publication.

Abstract. Teachers and students have their own perspectives on a learning environment. Congruent perspectives contribute to optimal teaching-learning processes in the environment and help to achieve optimal learning outcomes. This study investigates both teachers' and students' perspectives on an innovative learning environment in Dutch secondary education. All tenth graders (N = 994) of four secondary schools and their teachers (N = 136) filled out a questionnaire about their perceptions, desires, and dissatisfaction with regard to eight characteristics of the learning environment. Results predominantly show higher perceptions and lower dissatisfaction for teachers than for students. Teachers desire a more powerful learning environment than students, with the exception of the characteristics productive learning and student autonomy, which are desired more strongly by students than by teachers. Our findings stress the need for interventions that may help to decrease differences in perspectives. Discourse between teachers and students about (re)design of the learning environment is proposed.

6.1 Introduction

Students' perceptions of a learning environment as well as their desired way of learning direct their study behavior, which eventually determines the effectiveness of the environment (Entwistle & Tait, 1990; Vermetten, Vermunt, & Lodewijks, 2002). Furthermore, the discrepancy between the perceived learning environment and students' desires with regard to this environment has been found to be related to motivation (Eccles et al., 1993; Renzulli & Dai, 2001) as well as learning outcomes (Fraser, 1998; Fraser & Rentoul, 1980), which both improve if the discrepancy becomes smaller. Thus, students' perspectives on a learning environment are an important influencing factor in the learning process.

Like students' perceptions of a learning environment are related to their study behavior, teachers' perceptions are related to their teaching behavior (Roelofs & Terwel, 1999). Teachers also have their perceptions of a learning environment, their own desires with regard to particular characteristics of it, and are possibly dissatisfied with perceived characteristics that are not in congruence with their desires. Teachers' perceptions of a learning environment do not need to match students' perceptions of the same environment.

Human factors engineering stresses that the designers' and users' interpretation of any system has to be more or less the same for its optimal functioning (Norman, 1986, 1988). If perceptions or interpretations differ, this is likely to result in a decline of effectiveness (Bartholomew, Parcel, Kok, & Gottlieb, 2001). Applied to the field of education, this means that congruence between teachers' and students' perspectives on a learning environment is of central importance for an optimal progress of the teaching-learning process. If there is a gap between teachers' and students' perspectives, there is a clear need to bridge this gap because it is likely to decrease the effectiveness of the learning environment. Therefore, the main goal of the current study is to give insight in possible differences between students' and teachers' perspectives on a learning environment, especially their perceptions, desires with respect to its design, and discrepancies between perceptions and desires (i.e., (dis)satisfaction). This information might serve as a starting point for interventions aimed at diminishing these differences.

Teachers and students differ in their perceptions of the same learning environment (see den Brok, Bergen, & Brekelmans, 2003, for an overview), teachers tend to perceive a learning environment more favorable than their students do (Fraser, 1982; Fraser & O'Brien, 1985), and teachers have little insight in the perspectives of their students. They often do not know how students perceive the learning environment, what they desire, or which characteristics they would like to be different from the current situation. It has been found that teachers are not able

to assess their students' preferences in learning more accurate than by random guessing (Holt, Denny, Capps, & de Vore, 2005). Teachers are only aware of students' conceptions of learning in a limited extent, and believe the majority of the students have much less sophisticated conceptions of learning than they really have (Watkins, 2004). As conceptions influence perceptions (Pratt, 1992), teachers are likely to underestimate students' perceptions too.

The underestimation of student's perceptions by teachers may easily lead to an underestimation of achievable learning outcomes, which will be reflected in teaching practices. Students, for instance, considered independent learning and individual initiative as the third and fifth most important learning outcomes, while for teachers these outcomes were not at all ranked within the first six of ten possible learning outcomes (Doppelt, 2004). In addition to underestimating the achievability of particular learning outcomes, teachers' and students' perceptions of the impact of specific characteristics of the learning environment on learning outcomes differ. Students considered, for instance, classroom discussions to be the second most important learning environment characteristic, while teachers placed classroom discussions only on rank six of most important characteristics (ibid).

Teachers should know more accurately what students' perspectives are and how they differ from their own perspectives, because of both the importance of congruence between perspectives of teachers and students and the large influence of students' perceptions on the effectiveness of the learning environment. "To understand children's perspectives in school is to gain some insight into how they make sense of and interpret instructional experiences. It serves as a way to see the classroom from children's eyes" (Dahl, 1995, p. 124). The question that arises is: "How can we see through the students' eyes and gain insight in how they perceive the learning environment?"

The main characteristics of modern education are operationalized in design principles for powerful learning environments. A fine-grained analysis of teachers' and students' perspectives on these characteristics of a learning environment can yield new insights into discrepancies between perspectives. These insights may help to find ways for improving the effectiveness of learning environments.

Powerful learning environments are aiming at the acquisition of high-quality knowledge, fostering problem-solving skills and self-directed learning skills, and stimulating the transferability of knowledge and skills. There is considerable agreement about the most important characteristics of powerful learning environments (see de Corte, Verschaffel, Entwistle, & van Merriënboer, 2003; Könings, Brand-Gruwel, & van Merriënboer, 2005, for an overview). First, learning tasks are complex, realistic, and challenging (van Merriënboer & Paas, 2003). Second, learning is not directed at reproducing knowledge, but at an active

process of sense-making of the subject matter and creating mental models, which can be reused to solve problems in new situations (Collis & Winnips, 2002; Moreno & Mayer, 1999). Third, new knowledge is integrated with prior knowledge and experiences of the student (Merrill, 2002) and the learning environment aims at integrated sets of learning goals, directed at the acquisition of knowledge, skills, and attitudes in an integrated way (van Merriënboer & Paas, 2003). Fourth, a self-directed and independent way of learning and thinking is stimulated by gradually transferring the responsibility for the learning processes from the teacher to the students themselves (Vermunt, 2003). Fifth, by inclusion of small group collaborative work, and ample opportunities for interaction, students have an active and constructive role in the learning process (van Merriënboer & Paas, 2003). Sixth, individual differences between students are taken into account. For instance, by allowing for deductive as well as inductive approaches to learning, and by supporting both inquisitory and expository approaches to learning (van Merriënboer & Kirschner, 2001). Seventh, learning goals and task demands are made clear to students because they direct learning strategies (Broekkamp, van Hout-Wolters, Rijlaarsdam, & van den Bergh, 2002). Eighth and last, teachers are available for help and support. Starting with explicit external regulation and support, the teaching process is directed to teach students how they can obtain control over their own learning processes (Vermunt & Verschaffel, 2000).

When we study perspectives of teachers and students on these eight different aspects of modern learning environments, three aspects need to be considered: perceptions, desires, and dissatisfaction. First, perceptions of a learning environment are important because, in general, it is known that perceptions trigger corresponding behavior (Bargh, Chen, & Burrows, 1996; Dijksterhuis & van Knippenberg, 1998). Students' perceptions of a learning environment influence their learning and study behavior, determine the nature and quality of learning processes, and eventually determine the learning outcomes (Elen & Lowyck, 1999; Entwistle & Tait, 1990). Differences between perceptions of teachers and students would thus imply that teachers' and students' behavior are likely to be incongruent and not directed at the same goals.

Second, desires play a role in the teaching-learning process. Students' desires with respect to the design of the environment are likely to influence learning as it has been found that students tend to hold on to their learning preferences and habits, and only use those elements of the learning environment that fit well in their habitual way of learning (Vermetten, Vermunt, & Lodewijks, 2002). Students learning behavior is even stronger related to their preferred learning environment than to the actual environment (Yuen-Yee & Watkins, 1994). For teachers, it has been shown that desires influence the way in which they design their education.

Conceptions of teaching influence teaching behavior (Trigwell, Prosser, & Waterhouse, 1999) and those behaviors are difficult to change because teachers may unconsciously persist in habitual teaching practices (Tigchelaar & Korthagen, 2004). Research of Könings, Brand-Gruwel, and van Merriënboer (in press) shows that even in case of an educational innovation teachers are faithful to their conceptions of teaching: their conceptions guided their teaching practices more strongly than the design principles advocated by the innovation. Conflicting desires of teachers and students may hamper the effective implementation of a learning environment and the effectiveness of teaching-learning processes taking place in the environment.

Third, dissatisfaction with the perceived learning environment may influence its effectiveness. Studies on the fit between person and environment have found that discrepancies between students' desires and the perceived opportunities in the environment cause a decrease in motivation and self-conceptions (see Eccles et al., 1993, for an overview). Especially, the increasing desire for independence and autonomy during the early adolescent years has negative motivational consequences, especially if the environment does not adapt to this growing developmental need. In contrast, harmony between person and environment, and optimally tuning person and environment to each other, results in positive experiences like self-efficacy beliefs, intrinsic interest, and task commitment (Renzulli & Dai, 2001). Furthermore, it has been shown that the congruence between the perceived and desired learning environment affects student achievements (Brown, 1978; Fraser & Fischer, 1983; Fraser & Rentoul, 1980). Both teachers and students prefer an environment that fits with their desires, but as incongruity has such far-reaching effects for students, teachers should be aware of their dissatisfaction. For those characteristics of the environment for which students' dissatisfaction is larger than teachers' dissatisfaction, an adjustment or redesign seems to be valuable.

Concluding, the current study investigates the perspectives of students and teachers on an innovative learning environment in Dutch secondary education, which is meant to be a powerful learning environment. Both students' and teachers' perceptions of the environment, their desires with respect to its design, and dissatisfaction with the current environment are examined in the light of the eight before-mentioned characteristics of powerful learning environments. The main research question is: How do students' and teachers' perspectives on a learning environment differ?

This question falls apart in three sub questions:

- How do students' and teachers' perceptions of the same learning environment differ?
- To what extent do students and teachers have the same or different desires with respect to the design of the environment?
- How does students' and teachers' dissatisfaction with the current learning environment differ?

6.2 Method

6.2.1 Participants

The participants were 994 students and 136 teachers from four schools for secondary education in the South of the Netherlands. Students were all 10th graders (mean age = 16.32 years, *SD* = .61), following either senior general secondary education (46.8%) or pre-university education (53.2%). The sample consisted of 52.4% girls and 47.6% boys. The participating teachers were all teaching 10th grade students. Their mean age was 44.43 years (*SD* = 9.71), having an average of 18.37 years (*SD* = 10.20) of teaching experience. The sample consisted of 44 female teachers (33.1%) and 89 male teachers (66.9%). Three teachers did not indicate their sex. The courses teachers taught were representative for the whole curriculum. All teachers and students took part in an innovative learning environment in Dutch secondary education. Students were not following courses from all participating teachers at their school and teachers were not necessarily teaching all students in the sample from their school.

6.2.2 Materials

6.2.2.1 The learning environment

The context of this study is a nation-wide innovation in Dutch secondary education, called the Second Phase (Ministerie van OCW, 2005; Stuurgroep Profiel Tweede Fase Voortgezet Onderwijs, 1995; Veugelers, de Jong, & Schellings, 2004). This learning environment requires students to acquire knowledge and skills in an independent way. Students learn in a self-directed way, with ample opportunities for collaborative learning. Teachers have more room to take individual differences between students into account than in the traditional classroom situation. The teacher also serves less in the role of instructor and more in the role of coach, who creates better opportunities for contact with students and between students. The learning process is not only directed to knowledge

acquisition, but also to the selection and processing of the vast amounts of information available today (i.e., information problem solving skills). Furthermore, learning contents are actualized and broadened, because building a broad general knowledge base is an important educational goal of the Second Phase. The thematic integration of different subject matter domains is emphasized. Courses are clustered in so-called 'profiles', such as Nature & Technology or Culture & Society. According to the educational designers of the learning environment this enables more integration of subject matter domains and leads to a better preparation for higher professional education and university. In addition to improved integration of subject matter domains, the coherence between knowledge and skills is emphasized and the practical application of knowledge and skills in real-life settings is stressed.

6.2.2.2 Inventory of Perceived Study Environment Extended (IPSEE)

The aim of the IPSEE is to measure students' perceptions of the current learning environment and their desires with regard to the design of an environment. The discrepancy between perception scores and desire scores is a measure for (dis)satisfaction with the current learning environment.

The IPSEE consists of 67 items, covering eight internally consistent scales (Cronbach's alpha coefficients ranging from .66 to .85, all but one above .70; see Könings, Brand-Gruwel, & van Merriënboer, 2007a) that are considered as characteristics of powerful learning environments. The first scale is *fascinating contents* and contains items about the extent to which the learning contents are interesting, challenging, and personally relevant for students. The second scale is *productive learning*, indicating little emphasis on the sole reproduction of learning contents. The third scale is *integration* and includes items about the integration of newly acquired knowledge with prior knowledge, the integration of different subject matter domains, and the integration of knowledge and skills. The fourth scale is *student autonomy* and measures the attention paid to students' self-directedness with regard to the content of learning, the way of learning, and the planning of time. The fifth scale is *interaction*, which incorporates collaboration with peers and amount of interaction with the teacher. The sixth scale is *differentiation*, which inquires after opportunities for students to choose and perform different learning tasks, solve problems in different ways, and use different learning materials. The seventh scale is *clarity of goals* and includes items about the clarity of instructional goals and task demands. The eighth and last scale is *personalization* and measures the availability of support from teachers.

Each of the items of the IPSEE contains a statement about one of the characteristics of a learning environment and two questions. For example:

All students do the same work at the same moment.

A. This happens
B. I would like this to happen

The questions are rated on a six-point scale, ranging from totally disagree (score = 1) to totally agree (score = 6). Scores on question A give a measure of perceptions of the actual learning environment. Scores on question B give a measure of desires with regard to a learning environment. The discrepancy (i.e., absolute difference) between the scores on question A and question B is defined as the measure of (dis)satisfaction with the current learning environment. Large discrepancies between perceptions and desires indicate high dissatisfaction; small discrepancies between perceptions and desires indicate low dissatisfaction. It should be noted that low dissatisfaction can also be interpreted as high satisfaction, but only the term dissatisfaction is used to enable a univocal interpretation of results.

6.2.2.3 Inventory of Perceived Study Environment Extended-Teacher version (IPSEE-T)

This questionnaire is a parallel version of the IPSEE, consisting of 67 items divided over the eight scales in the same way as for the IPSEE. Some items are reformulated to reflect the teachers' perspective. The questionnaire measures teachers' perceptions and desires with respect to a learning environment. Together these measures give insight in teachers' dissatisfaction with the current learning environment, by looking at the discrepancies between perceptions and desires. Internal consistencies of all scales of the IPSEE-T are acceptable (Cronbach's alpha coefficients ranging from .64 to .87, all but two above .70; see Könings, Brand-Gruwel, & van Merriënboer, in press).

6.2.3 Procedure

The students filled out the IPSEE during regular school hours. Preceding the completion of the questionnaire, the experimenter gave oral information about its goal and contents and about the procedure. Students first had to fill out their name, age, year group, and school. The IPSEE takes 30 - 40 minutes to complete. Because data collection took place during regular school hours, the response rate was very high: all students that were present in a particular classroom at the time of data collection filled out the questionnaire.

All teachers who were teaching 10th graders at the participating school received a written invitation, accompanied by the IPSEE-T, to take part in the study. The first page of the questionnaire contained a description of the aim and the contents of the questionnaire and instructions for scoring the items. Teachers first answered

questions about their age, the number of years of teaching experience, sex, and the courses they were teaching. They could fill out the questionnaire at any moment and place they wanted. In total 136 of the 213 teachers returned their questionnaire (i.e., 63.8%).

6.2.4 Data analysis

To compute the mean scores for each scale of the IPSEE/IPSEE-T, a maximum of 25% of missing values was accepted. So, if at least 75% of the items at scale level was filled out, these items were used to compute the mean score of that scale. For each scale, a mean score could be calculated for at least 95% of the students and for at least 85% of the teachers. Dissatisfaction scores of the IPSEE were computed as the discrepancy (i.e., absolute difference) between desire scores and perception scores.

Mixed model analyses were conducted to test the differences between students' and teachers' scores. This type of analyses takes the nested nature of the data into account, whereas *t* tests would discard this. Students are grouped in classes with an *n* of about 25, which may cause interdependency in data of students from the same class. In mixed model analyses participants are considered as nested in classes by including *class* as a random factor in the model. Although classes are further nested within schools, *school* is not included as an additional random factor in the model, because the number of sampled schools is too small to permit inference to the population of schools. Instead, school is included as a fixed factor to correct for the correlation in the data due to nesting within schools. School and class were only included in the model if their effect was significant at a level of $p < .10$.

In mixed model analyses it is not possible to compare two scores directly. To investigate whether perception scores of students and teachers differ from each other, a difference score was computed on all scales for each student. This difference score is an indicator of the size of the difference between students' and teachers' scores. It is computed as follows: the student's perception score on a scale minus the mean perception score of all teachers of the particular school on that scale. Difference scores were computed in the same way for desire scores and dissatisfaction scores. A difference score of zero indicates no difference between students' and teachers' scores, whereas a high difference score indicates a large disagreement between students' and teachers' scores. To test whether difference scores on a scale deviate from zero, a simple model was build, including an intercept, class, and school. School and/or class were subsequently removed if $p > .10$. The significance of the intercept, now, indicates whether students' and teachers' scores differ significantly from each other. These analyses were

conducted for all scales of the IPSEE for perceptions, desires, and dissatisfaction. The following section only reports results significant at a level of $p < .01$.

6.3 Results

To answer the research question – How do students' and teachers' perspectives on their learning environment differ? – perception scores of students and teachers are reported, as well as their desire and dissatisfaction scores. Mixed model analyses are conducted to test if differences between students' and teachers' scores are statistically significant.

6.3.1 Perception scores

The upper part of Table 6.1 presents means and standard deviations for perception scores of both students and teachers, and for the difference scores. Table 6.2 presents the results of mixed model analyses testing if difference scores significantly deviate from zero, which would indicate perfect agreement between scores of students and teachers. The difference scores were significantly different from zero on seven out of the eight scales. The values of the intercept were negative: perception scores of teachers were higher than students' scores. Only on the scale student autonomy, students' and teachers' scores did not differ.

As can be seen in Figure 6.1, the difference between students' and teachers' scores was largest for the scales clarity of goals, personalization, fascinating contents, integration, and productive learning (for all scales $d > .80$). On the scales fascinating contents and productive learning, students' scores were below the neutral score of 3.5, whereas teachers' scores were above this neutral score. Thus, students reported they did not convincingly perceive these aspects to be present in the learning environment ($F(1, 980) = 152.29$, $p < .01$ for fascinating content; $F(1, 39.09) = 80.53$, $p < .01$ for productive learning), but teachers reported they did perceive these aspects to be present (in order, $t(114) = 10.09$, $p < .01$; $t(124) = 3.29$, $p < .01$). Perception scores on the scales student autonomy and differentiation were below the neutral score of 3.5 for both students and teachers (students: $F(1, 40.36) = 34.99$, $p < .01$ for student autonomy; $F(1, 982.00) = 104.54$, $p < .01$ for differentiation; teachers: $t(131) = 3.15$, $p < .01$ for student autonomy; $t(131) = 2.88$, $p < .01$ for differentiation). This indicates that these characteristics of a powerful learning environment were not convincingly perceived to be present in daily educational praxis.

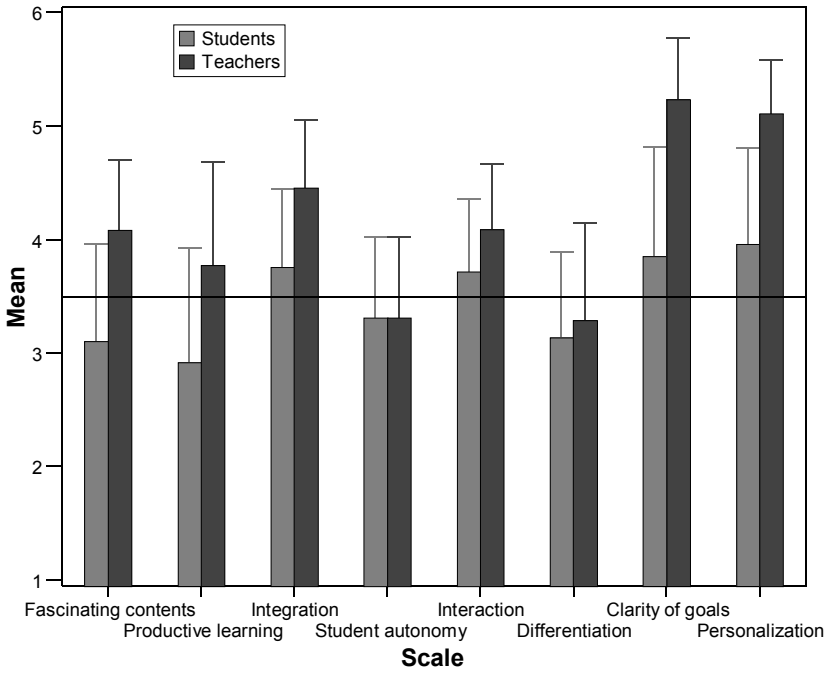

Figure 6.1 Mean scores and standard deviations of the perceived learning environment, according to students and teachers

Table 6.1 Means and standard deviations of students' and teachers' perception scores, desire scores, and dissatisfaction scores, as well as the difference scores

	Students		Teachers		Difference scores	
Scale	***M***	***SD***	***M***	***SD***	***M***	***SD***
Perception scores						
Fascinating contents	3.10	.86	4.08	.62	-.97	.86
Productive learning	2.91	1.02	3.77	.92	-.84	.97
Integration	3.75	.69	4.45	.60	-.68	.69
Student autonomy	3.31	.71	3.31	.71	.03	.75
Interaction	3.71	.65	4.09	.57	-.35	.67
Differentiation	3.13	.76	3.28	.86	-.12	.76
Clarity of goals	3.85	.96	5.24	.54	-1.39	.96
Personalization	3.96	.85	5.11	.47	-1.13	.86
Desire scores						
Fascinating contents	4.86	.64	5.21	.48	-.35	.64
Productive learning	3.86	1.00	3.67	1.08	.23	1.01
Integration	4.60	.55	5.07	.50	-.47	.56
Student autonomy	4.57	.60	3.78	.77	.80	.62
Interaction	4.57	.59	4.85	.52	-.26	.59
Differentiation	3.22	.85	3.44	.87	-.20	.85
Clarity of goals	5.31	.56	5.44	.53	-.13	.56
Personalization	4.99	.60	5.35	.44	-.34	.61
Dissatisfaction scores						
Fascinating contents	1.76	.98	1.12	.61	.65	1.00
Productive learning	1.23	1.01	.30	.38	.92	1.01
Integration	.89	.71	.65	.46	.23	.72
Student autonomy	1.32	.89	.55	.52	.77	.90
Interaction	.90	.63	.80	.51	.09	.65
Differentiation	.65	.65	.39	.48	.26	.65
Clarity of goals	1.49	1.05	.24	.34	1.26	1.05
Personalization	1.06	.84	.28	.33	.78	.84

Table 6.2 Results of mixed model analyses on the differences between students' and teachers' scores with respect to perceptions, desires, and dissatisfaction, corrected for class and school effects (if $p < .10$)

Scale	*F*	*df*	*B*	*SE B*	β	*d*
Perception scores						
Fascinating contents[s]	801.74	1, 980	-1.12	.12	-.11	1.13
Productive learning[cs]	142.04	1, 39.09	-1.10	.24	-.27	.87
Integration[s]	669.86	1, 949	-.94	.09	-.30	.99
Student autonomy[cs]	n.s.					.04
Interaction[s]	308.54	1, 982	-.86	.09	-.69	.52
Differentiation[s]	19.66	1, 982	-.27	.10	-.20	.16
Clarity of goals[s]	1213.93	1, 987	-1.49	.13	-.03	1.45
Personalization[s]	1237.68	1, 986	-1.61	.11	-.46	1.31
Desire scores						
Fascinating contents[s]	170.86	1, 970	-.28	.09	.12	.55
Productive learning[cs]	17.82	1, 36.20	.06	.19	-.17	.23
Integration[cs]	285.11	1, 41.03	-.59	.10	-.22	.84
Student autonomy[s]	756.76	1, 977	.52	.08	-.45	1.29
Interaction	199.07	1, 974	-.26	.02	.00	.44
Differentiation[cs]	24.61	1, 37.38	-.36	.16	-.19	.24
Clarity of goals[c]	25.37	1, 45.60	-.13	.03	.01	.23
Personalization[cs]	179.98	1, 36.93	-.65	.10	-.51	.56
Dissatisfaction scores						
Fascinating contents[s]	268.30	1, 969	.78	.13	.13	.65
Productive learning[s]	576.92	1, 970	1.37	.13	.45	.91
Integration[s]	62.32	1, 936	.31	.10	.11	.32
Student autonomy[s]	414.41	1, 973	.83	.12	.06	.86
Interaction[s]	70.54	1, 970	.65	.09	.87	.14
Differentiation[s]	90.40	1, 958	.22	.09	-.06	.04
Clarity of goals	1434.71	1, 985	1.26	.03	.00	1.20
Personalization	849.82	1, 982	.78	.03	.00	.93

Note. corrected for class effects. corrected for school effects. Cohen's *d* is based on uncorrected values.

6.3.2 Desire scores

The middle part of Table 6.1 presents the means and standard deviations of the desire scores of students and teachers, and the associated difference scores. Mixed model analyses (see middle part of Table 6.2) show that students' and teachers' desire scores for the design of the learning environment differed on all scales. On six out of the eight scales the value of the intercept was negative, indicating that teachers' desire scores were higher than students' scores. On two scales the intercept was positive: teachers' desire scores were lower than students' desire scores for productive learning and student autonomy.

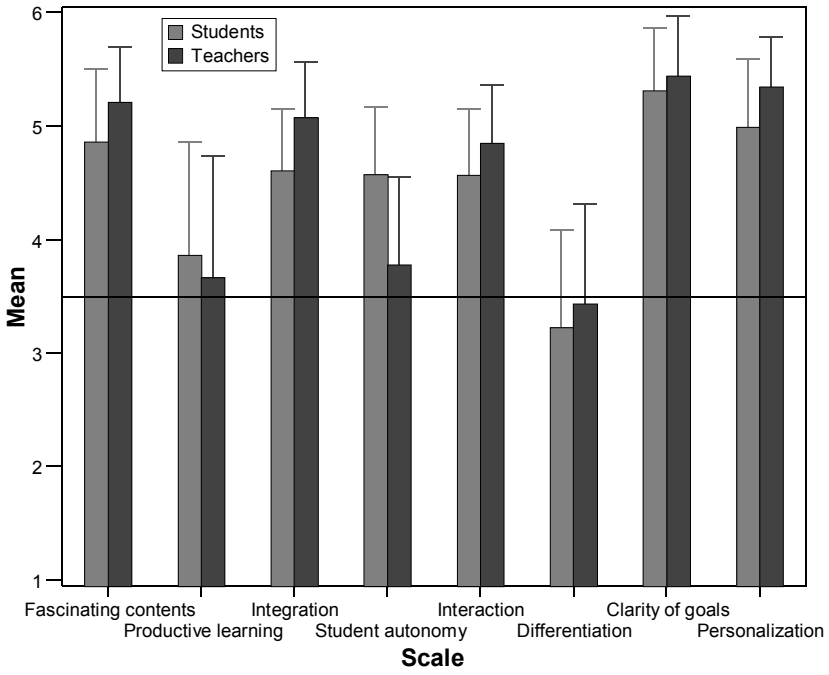

Figure 6.2 Mean scores and standard deviations of the desired learning environment, according to students and teachers**.**

From Figure 6.2 it can be seen that teachers' desires exceeded students' desires for the scales fascinating contents, integration, interaction, differentiation, clarity of goals, and personalization. The effect size was especially large on the scale integration (d = .84). On two scales students had higher desire scores than teachers. First, students preferred more emphasis on productive learning (i.e., less emphasis on reproduction of knowledge) than teachers did. Second, students desired much more student autonomy than teachers considered as desirable. Notably, this was the scale with the largest difference between students' and teachers' desire scores (d = 1.29). Furthermore, Figure 6.2 shows that for students all desire scores – except for differentiation – were above the neutral score of 3.5 (for all F tests $p < .01$). For teachers, the desire scores were above this neutral score on six scales (for all t tests $p < .01$). The desire scores for productive learning and differentiation did not differ

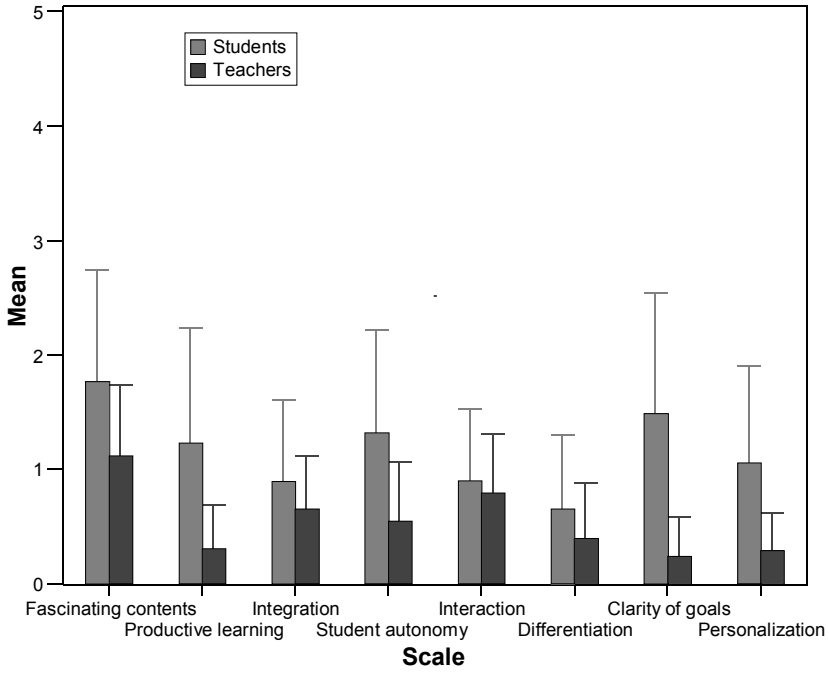

Figure 6.3 Mean scores and standard deviations of the dissatisfaction with the current learning environment, according to students and teachers.

from the neutral score. Thus, both students and teachers considered many characteristics of powerful learning environments as desirable characteristics of their own learning environment.

6.3.3 Dissatisfaction scores

The bottom part of Table 6.1 presents the means and standard deviations of students' and teachers' dissatisfaction scores, and the associated difference scores. Mixed model analyses show that students' and teachers' dissatisfaction with the current learning environment differed on all scales (see bottom part of Table 6.2). The value of the intercept was always positive: students' dissatisfaction scores were consistently higher than teachers' dissatisfaction scores.

As depicted in Figure 6.3, the results show that students perceived the learning environment as more incongruent with their desires than teachers did. This holds

for all scales, but the difference in dissatisfaction scores between students and teachers was largest for the scales clarity of goals, productive learning, personalization, student autonomy (for these scales $d > .80$), and fascinating contents ($d > .60$). Students were far more dissatisfied with their learning environment than teachers.

6.4 Conclusions and discussion

This study measured students' and teachers' perspectives on eight characteristics of a learning environment. We investigated to which extent students and teachers perceive their current learning environment as a powerful one. Also, their desires with respect to the learning environment were studied. The discrepancy between perceptions and desires provides insight in students' and teachers' dissatisfaction with particular characteristics of the current environment.

Teachers' perceptions are higher than students' perceptions for seven scales of the IPSEE. Teachers have much more favorable perceptions than students for the scales clarity of goals, personalization, fascinating contents, integration, and productive learning; there is no difference between students and teachers for the scale student autonomy. In general, teachers also have higher desires for the design of the learning environment than students. Students' desires only exceed teachers' desires for the scales productive learning and, especially, student autonomy. It is remarkable that students have a stronger desire for student autonomy than teachers, because it is an important element of the Second Phase. Both students and teachers perceived it only to a limited extent in the current learning environment. Possibly, teachers are reluctant to implement student autonomy because they do not find it desirable. Most other differences in desires are rather small. Finally, students are more dissatisfied than teachers, that is, their perceptions of the environment are more incongruent with their desires, especially for clarity of goals, productive learning, personalization, student autonomy, and fascinating contents. Because dissatisfaction jeopardizes student motivation (Eccles et al., 1993), our results not only stress the need for interventions reducing incongruity between students' and teachers' perspectives, but also interventions decreasing student dissatisfaction.

As a limitation of our study, it was not possible to couple the data of students directly to the data of those teachers who taught them. This was now limited to coupling students and teachers from the same school. Furthermore, students filled out the questionnaire for the overall learning environment (i.e., all lessons they are taking in tenth grade), not for the specific environment created by one teacher (i.e., the lessons this teacher is giving). In future research, it would be beneficial to make

a more direct coupling between students and teachers and between perspectives and specific lessons.

Summarizing, this study reveals that the perspectives of students and teachers are different from each other, both with regard to perceptions, desires, and dissatisfaction. There are at least three possible explanations for this: the actor-observer bias, differences in control, and differences in object of reflection. The *actor-observer bias* implies that people underrate situational factors when trying to understand behavior of others but, in contrast, overrate situational factors when attributing causes to own behaviors (Jones & Nisbett, 1972). This is also a well-known phenomenon in educational contexts (Guttmann, 1982). To preserve their self-image, teachers are inclined to project the responsibility for problems onto their students and away from themselves and the learning environment (Medway, 1979). As teachers create the learning environment, the self-protection bias may cause them to perceive the environment more favorable and to be less dissatisfied with it. Like teachers, students prevent damage of their self-image by attributing causes of problems rather to a teacher or to the learning environment than to themselves. The bias may cause them to perceive the environment less favorable and to be more dissatisfied with it.

Other explanations focus on differences in control and differences in objects of reflection. As already indicated above, there is a clear difference between students and teachers in the *amount of control* they have over the environment. Teachers have much more control over the design of the learning environment and what is happening in the environment than students. Thus, they can take the opportunity to set up the environment according to their desires, which will result in lower dissatisfaction. Students have only limited opportunities to change the environment according to their desires, which might result in higher dissatisfaction. Finally, students and teachers may *reflect on different objects* in the environment. It has been found that teachers regularly reflect on the desired manifestation of their teaching, but rarely on the actual educational reality and the effects of their teaching behaviors. Thus, their reflection is limited to the use of educational methods and strategies in their lessons (Ponte, Ax, Beijaard, & Wubbels, 2004), yielding a perspective that is a (too) positive reflection of reality. Students, on the other hand, are likely to reflect on the actual educational reality, yielding a less positive perspective.

The existence of different perspectives between students and teachers has important implications, since perspectives direct behavior. As the result of different perspectives, students' learning strategies and teachers' instructional strategies may be in disharmony. Small differences between learning strategies and instructional strategies challenge students to increase their learning and thinking skills (Vermunt

& Verloop, 1999). Such "constructive frictions", however, may easily evolve into "destructive frictions" if the differences between learning and instructional strategies become too large. Then, the frictions decrease students' learning and thinking skills. From the field of cybernetics, it is known that large discrepancies between perceptions and desires (i.e., dissatisfaction) influence subsequent behavior and cause negativism and a decline of motivation, especially if reduction of the discrepancy is impossible (Carver & Scheier, 1998). Teachers should thus recognize students' perspectives to prevent possible negative effects on their behavior, as students themselves have little or no opportunities to reduce their dissatisfaction by adjusting the learning environment in line with their desires.

A practical implication of this study is that, in daily school practice, more attention should be paid to the identification of perspectives of teachers and students as well as differences between them. Although teachers' perceptions are mostly more positive than students' perceptions, it is important to realize that perceptions may strongly vary between individuals, that is, both between teachers and between students. Previous research found that students' perceptions are related to learning-related characteristics: students with higher personal interest and constructivist conceptions of learning report more positive perceptions and are more satisfied with their learning environment. Students with problems with motivation and concentration and/or a lack of regulation strategies report more negative perceptions and dissatisfaction (Könings, Brand-Gruwel, & van Merriënboer, 2007a). For teachers, it has been found that teachers with a conceptual-change or student-focused approach to teaching perceive a learning environment as *more* powerful than teachers with an information-transmission or teacher-focused approach (Könings, Brand-Gruwel, & van Merriënboer, in press). The combination of these findings suggest that the largest differences in perspectives will exist between teachers with a conceptual-change or student-focused approach to teaching (highest perceptions), and students with problems with motivation and concentration and/or a lack of regulation strategies (lowest perceptions). For this combination, interventions to decrease the differences in perspectives are most urgently needed.

A first step to take students' perspectives into account would be explicitly informing teachers about students' perceptions, desires, and dissatisfaction. This might help teachers to see the learning environment through the eyes of their students and, possibly, better understand their behavior. However, more is needed to change the learning environment in such a way that differences between perspectives of students and teachers decrease. The effects of sole student evaluations on the quality of the learning environment are rather limited (Marsh & Dunkin, 1992). The effects improve when student evaluations are combined with

educational advice (Marsh & Roche, 1997), but teachers' reactions on student evaluations also depend on their evaluation of both the environment and their own functioning in this environment (Pambookian, 1976). Teachers who negatively evaluate themselves and are also negatively evaluated by their students do not improve their teaching practices, because student evaluations do not create much discomfort for them (although improvement is needed). In this respect, Pambookian stressed the importance of cognitive dissonance theory (Festinger, 1957). Teachers who are confronted with discrepancies between self-perceptions and student perceptions may reduce cognitive dissonance by rejecting the feedback as invaluable or by changing their own conceptions, rather than by changing their teaching practices.

Providing teachers with information on student perspectives is thus no guarantee they will change the learning environment or their teaching strategies. But even if it were successful, students would still not have any direct control over the learning environment or an opportunity to participate in its (re)design. Because the congruence between designers' and users' perception of a system is of utmost importance (Norman, 1986, 1988), we think that a true discourse between teachers and students is needed. In a dialogue, sharing of meaning is brought about by examining own opinions and sharing them with others, creating more coherence in thinking (Jenlink & Carr, 1996). By getting students involved in a discussion about (re)designing the learning environment, differences in perspectives could really be taken into account. Further research is needed to explore how a (productive) discourse between teachers and students could best be arranged, and to evaluate the effects of such a discourse on perspectives of teachers and students.

To conclude, this article shows that teachers and students have very different perspectives on their learning environment. Teachers have more favorable perceptions, higher desires, and are more satisfied than students. So, they see through more optimistic glasses than students do. There exists an undesirable incongruity between the two groups most directly involved in the teaching-learning process, with important implications because it negatively affects student's study behavior and learning outcomes. Starting a discourse between students and teachers is expected to be a useful intervention to diminish differences in perspectives. This study clearly indicates which characteristics of the learning environment are seen as most different through students' and teachers' glasses. Effective interventions should give priority to these topics.

7

Participatory design in secondary education: Is it a good idea? Students' and teachers' opinions on its desirability and feasibility

This chapter is published as:
Könings, K. D., van Zundert, M. J., Brand-Gruwel, S., & van Merriënboer, J. J. G. (in press). Participatory design in secondary education: Is it a good idea? Students' and teachers' opinions on its desirability and feasibility *Educational Studies*.

Abstract. Research has shown the importance of students' perceptions of a learning environment and the existence of discrepancies between students' and teachers' perceptions. Participatory design could be a helpful strategy to reduce such discrepancies and eventually improve the design of learning environment, as it has proven to be effective to optimize design in other domains. The current study investigated the desirability and feasibility of possible use of participatory design in education. Students and teachers in secondary education were interviewed about their opinions on the idea of participatory design of a learning environment. Both students and teachers displayed predominantly positive opinions towards possibly engaging in participatory design, supporting its desirability and feasibility. Practical suggestions for implementation are included.

7.1 Introduction

In education it is common practice for educational designers and teachers to create learning environments that are expected to be as beneficial as possible for students, without any interference of its users (i.e., students). In fact, students are often seen as consumers who do not have any influence on the design of the learning environment and teaching practices (Cook-Sather, 2001). This is remarkable and seems rather problematic regarding the fact that especially students' perceptions of a learning environment determine their learning behavior (Elen & Lowyck, 1999; Elen, Lowyck, & Bamps, 1998; Entwistle, 1991). Moreover, striking differences exist between students' and teachers' perceptions of a learning environment (Doppelt, 2004; Könings, Brand-Gruwel, & van Merriënboer, 2007b; Winne & Marx, 1982). Participatory design could help in taking into account students' perceptions of a learning environment, and offer a remedy for existing discrepancies between the perceptions of the students and the teachers. The current study explores the possibility of future implementation of participatory design in an educational context. This is done by investigating both teachers' and students' opinions on the feasibility and desirability of discussing and collaboratively designing education.

The perceptions of students are of central importance for effective learning. Foremost, their perceptions of the learning environment rather than the characteristics of the learning environment per se do appear to determine the effectiveness of their learning (Elen & Lowyck, 1999; Elen, Lowyck, & Bamps, 1998; Entwistle, 1991). Although a learning environment may have high potential to reach certain educational goals, its effectiveness may remain uncertain because this is greatly influenced by students' perceptions of this environment. The perceptions determine subsequent learning and study behavior, which affect learning outcomes, and thus determine the effectiveness of the learning environment (ibid). Therefore, it is very important to give students' perceptions a clear position in the design process of a learning environment (see also Könings, Brand-Gruwel, & van Merriënboer, 2005).

The need to pay more attention to the students' perspective on educational design is further strengthened by research showing that striking differences do exist between students' and teachers' perceptions. In 1982, Winne and Marx already described the differences between teachers' instructional stimuli, intended to evoke particular cognitive processes in students, and students' perceptions of these stimuli. Discrepancies between teachers and students are also shown in a study on perceptions of the impact of several aspects of a learning environment on learning outcomes (Doppelt, 2004). In this study, students considered, for instance,

classroom discussions to be the second most important learning environment characteristic to influence learning outcomes, while teachers placed this only on rank six of most important characteristics. A recent study of Könings, Brand-Gruwel, and van Merriënboer (2007b) has also shown significant differences between students' and teachers' perceptions of a learning environment in Dutch secondary education. It has shown students to have a more negative view on the learning environment than teachers, who were more positive. Students, for example, considered learning goals as less clear and rated subject matter as less interesting than teachers.

If users of an intervention perceive it differently than the designers who developed the intervention do, this is likely to result in a decline of the effectiveness of the intervention (Bartholomew et al., 2001). In an educational context, this would mean that if students perceive particular aspects of the learning environment differently than teachers, the effectiveness of the learning environment might be reduced. As research has shown the existence of such discrepancies between students' and teachers' perceptions, there is a clear need to invest effort for finding an effective method for reducing these discrepancies. A convincing solution or a useful method for reducing existing discrepancies has not yet been found. There are two lines of research that, at first sight, might contribute to the reduction of discrepancies and the consideration of students' perceptions: (1) matching studies, and (2) student evaluations as feedback for teachers.

First, in matching studies it is the goal to improve learning effectiveness by matching instruction to the individual characteristics and the needs of the student. As shown by Cunningham (1975), student-teacher pairing can for instance have positive effects on students' task orientation. Limited effects, however, are found in a study using students' cognitive style for matching (Packer & Bain, 1978). Interestingly, Trout and Crawley (1985) found a non-monotonic relation between the matching variables (i.e., need level, cognitive style, and locus of control) and outcome variables (i.e., attitude and achievement outcomes). "As compatibility became more complete student attitudes and achievement improved to a point. After some intermediate degree of compatibility was reached, further compatibility between learning needs and instruction only resulted in a decline in attitude and achievement" (Trout & Crawley, 1985, p. 415). More recently, Saracho (2003) concluded that matching practices are complex and experimental studies yielded conflicting results that restrict educationalists from generalization. She, however, stressed the persisting need to adapt instruction to students' needs.

A second line of research concentrates on informing teachers about students' evaluations of the learning environment (as a form of feedback). Research has shown that the agreement between teachers' self-perceptions of their own teaching

effectiveness and students' evaluation of actual teaching effectiveness is rather low, in absence of formal and systematic feedback from students (Roche & Marsh, 2000). After receiving student feedback, teachers' self-perceptions are correlated higher with student ratings, showing that teachers adjust their self-perceptions in response to feedback. However, delivering teachers negative feedback without providing help to improve teaching practices might be ineffective (ibid). Pambookian (1976) stressed the importance of cognitive dissonance theory (Festinger, 1957) in this context. Teachers who are confronted with discrepancies between self-perceptions and students' perceptions may reduce these discrepancies (i.e., cognitive dissonance) by rejecting the feedback as invaluable, or by changing own conceptions instead of changing instruction. In that respect, student evaluation of education is not a promising strategy for accounting more intensively for students' perceptions of a learning environment, and for reducing discrepancies between students' and teachers' perceptions.

Both matching approaches and the use of student evaluations have severe limitations. An alternative tool or strategy is needed to take into account students' perceptions of a learning environment and to bridge the gap between teachers' and students' perceptions. Participatory design can, possibly, offer a valuable approach.

Participatory design aims at active participation of users in the design process and in decisions that will affect themselves (Kensing & Blomberg, 1998; Mankin, Cohen, & Bikson, 1997). In many areas different from education, it is common practice to involve potential users of products and systems in their design, in order to produce a more effective and usable product or system. For example, in the field of cognitive ergonomics and health promotion the benefits of user participation are already demonstrated (Bartholomew, Parcel, Kok, & Gottlieb, 2001; Meister & Enderwick, 2002). A participatory (re)design process constitutes an analysis of needs and possibilities according to designers and the users, a collective generation of ideas for change, project management, and planning for implementation (Kensing, Simonsen, & Bødker, 1998). Designers need to gain more insight in the actual use of a system and users need to be informed by designers about possibly alternative designs. Relations should not be hierarchical or bureaucratic, but democratic, in order to spread responsibility for the process and the product, and, eventually, make successful participation possible (Mumford, 1997; Schweitz & Granata, 1997).

There are some claims in educational literature that support the investigation of new strategies to have students involved in the design process. Markopoulos and Bekker (2003) stated that educational design should be driven by knowledge of the students, and that they should not only be involved as users, testers and informants but as real design partners. Students are shrewd observers and possess valuable

knowledge about learning and teaching (Lincoln, 1995). Schools and teachers should hear students' voices, which requires a major shift in relations and in ways of thinking and, also, requires to trust students having relevant knowledge (Cook-Sather, 2002). Besides, students should be stimulated to think metacognitively and critically about their own perceptions of a learning environment, to be more engaged, and to feel more responsible for their education (ibid). Conversation between teachers and students is crucial for initiating changes in education. By conversation it is possible to create coherence in thinking (Jenlink & Carr, 1996). In a dialogue conversation, sharing of meaning is brought about by examination of individual opinions and sharing them with others. Participants become aware of the diversity of opinions and start creating new assumptions and more common opinions, which, eventually, lead to collective thoughts about educational design and possible changes in it.

Thus, educational literature offers some claims that participatory design might be a helpful strategy to deal with students' and teachers' differing perceptions of the effective characteristics of a learning environment and to reduce these discrepancies in perceptions. However, empirical findings supporting this claim are yet missing. The main goal of the current study is to find out how teachers and students think about possible use of participatory design in educational context. By investigating their opinions on the idea of participatory design *before* actually implementing it, we hope to improve the chance on successful future implementation of it. While the background of the current study is situated in discrepancies between students' and teachers' perceptions of a learning environment, the current study will, first of all, investigate the causes students and teachers give for these discrepancies. Additionally, students' and teachers' opinions will be examined on the desirability and feasibility of potential use of participatory design in education, as a strategy for taking students' perceptions into account and as a possible aid to bridge the gap between students' and teachers' perceptions. The study will investigate whether and in which ways teachers and students would be willing to engage in the participatory (re)design of their learning environment.

Related to these research questions, it is important to acknowledge that there is a great deal of variability among perceptions that different students have of the same learning environment (see, e.g., Könings, Brand-Gruwel, & van Merriënboer, 2007a). The same holds for teachers. The study mentioned earlier has shown that, on the one hand, student perceptions are generally lower (i.e. more negative) than teacher perceptions but, on the other hand, both students' perceptions and teachers' perceptions greatly vary between relatively low and relatively high. Looking at discrepancies between students' and teachers' perceptions, this implies that the

largest discrepancy exists between low-perception students and high-perception teachers. For them the greatest need exists for reducing discrepancies, which can possibly be achieved by means of participatory design. However, it is important to know whether a possible implementation of participatory design has to be adapted to these different types of students and teachers. Therefore, differences in opinions on the idea of participatory design between low and high-perception participants will also be investigated in the current study. In sum, the current study will answer the following research questions:

- Which causes do students and teachers themselves suggest for the differences in their perceptions of the learning environment?
- What are students' and teachers' opinions on possible use of participatory design in education, that is, involving students in (re)designing the learning environment in collaboration with teachers?
- What preferences do students and teachers have about the way participatory design can implemented in educational practice?
- Do opinions on participatory design differ between students who have high and low perceptions of the learning environment, as well as between high and low-perception teachers?

7.2 Method

7.2.1 Participants

The study was conducted at senior general secondary education and pre-university education departments of two schools for secondary education in the Netherlands. In total, 24 tenth-grade students and 12 teachers teaching tenth-graders were interviewed. Students were sampled on basis of data of a study by Könings, Brand-Gruwel, and van Merriënboer (2006). In this questionnaire study, students' perceptions about mathematics education and Dutch language education were measured with a 5-point Likert scale. The sample consisted of 12 students who had relative high (i.e., positive) perceptions of the learning environment for mathematics education or for Dutch language education (called high-perception students; $M = 4.41$; $SD = .34$). Another 12 students were selected because they had relative low (i.e., negative) perceptions about the learning environment for mathematics education or for Dutch language education (called low-perception students; $M = 2.60$; $SD = .56$). Half of the participants followed senior general education and half of them attended pre-university education. Both genders were equally represented. The mean age of the students was 16 ½ years ($SD = .7$).

Teachers were sampled on basis of their previously measured perceptions of the learning environment as well (Könings, Brand-Gruwel, & van Merriënboer, in press). The sample consisted of six teachers who had relative high perceptions of the learning environment as measured with a 5-point Likert scale (M = 4.63; SD = .35), and three teachers who had relative low perceptions of the learning environment (M = 3.83; SD = .21). The teachers (3 female, 9 male, with a mean age of 47 years (SD = 9) were teaching language courses (N = 4), science courses (N = 4), and humanities, such as history and geography (N = 4). On average, they had 23 years of teaching experience (SD = 10). Students and teachers were sampled, separately, on basis of data from previous research. Teachers were not necessarily teaching the students in this sample.

7.2.2 Materials

7.2.2.1 Student interview scheme

Student interviews contained 12 main questions (see Table 7.1). Each interview started with general questions concerning opinions on causes of the striking differences between students' and teachers' perceptions of learning environments. Then, students were asked how they would feel about collaboration with teachers in order to redesign their learning environment. Also, suggestions about how such collaboration could take place were inquired. Students were asked whether they would especially prefer implementing participatory design in specific (types of) courses and whether they think participatory design would be feasible and desirable for either mathematics or Dutch language education, in accordance with the questionnaire they filled out during the course-specific previous study (Könings, Brand-Gruwel, & van Merriënboer, 2006). For each interview question, additional sub questions were available in case students did not know what to answer or the discussion was not as elaborate as was desired by the experimenter.

7.2.2.2 Teacher interview scheme

Teacher interviews contained 11 questions, identical to the questions from the student interview except for the two course-specific questions, which were not relevant to the teachers and therefore were left out. One additional question was posed to teachers concerning the involvement of low-perception students in participatory design activities. Earlier research (Könings, Brand-Gruwel, & van Merriënboer, 2007a) showed that less motivated students often have low perceptions of a learning environment. Teachers were asked their opinion on the feasibility and desirability of involving these less motivated, low-perception

Table 7.1 Interview questions and interrater reliability of the coding system per question

	Interview question	Kappa
1	Why do you think that in general, students perceive education less positive than teachers?	.89
2	Does the student convey educational ideas to teachers?	.90
3	In your school, do students and teachers collaborate about educational design?	.89
4	How would you feel about engaging in participatory design of education yourself?	1.00
5	How do you think other students/teachers would feel about engaging in participatory design?	1.00
6	How do you think teachers/students would feel about engaging in participatory design?	.73
7	Which educational topics would you like to discuss when it comes to participatory design?	.77
8	When it comes to participatory design, which organizational format would you prefer?	.89
9	How often would you like the participation to take place?	1.00
10	If you participated, with which kind of teacher/students would you prefer to cooperate?	.83
11a	Research showed that especially students, who are less motivated for learning, perceive the learning environment more negative. Do you think it is valuable and feasible to brainstorm/cooperate with these students about improvement of the learning environment?	.84
11b	For which courses would you prefer to cooperate with teachers?	1.00
12	Do you think it would be possible to practice participatory design for mathematics/ Dutch language education?	1.00

Note. Question 11a is only used in teacher interviews. Question 11b and 12 are only used in student interviews.

students. For each interview question additional sub questions for making things more explicit and for elaboration were available.

7.2.2.3 Coding scheme for analyzing the interview data

A coding scheme was developed for labeling the data. The typed-out answers to the interviews were categorized with this coding scheme, which contained 61 labels in total for 13 interview questions (10 identical questions for students and teachers; 2 questions for students only, and 1 question for teachers only). The labels were developed on the basis of a literature study (top-down) as well as on the basis of the data themselves (bottom-up). In several iterations the labels were reformulated and refined until the interrater reliability was acceptable. The interrater reliability of the coding scheme was established by computing Cohen's Kappa for each interview question (see Table 7.1): six Kappas were between .90 and 1.00, five Kappas were between .80 and .90, and two Kappas were between .70 and .80. A description of the meaning of each label can be found in the Appendix. For example, when asked if students convey their educational ideas to teachers, one

response category (label) included ‘opportunity’. A precise description of ‘opportunity’ is: ’The teacher does not ask students directly about their ideas related to education, or does not provide the opportunity for students to give their opinion’.

7.2.3 Procedure

All participants were individually interviewed by the same experimenter, who did not have a working relation with the participating schools. After emphasizing that all information acquired during the interview would be handled confidentially, it was introduced that results from previous research in which they themselves had participated (conducted in their schools), showed big differences between students’ and teachers’ perceptions of the current learning environment, and in particular it showed that students generally had more negative perceptions than teachers. After this introduction the interview started, following the interview scheme. The interviews took between 20 and 40 minutes. Each interview was recorded with a tape recorder.

7.2.4 Data analysis

All interviews were typed out and labeled according to the coding scheme. The experimenter, who interviewed the participants, rated all data form the interviews. For computing Cohen’s Kappa, a second experimenter, independently, rated the answers of five participants for each interview question. In order to answer the research questions, the frequency of occurrence of each label was counted, both in student and teacher responses. Chi-square tests were computed on response frequencies of students and teachers, in order to test whether students and teachers significantly differed with regard to their answers to the interview questions. For investigating possible differences in responses between low- and high-perception participants, chi-square tests were computed on response frequencies, for students and teachers separately. In addition to significant results ($p < .05$), also trends with $p < .10$ will be discussed. For questions 11a, 11b, and 12, no chi-squares were computed, as these questions are not relevant to either students or teachers. For computing chi-squares the Fisher’s Exact Test was used. Because of the small number of participants, the expected cell frequency was sometimes less than five, indicating a reduced power of the tests. The Fisher’s Exact test accounts for this.

7.3 Results

Table 7.2 presents the response percentages per label (separately for students and teachers) and the results of chi-square tests comparing students' and teachers' response frequencies. It should be noted that the percentages do not necessarily sum up to 100%, as it is possible that respondents' answers fitted more than one label per question.

7.3.1 Causes for the differences between students' and teachers' perceptions

The first research question involved the causes that students and teachers suggest for the fact that students' perceptions of the learning environment are in general more negative than teachers' perceptions. Results of interview question 1 (see Table 7.2) showed that students stated that too much workload is imposed on them (58.3%), that school is obligatory, they do not have choices and must do as they are told (25.0%), and that students simply do not like going to school (16.7%). A quarter of the teachers mentioned the workload imposed on students, but the majority of the teachers provided answers in the category of other explanations (66.7%), like the differences in goals of students and teachers and the trend of school becoming less important for students due to an increase of after-school activities. Teachers more often provided other explanations for differences between students' and teachers' perceptions than students did ($\chi^2 = 9.00$; $p < .05$). More students than teachers regarded excessive workload to be an important reason for the more negative perceptions of students ($\chi^2 = 3.57$; $p < .10$).

7.3.2 Students' and teachers' opinions on participatory design

The second research question investigates students' and teachers' perceptions of the current state of discussion about educational practice and their opinions on the idea of possible use of participatory design, which was explored in interview question 2 up to 6. Looking at the results of interview question 2 (see Table 7.2), they show that not a single student agreed that students convey their ideas about education to teachers. Students give different reasons for this negative answer: the expectation that telling their ideas to teachers has no use because teachers do not use this information (29.2%); fear of conflicts with teachers when discussing about education and not daring to say anything (assertiveness, 16.7%), and teachers not giving the opportunity to students to convey their ideas (16.7%). Half of the teachers, however, stated that students do convey their ideas about education to them, which is a huge difference to students' responses ($\chi^2 = 14.40$; $p < .01$). A

negative answer because of negative expectations was provided by 29.2% of the students but none of the teachers ($\chi^2 = 4.35$; $p < .10$).

The results of interview question 3 showed that a large number of students (41.7%) replied that in their school no initiatives exist for discussing the educational design among students and teachers. This is remarkable, because in fact a discussion forum did exist in both schools. Some students (16.7%) stated that a kind of discussion group exists, but that this group does not operate in an effective way (i.e., no feedback from meetings was returned to teachers or other students). Also, half of the teachers did not confirm the existence of a discussion format (not present, 16.7%; do not know, 33%). A quarter of the teachers replied that the existing group does not function effectively.

The results of interview question 4 showed that 58.3% of the students would appreciate to engage themselves in the participatory design of education, while 20.8% of them did not think it to be a good idea. Half of the teachers were positive about engaging in participatory design as well. In addition, one quarter stated that participatory design would be possible for some educational topics, but not for other topics. Students never (i.e., significantly less) mentioned the latter answer ($\chi^2 = 6.55$; $p < .05$).

The results of interview question 5 showed that 41.7% of the students stated that the vast majority of their peer students would be willing to engage in the participatory (re)design of their educational environment. Almost half of the students (45.8%) thought that some of their peers would be interested but others would not. A quarter of the teachers thought that the majority of their colleagues would be positive, and a third expected that the majority would have a negative opinion. One third of the teachers figured a fairly equal distribution of proponents and opponents among their colleagues.

In response to interview question 6, half of the students answered to be confident that most of the teachers are willing to cooperate with students. Some students (20.8%) thought that the distribution of proponents and opponents would be more or less equal. Only part of the teachers (16.7%) believed that the majority of students want to cooperate with them, while a quarter thought that students would have a negative attitude towards collaboration with teachers. Two-third of the teachers assumed a more or less equal distribution or did not know how willing students would be (both 33.3%). It seemed that the confidence in the willingness of the other party to involved in participatory design was smaller for teachers than for students ($\chi^2 = 3.74$; $p < .10$).

Table 7.2 Response percentages to interview questions by students and teachers

Question	Response	Students	Teachers	χ^2
1	Why do you think that in general, students perceive education less positive than teachers?			
	Workload	58.3	25.0	3.57 *
	Obligation	25.0	16.7	.32
	No pleasure	16.7	0.0	2.25
	Other	16.7	66.7	9.00 **
2	Does the student convey educational ideas to teachers?			
	Yes	0.0	50.0	14.40 **
	No, negative expectations	29.2	0.0	4.35 *
	No, assertiveness	16.7	0.0	2.25
	No, no opportunity	16.7	8.3	.47
	No, never thought about it	12.5	0.0	1.64
	No, other or no explanation	29.2	41.7	.56
3	In your school, do students and teachers collaborate about educational design?			
	No	41.7	16.7	2.25
	Yes, though not effectively	16.7	25.0	.36
	Do not know	16.7	33.3	1.29
	Yes, resonance group	12.5	33.3	2.22
	Yes, student council	8.3	0.0	1.06
	Yes, in the classroom	8.3	16.7	.56
	Yes, coordinator	4.2	0.0	.51
4	How would you feel about engaging in participatory design of education yourself?			
	Positive	58.3	50.0	.23
	Negative	20.8	8.3	.90
	Sometimes yes, no	0.0	25.0	6.55 **
	Do not know/skeptic/neutral	16.7	8.3	.47
	No clear answer	4.2	8.3	.27
5	How do you think other students/teachers would feel about engaging in participatory design?			
	Majority is willing	41.7	25.0	.96
	Some will, some will not	45.8	33.3	.51
	Majority is not willing	12.5	33.3	2.22
6	How do you think teachers/students would feel about engaging in participatory design?			
	Majority is willing	50.0	16.7	3.74 *
	Some will, some will not	20.8	33.3	.67
	Majority is not willing	16.7	25.0	.36
	Do not know/ no clear answer	12.5	33.3	2.22
7	Which educational topics would you like to discuss when it comes to participatory design?			
	Pedagogies	62.5	66.7	.06
	Lesson content	25.0	8.3	1.42
	Planning	20.8	8.3	.90
	Everything	4.2	25.0	3.52 *
	Instructional material	12.5	0.0	1.64
	Amount	12.5	0.0	1.64
	Other	20.8	16.7	.09
8	When it comes to participatory design, which organizational format would you prefer?			
	Classical	58.3	41.7	.89
	Group of students	16.7	75.0	11.80 **
	A single student	33.3	16.7	1.11
	Meetings	8.3	0.0	1.06
	After lessons	8.3	8.3	.00
9	How often would you like the participation to take place?			

	Once to twice a month	54.2	16.7	4.63 **
	Once to thrice a year	16.7	41.7	2.67
	Situational	16.7	25.0	.36
	Every week	12.5	16.7	.12
	Do not know	0.0	8.3	2.06
10	If you participated, with which kind of teacher/students would you prefer to cooperate?			
	Open attitude	62.5	0.0	12.86 **
	Involved	20.8	0.0	2.90
	Other	29.2	0.0	4.35 *
	No preference	4.2	41.7	8.10 **
	Motivated	0.0	25.0	6.55 **
11a	Research showed that especially students, who are less motivated for learning, perceive the learning environment more negative. Do you think it is valuable and feasible to brainstorm/cooperate with these students about improvement of the learning environment?			
	Less motivated: yes	-	41.7	-
	Less motivated: do not know	-	50.0	-
	Less motivated: no	-	8.3	-
11b	For which courses would you prefer to cooperate with teachers?			
	Difficult courses	33.3	-	-
	No preference	33.3	-	-
	Important courses	12.5	-	-
	Poorly taught courses	12.5	-	-
	Other	8.3	-	-
12	Do you think it would be possible to practice participatory design for mathematics/Dutch language education?			
	Yes	79.2	-	-
	No	12.5	-	-

Note. $^{*}p < .10$. $^{**}p < .05$.

7.3.3 Preferences for participatory design in practice

The third research question involved acquiring concrete ideas about the ways in which students and teachers want to implement participatory design. Interview questions 7 up to 12 were analyzed in order to answer this research question.

In response to interview question 7, 62.5% percent of the students indicated that pedagogies are a negotiable topic. A quarter of them named the contents of the lessons and somewhat more than one fifth (20.8%) emphasized planning as a topic of central importance. Most of the teachers too (66.7%) considered pedagogies as a negotiable topic. One quarter of the teachers agreed on discussing all topics students wish to discuss. There was a tendency that this answer was given more frequent by teachers than by students ($\chi^2 = 3.52$; $p < .10$).

In response to interview question 8, 58.3% of the students indicated they found in-class discussions as a suitable format for participatory design. Of the teachers, 41.7% preferred in-class discussions. However, most of them (75.0%) would prefer to discuss (re)design with a small group of students. More teachers than students preferred this small-group discussion format ($\chi^2 = 11.80$; $p < .01$).

In response to interview question 9, which addressed how frequent discussions between teachers and students should best take place, 54.2% of the students showed a preference for once or twice a month. Less teachers (16.7%) were willing to collaborate that often ($\chi^2 = 4.63$; $p < .05$). Teachers preferred a frequency of one to three times a year (41.7%) or the preferred situational discussions, only when problems arise or the necessity is felt (25.0%).

The results of interview question 10 showed that students would like to work with teachers who have an open attitude (62.5%), or with teachers who are involved with students (20.8%). Almost 30% of the students mentioned other desirable personality traits of teachers, for example, wisdom and humor. About 40% of the teachers felt no preference for cooperating with a specific type of students. One quarter of the teachers explicitly wished to work with motivated students only. The differences between students and teachers concerning an open attitude ($\chi^2 = 12.86$; $p < .01$), no preferences ($\chi^2 = 8.10$; $p < .01$), and preferences for motivated participants ($\chi^2 = 6.55$; $p < .05$) were significant.

Interview question 11a asked teachers whether they thought it would be possible and valuable to involve low-perception students, who are expected to be less motivated as well (Könings, Brand-Gruwel, & van Merriënboer, 2007a). A positive opinion on working with less motivated students was indicated by 41.7% of all teachers, while half of the teachers was not sure whether involvement of these students would positively contribute to the (re)design process.

Interview question 11b asked students about preferences for courses in which participatory design could best be implemented. One third of the students preferred to apply participatory design to difficult school subjects, while another third did not show any preferences.

Interview question 12, finally, asked students if they thought it would be possible to implement participatory design in either Dutch language lessons or mathematics lessons. About 80% of the students answered with ‘yes’.

7.3.4 Differences between high-perception and low-perception participants

The fourth and final research question concerned whether high and low-perception students and high and low-perception teachers differed in their opinions on possible use of participatory design. Only one difference between high and low-perception teachers emerged, namely, for interview question 2. When teachers were asked if students convey their ideas about education to them, only 16.7% of the low-perception teachers agreed while 83.3% of the high-perception teachers agreed ($\chi^2 = 5.33$; $p < .10$). No other significant differences between high and low-perception students or high and low-perception teachers were found.

7.4 Conclusions and discussion

The current study explored students' and teachers' opinions on possible use of participatory design in education for reducing the discrepancies between students' and teachers' perceptions of the learning environment, what eventually would improve the quality of the learning environment. The study aimed to examine if and how both students and teachers in secondary education would be willing to engage in participatory (re)design of their learning environment.

The aim of the first research question was gaining insight in causes that students and teachers themselves suggest for the differences between them in perceptions of the learning environment. Many students address the issue of high-imposed workload as a cause for more negative student perceptions, whereas teachers often provide other reasons such as students having less interest in school. The fact that only a few teachers acknowledge that many students suffer from high pressure provides evidence for the existence of a gap between students' and teachers' perceptions and interpretations of the situation. The need for better communication and more common understanding between students and teachers is underlined.

In order to gain more insight in students' and teachers' opinions on possible use of participatory design (the first part second research question), both the current situation concerning discussion about educational practice and their preferences with respect to participatory design initiatives are queried. Remarkably, students' and teachers' perceptions of the current situation appear to differ astonishingly. Although half of all teachers claim that students convey their educational ideas to them, not a single student says he/she does. One of the reasons students put forward for not conveying their ideas to teachers is their expectation that teachers will not use this information. Another reason is the lack of opportunities to talk about their ideas about education. The existence of current discussion formats in school is not clear to either students or teachers. This is a rather unexpected outcome, as inquiry of the school policies learned a resonance group of students and teachers to be present in both schools. Hence, these groups may not be completely effective and more action seems to be necessary to reach everyone in the school. A suggestion could be to distribute explicit reports from discussions that take place in the resonance group to all students and teachers.

The second part of research question 2 investigated the desirability and feasibility of future implementation of participatory design. It shows that a majority of both students and teachers holds positive opinions toward cooperating with one another to improve education in their school. Some of the teachers who favor participatory design are, however, not willing to involve students in all educational topics. In particular, some topics would be less negotiable because these are

difficult to change due to governmental restrictions and a mandatory minimal curriculum (e.g. learning contents). The few students and teachers who have a negative opinion state that participatory design would take too much of their spare time, and means longer days in school. To overcome this problem, it would be beneficial if student-teacher negotiations will be scheduled during regular school hours. Additionally, some students who do not favor participatory design claim that teachers are the professionals and they "know what is best". It is true that teachers are professionals who are knowledgeable and experienced in educational issues. However, this does not mean that teachers are omniscient, and could not benefit from feedback and differential views from students. In contrast, one might claim that real professionals should be sensitive for the needs of their target group. This needs to be clarified for both teachers and students. If the skeptical students recognize their ability and necessity to contribute, their appreciation of participatory design might increase. Overall, the predominantly positive opinions of many students and teachers towards possible use of participatory design provide a promising perspective for its implementation in secondary schools.

The third part of research question 2 involved students' and teachers' ideas about the attitudes of other students and teachers toward participatory design. Most students state that a vast majority of peer students would appreciate the idea of collaborating with teachers or that there will be an equal distribution between proponents and opponents of participatory design. Only a few students think that the majority of their peers would not be willing to engage in participatory design. Among teachers, the supposition of attitudes from colleagues is more or less the same. Furthermore, students' notions and ideas about the willingness of teachers to cooperate with students are fairly positive. However, teachers are less positive about students' willingness: they express doubts on students' enthusiasm to collaborate with teachers. Some teachers state that students are not really interested in educational matters. However, exactly for these students, being more involved in the educational process may raise their interest in it.

The third research question concerned students' and teachers' preferences for the way of implementing participatory design. As for topics, both students and teachers would prefer to discuss pedagogies. They both indicate that discussions between the students and their teacher can be well organized in a class context. However, especially teachers (but students also) prefer discussion groups consisting of a teacher and a small group of students. The idea is that small groups of students are able to represent the opinion of the whole year group, without resulting in messy discussions that get out of hand.

With respect to the desired frequency of participatory design meetings, most students prefer to collaborate with teachers once or twice every month. Many

teachers prefer a frequency of one to three times a year. An important objection turned out to be time commitment. Students as well as teachers emphasize that participatory design costs time. Investing even more time in school is not a welcome idea, because students and teachers already have a busy schedule. A solution, already put forward, includes scheduling time for participatory design during regular school hours. Students prefer to implement participatory design especially for difficult subjects and subjects which are important for them because they prepare for their final examination.

Students prefer to cooperate especially with teachers who are tolerant towards different opinions and who have an open attitude, meaning that they listen to what students have to say. Many teachers express no preferences concerning types of students with whom they want to be involved in participatory design. Teachers were also explicitly asked for their opinions on working with less motivated students, and they are either doubtful or positive towards working with them. The fact that most teachers do not rule out the possibility to work with less-motivated students, provides support for involving a diverse group of students in participatory design activities. Less motivated students often experience the learning environment negatively (Könings, Brand-Gruwel, & van Merriënboer, 2007a). As perceptions of the learning environment of these low-perception students generally differ most with perceptions of teachers, involving them in participatory design may be interesting and beneficial.

The fourth research question was focused on the identification of differences in opinions on possible use of participatory design between high and low-perception students and between high and low-perception teachers. It seems that high-perception teachers state more often that students convey their educational ideas to them than low-perception teachers. The lack of further differences implies that students' and teachers' opinions on possible use of participatory design as well as preferences concerning the format of implementation do not depend on their (more positive or negative) perceptions of the learning environment. Consequently, it would be unnecessary to specifically adapt the format of participatory design activities to students and/or teachers who have high or low perceptions of the learning environment.

In sum, the results of our study show that – according to students and teachers – participatory design is feasible and desirable initiative in secondary education. The following seven preferences can be deduced out of this study: (1) the discussion topic of pedagogies should be emphasized, because the desire to discuss this is high amongst both students and teachers; (2) cooperation between a teacher and a small group of students, rather than a whole year group, seems desirable; (3) both students and teachers prefer planning discussions with a frequency of about three

times a year, whereas part of the students prefer it to be more frequent; (4) students prefer implementing participatory design especially for difficult subjects and courses which are important for them; (5) teachers should try to have an open and tolerant attitude; (6) a group of students participating in the (re)design process must be heterogeneous with regard to motivation, and (7) the format of participatory design activities does not need to be adapted to high- or low-perception students and teachers.

When intending to implement participatory design into practice, it is important to realize that teachers will consider the value of this innovative initiative, before starting to invest in its implementation. Teachers are likely to value innovations highly that match their ideas of what is a practicable (Paulussen, Kok, Schaalma, & Parcel, 1995). Innovations are considered to be practical if they provide clear procedural instruction, and are compatible with prevailing classroom conditions. Furthermore, teachers will consider the costs (i.e., time and invested energy), in relation to the potential return of the implementation of the innovation. If costs are lower than the return, teachers are more willing to implement the innovation than in case the costs are higher than the return. Some potential returns of participatory design could be an increase in students' and teachers' satisfaction with the learning environment, an increasing sense of responsibility and involvement of students in education, and a stimulating influence on metacognitive learning processes. Providing teachers with profound information about the importance and benefits of participatory design may stimulate the implementation. It would be an advantage if school management promotes and supports teachers in practicing participatory design. In addition, scheduling some time for incorporating participatory design in normal school practice would be favorable.

A limitation of the current study may be its generalizibility, because the data collection was conducted in only two schools for secondary education. However, a comparison between the results of both schools on all 61 labels (using Chi-square tests, separately for students and teachers) only shows two significant differences between the schools. This indicates that the limitation is likely not to be severe. Another potential limitation is the social desirability of the given answers. Although the use of interviews was adequate for this qualitative, explorative study, participants might have been influenced by the experimental situation and the presence of the interviewer, possibly resulting in social desirable answers to the interview questions. Additionally, the respondents were required to answer more or less immediately after listening to the question. They did not have much time to think about the answer thoroughly, which might lead to incomplete or slightly inaccurate accounts.

In order to be able to provide a more complete and universal picture of the desirability and feasibility of participatory design in educational settings, future research in other schools and educational sectors will be beneficial, as well as including a larger number of participants. The use of anonymous questionnaires rather than personal interviews could also be considered, in order to decrease the participants' potential tendency to provide social desirable answers. More innovative future research, however, would be to implement participatory design into practice, using the provided guidelines and evaluate the effects of participatory design on students' and teachers' perceptions of the learning environment.

To conclude, both background literature and the results of the current study favor the implementation of participatory design in secondary education. Areas in which participatory design is already practiced, notice large benefits of this as it leads to more effective design. The current study underlines the existence of a gap between students and teachers. The results support that participatory design could be a tool for bridging this gap, while considered as a desirable and feasible initiative by both teachers and students. Concrete suggestions for practicing participatory design emerged from this study, based on students' and teachers' own preferences.

Appendix

Coding scheme: Description of response categories to interview questions

Question	Label	Description
1	Why do you think that in general, students perceive education less positive than teachers?	
	Workload	Students have to work hard; difficult work; little time; difficulties with planning; according to students, teachers experience less pressure than they do.
	Obligation	School is obligatory for students; students do not have much freedom of choice, whereas teachers do.
	No pleasure	Students simply do not like going to school; school is boring; students prefer doing other things.
	Other explanations	An explanation other than listed above is given.
2	Does the student convey educational ideas to teachers?	
	Yes	Students do convey their ideas to teachers.
	No, negative expectations	Students assume that conveying their ideas to teachers is of no use; according to students, teachers do not use students' opinions.
	No, assertiveness	Students do not dare to convey their ideas to teachers; students are afraid of conflicts with teachers.
	No, no opportunity	Teachers do not ask students about their opinions; teachers do not give students the opportunity to convey their ideas.
	No, never thought about it	Students have never considered the possibility of conveying their ideas to teachers.
	No, other or no explanation	The answer is no, but another explanation than listed above is given, or no explanation is given at all.
3	In your school, do students and teachers collaborate about educational design?	
	No	No form of discussion between students and teachers exists.
	Yes, though not effectively	A discussion format exists, but in an ineffective way; no feedback emerges; nobody actually knows what is discussed; discussions do not include educational topics.
	Do not know	The participant is not sure whether any form of discussion group exists or not.
	Yes, resonance group	A group consisting of students and teachers deliberates about educational topics; a few students per class discuss problems and opinions with a group of teachers of several disciplines.
	Yes, student council	A group of students deliberates about school topics with a guiding teacher.
	Yes, in the classroom	Discussions between students and teachers take place in the classroom.
	Yes, coordinator	Discussions take place between students and the class coordinator.
4	How would you feel about engaging in participatory design of education yourself?	
	Positive	Clearly positive attitude towards cooperating with students/teachers.
	Negative	Clearly negative attitude towards cooperating with students/teachers.
	Sometimes yes, no	It depends: some topics are negotiable, whereas others are not.
	Do not know/skeptic/ neutral	The participant is not sure about their opinion towards cooperating with students/teachers, or has a neutral opinion on this.

	No clear answer	The participant does not provide a clear answer to the question.
5	How do you think other students/teachers would feel about engaging in participatory design?	
	Majority is willing	Most students/teachers will have a positive attitude towards cooperating with teachers/students.
	Some will, some will not	It varies among individuals; the distribution between proponents and opponents will be more or less equal.
	Majority is not willing	Most students/teachers will have a negative attitude towards cooperating with teachers/students.
6	How do you think teachers/students would feel about engaging in participatory design?	
	Majority is willing	Most students/teachers will have a positive attitude towards cooperating with teachers/students.
	Some will, some will not	It varies among individuals; the distribution between proponents and opponents will be more or less equal.
	Majority is not willing	Most students/teachers will have a negative attitude towards cooperating with teachers/students.
	Do not know/ no clear answer	The participant does not know how most students/teachers will feel about cooperation; the participant does not provide a clear answer.
7	Which educational topics would you like to discuss when it comes to participatory design?	
	Pedagogies	Teacher behavior in class related to teaching; lesson structure; work groups or individual work.
	Lesson content	(Contents of) subject matter.
	Planning	Planning of deadlines for assignments; scheduling of subject matter.
	Everything	Everything students want to discuss is negotiable.
	Instructional material	E.g., books used for lessons.
	Amount	Amount of subject matter, homework, workload.
	Other	Another answer than listed above is given.
8	When it comes to participatory design, which organizational format would you prefer?	
	Classical	Discussions take place in the classroom, with the entire class.
	Group of students	A small group of students discusses with a teacher.
	A single student	Students discuss individually with teachers; a class representative conveys class' opinions to teachers.
	Meetings	Discussions occur in organized, structured meetings.
	After lessons	Discussions take place after classes.
9	How often would you like the participation to take place?	
	Once to twice a month	Discussions take place one to two times a month.
	Once to thrice a year	Discussions take place one to three times a year.
	Situational	Discussions take place occasionally, if the need for this arises due to problems or situations.
	Every week	Discussions take place every week or more often.
	Do not know	The participant does not know how often discussions should take place; has no preference towards this; provides more than one, possibly inconsistent answer.
10	If you participated, with which kind of teacher/students would you prefer to cooperate?	
	Open attitude	Display an open attitude towards other opinions; listening to what other has to say.
	Involved	Knowing personal things about people; being active and arranging many things; wants what is best for other.
	Other	Another answer than listed above is given.
	No preference	The participants do not have preferences concerning types of people she/he would want to cooperate with.

	Motivated	Someone who is motivated and driven in schoolwork.
11a	Research showed that especially students, who are less motivated for learning, perceive the learning environment more negative. Do you think it is valuable and feasible to brainstorm/cooperate with these students about improvement of the learning environment?	
	Less motivated: yes	Cooperating with less motivated students is possible.
	Less motivated: do not know	The participant is not sure, has a skeptic attitude towards cooperating with less motivated students.
	Less motivated: no	Cooperating with less motivated students is impossible.
11b	For which courses would you prefer to cooperate with teachers?	
	Difficult courses	Courses in which student encounters difficulties.
	No preference	The participant does not have preferences concerning courses he/she would want to practice participatory design for.
	Important courses	Courses which are important for students because they prepare for their final examination.
	Poorly taught courses	Courses which are educated ineffectively.
	Other	Another answer than listed above is given.
12	Do you think it would be possible to practice participatory design for mathematics/Dutch language education?	
	Yes	Student thinks it possible to practice participatory design for current Dutch/mathematics education.
	No	Student thinks it impossible to practice participatory design for current Dutch/mathematics education.

8

Participatory design by students and teachers in secondary education: Experiences and perceived effects on instruction

This chapter is submitted as:
Könings, K. D., Brand-Gruwel, S., & van Merriënboer, J. J. G. (2007).
Participatory design by students and teachers in secondary education: Experiences and perceived effects on instruction.
Manuscript submitted for publication.

Abstract. Students and teachers have different perspectives on their learning environment and only limited insight in the perspectives of each other. This is likely to threaten the effectiveness of the learning processes taking place in the environment. Participatory design might be a good strategy to take student perspectives into account in instructional (re)design. In this study, six teachers in secondary education had a participatory design meeting with seven co-designing students from one of their classes. Students' and teachers' experiences were investigated. In addition, effects of the adaptation of the environment on students' and teachers' perspectives were examined. Results show that teachers and students were satisfied with the meeting. The perspective of teachers and co-designing students on the learning environment was more positive after the intervention, but, unexpectedly, dissatisfaction with the environment increased for non-co-designing students from the same class. Possible causes for this unexpected result are discussed. Participatory design seems to be a promising approach to improve education, but further research is needed on how to reach positive effects for non-co-designing students.

8.1 Introduction

Teachers and students differ in their perceptions of a learning environment (for an overview, see den Brok, Bergen, & Brekelmans, 2003). In general, teachers tend to perceive the learning environment they are working in as more positive than their students (Fraser, 1982; Fraser & O'Brien, 1985), students and teachers differ in their preferences with respect to the design of an environment (Doppelt, 2004), and teachers have less desires to change the environment than their students (Könings, Brand-Gruwel, & van Merriënboer, 2007b). Teachers often do not have a good insight in the perceptions, desires, and possible criticisms of students in their class (Holt, Denny, Capp, & de Vore, 2005; Watkins, 2004). Yet, it is valuable to make student perspectives on the learning environment explicit, because they directly influence learning processes and are very difficult to predict for teachers (Donaldson, 1978; Kershner & Pointon, 2000; Oldfather, 1995a). Nevertheless, there are only few attempts to listen to students' voices on education, and a discourse between teachers and students about learning experiences is often lacking (Cook-Sather, 2001).

The fact that teachers are not well informed about the perspectives of their students is problematic for two reasons. First, according to human-factors engineering (e.g., Norman, 1986, 1988), designers' and users' interpretations of any system have to be more or less the same in order to reach optimal functioning and effectiveness of the system (Bartholomew, Parcel, Kok, & Gottlieb, 2001). This means that discrepancies between teachers' and students' perspectives on a learning environment are likely to threaten its effectiveness. Second, student perspectives on the environment also directly influence its effectiveness, because perceptions influence the quality of learning and study behavior (Elen & Lowyck, 1999; Entwistle & Tait, 1990). Students tend to stick on learning preferences and habits, and only use those elements of the learning environment that fit well in their habitual way of learning (Vermetten, Vermunt, & Lodewijks, 2002). In addition, dissatisfaction with the perceived environment is likely to have negative consequences on student motivation and engagement (Eccles et al., 1993). Thus, student perspectives are of crucial importance because they determine the learning and motivational processes actually taking place in the learning environment. If teachers are not well-informed about those perspectives, this might undermine the achievement of educational goals.

Student perspectives should thus get a far more prominent place in instructional (re)design than they currently have. A good design takes student perspectives into account and bridges the gap with teacher perspectives. Therefore, the main goal of the current study is to investigate student participation in the redesign of a learning

environment, in particular, how students and teachers experience it and how it affects their perspectives on the newly designed environment. Participatory design is expected to diminish differences between perceptions of teachers and students, to increase student satisfaction with the learning environment, and to raise student perceptions of the re-designed environment as being a *more powerful* learning environment.

Educational research acknowledges the relevance of having insight in student perspectives. Written student evaluations are frequently used and efficiently provide information about the perspectives of sometimes large groups of students, based on their experiences throughout a relatively long period (i.e., representative for the whole learning environment; de Jong & Westerhof, 2001). Student evaluations might inform teachers about possible discrepancies between student perspectives and their own perspective. These discrepancies may create a state of disequilibrium, which leads teachers to taking actions to improve the learning environment. This, however, will only happen under appropriate circumstances (Roche & Marsh, 2000). For the most part, the effects of sole student evaluations on the quality of the learning environment are rather limited (Marsh & Dunkin, 1992), although effects may improve if information on student evaluations is combined with educational advice (Fraser & O'Brien, 1985; Roche & Marsh, 2000). Some teachers are not affected by student evaluations, because they become anxious and defensive about their own teaching behavior and try to preserve their self-image. Pambookian (1976) pointed out the relevance of cognitive dissonance theory (Festinger, 1957) when trying to understand teachers' reactions on student feedback. Teachers who are confronted with discrepancies between perspectives of their students and their own perspective might reduce these discrepancies (i.e., cognitive dissonance) by rejecting the student feedback as invaluable, or by changing their own view on the learning environment, rather than by changing the environment. Thus, informing teachers about student perspectives does not guarantee that those perspectives are actually taken into account.

A more promising alternative might be to listen to students as important partners in an ongoing dialogue about the learning environment and the teaching-learning processes taking place in this environment (Cook-Sather, 2001). "If school is about what students know, value, and care about, we need to know who students really are. We need to listen to them, pay attention to what they show us about themselves and their views… Students' voices help us understand what they need and value as learners" (Dahl, 1995, p. 124). Thus, listening to students enables teachers to see the environment through their students' eyes and gives them better insight in how students interpret the learning environment. Students are the primary stakeholders of education and experts in their own experiences (Oldfather, 1995b).

Too often, students' potential is neglected as adults "underestimate the ability of children to be shrewd observers, to possess insight and wisdom about what they see and hear, and to possess internal resources we routinely underestimate" (Lincoln, 1995, p. 89). Qualities, insights, and observations of teachers and students should be brought together in a dialogue on improving education. "Students should help shape rather than simply be shaped by educational policies and practices" (Cook-Sather, 2003, p. 22).

Excluding students from the instructional (re)design process is common practice, despite the fact that it is likely to have negative consequences for the effectiveness of the instruction. On top of this, the sense of not-being-heard may have negative effects on student behaviors. It causes alienation, experiences of anonymity, and powerlessness, which contribute to disengagement from school with possible consequences such as skipping classes and dropping out of school (Mitra, 2004). A feeling of being out of control is also related to academic goals: students who experience little control will adopt work-avoidance goals (Seifert & O'Keefe, 2001), that is, they minimize the amount of effort invested in school and study. These negative effects are likely to be persistent unless the situation is explicitly altered. When students are continuously confronted with teachers who do not listen to them, they will give up communicating their experiences and ideas for improving education (Stevens, Beekers, Evers, Wentzel, & van Werkhoven, 2004).

Giving students the opportunity to participate in the (re)design of their learning environment may have at least three positive effects, other than improved education per se. First, it increases the sense of belonging and school attachment and may so help to reengage alienated students. Students get the chance to build up a supportive, positive way of communicating with their teacher and to learn from one another (Mitra, 2004). Second, the sense of being in control increases because students have the opportunity to take part in changes and to exert influence on the learning environment (ibid). A greater sense of control is associated with putting more effort in school and study instead of avoiding work (Seifert & O'Keefe, 2001). Third, students are stimulated to develop general competences, such as problem-solving skills (Mitra, 2004) and metacognitive thinking skills, because they are challenged to critically reflect on their own educational experiences and learning behaviors in relation to the design of the learning environment (Cook-Sather, 2002).

In addition to positive effects on sense of belonging, feeling in control, and general competences, students' participation in the (re)design process is expected to have a positive effect on their perspectives on the learning environment. This is probably the most important effect because perceptions directly determine students' learning behaviors (Entwistle & Tait, 1990), motivation to learn (Eccles

et al., 1993), and, ultimately, the instructional effectiveness of the learning environment. Furthermore, the degree of congruence between teachers' and students' perceptions affects how well-tuned their behaviors are. As perceptions trigger corresponding behaviors (Bargh, Chen, & Burrows, 1996; Dijksterhuis & van Knippenberg, 1998), discrepancies between perceptions are likely to cause divergent behavior patterns for teachers and students in the same learning environment. Consequently, the effectiveness of the environment might be at risk. Taken together, three aspects of student perspectives on a learning environment seem important for its optimal functioning: (1) perceptions, (2) (dis)satisfaction, and (3) the discrepancy between students' and teachers' perceptions.

In the current study, eight characteristics of powerful learning environments (PLEs) are taken as a starting point to study perceptions, (dis)satisfaction, and discrepancies between students and teachers. These characteristics enable a fine-grained analysis of student perspectives on the learning environment and may be considered as central features of a *powerful* environment. They promote the acquisition of high-quality knowledge, problem-solving skills, and self-directed learning skills and so facilitate the transfer of what is learned to new situations (for an overview, see de Corte, Verschaffel, Entwistle, & van Merriënboer, 2003; Könings, Brand-Gruwel, & van Merriënboer, 2005).

First, learning tasks in a powerful learning environment are complex, realistic, and challenging (van Merriënboer & Paas, 2003). Second, learning is not directed at reproducing knowledge, but at an active process of sense-making of the subject matter and creating mental models, which can be reused to solve problems in new situations (Collis & Winnips, 2002; Moreno & Mayer, 1999). Third, new knowledge is integrated with prior knowledge and experiences of the student (Merrill, 2002), and the learning environment aims at integrated learning goals, directed at the simultaneous acquisition of knowledge, skills, and attitudes (van Merriënboer & Paas, 2003). Fourth, a self-directed and independent way of learning and thinking is stimulated by gradually transferring the responsibility for the learning processes from the teacher to the students (Vermunt, 2003). Fifth, by applying collaborative learning settings and ample opportunities for interaction, students have an active and constructive role in the learning process (van Merriënboer & Paas, 2003). Sixth, individual differences between students are taken into account. For instance, by allowing for deductive as well as inductive approaches to learning, and by supporting both inquisitory and expository approaches to teaching (van Merriënboer & Kirschner, 2001). Seventh, learning goals and task requirements are made clear to students because they direct learning strategies (Broekkamp, van Hout-Wolters, Rijlaarsdam, & van den Bergh, 2002). Eighth and last, one important role of the teacher is that of a coach providing help

and support. Starting with external regulation and support, the coaching process helps students to learn how they can obtain control over their own learning processes (Vermunt & Verschaffel, 2000).

When students participate in the (re)design of their learning environment, the eight characteristics of a powerful learning environment could all be topics of discussion. The literature, however, remains vague with regard to answering the question *in which way* students can best participate in the (re)design process and how "listening to student experiences" can best be organized. But some preconditions for having a successful discussion are known. Teachers must be willing to listen to student experiences and honor their comments (Lincoln, 1995). This requires a major shift in existing relations and "in ways of thinking and feeling about the issues of knowledge, power, and self" (Oldfather, 1995a, p. 87). It also requires to trust students having relevant knowledge and being responsible (Cook-Sather, 2002). Obstacles resulting from the hierarchical difference between teachers and students should be overcome and an emphatic and sensitive climate has to be created (Papatheodorou, 2002), in which participants can talk in a democratic way (Johnston & Nicholls, 1995). These preconditions do not, however, concretely prescribe how to create in a school context a discourse fostering a productive and effective student participation in the educational (re)design process. Therefore, the current study uses a newly developed procedure to elicit experiences from students and teachers, and to help them systematically discuss possibilities for improving the learning environment.

The procedure for including students in the redesign process is based on ideas from participatory design. Participatory design aims at the active participation of users of any system in its design process, and in making decisions that will affect them (Berns, 2004; Kensing & Blomberg, 1998; Mankin, Cohen, & Bikson, 1997). In many areas outside the field of education, it is common practice to involve potential users of a product or system in the design phase. Positive effects have, for instance, been demonstrated in the fields of cognitive ergonomics and health promotion (Bartholomew, Parcel, Kok, & Gottlieb, 2001; Meister & Enderwick, 2002). Effective involvement in the design phase yields improved adjustment of the system to the users' needs, higher levels of acceptance of the final design by its users, and better understanding of the design by the users which results in higher usability (Damodaran, 1996). A participatory design process consists of three phases: (1) analysis, (2) design, and (3) implementation (Cabana, 1995). Participants analyze the current situation and assess its shortcomings taking their own needs and desires into account. Then, they come up with ideas for (re)design and finally devise a plan for implementing the new design.

It is a major challenge to adapt participatory design techniques in such a way that they can be used to involve secondary school students in the (re)design of their learning environment. Earlier interviews with students and teachers about their preferences for a possible implementation of participatory design yielded several practical guidelines, such as: participatory design meetings should be organized for one teacher and a small group of students (rather than the whole year group); selected students (i.e., co-designers) must be heterogeneous with regard to their view on the environment, and participatory design meetings should not take too much time (Könings, van Zundert, Brand-Gruwel, & van Merriënboer, in press).

In the current study, newly developed participatory design techniques are applied to improve the design of the learning environment. Students are included in a discussion with their teacher and exchange positive and negative experiences with their learning environment. Together with the teacher, they discuss possibilities for improving the learning environment and overcoming negative points, and they plan how these ideas will be implemented in the environment. The study aims to evaluate the participatory design meetings, in order to find out if the participatory design techniques are adequate for use with students in secondary education. Furthermore, the effects of the redesign effort are investigated on two levels: over classes and separately per class. The participatory design process took place in six classes (with seven co-designing students in each class) and in each class a different, tailor-made redesign was worked out. Overall effects were evaluated by using measures of student perceptions of the learning environment, their dissatisfaction with the environment, and discrepancies between perceptions of students and teachers. Class-specific effect were evaluated on the basis of specific features of the re-designed learning environment. Summarizing, this study answers the following research questions:

1. How do co-designing students and teachers evaluate the participatory design meeting, and how does the rest of the class (i.e., non-co-designing students) evaluate the outcomes of the meeting, such as the formulated action points?

2a. What are the overall effects of the participatory design meeting and subsequent redesign of the learning environment on students' (co-designers and rest of the class) and teachers' perspectives on the environment, and on the discrepancies between student and teacher perspectives?

2b. What are in each experimental class the effects on perspectives of students and teachers on particular characteristics of the re-designed learning environment, and on the discrepancy between both perspectives?

8.2 Method

8.2.1 Participants

In the experimental condition, the sample consisted of six teachers (5 male, 1 female) of two different schools for secondary education and the tenth grade pre-university students of one class of each teacher (N = 137). The teachers voluntary decided to participate in this experiment. They were teaching mathematics (teacher 1, 2, and 3), economics (teacher 4 and 5), and English as a foreign language (teacher 6). In each experimental class students were divided in a small group of seven co-designing students (called co-designers) and students who were not directly involved in participatory design, but got the lessons in the redesigned way (called rest of the class).

In the control condition, the sample consisted of seven teachers (all male) from two schools for secondary education and the tenth grade pre-university students of one class of each teacher (N = 102). One school also participated in the experimental condition; the other school only participated in the control condition. The control teachers taught courses matching the courses in the experimental condition: three teachers were teaching mathematics, three were teaching economics, and one was teaching English. Three instead of two economics teachers (as in the experimental condition) participated because of small group sizes in the control condition.

8.2.2 Materials

8.2.2.1 The learning environment

The context of this study is an innovation in Dutch secondary education, called Second Phase (Ministerie van OCW, 2005; Stuurgroep Profiel Tweede Fase Voortgezet Onderwijs, 1995; Veugelers, de Jong, & Schellings, 2004). According to the educational design, this learning environment requires students to acquire skills and knowledge in an independent way and learn in a self-directed way, with possibilities for collaborative learning. There is more room for individual differences than in the traditional class situation and teachers take these differences into account. The teacher acts more like a coach and less like an instructor, which creates more possibilities for contact between students and the teacher. The learning process is not only directed to knowledge acquisition, but also to the selection and processing of the vast amounts of information available today. Furthermore, learning contents are actualized and broadened and integration of different subject matter domains is emphasized, as well as the coherence between knowledge and skills and the application of knowledge.

How this innovation is implemented by the teachers and how the factual learning environment is experienced by the students, is investigated by using the following questionnaires.

8.2.2.2. Opinion Questionnaire (OQ)

This questionnaire consists of three questions concerning students' opinion toward the particular course and learning environment: (1) "How well or bad do you judge the offered education in this course (at the moment)?", (2) "How much do you enjoy this course?", and (3) "How well are you doing your best for this course?". Students rate these questions on a scale from 10 (very badly) to 100 (very well). At the posttest one additional question is added to this questionnaire, called "the OQ^+-question": "Do you have noticed changes in the way this course is taught during the last two months?". Three response categories are provided: "no changes", "yes, namely improvement", "yes, namely worsening". This OQ^+-question is also asked to teachers at the posttest, using two response categories: "no changes" and "yes, the following changes: ….".

8.2.2.3 Inventory of Perceived Study Environment Extended (IPSEE)

The aim of the IPSEE is to measure student perceptions of a particular learning environment and their desires with regard to the design of this environment. The discrepancy between perception scores and desire scores is a measure for (dis)satisfaction with the learning environment.

The IPSEE consists of 67 items. Thirty-one of these items originate from the Inventory of Perceived Study Environment (IPSE; Wierstra, Kanselaar, van der Linden, & Lodewijks, 1999), translated into Dutch by the Expertise Centre Active Learning of Maastricht University (Picarelli, Slaats, Bouhuijs, & Vermunt, 2006). We constructed another 36 items to be able to measure the characteristics of powerful learning environments more completely. Such learning environments, based on principles of cognitive psychology and constructivism, are aiming at the main goals of modern education: acquisition of high-quality knowledge, problem-solving skills, self-directed learning skills, and transferability of knowledge and skills. In the literature several characteristics of a powerful learning environment are described, like active knowledge construction, gradual transfer of responsibility from the teacher to the students, and the use of complex and realistic learning tasks as the driving force for learning (see de Corte, Verschaffel, Entwistle, & van Merriënboer, 2003, and Könings, Brand-Gruwel, & van Merriënboer, 2005, for an overview). In order to diminish the time needed for filling out the questionnaire, some of the original IPSEE items were excluded in the current experiment (based on results of factor analyses). The used version of the IPSEE consists of 56 items.

The items of the IPSEE are covering eight scales that can be considered as central characteristics of powerful learning environments. Internal consistency is computed for perception items of all eight scales. The first scale is *fascinating contents* and contains items about the extent to which the learning contents are interesting, challenging, and personally relevant for students (8 items; α_{T1} = .83; α_{T2} = .86; T1 and T2 refer to measures at the beginning and the end of the experiment). The second scale is *productive learning*, indicating little emphasis on the sole reproduction of learning contents (5 items; α_{T1} = .76; α_{T2} = .81). The third scale is *integration* and includes items about the integration of new knowledge with prior knowledge, the integration of different knowledge domains, and the integration of knowledge and skills (7 items; α_{T1} = .80; α_{T2} = .81). The fourth scale is *student autonomy* and measures attention paid to student's self-steering with regard to the content of learning, the way of learning, and time planning (10 items; α_{T1} = .79; α_{T2} = .82). The fifth scale is *interaction*, which incorporates collaboration with peers and interaction with the teacher (11 items; α_{T1} = .67; α_{T2} = .72). The sixth scale is *differentiation*, which inquires after opportunities for students to choose and make different tasks, solve problems in different ways, and use different learning materials (5 items; α_{T1} = .69; α_{T2} = .76). The seventh scale is *clarity of goals* and includes items about the clarity of instructional goals and task demands (4 items; α_{T1} = .86; α_{T2} = .86). The eighth and last scale is *personalization* and measures the availability of support of teachers (6 items; α_{T1} = .85; α_{T2} = .89). All Cronbach's alpha coefficients were acceptable.

Each of the items of the IPSEE contains a statement about one of the characteristics of a learning environment and two questions. For example:

All students do the same work at the same moment.

A. This happens
B. I would like this to happen

The questions are rated on a six-point scale, ranging from totally disagree (1) to totally agree (6). Scores on question A give a measure of the student's perception of the learning environment. Scores on question B show how the desired learning environment of the student would look like. The discrepancy (i.e., absolute difference) between the scores on question B and question A is defined as the measure of (dis)satisfaction with the learning environment. Increasing discrepancies between perceptions and desires indicate increasing dissatisfaction. Small discrepancies between perceptions and desires indicate low dissatisfaction. It should be noted that low dissatisfaction can also be seen as high satisfaction, but only the term dissatisfaction is used to interpret the results in an univocal way.

8.2.2.4 Inventory of Perceived Study Environment Extended-Teacher Version (IPSEE-T)

This questionnaire, consisting of 56 items, is a parallel version of the IPSEE. Some items are reformulated in such a way that they reflect a teachers' perspective. The questionnaire measures teachers' perceptions and desires with respect to the learning environment. Together these measures give insight in teachers' dissatisfaction with the current learning environment.

8.2.2.5 Participatory Design Meeting Evaluation Questionnaire (PDMEQ)

For evaluating the participatory meeting and its outcomes three versions of this questionnaire were constructed, consisting of open questions about the quality of the meeting and/or the recognizability of its outcomes.

The *PDMEQ for co-designers* consists of four questions: (1) How was the atmosphere during the meeting? (2) Did you have enough possibilities to tell what you wanted to tell? (3) Did you recognize the remarks made by other co-designers? and (4) Do you agree upon the formulated action points?

The version of the *PDMEQ for the rest of the class*, that is, students in the experimental condition but not directly involved in the participatory design, started with a short written summary of the meeting of co-designers and their teacher: the most important positive and negative aspects of the lessons and the formulated action points were given. After reading this summary, students answered two open questions: (1) Is the content of the discussion recognizable to you? Are there remarks that you do not agree upon? Do you miss important remarks?, and (2) What do you think about the formulated action points? Are they good ideas? If not, why not?

The *PDMEQ for teachers* consists of four questions that are partly different from the questions posed to the students: (1) How was the atmosphere during the meeting? (2) Did you recognize students' remarks? Did students mention things that you experience otherwise? (3) To what extent do you think students' suggestions are useable in practice? and (4) What is your general opinion on the meeting?

8.2.2.6 Coding scheme for analyzing data from the PDMEQ

For labeling the data of the PDMEQ a coding scheme was developed, based on the answers given in the questionnaire. Labels were only defined if more than one student or more than one teacher gave the same answer.

The coding scheme for the co-designers was as follows. There were four labels for question 1 about the atmosphere during the meeting: "pleasant/comfortable",

"in the beginning a bit uncomfortable, but later on better", "well, but a bit stressed", and "I found the activity with the colored balls childish" (the activity with the balls will be described in the Procedure section). There was only one label for question 2 about having enough possibilities to tell what you wanted to tell: "yes". There were three labels for question 3 about recognizability of and agreement with other students' remarks: "totally agree", "largely agree", and "partly agree and partly disagree". There were two labels for question 4 about agreement with the formulated action points: "totally agree" and "agree, but one action point is personally less relevant or disagreement with one action point". Two spontaneous remarks were frequently made: "I already saw the teacher implementing particular action points" and "I hope it will be implemented, because I think it would improve the course".

The coding scheme for the rest of the class was as follows. There were three labels for question 1 about the recognizability of and agreement on the content of the discussion: "totally recognizable and agreement", "agree, except on one remark", and "disagree on more than one remarks". There were four labels for question 2 about opinions on the formulated action points: "good/totally agree", "good/totally agree, but with adding a suggestion on it", "agree, but disagree on one action point, or one point is superfluous", and "disagree on more than one action point, or more than one point is superfluous". For labeling the spontaneous remarks, the same two labels were defined as used for co-designers.

For categorizing the teachers' answers, the coding scheme was as follows. There were three labels for question 1 about the atmosphere of the meeting: "good atmosphere", "students have well expressed themselves", and "in the beginning reserved/shy, but later on better". There were two labels for question 2 about recognizability of students' remarks: "totally agree" and "one remark was not well recognizable". There were two labels for question 3 about usability of the students' suggestions: "well usable" and "difficult to implement or I have to think about how to implement it". And, finally, there was only one label for question 4 on a general opinion about the meeting: "positive/interesting/meaningful".

For computing Cohen's Kappa (interrater reliability), a second experimenter independently rated the answers of five co-designers, five students from the rest of the class, and three teachers. The Kappa was .89 for labeling the answers of co-designers, .78 for labeling teachers' responses, and .81 for labeling the answers of the rest of the class.

8.2.2.7 Action Point Evaluation Questionnaire (APEQ)

This questionnaire was only administered at the posttest in the experimental condition and measured to what extent students experienced the implementation of

each of the action points in the lessons, for example: To what extent did you notice that the teacher used more examples from daily life when explaining theory? The questions are rated on a scale from 10 (not at all noticeable) to 100 (very well noticeable). For each experimental class a different version of this questionnaire was composed, referring to the specific action points that had to be implemented in that particular class. The number of questions was equal to the number of formulated action points (a minimum of 3 and a maximum of 6). The questions of the teacher-version of the APEQ also refer to the specific action points of each particular class and asked to what extent teachers succeeded in the implementation of each action point in educational practice.

8.2.3 Procedure

At the pretest, all students filled out the OQ and the IPSEE. Preceding the completion of the questionnaires, students got an oral instruction about the goal and content of the questionnaires and about the way items had to be scored, which was also described at the first page of each questionnaire. Students had to fill out their name, class, and school. Also the teachers of these classes filled out a questionnaire: the IPSEE-T. The instruction was included at the first page of the questionnaire.

Based on the results of the IPSEE, seven students from each experimental class were selected to join in the participatory design meeting, together with their teacher. For each student an overall perception score was computed (i.e., mean of the scores on the eight IPSEE scales). Within each experimental class students were ranked on the basis of their mean perception scores and divided in three equally sized groups: high perceivers, moderate perceivers, and low perceivers. Subsequently, within the group of high perceivers the student with the highest score on the first question of the OQ (How well or bad do you judge the offered education in this course (at the moment)?) was selected, as well as the student with the lowest score on this question. The same procedure was used to select two students from the group of low perceivers. Three students were selected from the group with moderate perceivers: one with the highest score, one with the lowest score, and a third one with a moderate score. The selected students were informed about their role as “co-designer” in the experiment and were invited for the participatory design meeting, which was planned about one week after completing the pretest. All other students in the experimental class (not invited to be a co-designer) are called “rest of the class”.

The participatory design meeting was arranged during regular school time and lasted 50 minutes. The experimenter (i.e., first author) acted as the chair for the meeting. At the beginning of the meeting the chair welcomed everyone and shortly

explained the intention of the meeting. The teacher, who participated as an equal group member and was not meant to lead the group, was asked to explicitly assure the students that criticisms to his/her lessons would not have any personal consequences to them. The meeting consisted of three stages: (1) brainstorming about positive and negative experiences during lessons, (2) describing and discussing the most important positive and negative aspects of the current educational practice, and (3) discussing possible ideas for improvement for the negative points, and formulating action points for adapting forthcoming lessons.

During the first stage, the students and teacher cooperatively listed all positive and negative aspects of the current lessons that they could think of. To do so, a small yellow ball was introduced. If one held the ball in his/her hands, s/he had to say something positive about the current learning environment. Students and the teacher sat around a right-angled table and rolled the ball to each other. All had to catch the ball as often as they wanted, but at least once. Subsequently, a small dark blue ball was introduced. If one held this ball, one had to mention a negative point of the current learning environment. Again, everyone had to catch the ball at least once. In this phase it was not allowed to start a discussion about the positive and negative points that were articulated.

During the second stage, group discussion on the main positive and negative points was the goal. The students and teacher individually described their most important remarks. Three piles of small cards, colored in the colors of traffic lights, were put down in the middle of the table: green cards with the emoticon ☺ and some lines for writing down a positive remark, orange cards with a 😐 and lines for a doubtfully or moderately negative remark, and red cards with a ☹ for writing down seriously negative remarks. Only one remark had to be described on a card and everyone could take as many cards as desired. After everyone finished writing, the chair took a big paperboard for starting the group discussion about the cards. First, it was explored which positive remarks were written down on green cards. These cards were stuck on the board, clustered by content. The same was done for the orange and red cards. The board now contained an overview of the most important remarks on the current learning environment. This was the starting point for the discussion about redesigning the learning environment, or the exchange of ideas to overcome weaknesses in the environment.

In the third and final stage of the meeting, for each orange and red theme on the board the students and teacher discussed how the situation could be improved. The chair of the meeting took notes of the suggestions that came up and stuck them on the board too. At the end of this discussion the students and teacher were asked to cooperatively formulate action points for directing the changes in the forthcoming lessons. Finally, these action points were written down and stuck to the board.

A few days after the participatory design meeting, the PDMEQ was sent by e-mail to teachers, co-designers and the rest of the class. From the 40 students who had a co-designing role in this experiment 28 students responded (70%). For the rest of the class the response rate was 47.4% (46 of 97 students). All teachers responded.

In the two months following the participatory design meeting teachers were expected to implement the formulated action points. This period consisted of about six effective school weeks. Teachers 1, 2, and 3 were teaching their class three times a week (3 x 50 min.); teachers 4, 5, and 6 did so two times a week.

At the end of the intervention period a posttest was conducted. Students filled out the same questionnaire as at the pretest: the OQ (now including OQ^+) and the IPSEE. Additionally, students in the experimental condition filled out the APEQ, adapted to the specific action points formulated for their class. Teachers also filled out the IPSEE-T and the OQ^+-question. The teachers in the experimental condition, in addition, filled out the APEQ, adapted to the specific action points applicable for their class.

8.2.4 Data analysis

For each scale of the IPSEE and IPSEE-T mean scores were computed at both T1 and T2. At scale level, a maximum of 25% of missing values was accepted. Thus, if at least 75% of the items at a scale were filled out, these items were used to compute the mean score of that scale. Looking at the mean perception scores, it showed that on each scale a mean score could be calculated for at least 93% of the participants. Dissatisfaction scores were computed as the discrepancy (i.e., absolute value of the difference) between desire scores and perception scores on each scale. Disagreement scores give insight in the degree to which students' and teachers' perceptions match, and were computed as the discrepancy between a student's perception score on a scale and his/her teacher's score on the same scale.

The perception scores as well as the dissatisfaction scores and disagreement scores at scale level provide detailed information about different characteristics of the learning environment. To evaluate the general effects of the intervention (research question 2A) on perceptions, dissatisfaction, and disagreement more general measures are needed. An overall mean of all eight IPSEE(-T) scale scores was computed if, for a participant, at least on six of eight scales a (scale mean) score was available. In this way, three overall scores were computed: (1) an overall perception score, indicating to which extent students and teachers perceive the learning environment as a powerful learning environment, (2) an overall dissatisfaction score, indicating to what extent students and teachers were dissatisfied with the current learning environment, and (3) an overall disagreement

score, indicating to what extent students' perceptions differ from the teacher's perception (computed for students only).

The raw data from the OQ and the APEQ are used in the analyses. For the APEQ, additionally an overall score was computed, providing an overall measure of the degree of implementation of the action points.

8.2.4.1 Research question 1

For evaluating the participatory design meeting, the data of the PDMEQ were rated qualitatively according to the coding scheme. The frequency of occurrence of each label was counted. This was done separately for each version of the questionnaire, that is, for co-designers, the rest of the class, and teachers.

8.2.4.2 Research question 2A

For examining the general effect of the intervention several analyses were executed. Teachers in the experimental and control condition differed in the response to the question whether changes took place in educational practice between T1 and T2 (OQ^+-question). Using a χ^2 test, differences in the frequencies of the categorical responses were tested. Additionally, *t* tests were used to examine whether teachers in the experimental and control condition differed with respect to the changes in overall scores on perception and dissatisfaction between T1 and T2.

In all analyses for students, three groups were distinguished: the co-designers in the experimental condition, the rest of the class in the experimental condition, and the control group. A χ^2 test was used to test whether the frequencies of the categorical responses to the OQ^+-question differed between the three groups. ANOVAs were conducted to investigate if changes in the period between T1 and T2, on overall IPSEE-scores for perception, dissatisfaction, and disagreement, were different for the three groups. Post-hoc tests (with Tukey correction) were executed to explore which groups significantly differed from each other. Furthermore, ANOVAs (including post-hoc tests) were conducted to test if changes between T1 and T2 on students' judgments of the lessons, their enjoyment, and their invested effort (questions of the OQ) differed between groups. An unpaired *t* test was conducted to test if the overall score on the APEQ differs between co-designing students and the rest of the class. Because students in the control condition did not fill out the APEQ, only a comparison between these two groups was made. Pearson correlations were calculated to determine how the overall score on the APEQ related to changes in overall perception scores, dissatisfaction scores, and disagreement scores, as well as changes in the results of the OQ. These correlations give insight in how the noticed implementation of the action points relates to

changes during the intervention period with respect to perceptions, dissatisfaction, disagreement, and scores on the OQ.

8.2.4.3 Research question 2B

For examining the specific effects of the participatory design on the perceptions of characteristics of the particular learning environment in each experimental class, analyses were conducted at scale level of the IPSEE, separately for each experimental class. For this research question, no analyses could be done for teachers because there is only one teacher in each class. For students, again three groups were compared: co-designers, the rest of the class, and the control group. The control class that was linked to an experimental class always matched with respect to the course. In case of the English class, linking the experimental class and the control class was obvious, because only one class was included in both conditions. However, in the case of mathematics and economics it was rather arbitrary which control class to link with which experimental class. Therefore, we decided to join all control students per course together in one group. Subsequently, for each experimental class in the course of mathematics, one third of the mathematics control students was randomly selected and linked to that specific class. For economics, the three – relatively small – control classes were joined together and randomly divided into two groups that were subsequently linked to the two experimental classes.

All analyses were done separately for each experimental class (including its linked control group). ANOVAs were conducted to see whether the changes between perception scores at T1 and T2 differed between the three groups. Post-hoc tests (with Tukey correction) were used to determine which groups differed significantly. Unpaired *t* tests were executed on the scores of each question of the APEQ (experimental condition only) in order to see whether co-designers noticed the implementation of the action points more strongly than the rest of the class. One-sample *t* tests were used to see if students' and teachers' evaluation of the implementation differed. The control group was excluded here, because these students did not fill out the APEQ.

In the following section, results are reported which are significant at a level of $p < .05$. Because of the limited sample size for analyses on teacher results (research question 2A) and student results per class (research question 2B), trends with $p < .10$ will also be discussed for these analyses.

8.3 Results

8.3.1 Evaluation of the participatory design meeting

The frequencies of the labels of the PDMEQ were counted to answer the first research question. Of the 28 responding co-designing students, 24 students experienced the atmosphere during the meeting as comfortable. Three students said the atmosphere was a bit uncomfortable in the beginning but got better during the meeting; two students experienced the meeting as a bit stressed, and four students indicated they found the activity with the colored balls childish. All students experienced enough opportunities to say what they wanted to say. Eighteen students recognized all remarks of others and agreed with them; seven students largely recognized the remarks of others and agreed with them, and three students partly recognized the remarks of others and partly agreed and partly disagreed with them. All but three students agreed on the formulated action points. These three students agreed but found one action point superfluous or disagreed with it. Five students spontaneously stated that they already saw their teacher implementing the action points, and three students remarked they expected the course to improve by the implementation of the action points.

Five of six teachers reported a pleasant atmosphere during the participatory design meeting. Two teachers stated students were well able to express themselves; also two teachers remarked that students were reserved at the beginning of the meeting but became more talkative later on. All teachers answered they recognized most of the students' remarks; only three times a remark was conceived as not well recognizable. The usability of students' suggestions was good according to all teachers. Two teachers reported they found it difficult to implement one of the suggestions and/or needed more time to think about how it could be implemented. The general opinion on the meeting was positive for all teachers.

Non-co-designing students (i.e., the rest of the class) received a summary of the remarks and action points resulting from the meeting and reported on their recognizability. Of the 46 responding students, 30 students fully agreed on the summary and recognized all remarks; four students largely agreed but disagreed on one remark, and four students disagreed on more than one remark. In response to the question about the formulated action points, 24 students totally agreed; two students agreed but added a suggestion to it; 16 students largely agreed but disagreed on one action point or found it superfluous, and three students disagreed on more than one action point or found them superfluous. Seven students spontaneously stated that they already saw their teacher implementing one or more of the action points, and six students remarked they expected the course to improve if action points were implemented.

8.3.2 General effects of the intervention

In respect to research question 2A concerning the general effects of the intervention, results of analyses on teacher data showed that teachers in the experimental condition reported far more often that changes in educational practice took place between T1 and T2 than teachers in the control condition (OQ^+-question), $\chi^2(1, N = 11) = 7.64$, $p < .01$. All teachers in the experimental condition reported changes, versus only 16.67% of the teachers in the control condition. Results of *t* tests on the overall scores of the IPSEE-T also support this finding. Overall perception scores of teachers in the experimental condition increased more strongly between T1 and T2 ($M = .25$, $SD = .09$) than scores of teachers in the control condition ($M = -.09$, $SD = .21$), $t(11) = 3.73$, $p < .01$, $d = 2.05$. Thus, teachers in the experimental condition saw more changes in the direction of a powerful learning environment than teachers in the control condition. Likewise, dissatisfaction scores declined more strongly for teachers in the experimental condition ($M = -.21$, $SD = .04$) than for teachers in the control condition ($M = -.04$, $SD = .23$), $t(11) = -1.88$, $p < .10$, $d = .99$.

The results of analyses on student data revealed that co-designing students, the rest of the class, and the control group significantly differed in their response to the OQ^+-question whether they noticed changes in educational practice or not, χ^2 (8, $N = 239$) = 107.29, $p < .01$. Of the co-designers 86.8% noticed improvement, 13.2% noticed no changes, and nobody noticed worsening. Of the rest of the class 64.1% noticed improvement, 32.6% noticed no changes, and 3.3% noticed worsening. In the control group 8.8% of the students noticed improvement, 90.2% noticed no changes, and 1.0% noticed worsening.

Table 8.1 Means and standard deviations of the differences between overall scores at T1 and T2 (T2 minus T1)

	Co-designers (*N* = 40)		**Rest of class (*N* = 97)**		**Control group (*N* = 102)**	
	M	***SD***	***M***	***SD***	***M***	***SD***
Perception score	.04	.42	-.02	.35	.03	.35
Dissatisfaction score	-.09	.48	.10	.39	-.08	.31
Disagreement score	.10	.33	.12	.34	.06	.32
OQ-question 1 (judgment on quality of course)	5.13	12.59	-.27	8.60	-.51	11.87
OQ, question 2 (enjoyment in course)	1.78	9.43	-2.75	10.49	-.79	10.60
OQ, question 3 (invested effort in course)	.85	11.62	1.22	14.23	-.71	14.79
APEQ (extent of implementation of action points)	69.36	12.63	63.08	15.28		

Note. The APEQ is not applicable to the control group.

Table 8.1 presents the means and standard deviations of differences between student scores at T1 and T2 on the IPSEE (overall scores on perception, dissatisfaction, and disagreement), the three OQ questions, and the overall score on the APEQ – separately for co-designers, the rest of the class, and the control group. ANOVAs on the differences between overall scores of the IPSEE at T1 and T2 showed no effect on perception scores and disagreement scores. However, the change in dissatisfaction scores between T1 and T2 differed significantly depending on the group students belonged to, $F(2, 228) = 6.22$, $p < .01$, $\eta^2 = .05$. Especially, the rest of the class showed a change between T1 and T2 that was significantly different from that of the control group ($\Delta = .18$, $SE = .05$, $p < .01$) and the co-designers group ($\Delta = .19$, $SE = .07$, $p < .05$). Surprisingly, dissatisfaction scores of the rest of the class increased from TI to T2, while for both co-designers and the control group dissatisfaction scores decreased over time.

ANOVAs on the scores of the OQ at T1 and T2 showed a significant group effect on scores of question 1 about students' judgment on the quality of the course, $F(2, 239) = 4.36$, $p < .01$, $\eta^2 = .04$. Co-designers showed a larger increase in scores than both the rest of the class ($\Delta = 5.40$, $SE = 2.03$, $p < .05$) and the control group ($\Delta = 5.64$, $SE = 2.01$, $p < .05$). No effects were found for OQ questions 2 and 3.

An unpaired t test on the overall scores of the APEQ showed that co-designers noticed the implementation of the formulated action-points more clearly than the rest of the class, $t(135) = 2.30$, $p < .05$, $d = .43$.

Pearson correlations showed that the overall score at the APEQ was related to the size of the change between T1 and T2, with respect to perception scores ($r = .32$, $p < .01$), dissatisfaction scores ($r = .-32$, $p < .01$), disagreement scores ($r = -.27$, $p < .01$), and the scores at question 1 of the OQ ($r = .25$, $p < .01$). The more students noticed the implementation of the action points, the more their perception scores and judgments of the course increased, and the more their dissatisfaction scores and disagreement scores decreased.

8.3.3 Class specific effects of the intervention

For answering research question 2B, the formulated action points are described for each experimental class, as well as the extent to which they were implemented in educational practice according to students and their teachers. Results of ANOVAs on IPSEE scores are presented per class in a Table. For the IPSEE scales, only those results are described that are relevant to the action points of that particular class.

8.3.3.1 Class 1

Table 8.2 presents the means and standard deviations of the IPSEE scores of co-designers of class 1, the rest of the class, their teacher, and the linked control group. The formulated action points resulting from the participatory design meeting of this class related to a clearer structure and planning of the subject matter, improving the atmosphere in the class, and the broader availability of exercise materials. Students were used to work individually on mathematics exercises from the book, all in their own pace. By consequence, all students were active with different exercises and when the teacher gave an explanation, this was seldom just-in-time, that is, at the right moment in the learning process for each student. Therefore, the first action point contained that the teacher should give a clear planning of the contents for each lesson, and should only explain and answer questions about the planned content of a particular lesson. Only the last 15 minutes of a lesson should be reserved for giving explanations of other exercises. The second action point concerned silence in the classroom. Students asked the teacher to be more strict to students talking loudly with each other (also task-related discussions), because it hampered the concentration of other students. Whispering should be allowed and even be stimulated. Third, it should be made clearer where students could find extra exercises when needed.

The scores of the APEQ give insight in the extent to which the students and the teacher noticed the implementation of these three action points. With respect to the first action point, two questions were asked in the APEQ: one about giving a clear planning and another about the teacher giving predominantly explanations about the planned subject matter. On a scale from 10 to 100, students generally assessed the implementation of the clearer planning as 77.91 (SD = 13.60) and the teacher assessed it with a score of 80. The mean score on the question about the implementation of "just-in-time" explanations was 65.23 (SD = 13.51) for students and 70 for the teacher. The mean score on the implementation of the second action point about silence in the classroom was 58.14 (SD = 19.36) for students and 62.50 for the teacher. The implementation of the third action point about the availability of extra exercises was evaluated by students as 60.50 (SD = 22.80) and as 100 by the teacher, which was a significant difference between students' and the teacher's judgment, $t(21) = 8.13$, $p < .01$, $d = 1.73$. No significant differences were found between the scores of co-designers and the rest of the class.

Table 8.2 Means and standard deviations of the IPSEE scores of experimental class 1

	Co-designers (N = 7)		Rest of class (N = 15)		Control (N = 15)		Teacher	
Scale	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Perception scores								
Fascinating contents	3.02 (.98)	2.45 (1.09)	3.05 (1.01)	3.00 (1.33)	3.28 (.99)	2.98 (.75)	3.75	4.38
Productive learning	3.62 (.76)	4.11 (.90)	4.33 (1.08)	4.17 (1.30)	3.44 (.88)	4.04 (.65)	4.40	4.20
Integration	3.77 (.65)	2.98 (.98)	3.74 (1.15)	3.78 (1.02)	4.31 (.78)	4.28 (.88)	3.86	4.57
Student autonomy	4.33 (.73)	3.87 (.68)	4.47 (.69)	4.46 (.83)	3.89 (.73)	4.04 (.88)	4.40	4.30
Interaction	3.84 (.72)	3.69 (.51)	3.91 (.43)	3.69 (.49)	3.79 (.61)	3.71 (.58)	4.78	4.82
Differentiation	4.11 (.73)	3.99 (.68)	3.65 (.83)	3.83 (.96)	2.71 (.72)	2.79 (.79)	4.80	4.60
Clarity of goals	4.36 (.89)	3.00 (.82)	4.23 (.91)	3.45 (1.23)	4.88 (.89)	4.67 (.89)	4.00	5.00
Personalization	4.62 (.83)	4.45 (.81)	4.84 (.60)	4.82 (.94)	5.01 (.66)	4.86 (.91)	5.33	5.50
Dissatisfaction scores								
Fascinating contents	1.80 (.93)	2.00 (1.04)	1.32 (1.42)	1.78 (1.21)	1.52 (1.03)	1.71 (1.02)	1.25	1.13
Productive learning	.58 (.64)	.57 (.67)	.68 (.67)	.60 (.79)	.85 (.92)	.51 (.36)	.60	.20
Integration	1.11 (.46)	1.39 (.77)	.87(1.24)	1.02 (1.00)	.59 (.73)	.35 (.70)	.57	.43
Student autonomy	.48 (.38)	.44 (.25)	.50 (.46)	.49 (.52)	.84 (.69)	.81 (.72)	.70	.30
Interaction	.68 (.59)	.65 (.42)	.47 (.48)	.62 (.65)	.80 (.58)	.88 (.58)	.44	.27
Differentiation	1.03 (1.05)	.82 (.78)	.43 (.47)	1.05 (1.04)	.61 (.34)	.37 (.53)	.20	.20
Clarity of goals	.71 (.68)	1.64 (.85)	1.13 (1.04)	2.05 (1.50)	.58 (.55)	.68 (.64)	.75	.50
Personalization	.52 (.63)	.53 (.71)	.54 (.52)	.51 (.85)	.35 (.40)	.48 (.63)	.17	.00
Disagreement scores								
Fascinating contents	.88 (.83)	1.93 (1.09)	.96 (.76)	1.59 (1.03)	.78 (.52)	.44 (.40)	-	-
Productive learning	.78 (.76)	.66 (.56)	.78 (.72)	1.04 (.74)	.90 (.66)	.75 (.54)	-	-
Integration	.50 (.38)	1.59 (.98)	.81(.79)	.86 (.95)	.65 (.57)	.56 (.59)	-	-
Student autonomy	.58 (.38)	.60 (.51)	.57 (.36)	.63 (.54)	.58 (.65)	.91 (.75)	-	-
Interaction	.94 (.72)	1.13 (.51)	.87 (.43)	1.13 (.49)	.39 (.37)	.47 (.45)	-	-
Differentiation	.74 (.66)	.78 (.42)	1.15 (.83)	1.01 (.68)	1.77 (.78)	1.33 (.95)	-	-
Clarity of goals	.79 (.47)	2.00 (.82)	.80 (.45)	1.55 (1.23)	.77 (.50)	.70 (.62)	-	-
Personalization	.90 (.57)	1.05 (.81)	.65 (.42)	.81 (.82)	.84 (.62)	.74 (.65)	-	-

The results of the ANOVAs on the IPSEE scores are presented in Table 8.3. With respect to the content, the first action point especially refers to the IPSEE scale differentiation (i.e., *diminishing* differentiation in the lessons). On this scale, dissatisfaction scores of co-designers decreased more strongly than for the rest of the class, but also scores of the rest of the class decreased less strongly than for the control group. Actually, for the rest of the class dissatisfaction scores increased, while for co-designers and the control group the scores decreased. The second and third action points are not clearly related to particular scales of the IPSEE.

Table 8.3 Results of the ANOVAs on the IPSEE scores of experimental class 1

				Post Hoc Tests			
Scale	***F***	**η^2**	***p***	**groups***	**Δ**	***SE***	***p***
Perception scores							
Fascinating contents							
Productive learning	3.08	.16	.06	C-R	.83	.35	.06
Integration	3.42	.18	.05	R-D	.87	.35	.05
				C-D	.81	.35	.07
Student autonomy							
Interaction							
Differentiation							
Clarity of goals	3.26	.16	.05	C-D	1.14	.46	.05
Personalization							
Dissatisfaction scores							
Fascinating contents							
Productive learning							
Integration							
Student autonomy							
Interaction							
Differentiation	5.05	.23	.01	R-C	.88	.30	.02
				R-D	.83	.37	.08
Clarity of goals							
Personalization							
Disagreement scores							
Fascinating contents	11.80	.43	.00	D-C	1.39	.32	.00
				R-C	.97	.26	.00
Productive learning							
Integration	3.79	.19	.03	D-R	1.07	.43	.04
				D-C	1.07	.43	.05
Student autonomy							
Interaction							
Differentiation							
Clarity of goals	4.43	.21	.02	D-C	1.29	.47	.03
				R-C	.82	.38	.09
Personalization							

Note. df = 2. * Groups that showed to differ significantly in post hoc tests; 'D' refers to co-designers, 'R' refers to the rest of the class, and 'C' refers to the control group.

8.3.3.2 Class 2

Table 8.4 presents the means and standard deviations of the IPSEE of the co-designers of class 2, the rest of the class, their teacher, and the linked control group of the second experimental class, and the linked control group. The participatory design meeting yielded three main action points. The first action point concerned receiving instruction about new subject matter. Usually, students worked autonomously on mathematics exercises and asked the teacher for individual help and instruction only when they experienced problems. Students remarked that this procedure had the disadvantage that they often needed to wait until the teacher had time for them (i.e., is not busy with other students), but also that it was inefficient

to first try an exercise while not yet understanding the theory. Therefore, students asked the teacher to give a short explanation of the new subject matter during each lesson. Students should not be obliged to listen to it. The second action point was linked to the first one: students preferred receiving teacher support more quickly when having questions (i.e., shorter waiting time). The co-designing students expected that this point would improve automatically when the teacher would give the class an instruction on the subject matter, because now the teacher does no longer have to explain the same things repeatedly to different individual students, which frees up extra time. The third action point concerned the learning materials. The answer book, which accompanied the exercise book, sometimes contained errors. It should be explicitly reported in the class if an error appears, so that everyone is informed about it.

Table 8.4 Means and standard deviations of the IPSEE scores of experimental class 2

	Co-designers (*N* = 7)		**Rest of class (*N* = 15)**		**Control (*N* = 15)**		**Teacher**	
Scale	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Perception scores								
Fascinating contents	3.96 (1.20)	3.97 (1.36)	4.02 (.53)	3.89 (.56)	3.08 (.82)	3.09 (.73)	4.17	4.00
Productive learning	4.43 (.78)	4.44 (.87)	4.39 (1.05)	4.32 (.85)	3.79 (.91)	4.11 (1.26)	4.20	5.20
Integration	4.04 (1.20)	4.45 (.78)	4.33 (.61)	4.28 (.54)	4.00 (.92)	4.06 (.76)	3.29	4.14
Student autonomy	4.38 (.92)	4.72 (.59)	4.56 (.57)	4.44 (.42)	3.93 (.99)	4.11 (.85)	3.60	2.80
Interaction	4.14 (.49)	4.42 (.56)	4.19 (.25)	4.31 (.45)	3.65 (.59)	3.90 (.58)	4.00	4.27
Differentiation	2.89 (.41)	3.34 (.91)	3.11 (.80)	3.28 (.81)	3.35 (1.00)	3.55 (1.20)	3.60	3.80
Clarity of goals	4.89 (.90)	4.93 (1.01)	5.02 (.53)	4.97 (.69)	4.83 (1.16)	4.93 (.94)	4.75	4.75
Personalization	5.64 (.20)	5.67 (.22)	5.53 (.22)	5.56 (.34)	4.99 (.98)	5.06 (.56)	5.83	5.33
Dissatisfaction scores								
Fascinating contents	.89 (1.01)	1.19 (1.56)	.64 (.53)	.77 (.62)	1.18 (.99)	1.13 (.87)	1.08	1.13
Productive learning	.80 (.82)	.52 (.49)	.54 (.31)	.32 (.32)	.57 (.39)	.31 (.45)	.80	.00
Integration	.86 (1.11)	.56 (.60)	.37 (.35)	.42 (.36)	.85 (.71)	.58 (.50)	1.43	.86
Student autonomy	.93 (1.11)	.20 (.25)	.43 (.32)	.56 (.35)	.73 (.65)	.52 (.62)	.78	.60
Interaction	.63 (.47)	.16 (.16)	.23 (.21)	.23 (.20)	.88 (.63)	.52 (.49)	1.00	.93
Differentiation	.76 (1.28)	.39 (.42)	.33 (.29)	.61 (.55)	.63 (.55)	.45 (.52)	.60	.20
Clarity of goals	1.07 (1.07)	.68 (.64)	.58 (.49)	.50 (.54)	.78 (.94)	.52 (.68)	.00	.25
Personalization	.11 (.14)	.10 (.19)	.12 (.10)	.13 (.23)	.51 (.75)	.24 (.38)	.00	.17
Disagreement scores								
Fascinating contents	.82 (.83)	.92 (.94)	.42 (.35)	.48 (.28)	.71 (.56)	.69 (.48)	-	-
Productive learning	.69 (.34)	.88 (.73)	.88 (.55)	1.02 (.66)	.82 (.62)	1.16 (.94)	-	-
Integration	1.20 (.64)	.67 (.44)	1.14 (.37)	.51 (.20)	.68 (.51)	.60 (.41)	-	-
Student autonomy	1.09 (.41)	1.92 (.59)	1.00 (.50)	1.64 (.42)	.82 (.65)	.86 (.78)	-	-
Interaction	.38 (.32)	.45 (.31)	.26 (.16)	.35 (.26)	.47 (.35)	.53 (.34)	-	-
Differentiation	.71 (.41)	.91 (.32)	.74 (.55)	.73 (.61)	1.32 (.99)	1.69 (.91)	-	-
Clarity of goals	.64 (.59)	.75 (.63)	.47 (.35)	.62 (.35)	.74 (.74)	.73 (.55)	-	-
Personalization	.19 (.20)	.33 (.22)	.30 (.22)	.33 (.22)	.73 (.73)	.52 (.42)	-	-

The results of the APEQ showed that the implementation of the first action point about giving the class extra explanation was evaluated by students as 78.41 (*SD* = 17.95) and by the teacher as 50. Student scores and the score of the teacher differed significantly, $t(21) = 7.42$, $p < .01$, $d = 1.58$, but this is likely due to the fact that the teacher expressed a frequency rather than a value with his score. He responded "50, in half of the lessons". The mean score on the second action point about the teacher's available time for answering questions was 55.71 (*SD* = 22.49) for students and 50 for the teacher, who again stated "half of the cases". The implementation of the third action point about errors in the answer book was evaluated by students with a mean score of 71.32 (*SD* = 23.28) and with a score of 70 by the teacher. Furthermore, co-designers and the rest of the class differed with respect to their evaluation scores of the first action point. Co-designers noticed the implementation of the instruction on new subject matter (*M* = 88.57, *SD* = 10.69) more strongly than the rest of the class (*M* = 73.67, *SD* = 18.94), $t(18.99) = 2.35$, $p < .05$, $d = .87$.

Table 8.5 presents the results of the ANOVAs on the scales of the IPSEE. The proposed changes, formulated in the first and second action points refer to the degree of student autonomy and interaction processes during learning, especially between students and teacher. The third action point does not clearly refer to any of the scales of the IPSEE. On the scale student autonomy, dissatisfaction scores of co-designers decreased more strongly than scores of the rest of the class, which even increased (see Table 8.4). Disagreement scores increased more strongly for both co-designers and the rest of the class, compared to the control group. Disagreement scores represent the discrepancy between student perception scores and the teacher's score. An increase in disagreement is thus an undesirable result. As student perception scores did not show significant changes between T1 and T2 (see first part of Table 8.5), the cause of the increase of disagreement scores is the teacher's decrease in perception scores (at T1: 3.60, at T2: 2.80). Apparently, he perceived a decrease in student autonomy and – in combination with unchanging student perception scores – this is reflected in an increase in disagreement scores.

With respect to the scale interaction, dissatisfaction scores of co-designers decreased more strongly than scores of the rest of the class. Even dissatisfaction scores of the control group decreased more strongly than the scores of the rest of the class. Inspecting Table 8.4 makes clear that the dissatisfaction scores of the rest of the class did not change between T1 and T2, and that the dissatisfaction scores of both co-designers and the control group decreased in this period.

Table 8.5 Results of the ANOVAs on the IPSEE scores of experimental class 2

				Post Hoc Tests			
Scale	***F***	**η^2**	***p***	**groups***	**Δ**	***SE***	***p***
Perception scores							
Fascinating contents							
Productive learning							
Integration							
Student autonomy							
Interaction							
Differentiation							
Clarity of goals							
Personalization							
Dissatisfaction scores							
Fascinating contents							
Productive learning							
Integration							
Student autonomy	5.49	.25	.01	R-D	.89	.27	.01
Interaction	5.04	.25	.01	R-D	.47	.16	.02
				R-C	.33	.14	.05
Differentiation							
Clarity of goals							
Personalization							
Disagreement scores							
Fascinating contents							
Productive learning							
Integration	2.88	.16	.07	C-R	.49	.22	.07
Student autonomy	6.10	.26	.01	D-C	.78	.26	.02
				R-C	.60	.21	.02
Interaction							
Differentiation							
Clarity of goals							
Personalization	2.45	.13	.10	-			

Note. df = 2. * Groups that showed to differ significantly in post hoc tests; 'D' refers to co-designers, 'R' refers to the rest of the class, and 'C' refers to the control group

8.3.3.3 Class 3

Table 8.6 presents the means and standard deviations of the IPSEE scores of the co-designers of class 3, the rest of the class, their teacher, and the linked control group. Three action points resulted from the participatory design meeting. First, students asked the teacher to give the class short summaries of the subject matter of the previous lesson as a supplement to the predominantly individual and self-directed way of working in this class. These summaries were especially meant for those students who needed this extra explanation and listening to them should be voluntary. Second, students preferred the opportunity to skip mathematics exercises if these were highly similar to each other. Because of the extensive mathematics curriculum students sometimes experienced shortage of time and skipping exercises could free up some time. The teacher remarked that students are

themselves responsible for skipping exercises and emphasized that making more exercises is sometimes needed to get enough practice. Third, students asked the teacher to be more precisely in writing down numbers of worked-out exercises on the blackboard, so that students could pick up the explanation more easily if they did not pay full attention from the beginning.

The scores of the APEQ showed that students rated the implementation of the first action point concerning summaries as 56.73 (SD = 24.90) and the teacher as 80, which is a significant difference, $t(25) = 4.77$, $p < .01$, $d = .93$. The implementation of the second action point on skipping exercises was evaluated as

Table 8.6 Means and standard deviations of the IPSEE scores of experimental class 3

	Co-designers (N = 6)		Rest of class (N = 20)		Control (N = 16)		Teacher	
Scale	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Perception scores								
Fascinating contents	2.98 (1.07)	3.00 (1.00)	3.12 (.82)	3.16 (.91)	3.18 (1.13)	3.12 (1.36)	3.50	4.33
Productive learning	3.77 (.79)	3.73 (1.16)	3.78 (1.02)	3.75 (1.27)	4.17 (1.01)	4.21 (.87)	3.60	2.50
Integration	3.69 (.89)	4.12 (1.03)	3.82 (1.04)	3.94 (1.02)	3.95 (1.03)	4.01 (1.22)	-	5.14
Student autonomy	3.63 (.61)	4.13 (.39)	3.54 (.73)	3.58 (.84)	3.73 (.95)	3.86 (1.05)	3.90	4.90
Interaction	3.65 (.42)	3.69 (.59)	3.68 (.45)	3.72 (.58)	3.66 (.86)	3.69 (.96)	3.90	4.45
Differentiation	2.83 (.73)	3.35 (.70)	3.30 (.74)	2.98 (.75)	3.55 (.95)	3.18 (1.08)	4.00	3.00
Clarity of goals	4.42 (.74)	4.71 (.66)	4.31 (1.03)	4.18 (1.23)	4.75 (.93)	4.34 (1.00)	4.75	5.50
Personalization	4.80 (.58)	5.08 (.57)	4.63 (.88)	4.71 (.85)	5.05 (.98)	4.98 (1.07)	5.00	5.83
Dissatisfaction scores								
Fascinating contents	1.52 (1.44)	1.52 (1.47)	.99 (.81)	1.20 (.97)	1.28 (1.33)	1.42 (1.28)	.36	.00
Productive learning	.67 (.67)	.51 (.73)	.72 (.51)	.57 (.55)	.51 (.39)	.49 (.53)	.20	.00
Integration	.58 (.45)	.58 (.90)	.53 (.63)	.57 (.77)	.87 (.94)	.70 (.89)	-	.00
Student autonomy	.79 (.63)	.55 (.58)	.78 (.59)	.57 (.48)	.72 (.62)	.66 (.56)	.10	.00
Interaction	.79 (.38)	.63 (.50)	.58 (.53)	.52 (.58)	.88 (.77)	1.00 (.83)	.30	.00
Differentiation	.28 (.20)	.49 (.33)	.37 (.37)	.46 (.50)	.57 (.60)	.41 (.56)	.00	.00
Clarity of goals	.88 (.61)	.71 (.68)	.86 (.89)	.90 (1.25)	.53 (.75)	.80 (.80)	.00	.00
Personalization	.39 (.60)	.22 (.34)	.61 (.83)	.46 (.81)	.50 (.57)	.41 (.60)	.00	.00
Disagreement scores								
Fascinating contents	.73 (.91)	1.34 (1.00)	.74 (.50)	1.20 (.88)	.88 (.69)	.94 (.78)	-	-
Productive learning	.63 (.43)	1.48 (.73)	.82 (.61)	1.47 (.99)	1.08 (.61)	1.00 (.64)	-	-
Integration	-	1.02 (1.03)	-	1.25 (.96)	.66 (.66)	.95 (.61)	-	-
Student autonomy	.51 (.39)	.77 (.39)	.64 (.49)	1.35 (.79)	.79 (.41)	1.13 (.44)	-	-
Interaction	.35 (.33)	.76 (.59)	.41 (.27)	.78 (.51)	.65 (.32)	.58 (.52)	-	-
Differentiation	1.18 (.73)	.55 (.52)	.87 (.53)	.57 (.47)	1.09 (.85)	1.58 (.76)	-	-
Clarity of goals	.50 (.61)	.79 (.66)	.86 (.70)	1.37 (1.17)	.66 (.58)	.91 (.76)	-	-
Personalization	.37 (.48)	.75 (.57)	.63 (.70)	1.13 (.85)	.67 (.80)	.83 (.82)	-	-

Note. At T1 the teacher had more than 25% of missing values at the scale integration. By consequence, no disagreement scores could be computed on this scale for co-designers and the rest of the class at T1.

50.96 (*SD* = 25.06).The teacher did not fill out this question. The mean score on the implementation of the third action point about exercise numbers on the blackboard was 81.73 (*SD* = 27.46) for students and 80 for the teacher. Co-designers and the rest of the class differed with respect to their evaluation scores for the first action point: co-designers (*M* = 68.33, *SD* = 11.69) rated the implementation of summaries higher than the rest of the class (*M* = 53.25, *SD* = 26.92), $t(20.14) = 1.96$, $p < .10$, $d = .62$.

Table 8.7 Results of the ANOVAs on the IPSEE scores of experimental class 3

				Post Hoc Tests			
Scale	***F***	**η^2**	***p***	**groups***	**Δ**	***SE***	***p***
Perception scores							
Fascinating contents							
Productive learning							
Integration							
Student autonomy							
Interaction							
Differentiation	3.06	.14	.06	D-C	.89	.37	.06
				D-R	.80	.37	.09
Clarity of goals							
Personalization							
Dissatisfaction scores							
Fascinating contents							
Productive learning							
Integration							
Student autonomy							
Interaction							
Differentiation							
Clarity of goals							
Personalization							
Disagreement scores							
Fascinating contents	2.46	.12	.10	-			
Productive learning	3.18	.15	.05	D-C	.87	.41	.10
				R-C	.64	.30	.10
Integration							
Student autonomy	2.65	.12	.08	-			
Interaction	5.08	.21	.01	R-C	.44	.15	.02
				D-C	.49	.21	.07
Differentiation	6.97	.27	.00	C-D	1.11	.36	.01
				C-R	.80	.26	.01
Clarity of goals							
Personalization							

Note. df = 2. * Groups that showed to differ significantly in post hoc tests; 'D' refers to co-designers, 'R' refers to the rest of the class, and 'C' refers to the control group.

Table 8.7 presents the results of the ANOVAs on the IPSEE scales. With respect to the content, the action points refer to the scales differentiation and student autonomy. On the one hand, more differentiation and student autonomy is proposed by giving students the opportunity to skip exercises. On the other hand, asking for a teacher who is providing summaries can be considered as a request to give up some student autonomy and differentiation. In respect to differentiation, the results showed that perception scores increased more strongly for co-designers than for both the rest of the class and the control group, whose scores even decreased. Disagreement scores of differentiation decreased more strongly for co-designers and the rest of the class (i.e., whole experimental group) than for the control group. On the scale student autonomy, a group effect was found on disagreement scores but post-hoc analyses did not show any significant effects between groups.

8.3.3.4 Class 4

The mean scores and standard deviations of the IPSEE scores of co-designers in class 4, the rest of the class, their teacher, and the linked control group are presented in Table 8.8. The participatory design meeting resulted in six action points. First, students asked the teacher to provide them more frequently with a summary of the subject matter during the lessons. Second, more examples out of daily life and news items were asked for to make the economics lessons and learning contents more interesting. Third, to overcome a sometimes passive attitude, students should be stimulated to actively contribute to the lesson by asking questions to each other and to the teacher, and to take questions seriously and try to answer them. Fourth, students asked the teacher to provide them with exercises allowing them to better prepare for the test. Fifth and also with respect to examination, students remarked that they often experienced a lack of time during the test. For optimizing test results, students asked the teacher to give an indication of the maximum number of attainable points per question. This might help them to fill out the most important questions in time. Sixth, students asked for more silence in the classroom.

The scores of the APEQ showed that students rated the implementation of the first action point about giving short summaries as 66.95 (SD = 15.81) and the teacher as 80, which is a significantly higher score, $t(20) = 3.78$, $p < .01$, $d = .83$. The mean score on the implementation of the second action point concerning the use of more examples from daily life was 58.00 (SD = 19.89) for students and significantly lower for the teacher, namely 50, $t(20) = 1.84$, $p < .10$, $d = .40$. The implementation of the third action point concerning the active asking of questions was evaluated as 60.38 (SD = 25.78) by students and as 70 by the teacher, which is

Table 8.8 Means and standard deviations of the IPSEE scores of experimental class 4

	Co-designers (N = 6)		Rest of class (N = 15)		Control (N = 16)		Teacher	
Scale	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Perception scores								
Fascinating contents	3.37 (.94)	3.61 (.75)	3.17 (1.03)	3.13 (.87)	3.98 (.74)	3.58 (.78)	3.38	3.50
Productive learning	3.17 (.76)	3.63 (.37)	3.67 (.74)	3.47 (.94)	3.59 (1.10)	3.78 (.91)	4.80	4.80
Integration	3.98 (.76)	4.00 (.56)	3.90 (.48)	3.66 (.65)	4.18 (.40)	3.93 (.57)	4.00	4.14
Student autonomy	3.15 (.22)	3.99 (.74)	3.12 (.63)	3.26 (.69)	3.96 (.62)	3.83 (.63)	3.50	3.80
Interaction	3.22 (.66)	3.33 (.48)	3.54 (.61)	3.46 (.49)	3.72 (.69)	3.34 (.70)	3.18	3.89
Differentiation	3.04 (.26)	3.23 (.50)	2.62 (.62)	2.90 (.75)	2.88 (.86)	3.23 (.81)	3.20	3.80
Clarity of goals	3.46 (1.14)	4.25 (.91)	3.82 (.92)	4.23 (.92)	4.50 (1.12)	4.03 (1.18)	5.00	5.00
Personalization	4.81 (.59)	4.75 (.46)	4.65 (.43)	4.67 (.42)	4.10 (1.14)	3.86 (1.22)	5.00	4.83
Dissatisfaction scores								
Fascinating contents	1.72 (1.03)	1.17 (.94)	1.26 (1.29)	1.56 (1.23)	.76 (.56)	1.00 (.77)	1.75	1.13
Productive learning	.40 (.32)	.53 (.33)	.89 (.91)	1.07 (1.04)	.44 (.28)	.57 (.68)	.00	.00
Integration	.93 (.87)	.69 (.74)	.36 (.30)	.62 (.58)	.35 (.31)	.54 (.56)	1.14	.71
Student autonomy	.56 (.54)	.41 (.35)	1.24 (.98)	1.10 (.91)	.62 (.60)	.64 (.66)	.40	.30
Interaction	1.24 (.90)	.71 (.54)	.89 (.79)	1.08 (.56)	.70 (.65)	.87 (.84)	1.36	1.00
Differentiation	.05 (.10)	.17 (.15)	.72 (.72)	.69 (1.05)	.26 (.22)	.38 (.48)	.20	.00
Clarity of goals	2.26 (1.02)	.75 (1.25)	1.47 (.97)	1.13 (.94)	.99 (1.09)	1.22 (1.25)	.00	.00
Personalization	.60 (.52)	.22 (.25)	.26 (.18)	.27 (.29)	.82 (.86)	1.04 (1.23)	.17	.00
Disagreement scores								
Fascinating contents	.75 (.47)	.65 (.26)	.75 (.70)	.70 (.61)	.80 (.47)	1.25 (.51)	-	-
Productive learning	1.63 (.76)	1.17 (.37)	1.13 (.74)	1.36 (.90)	1.41 (1.01)	1.23 (.89)	-	-
Integration	.55 (.47)	.38 (.40)	.42 (.24)	.67 (.43)	.43 (.28)	.81 (.40)	-	-
Student autonomy	.35 (.22)	.49 (.56)	.59 (.42)	.66 (.57)	.94 (.54)	1.02 (.73)	-	-
Interaction	.52 (.33)	.56 (.48)	.61 (.32)	.55 (.33)	.57 (.45)	.74 (.37)	-	-
Differentiation	.24 (.17)	.63 (.39)	.71 (.45)	.93 (.71)	.78 (.42)	.84 (.58)	-	-
Clarity of goals	1.54 (1.14)	1.00 (.55)	1.18 (.92)	.90 (.78)	.86 (.95)	1.03 (1.08)	-	-
Personalization	.53 (.25)	.36 (.25)	.44 (.32)	.34 (.28)	1.29 (1.19)	.92 (.84)	-	-

a significantly higher score, $t(20) = 1.71$, $p < .10$, $d = .37$. The implementation of the fourth action point about extra exercises was evaluated by students as 60.52 (SD = 26.53) and as 90 by the teacher, which is again a significantly higher score for the teacher, $t(20) = 5.09$, $p < .01$, $d = 1.11$. The mean score on the implementation of the fifth action point concerning giving attainable points for test questions was 79.85 (SD = 27.94) for students and 100 for the teacher, $t(19) = 3.23$, $p < .01$, $d = .72$. The implementation of the sixth action point on silence in the classroom was evaluated by students as 60.33 (SD = 15.37) and as 50 by the teacher, which is a significantly lower score, $t(20) = 3.08$, $p < .01$, $d = .67$.

With respect to the evaluation of the second action point concerning the use of more examples from daily life, it was found that co-designers (M = 75.00, SD = 5.48) had higher scores than the rest of the class (M = 51.20, SD = 19.52), $t(18.09) = 4.32$, $p < .01$, $d = 1.42$. The same held for the evaluation of the fifth action point concerning attainable points for test questions:

Table 8.9 Results of the ANOVAs on the IPSEE scores of experimental class 4

				Post Hoc Tests			
Scale	***F***	**η^2**	***p***	**groups***	**Δ**	***SE***	***p***
Perception scores							
Fascinating contents							
Productive learning							
Integration							
Student autonomy	7.18	.30	.00	D-C	.97	.25	.00
				D-R	.70	.26	.03
Interaction							
Differentiation							
Clarity of goals	6.22	.27	.00	D-C	1.26	.42	.01
				R-C	.89	.32	.02
Personalization							
Dissatisfaction scores							
Fascinating contents	3.56	.18	.04	R-D	.93	.36	.04
				C-D	.79	.35	.08
Productive learning							
Integration							
Student autonomy							
Interaction	2.57	.14	.09	R-D	.82	.37	.08
Differentiation							
Clarity of goals	8.91	.34	.00	C-D	1.74	.41	.00
				R-D	1.18	.42	.02
Personalization	2.67	.14	.08	C-D	.67	.30	.08
Disagreement scores							
Fascinating contents	4.38	.21	.02	C-R	.51	.19	.03
				C-D	.55	.25	.09
Productive learning	2.69	.14	.08	R-D	.69	.33	.10
Integration	2.48	.14	.10	C-D	.52	.23	.08
Student autonomy							
Interaction							
Differentiation							
Clarity of goals							
Personalization							

Note. df = 2. * Groups that showed to differ significantly in post hoc tests; 'D' refers to co-designers, 'R' refers to the rest of the class, and 'C' refers to the control group.

co-designers (M = 98.33, SD = 4.08) evaluated more affirmatively than the rest of the class (M = 71.93, SD = 30.15), $t(14.07) = 3.21$, $p < .01$, $d = 1.03$.

Table 8.9 presents the results of the ANOVAs on the IPSEE scales. The action points refer to the scale fascinating contents (using more examples from daily life), student autonomy and interaction (taking the initiative to ask questions and taking each other's questions seriously), and clarity of goals (providing exercises for tests and providing attainable points per test question). With respect to fascinating contents, dissatisfaction scores of co-designers decreased more strongly between T1 and T2 than for both the rest of the class and the control group, whose scores in fact increased. The disagreement scores decreased more strongly for both co-designers and the rest of the class (i.e., whole experimental group), compared to the

control group. With respect to student autonomy, perception scores of co-designers showed to increase more strongly than for both the rest of the class and the control group. On the scale interaction, the dissatisfaction scores of co-designers decreased more than the scores of the rest of the class. With respect to clarity of goals, for both co-designers and the rest of the class (i.e., whole experimental group) the perception scores increased more than for the control group. Dissatisfaction scores decreased more for co-designers than for both the rest of the class and the control group.

8.3.3.5 Class 5

Table 8.10 presents the means and standard deviations of the IPSEE scores of the fifth experimental class: the co-designers, the rest of the class, the linked control group, and the teacher. Six action points were formulated during the meeting. First, students appreciated more clarity about which economics exercises they had at least to complete during each lesson. Second, students remarked that the subject matter would become more interesting if the teacher included more examples from news items and daily life. Third, students should be stimulated to explain the subject matter to each other in order to improve understanding. Also, it was proposed that sometimes a student instead of the teacher could use the blackboard to demonstrate how an exercise should be solved. Fourth, students asked the teacher to provide a procedure for solving difficult problems in order to improve their comprehension of the problem-solving process. Fifth, students remarked that the presented tasks in tests often did not correspond to the exercises dealt with during the lessons. Tests were perceived to require deeper understanding of the subject matter and to be more difficult. Thus, tests should better match the degree of difficulty of problems dealt with during lessons. Sixth, students stated that they sometimes became bored if the teacher elaborated too long on a question posed by a single student. It was proposed that the teacher should answer such questions individually at the end of the lesson.

The results of the APEQ showed that students evaluated the first action point about clarity of exercises that had at least to be completed during a lesson as 69.00 (SD = 14.43) and the teacher as 70. The implementation of the second action point about including more examples from daily life was evaluated by students as 68.04 (SD = 14.84) and by the teacher as 70. The mean score on the third action point about stimulating students to explain to each other was 67.16 (SD = 15.44) for students and 80 for the teacher, which is a significantly higher score for the teacher, $t(24) = 4.16$, $p < .01$, $d = .83$. The implementation of the fourth action point about providing a procedure for difficult exercises was evaluated as 42.38 by students

Table 8.10 Means and standard deviations of the IPSEE scores of experimental class 5

	Co-designers (*N* = 7)		Rest of class (*N* = 18)		Control (*N* = 19)		Teacher	
Scale	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Perception scores								
Fascinating contents	3.56 (.65)	3.11 (.91)	3.56 (.92)	3.36 (.78)	4.08 (.93)	4.02 (.88)	4.13	4.00
Productive learning	3.49 (1.04)	3.69 (.96)	4.09 (1.01)	3.89 (.60)	3.77 (.81)	3.90 (.85)	2.80	2.40
Integration	4.33 (.75)	4.02 (.61)	4.34 (.76)	3.97 (.65)	4.23 (.68)	4.39 (.79)	3.43	4.29
Student autonomy	4.26 (.50)	4.10 (.63)	3.88 (.54)	4.40 (.56)	3.52 (.98)	3.32 (.94)	3.30	4.00
Interaction	3.97 (.56)	3.65 (.32)	4.01 (.50)	3.82 (.51)	3.52 (.79)	3.44 (.89)	3.64	4.18
Differentiation	2.79 (.42)	3.29 (.72)	3.29 (.86)	3.61 (.79)	2.74 (.62)	2.73 (1.04)	3.60	4.00
Clarity of goals	4.46 (1.09)	3.36 (1.08)	3.93 (1.28)	3.53 (1.29)	4.41 (1.14)	4.51 (1.01)	4.00	4.50
Personalization	4.95 (.61)	4.60 (.96)	5.15 (.62)	4.76 (.95)	4.30 (1.26)	4.21 (1.46)	5.33	5.00
Dissatisfaction scores								
Fascinating contents	1.21 (.80)	1.66 (.93)	.81 (.53)	1.10 (.84)	1.05 (.84)	1.04 (.74)	.75	.88
Productive learning	1.23 (.88)	.43 (.47)	.57 (.62)	.54 (.40)	.70 (.55)	.42 (.37)	.20	.15
Integration	.24 (.38)	.65 (.38)	.50 (.50)	.50 (.41)	.56 (.45)	.53 (.40)	1.00	.71
Student autonomy	.45 (.15)	.70 (.56)	.42 (.34)	.48 (.68)	.99 (1.01)	.99 (.79)	.20	.10
Interaction	.59 (.48)	.70 (.42)	.57 (.38)	.69 (.40)	.97 (.81)	.99 (.76)	1.27	.64
Differentiation	.23 (.15)	.34 (.47)	.39 (.34)	.30 (.40)	.44 (.60)	.33 (.39)	.40	.20
Clarity of goals	.86 (.72)	2.04 (1.30)	1.29 (1.14)	1.86 (1.47)	1.09 (.98)	.74 (.78)	1.00	.25
Personalization	.22 (.18)	.33 (.33)	.31 (.34)	.42 (.44)	.92 (1.05)	1.00 (1.04)	.33	.17
Disagreement scores								
Fascinating contents	.74 (.39)	1.04 (.72)	.81 (.70)	.78 (.63)	.88 (.60)	.91 (.75)	-	-
Productive learning	1.03 (.63)	1.29 (.96)	1.38 (.88)	1.49 (.60)	1.16 (.69)	1.15 (.77)	-	-
Integration	1.04 (.48)	.51 (.39)	1.04 (.57)	.58 (.41)	.68 (.48)	.87 (.62)	-	-
Student autonomy	.96 (.50)	.47 (.38)	.62 (.50)	.55 (.40)	.92 (.61)	.77 (.52)	-	-
Interaction	.51 (.37)	.53 (.32)	.49 (.37)	.46 (.42)	.81 (.41)	.70 (.53)	-	-
Differentiation	.81 (.42)	.89 (.45)	.73 (.52)	.76 (.40)	.83 (.57)	1.43 (.74)	-	-
Clarity of goals	.96 (.60)	1.21 (.98)	1.04 (.70)	1.25 (1.00)	.96 (.84)	.89 (.66)	-	-
Personalization	.50 (.51)	.60 (.83)	.44 (.46)	.78 (.56)	1.07 (1.33)	.99 (.92)	-	-

(*SD* = 26.21) and as 60 by the teacher: students' scores were lower than the teacher's score, $t(23) = 3.30$, $p < .01$, $d = .67$. Also, the implementation of the fifth action point about better congruence between the degree of complexity of tests and exercises during the lessons was evaluated lower by students (M = 50.56; SD = 23.82) than by the teacher who scored 80, $t(24) = 6.18$, $p < .01$, $d = 1.24$. The sixth action point about answering individual questions only at the end of the lesson was scored by students as 37.13 (SD = 25.30) and by the teacher as 50: student scores were significantly lower than the teacher's score, $t(23) = 2.49$, $p < .01$, $d = .51$. Additionally, the results showed that the co-designers (M = 75.86; SD = 5.49) rated the implementation of the third action point, concerning students explaining to each other, significantly higher than the rest of the class (M = 63.78; SD = 16.82), $t(22.75) = 2.70$, $p < .01$, $d = .85$.

Table 8.11 presents the results of the ANOVAs on the relevant scales of the IPSEE. The proposed changes in the lessons, as formulated in the action points, refer to fascinating contents (including examples from daily life), differentiation (clarity of minimally completed exercises – a request for *less* differentiation), interaction (students explaining the subject matter to each other), clarity of goals (more congruence between degree of complexity of lessons and tests), and personalization (support for individual students at the end of the lesson instead of during the lesson).

Table 8.11 Results of the ANOVAs on the IPSEE scores of experimental class 5

				Post Hoc Tests			
Scale	***F***	**η^2**	***p***	**groups***	**Δ**	***SE***	***p***
Perception scores							
Fascinating contents							
Productive learning							
Integration	2.95	.14	.07	C-R	.52	.23	.08
Student autonomy	7.97	.29	.00	R-C	.67	.18	.00
				R-D	.75	.26	.02
Interaction							
Differentiation							
Clarity of goals	4.31	.17	.02	C-D	1.21	.42	.02
Personalization	3.50	.15	.04	C-R	.46	.19	.04
Dissatisfaction scores							
Fascinating contents							
Productive learning	2.78	.12	.07	R-D	.78	.33	.06
Integration							
Student autonomy							
Interaction							
Differentiation							
Clarity of goals	8.96	.30	.00	D-C	1.53	.40	.00
				R-C	.92	.30	.00
Personalization							
Disagreement scores							
Fascinating contents							
Productive learning							
Integration	4.15	.18	.02	C-R	.66	.25	.03
Student autonomy							
Interaction							
Differentiation	6.23	.24	.00	C-R	.56	.17	.01
				C-D	.53	.23	.06
Clarity of goals							
Personalization							

Note. df = 2. *Groups that showed to differ significantly in post hoc tests; 'D' refers to co-designers, 'R' refers to the rest of the class, and 'C' refers to the control group.

The results showed no effects on the scales fascinating contents and interaction. On the scale differentiation the disagreement scores of both co-designers and the rest of the class increased less strongly than for the control group. Remarkably, the perception scores concerning clarity of goals decreased more strongly for co-designers than for the control group students, whose scores actually increased. Also, dissatisfaction scores of both co-designers and the rest of the class increased more strongly than scores of the control group. With respect to personalization, perception scores decreased more strongly for the rest of the class than for the control group.

8.3.3.6 Class 6

Table 8.12 presents the means and standard deviations of the IPSEE scores of the co-designers in class 6, the rest of the class, their teacher, and the linked control group. Three action points were formulated in the participatory design meeting.

Table 8.12 Means and standard deviations of the IPSEE scores of experimental class 6

	Co-designers (*N* = 7)		Rest of class (*N* = 14)		Control (*N* = 21)		Teacher	
Scale	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Perception scores								
Fascinating contents	3.56 (.82)	3.64 (.34)	3.20 (.58)	3.23 (.65)	3.40 (.71)	3.72 (.86)	2.86	3.67
Productive learning	2.89 (.46)	2.97 (.60)	3.00 (1.15)	3.14 (.89)	3.93 (1.02)	4.20 (.96)	1.80	2.80
Integration	3.65 (.56)	3.82 (.59)	3.67 (.86)	3.91 (.29)	3.81 (.71)	4.06 (.96)	4.17	3.86
Student autonomy	3.47 (.66)	3.79 (.45)	3.33 (.51)	3.70 (.55)	3.75 (.67)	3.78 (.64)	3.60	3.80
Interaction	3.45 (.61)	3.84 (.33)	3.67 (.54)	3.70 (.51)	3.47 (.45)	3.82 (.50)	3.82	4.20
Differentiation	2.49 (.30)	2.74 (.57)	2.66 (.75)	2.93 (.83)	2.36 (.76)	2.50 (.71)	2.20	3.00
Clarity of goals	5.04 (.30)	4.96 (.37)	4.77 (.78)	4.52 (.71)	5.04 (.64)	5.23 (.45)	5.25	5.00
Personalization	5.12 (.47)	5.14 (.42)	4.88 (.53)	4.76 (.81)	4.82 (.58)	4.98 (.62)	5.33	5.00
Dissatisfaction scores								
Fascinating contents	1.23 (.73)	.98 (.59)	1.19 (.89)	1.65 (.87)	1.03 (.76)	.82 (.88)	2.77	2.08
Productive learning	.61 (.35)	.69 (.61)	.92 (.69)	.92 (.99)	.45 (.34)	.24 (.31)	.20	.40
Integration	.82 (.59)	.73 (.50)	.77 (.84)	.79 (.43)	.53 (.40)	.34 (.49)	1.55	1.43
Student autonomy	.76 (.70)	.76 (.69)	1.17 (.75)	.95 (.74)	.95 (.82)	.69 (.54)	1.50	1.40
Interaction	.79 (.41)	.55 (.51)	.66 (.53)	.80 (.57)	.72 (.48)	.37 (.34)	1.45	1.07
Differentiation	.23 (.21)	.29 (.20)	.43 (.65)	.29 (.34)	.64 (.74)	.34 (.41)	2.40	1.80
Clarity of goals	.46 (.42)	.29 (.27)	.54 (.67)	.84 (.82)	.41 (.48)	.19 (.34)	.00	.00
Personalization	.29 (.37)	.14 (.18)	.40 (.37)	.44 (.85)	.37 (.29)	.18 (.30)	.00	.00
Disagreement scores								
Fascinating contents	.87 (.61)	.23 (.24)	.55 (.37)	.54 (.55)	.77 (.66)	.75 (.56)	-	-
Productive learning	1.09 (.46)	.40 (.46)	1.30 (1.03)	.68 (.65)	.95 (.62)	.82 (.63)	-	-
Integration	.58 (.48)	.45 (.33)	.80 (.57)	.22 (.19)	.51 (.58)	.74 (.62)	-	-
Student autonomy	.53 (.36)	.36 (.24)	.47 (.31)	.44 (.33)	.52 (.44)	.52 (.41)	-	-
Interaction	.49 (.49)	.38 (.30)	.44 (.33)	.50 (.51)	.47 (.30)	.38 (.33)	-	-
Differentiation	.34 (.22)	.55 (.24)	.71 (.49)	.65 (.49)	.66 (.42)	.55 (.44)	-	-
Clarity of goals	.29 (.22)	.25 (.25)	.70 (.58)	.62 (.58)	.65 (.44)	.75 (.40)	-	-
Personalization	.36 (.35)	.34 (.25)	.57 (.39)	.55 (.63)	.50 (.28)	.57 (.38)	-	-

First, more time should be given to practice on English speaking skills and pronunciation during the lessons. Students felt too little emphasis on this aspect of learning the language. Second, students preferred to practice the reading of English texts more often. Text comprehension is part of the final examination and students experienced too little preparation for it. The teacher agreed on this but did not see possibilities to spend much more time on reading texts during lessons, because of the full lesson program. The students and the teacher decided to start intensifying the training in reading texts as homework. Third, students remarked that they sometimes experienced difficulties comprehending the grammar. Students had to study the grammar from the course book, without an explanation given by the teacher to the whole class.

The results of the APEQ showed that the implementation of the first action point about speaking skills was evaluated as 77.62 by the students (SD = 11.79) and as 70 by the teacher, which is higher for the students than for the teacher, $t(20) = 2.96$, $p < .01$, $d = .65$. The score for the second action point about practicing reading was 67.14 (SD = 21.42) for the students and 70 for the teacher. The implementation of the third action point was evaluated by students as 75.86 (SD = 11.85) and as 60 by the teacher, which is a significantly lower score for the teacher, $t(20) = 6.13$, $p < .01$, $d = 1.34$. Additionally, co-designers (M = 85.71; SD = 10.18) evaluated the implementation of the first action point, concerning the practice of speaking skills, significantly higher than the rest of the class did (M = 73.57; SD = 10.64), $t(19) = 2.50$, $p < .05$, $d = 1.16$.

The results of the ANOVAs on the IPSEE scales are presented in Table 8.13. The content of the action points is not clearly related to particular scales of the IPSEE, but could possibly be linked to two scales. Practicing speaking and reading skills are likely to improve personal relevance and the challenging character of the subject matter (fascinating contents), because students themselves pointed out these aspects as important. Also the scale clarity of goals could be relevant in this context, because the proposed additions to the lesson program could decrease the clarity of what is expected of students. Having to do something new could lead to increasing uncertainty about learning goals.

With respect to the scale fascinating contents, results revealed that dissatisfaction scores decreased more strongly for co-designers than for the rest of the class, whose scores actually increased during the intervention period. This increase in dissatisfaction scores of the rest of the class was even larger than for the control group. Furthermore, the disagreement scores of the co-designers decreased more strongly than for the rest of the class. As expected, clarity of goals decreased

Table 8.13 Results of the ANOVAs on the IPSEE scores of experimental class 6

				Post Hoc Tests			
Scale	***F***	**η^2**	***p***	**groups***	**Δ**	***SE***	***p***
Perception scores							
Fascinating contents							
Productive learning							
Integration							
Student autonomy							
Interaction	2.94	.13	.07	C-R	.31	.14	.08
Differentiation							
Clarity of goals	3.05	.14	.06	C-R	.44	.18	.05
Personalization							
Dissatisfaction scores							
Fascinating contents	3.89	.18	.03	R-C	.58	.23	.04
				R-D	.63	.29	.09
Productive learning							
Integration							
Student autonomy							
Interaction	5.64	.23	.01	R-C	.47	.14	.01
Differentiation							
Clarity of goals	5.34	.22	.01	R-C	.52	.17	.01
				R-D	.48	.22	.09
Personalization							
Disagreement scores							
Fascinating contents	2.76	.13	.08	C-D	.63	.28	.08
Productive learning							
Integration	5.04	.25	.01	C-R	.84	.26	.01
Student autonomy							
Interaction							
Differentiation							
Clarity of goals							
Personalization							

Note. df = 2. *Groups that showed to differ significantly in post hoc tests; 'D' refers to co-designers, 'R' refers to the rest of the class, and 'C' refers to the control group

during the intervention period. Especially, the perception scores of the rest of the class decreased more strongly than the scores in the control group. Additionally, the dissatisfaction scores of the rest of the class increased more strongly than the scores of both the co-designers and the control group students. For the latter two groups dissatisfaction scores even decreased.

8.4 Conclusions and discussion

This study investigated students' and teachers' experiences with the use of participatory design in secondary education. Student participation in instructional redesign was a new initiative for both teachers and students. In addition to evaluating the used techniques for participatory design, its effects on students' and teachers' perspectives on the redesigned learning environment were examined.

The first research question concerned the evaluation of the participatory design meeting by co-designers and teachers, and the evaluation of the outcomes of the meeting by the rest of the class. Results reveal that co-designers and teachers are predominantly positive about the meeting. The atmosphere is experienced as pleasant, although some students find it especially in the beginning a bit stressed and uncomfortable. Students are well able to express themselves and experience enough opportunities to express their comments and suggestions. Teachers are positive about the usability of student suggestions. The rest of the class evaluated the meeting on the basis of a written summary. Non-co-designing students predominantly recognize the remarks discussed in the meeting and the majority totally or largely agrees on the formulated action points. So, the proposed redesign of the learning environment is accepted by the whole class. The inclusion of seven co-designers from each class thus seems to provide a good representation of all student perspectives in that class. The newly developed techniques for participatory design in secondary education work effectively and both teachers and students are satisfied with it.

Research question 2A focused on general effects of the redesigned learning environment on students' and teachers' perspectives and the discrepancy between both. Compared to teachers in the control group, teachers in the participatory design group show an increase of satisfaction as well as a strong increase in their perception of the learning environment as a *powerful* environment. For students, co-designers notice improvements in educational practice more often than the rest of the class, and far more often than the control group. Remarkable, however, is that the overall dissatisfaction with the learning environment increases for the rest of the class, while it decreases for co-designers and the control group. Judgments on the quality of the course increase more strongly for co-designers than for the rest of the class and the control group. Co-designers also notice the implementation of the formulated action points more clearly than the rest of the class. Furthermore, if students notice the implementation of action points more clearly, their perceptions and judgments about the quality of the course increase more, and their dissatisfaction and disagreement scores decrease more.

The findings for the first part of the second research question show convincing positive changes in teachers' perspectives. For students, the effects clearly differ between co-designers and the rest of the class. Several measures indicate that co-designers' perspectives on the learning environment become more positive by the intervention. For the rest of the class, the redesign of the environment does not positively influence perspectives, dissatisfaction even unexpectedly increases.

Research question 2B investigated the effects of the intervention in more detail by looking separately at the six experimental classes. Effects were studied on those characteristics of the learning environment that most closely corresponded with the proposed changes. The formulated action points were very different across classes, thus, for each class effects are expected on different characteristics of the learning environment. We hypothesized that the intervention will increase student perceptions, decrease student dissatisfaction, and decrease disagreement between teacher and students concerning the redesigned characteristics of the learning environment.

In experimental class 1, dissatisfaction with differentiation decreases for co-designers and increases for both the rest of the class and the controls. In experimental class 2, dissatisfaction with the provided degree of student autonomy decreases for co-designers and increases for the rest of the class. Dissatisfaction with interaction decreases more for co-designers than for both the rest of the class and the control group. For student autonomy, student-teacher disagreement increases for co-designers and the rest of class, but this is due to a decrease in the teacher's perception, which increases the discrepancy with the student scores. In experimental class 3, perceptions of differentiation increase more for co-designers than for both the rest of the class and the controls. Disagreement on differentiation decreases more strongly for co-designers and the rest of the class than for the control group. In experimental class 4, perceptions on student autonomy increase more for co-designers than for the rest of the class, and perceptions of clarity increase more for co-designers and the rest of the class than for the control group. Dissatisfaction with fascinating contents and clarity of goals decreases more strongly for co-designers than for both the rest of the class and the control group, and dissatisfaction with interaction decreases more strongly for co-designers than for the rest of the class. Disagreement on fascinating contents decreases more for co-designers and the rest of the class than for controls. In experimental class 5, disagreement on differentiation increases less for co-designers and the rest of the class than for the control group. Remarkable, perceptions of clarity of goals decrease more for co-designers than for the control group, and perceptions of personalization decrease more for the rest of the class than for the control group. Also, dissatisfaction with clarity of goals increases more for co-designers and the

rest of the class than for controls. These unexpected outcomes are probably related to the low evaluation scores on the two action points concerned. Students rated the implementation in the lessons of the action points for clarity of goals and personalization as insufficient. Then, no positive effects can be expected and the failed implementation appears to have negative effects on student perspectives. In experimental class 6, dissatisfaction with fascinating contents decreases more strongly for co-designers than for the rest of the class; for the rest of the class, dissatisfaction increases even more than for the controls. Disagreement on fascinating contents decreases more for co-designers than for the rest of the class. One of the action points (i.e., more emphasis on practicing English speaking and reading skills) was expected to have negative effects on the clarity of goals. This is indeed found for the rest of the class. Perceptions on clarity of goals decrease more strongly for the rest of the class than for the control group, and dissatisfaction with clarity of goals increases more for the rest of the class than for both co-designers and controls.

The findings for the first and second part of the second research question are fully in line with each other. The intervention yields strong effects when examining it at the level of specific changes on particular characteristics of the learning environment. At an overall level, the effects are smaller because characteristics of the learning environment not redesigned at all are yet included in the analysis. Nevertheless, results for both parts of the second research question point to the same conclusion: participatory design results in an improvement of co-designers' perspectives and yields no or negative effects for the rest of the class.

The positive effects for co-designers may have at least three underlying causes. First, co-designers probably have more eye for those aspects of the learning environment discussed and re-designed in the participatory design meeting. Co-designers' expectations raised in the design meeting might have directed their attention towards cues of successful implementation (i.e., selective attention, Olson, Roese, & Zanna, 1996). Second, increases in sense of control (Seifert & O'Keefe, 2001), sense of agency, belonging, and competences (Mitra, 2004), as well as a better understanding of the teacher's work and perspective (Cook-Sather, 2002), may lead to an increased engagement and a more positive view on the learning environment. Third, interpersonal and affective aspects are very important when students evaluate their teacher or the environment created by their teacher (Johannessen, Harkin, & Mikalsen, 2002). For secondary school students, being a good teacher is almost equivalent to establishing good personal relationships with students (Beishuizen, Hof, van Putten, Bouwmeester, & Asscher, 2001). Adolescent students feel a strong need to be supported, understood, and listened to (Blanco, Soto, Gómez, Revilla, & Muñoz, 2002). The improved and intensified

relationship between co-designers and their teachers may thus have created a more positive learning climate.

Attention focusing, increased engagement, and an improved relationship with the teacher due to the participatory design meeting could not occur for the rest of the class. In contrast to the co-designers, these students could *only* perceive some redesigned features in the learning environment. Apparently, this did not cause a positive change in their perspectives on the environment. Effects on perceptions are lacking and dissatisfaction with the environment even increases. The lacking effects may indicate that the redesign per se is not effective and does not guarantee that all students profit from it. With regard to the increase in dissatisfaction, the rest of the class was confronted with co-designing peer students who could influence the learning environment, while they did not have such control themselves. As indicated in the Introduction, excluding students from the design process might have caused an increase in negative feelings about the learning environment. Another explanation might be that students became aware of the possible shortcomings of the learning environment. This may stimulate the external attribution of problems with learning and students may overrate the role of the environment, and therefore become more critical on it. Finally, the increase in dissatisfaction may result from being informed by peer students that certain aspects of the environment need to be changed, but missing the cues that these changes really take place. This may make students extra critical. This explanation is supported by the finding that the rest of the class notices the implementation of action points to a lesser degree than co-designers. More research is needed to reveal whether this is caused by incomplete or unsuccessful implementation or by paying too little attention to the changes.

A first implication of our study is that participatory design seems to be well applicable to the field of education. Techniques used in domains outside the field of education, such as cognitive engineering and health promotion, can be successfully adapted to education. In addition, students in secondary education of about 16 years old are well able to participate in a constructive way in the instructional (re)design process. A second theoretical implication is that effects of student participation can and should be empirically tested to reach a more accurate model of its effects. The literature on this topic is yet incomplete, as indicated by the finding of our study that participatory design can have negative effects on perspectives of non-co-designing students (i.e., the rest of the class). The rest of the class should be involved in the (re)design process to improve the overall effectiveness of participatory design, for instance, by regularly changing the composition of the co-design group so that all students are eventually given an opportunity to participate in (re)design activities.

A practical implication of our study is that teachers should be supported with implementing collaboratively formulated action points for redesign, because an appropriate implementation cannot be taken for granted. According to both teachers and students, the majority of the action points was implemented in the learning environment to a satisfactory degree. However, all teachers in this study participated on a voluntary basis and were motivated to experiment with participatory design. Co-designing students in all classes mentioned that student participation was more badly needed for other courses with other teachers. We expect that not all teachers would be able, or even would be motivated to implement the outcomes of a participatory design meeting in their educational practice. An educational advisor might be necessary to support teachers with the implementation process.

A limitation of this study is that the instruments used to study effects – IPSEE, IPSEE-T, and OQ – are not for each class fully attuned to the re-designed characteristics of the learning environment. For instance, the IPSEE(-T) measures eight main characteristics of a powerful learning environment, but the action points for redesign did not always completely fit those eight characteristics. Thus, the questionnaires may have suboptimal sensitivity to measure effects of specific changes in the design of the learning environment. Moreover, preceding the participatory design meeting (i.e., at T1) it is not predictable which aspects of the learning environment will actually be redesigned. Consequently, when using a 'pretest-posttest design' it is impossible to use other than relatively rough measures for examining effects of participatory design. This limitation is difficult to avoid because the experimental testing of effects is of utmost importance. To investigate the effects of specific points in the redesign we included retrospective measures in the APEQ. But such measures have the disadvantage that control group students cannot directly answer questions about a redesign that did not take place in their own class.

This study provides insight in the use and effects of participatory design in education, but several questions are left for future research. First, it would be interesting to study long-term effects of participatory design meetings and subsequent redesign activities, in addition to the short-term effects investigated in this study. Second, direct effects on learning outcomes and the effectiveness of the learning environment should be examined in more detail. This study focused on effects of participatory (re)design on perceptions, dissatisfaction, and disagreement between teacher and student scores. But student perspectives on a learning environment influence their learning and study behavior and eventually their learning outcomes (Elen & Lowyck, 1999; Entwistle & Tait, 1990). Influencing student perspectives through the redesign of the learning environment is thus also

expected to affect and improve students' learning behavior and, consequently, the effectiveness of the environment. Third, it would be valuable to examine in more detail the effects of student participation on students' sense of belonging, agency, and general competences, as discussed in the Introduction. Experiments measuring these variables may also help to explain the differential effects for co-designing students and the rest of the class. A related, fourth and final aim of future research is to explore ways to improve effects of a redesigned learning environment for non-co-designing students. An obvious approach would be to implement participatory design in such a way that *all* students are involved. Alternatively, better communication about the (re)design process with the rest of the class might be beneficial.

To conclude, this study reveals that participatory design can be used in education as a promising technique to better account for students' perspectives in the instructional (re)design process. Both students and teachers were positive about the quality of the discussion in the participatory design meetings as well as the formulated ideas for redesign. For co-designing students, perceptions of the learning environment and satisfaction increase and discrepancies between students' and teacher's perceptions decrease. However, in contrast with our expectations, dissatisfaction with the learning environment increases for non-co-designing students. This effect should be studied in more depth. Nevertheless, if participatory design is applied in such a way that all students are involved, it is an effective tool to take students' perspectives into account and to improve the learning environment through instructional redesign.

9

General discussion

9.1 Main findings and conclusions

Student perceptions are of central importance when exploring the effects of powerful learning environments (PLEs) on learning. Student perceptions of a learning environment, rather than the environment per se, determine their subsequent learning behaviour, and, consequently, the quality of learning outcomes. Usually, the environment is developed by educational designers and implemented into practice by teachers, both having different perspectives on education. Educational designers use their knowledge of characteristics of PLEs to design learning materials, that is, to select instructional strategies for presenting and practicing contents and providing feedback. Teachers' conceptions of learning and teaching influence the way they implement the learning environment. Nevertheless, discourse and cooperation between designers, teachers, and other stakeholders is often lacking. In order to optimize PLEs, a reciprocal relationship between all stakeholders is needed. Student perceptions of a learning environment should provide input for the design process of PLEs as carried out by educational designers and teachers. In order to fine-tune the learning environment, designers and teachers must take the perspective of students into account. In the case of discrepancies between perspectives of students on the one hand, and designers and teachers on the other hand, attempts should be made to reach more congruence between the different perspectives.

The Combination-Of-Perspectives (COOP) model summarizes the different perspectives of the stakeholders involved in the development and realization of a learning environment. It visualises the proposed feedback loops between teachers and designers, and between students and teachers/designers (see Figure 9.1). This

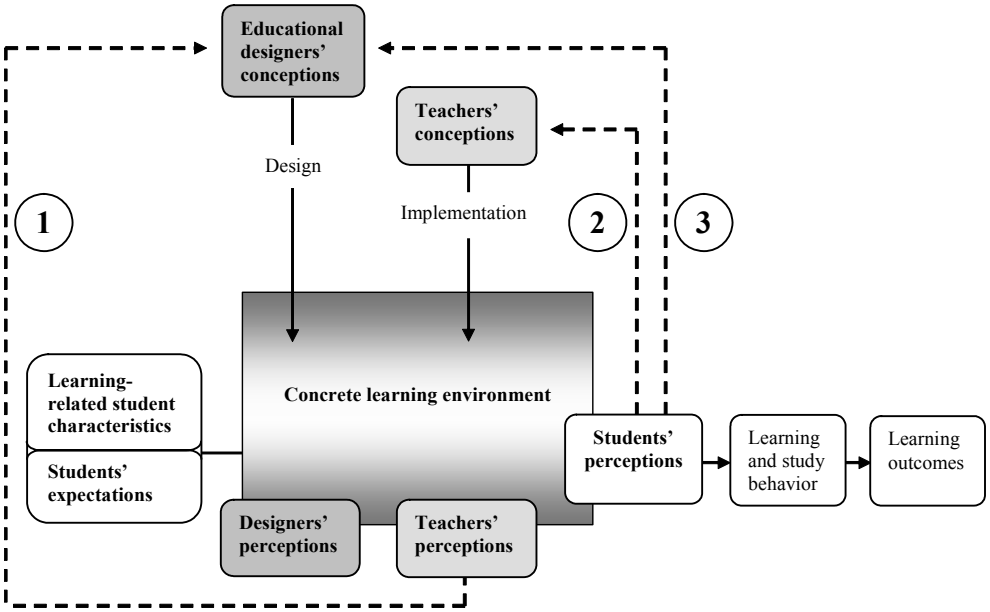

Figure 9.1 The Combination-Of-Perspectives (COOP) model.

model forms the theoretical basis of the thesis. The COOP model can be helpful to explore the different perspectives of designers, teachers, and students, and to identify discrepancies between them. The studies described in Chapters 3 to 6 focus, in order, on perspectives of students (Chapter 3 and 4), teachers (Chapter 5), and discrepancies between both (Chapter 6). The identified discrepancies yield the starting point for the optimization of a learning environment and harmonization between stakeholders involved. As in the tradition of human factors engineering, congruence between different stakeholders is expected to create a situation where students use a learning environment as intended by teachers and designers. The studies described in Chapters 7 and 8 are intended to deliver a approach that can help to create *more powerful* learning environments, by stimulating communication and cooperation between teachers and students during the instructional (re)design process. All studies are conducted in the context of an educational innovation in Dutch secondary education, called the Second Phase.

It is known that expectations influence perceptions and motivation, which, in turn, affect the effectiveness of particular interventions. Nevertheless, students' expectations of a new learning environment have received little attention in research. The longitudinal survey described in Chapter 3, shows that it is not self-evident that students form realistic expectations of a new learning environment.

Although the expectations are unrealistic, they yet influence the perceptions students have on the new environment. Moreover, disappointing perceptions are likely to decrease the effectiveness of the learning environment and are also related to undesirable changes in learning-related student characteristics. Motivational problems and fear of failure were found to be risk factors for educational innovations. More effective approaches are needed to prepare students for major educational changes, since expectations influence students' perspectives on the learning environment once they are working in it.

Although the relevance of student perspectives is widely recognized, it is common practice that students do not participate in the (re)design of a learning environment. A first step to increase the involvement of students in the design process is to measure their perceptions of the current learning environment, their desires with regard to the design of an innovative learning environment, and their (dis)satisfaction with the current environment. The study on perspectives of 10th grade students on their learning environment (Chapter 4) shows that they perceive it only to a limited degree as a powerful learning environment. Students desire a more powerful and innovative learning environment than they currently perceive: they are not satisfied and see ample room for improvement. A remarkable finding is that educationally favourable student characteristics, such as personal interest in learning, are related to high perceptions and low dissatisfaction, while educationally unfavourable student characteristics, such as motivational problems, are related to low perceptions and high dissatisfaction. Roeser, Eccles, and Sameroff (2000) clearly distinguish between students for whom a low valuing of school is a marker for serious problems (e.g., poor motivation to learn, poor mental health, poor grades, affiliation with negative peers), and students who are just bored with their schooling because the environment does not fit their needs well. A suboptimal learning environment may lower student motivation. There is a reciprocal causal relationship between learning-related student characteristics on the one hand, and perceptions and dissatisfaction on the other hand, making it likely that – at least part of – the students report problems with motivation, concentration, and regulation because of characteristics of their current learning environment. This underlines the claim that learning environments should be improved and that students' perceptions, desires, and dissatisfaction need to be communicated to teachers and designers to reach this goal (see feedback loops 1 and 2 in Figure 9.1).

The study reported in Chapter 5 focuses on teacher perceptions on the learning environment as well as their desires and (dis)satisfaction with this environment, since this is valuable feedback for designers (feedback loop 3). Results show that teachers perceive a predominantly powerful learning environment, and also value

almost all of its characteristics, measured as indicators of a powerful learning environment, positively. Furthermore, teachers desire a learning environment that is even more powerful than they perceive it to be at the moment, with the exception of the characteristic productive learning. Teachers' perceptions and desires are related to their approaches to teaching. Moreover, their dissatisfaction is totally independent from their approaches to teaching. A plausible conclusion is that teachers constitute their educational practices according to their own desires, but these practices are not always fully in line with the intended design. Because of this inconsistency, teachers should be offered guidance when implementing an innovative educational design in school practice. However, teachers may also adapt the design because they experience problems with its feasibility. These experiences must be reported to designers and should be a starting point for closer cooperation between designers and teachers. Such cooperation might lead to more workable designs better fitting school practice.

Results of the study on differences between students' and teachers' perspectives (Chapter 6) predominantly show higher perceptions and lower dissatisfaction for teachers than for students. Teachers desire a more powerful learning environment than students, with the exception of the characteristics productive learning and student autonomy, which students desire more strongly than teachers. Teachers are more satisfied with the environment than students. The existence of different perspectives between students and teachers has important implications because perspectives directly influence behaviour. As the result of different perspectives, students' learning strategies and teachers' instructional strategies may be in disharmony. Because students' dissatisfaction jeopardizes their motivation (Eccles et al., 1993), our results not only stress the need for interventions reducing incongruity between student and teacher perspectives, but also the need for interventions decreasing student dissatisfaction. Providing teachers solely with information on student perspectives, however, is no guarantee they will change the learning environment and/or their teaching strategies. Moreover, even if teachers would make changes in line with student perspectives, students would still not have any type of direct control over the learning environment or an intended opportunity to participate in its (re)design. Differences in student and teacher perspectives could better be taken into account by involving students in a planned discussion about the (re)design of the learning environment.

Taken together, the studies described in Chapters 3 to 6 yield at least three important issues to consider when improving education. First, there are discrepancies between student perceptions and teacher perceptions. Teacher perceptions are more favourable than student perspectives. Unfortunately, it are exactly the student perceptions that determine study behaviour and quality of

learning outcomes. Second, there are discrepancies between student perceptions and student desires (i.e., dissatisfaction). The learning environment is only to a limited degree in agreement with the desires of students. Dissatisfaction in combination with a lack of control over the environment is likely to have negative effects on student motivation. Third, there are discrepancies between student expectations and student perceptions. Student expectations with regard to a new learning environment (i.e., the Second Phase) are more positive than the perceptions of this environment once they are working in it. Needless to say, disappointment is an undesirable side effect of entering a new environment. These three bottlenecks need to be tackled to improve the effectiveness of a learning environment. The research reported in Chapters 6 and 7 especially focuses on decreasing discrepancies between student perceptions and teacher perceptions, and on decreasing discrepancies between student perceptions and student desires.

Participatory design has proven to be effective to optimise design processes in other domains than education. It might also be a helpful strategy to reduce the reported discrepancies and, eventually, to improve the effectiveness of a learning environment. The study described in Chapter 7 investigates the desirability and feasibility of the use of participatory design in education. The results show that both students and teachers display predominantly positive opinions towards becoming engaged in participatory design. They support the idea that participatory design might be an approach to bridge the gap between student and teacher perspectives. Concrete suggestions for bringing participatory design into practice emerged from this study, based on the own preferences of students and teacher.

Participatory design is implemented in the study described in Chapter 8. Results reveal that participatory design may be used in education as a technique to better account for student perspectives in the instructional (re)design process. Both students and teachers were positive about the quality of the discussion in the participatory design meeting and the generated action points for redesign. The effects of implementing the action points are not unanimously positive for all students. For co-designing students, perceptions of the learning environment increase, and both student dissatisfaction and discrepancies between perceptions of students and teachers decrease. But in contrast to our expectations, for non-co-designing students (i.e., rest of the class) dissatisfaction with the environment increases. Effects for the rest of the class should be improved before participatory design is widely implemented in education.

Concluding, the conducted studies indicate that perspectives of different stakeholders differ considerably. Within each group of stakeholders there is also variation in perspectives, partly due to differing individual learning-related (students) and teaching-related (teachers) characteristics. Nevertheless, the existing

discrepancies between student perspectives and teacher perspectives, and between student perceptions and student desires, are likely to cause suboptimal teaching-learning processes in the environment. Student involvement in the instructional (re)design process may help to create more congruence between different perspectives and so decrease student dissatisfaction. Participatory design is indeed a feasible and useful approach to reach this goal in secondary education: discrepancies decrease and more positive student perspectives are fostered, but only for those students directly involved in the redesign process.

9.2 Implications

The studies conducted as part of this research project show that perspectives of different stakeholders are very different from each other. Therefore, communication and cooperation between stakeholders should be strengthened and become part of a standard procedure for designing new learning environments or redesigning existing ones.

Teachers should be more involved in educational design projects and learn from designers why and how certain educational innovations are expected to improve student learning. Designers should be more involved in teachers' work, on the one hand, to assist them with the appropriate implementation of innovations, and on the other hand, to learn from their practical experiences and the problems they encounter when implementing a design. Results from our study on teacher perspectives on the Second Phase indicate that the design is not fully implemented as originally meant by its designers, at least partly because teachers experienced feasibility problems with implementing it. Improved communication and cooperation between designers and teachers is expected to make the design and implementation of educational innovations much more effective. Participatory design could be a valuable approach to do so, but exploring this fell beyond the scope of the project.

Students should also get a more prominent place in the instructional (re)design process, because there are considerable discrepancies between student perspectives and teacher perspectives, and between student perceptions and desires (i.e., they are dissatisfied). Students appreciate to take co-responsibility for educational processes, but mostly do not have the opportunity to contribute to the process or to communicate their ideas. Of course, teachers consider themselves as the "teaching professionals" and they are. However, this does not mean that they cannot learn from the views of their students. Besides, listening to students' experiences, opinions, and ideas does not mean that the educational design must always be adapted to their preferences. Discourse yields mutual understanding and helps to

gain better insight in each other's experiences and preferences. The optimal design of a learning environment has to be defined collaboratively.

Student involvement in instructional (re)design is something relatively new, requiring drastic changes in the school culture (Cook-Sather, 2002). Teachers must trust co-designing students as "experts" since they have a lot of experience with education, trust them to have valuable ideas and suggestions, and trust them as partners in the educational process. Student's engagement, motivation, and respect for teachers are then likely to improve. Mutual trust and respect is a precondition for effective cooperation when improving educational designs. The study described in Chapter 8 has shown that such a shift in culture and breakthrough of existing hierarchies may be realized through participatory design. A safe context has to be created, and teachers and students should be stimulated to take each other seriously. Becoming equal partners in the discourse is facilitated by having an independent chair for the participatory design meeting.

Schools should best implement standard procedures to include students in instructional (re)design processes. It will probably be difficult to organize student involvement for all courses at once. A good starting point might be to focus first on those courses or classes where discrepancies are large. A system with regular written student evaluations could signal these situations. Subsequently, teachers and students examine the particular instructional design in more detail. Additionally, a procedure could be specified that gives students the opportunity to apply for discussing the design of a learning environment when they think this is desirable.

More attention should also be paid to preparing students on changes in their learning environment. When implementing large-scale innovations such as the Second Phase, it is important to set up a program promoting realistic expectations of it beforehand. Results indicate that students do not have expectations that agree with their later perceptions, thus, they should be provided with better information beforehand to prevent disappointments. Teachers and designers should be stimulated to take the preparatory phase preceding educational changes more seriously. And possibly, students may also be involved in setting up and optimizing such preparatory programs.

Concluding, participatory design has shown to be an effective approach to elicit a valuable discussion between students and their teacher. The whole redesign process can be completed within a relatively short period of time. Large-scale implementation of this approach in its present form, however, is not yet appropriate because of the lacking and even negative effects on non-co-designing students. More insight is needed in the underlying processes that caused the different effects for co-designing and the rest of the class. As long as this insight is lacking,

participatory design should be implemented in such a way that all students are involved in the process.

9.3 Suggestions for further research

Future research should study why participatory design has different effects on perspectives of co-designing students and the rest of the class. An obvious first step might be to separate possible underlying causes of the positive effects for co-designing students: (1) psycho-social effects of closer personal contacts with the teacher; (2) higher engagement with the learning environment, and (3) higher quality of the learning environment resulting from the collaborative redesign. For instance, a research design might distinguish three groups: (1) one group is involved in the participatory design meeting, (2) one group is involved in a meeting with their teacher to discuss a topic not related to the design of the environment (e.g., a school party), and (3) one group is not involved in a discussion with the teacher. All groups study in the redesigned learning environment. Differential effects of the interventions may then be studied by comparing Group 1 (i.e., combined effects of personal contact, increased engagement, and improvement of the learning environment), Group 2 (i.e., combined effects of personal contact and improvement of the learning environment), and Group 3 (i.e., only effects of the improved learning environment).

This setup, however, will not give insight in the causes of the increased dissatisfaction found for the rest of the class. In Chapter 8, two possible explanations were given: non-co-designing students become conscious of shortcomings in their learning environment and do not experience enough improvements related to those shortcomings, and non-co-designing students realize their lack of control over the environment because some of their peers participate in the design meeting and they do not. In principle, however, it could also be possible that these students experience a real deterioration in the design of the learning environment. To investigate the possible causes of increased dissatisfaction, the redesign of the environment should also be implemented in a another fourth group, where none of the students has been involved in participatory redesign. If no increase in dissatisfaction is found in this group, the negative effects for the rest of the class are likely the result of becoming conscious of shortcomings and/or lack of control. If, however, an increase of dissatisfaction is found, this would imply that the design of the learning environment actually suffers from its participatory redesign. This would be a reason to reconsider the proposed way of student involvement. It should be stressed, however, that there is currently no support at all for this latter hypothesis because teachers were satisfied with the quality of students' remarks and suggestions.

A better understanding of the differential effects of participatory design for co-designing students and the rest of the class will yield suggestions to adapt the approach in such a way that it becomes effective for all students. In addition, it would be valuable to register the way teachers implement the redesign. This provides extra information that may help to improve its effectiveness. Implementation can possibly be optimised by a proper educational coaching of teachers. The effects of such coaching can also be evaluated by observing teacher behaviors in the redesigned learning environment. In the reported studies, information about the learning environment has only been gathered through the eyes of students and teachers. The "objective" environment was not observed or registered otherwise. This was beyond the scope of the project, which stressed the subjective perspectives on a learning environment. However, alternative observations of the environment offer a valuable addition to future research.

A next step after optimalization of the effectiveness of participatory design might be to extend its application to situations where discrepancies between perspectives and student dissatisfaction are very large. The teachers who participated in the experiment reported in Chapter 8 voluntary decided to become involved in the implementation of participatory design and the design problems in their classes were rather small. For cases in which discrepancies are very large, experiences with participatory design in the technical domain indicate it might then be valuable to first organize a meeting with students only (Bødker, 1996). This could help them to become less reluctant to express their criticisms when the teacher participates, and thus prevents that ideas for improvement are lost.

Another possible application of participatory design pertains to the improvement of programs to prepare students for changes in their learning environment due to large-scale educational innovations. Such programs should help students form realistic expectations. The study reported in Chapter 3 clearly shows that this is important, because otherwise large discrepancies occur between student expectations and later perceptions, that is, students become disappointed. By involving students in the redesign of such programs, they could possibly be improved. In addition, the application of participatory design to improve communication and cooperation between educational designers and teachers could be an interesting focus of future research.

Future initiatives might also broaden the study of participatory design from re-designing learning environments, to the exploration of possibilities to involve students right from the start in the design process. The use of participatory design to prepare an educational innovation is likely to yield a design that is better adapted to the different stakeholders in the teaching-learning process. Redesigning afterwards, or making revisions to repair suboptimal design decisions, might then

possibly be less needed. When students are co-designing a new environment, however, they cannot rely on their perceptions of it because they do not have earlier experiences with the learning environment to be designed. This is likely to have implications for shaping the approach taken to participatory design, and is a highly interesting line for future research.

To conclude, this dissertation showed that stakeholders' perspectives are of utmost importance to optimise instructional (re)design. Participatory design is a promising approach to include students in the (re)design process. Several aspects of its implementation still have to be studied in more detail and new contexts for its application are still open to be explored.

Summary

Nowadays, educational institutes invest much effort in innovating and improving the quality of their education. This proves to be a difficult process. Part of the problems is due to the extent to which different people involved in the educational process exchange experiences and ideas with each other. Communication between different stakeholders is often limited. A first point of consideration is that designers seldom accept co-accountability for the translation of their ideas into teaching practices (Staub, 2004). Implementation is likely to suffer from this. In addition, the design cannot be adapted and improved on the basis of teachers' experiences if communication between designers and teachers is so much limited. A second point is that students are mostly not involved in the design of their learning environment (Cook-Sather, 2001, 2006). In fact, students are often seen as "consumers" of teaching practices. However, human-factors engineering stresses that designers' and users' interpretation of any system or design has to be more or less the same to eventually reach the designers' intentions (Norman, 1986, 1988), otherwise a decline in effectiveness is to be expected (Bartholomew, Parcel, Kok, & Gottlieb, 2001). Thus, if communication with students about the learning environment is absent or suboptimal, their dissentient perceptions are likely to remain unnoticed but they nevertheless undermine the effectiveness of the learning environment.

More congruence between perspectives of designers, teachers, and students is expected to improve the effectiveness of a learning environment. Cooperation and providing feedback to one another are needed to account for the different viewpoints of stakeholders and to achieve better alignment between perspectives. The Second Phase is an innovative learning environment in Dutch secondary education that has suffered from incongruity between perspectives and lack of communication and cooperation between different stakeholders. Schools and

teachers have experienced numerous problems with implementing the Second Phase and students grumble about an overfilled curriculum or lesson program (Veugelers, de Jong, & Schellings, 2004). This learning environment is the educational context of the research project described in this thesis. The main goal of the reported project is twofold. First, it aims to gain insight in different perspectives of people involved in the educational process. Second, effects of participatory design are studied as an approach to improve the congruence between the perspectives of teachers and students.

Chapter 2 presents the COmbination-Of-Perspectives (COOP) model. It discusses findings reported in the literature about perspectives of different stakeholders on a learning environment, namely: educational designers, teachers, and students. The perspective of educational designers reflects the aims and characteristics of modern education (de Corte, 1990, 2003; Merrill, 2002; van Merriënboer & Paas, 2003; Vermunt, 2003), like student autonomy, interactive learning, and differentiation. Teachers have their own perspective on education, which is influenced by their conceptions of learning and teaching (Pratt, 1992; Trigwell, Prosser, & Waterhouse, 1999). They implement the designs of innovative learning environments produced by educational designers, but because communication and cooperation between designers and teachers is often lacking (e.g., Keys & Bryan, 2001; Pedersen & Liu, 2003; Staub, 2004), it is likely that discrepancies exist between perspectives of teachers and designers. Therefore, the COOP model includes a feedback loop from teachers' perceptions of a learning environment to designers' conceptions.

Finally, students also have their own perspective on a learning environment. This perspective is the result of the interaction between the environment and the student who has certain learning-related characteristics (Luyten, Lowyck, & Tuerlinckx, 2001; Wierstra & Beerends, 1996), like a particular motivational orientation, conception of learning, and affective processing strategy. The student perspective on a learning environment is of crucial importance, because it directly influences learning and study behavior and thus the quality of learning (Entwistle & Tait, 1990). An environment per se does not directly influence student learning, and therefore the student perspective should have a far more prominent place in educational design processes than it currently has. The COOP-model visualizes this by including feedback loops from students' perceptions of the learning environment back to teachers' and educational designers' conceptions.

Building on the COOP-model described in Chapter 2, the further chapters focus on the perspectives of students in Dutch secondary education (Chapters 3-4), their teachers (Chapter 5), the differences between both (Chapter 6), and finding ways to diminish the differences in perspectives (Chapters 7-8). In most studies, three

aspects of perspectives are considered, namely: perceptions, desires, and (dis)satisfaction.

Chapter 3 describes a large-scale longitudinal study on students' expectations and perceptions of a learning environment. School transitions and educational innovations confront students with changes in their learning environment. Though it is known that expectations influence perceptions and motivation, which in turn influence the effectiveness of any situation, students' expectations for a new learning environment have received little attention. A longitudinal survey (N = 1335 students) studies students' expectations and subsequent perceptions of eight characteristics of a new environment, their desires, and their (prospective) dissatisfaction. The investigated characteristics (fascinating contents, productive learning, integration, student autonomy, interaction, differentiation, clarity of goals, and personalization) cover elements considered important in powerful learning environments. Students (about 15 years old) were on the eve of entering the Second Phase, when they filled out a questionnaire on their expectations. In two subsequent years these students again filled out a questionnaire to report on their perceptions of this environment.

Results show that students were disappointed about most of the characteristics of the new environment: it does not meet the expectations students had beforehand. This is related to undesirable changes in learning-related student characteristics, such as increased fear of failure. Productive learning is the only aspect for which perceptions exceed the expectations. Students' desires are fairly stable and show only small changes, except for a clear decrease in the desirability of student autonomy. Dissatisfaction with the learning environment increases, especially between the first and the second measurement. Students are disappointed with the new environment, except for its use of productive learning.

Expectations relate positively to later perceptions. Thus, the higher the expectations for one particular aspect beforehand, the higher the perceptions for this aspect later on, and the lower the expectations beforehand, the lower the perceptions later on. Also, desires at different measurement moments relate to each other; the same holds for dissatisfaction.

Prospective reports are related to student characteristics. Having a personally interested motivational orientation and conceiving learning as the construction and use of knowledge are both related to higher expectations. Motivational problems and fear of failure are found to be clear risk factors for educational innovations. The findings of this study stress the importance of a good preparation of students for curricular changes and the need to provide extra support to students with motivational problems and fear of failure.

Chapter 4 reports a study of students' perspectives on the Second Phase, while they are already learning in this environment. Students' perspectives on a learning environment influence their learning processes. Although, it is important to take these perspectives into account, students mostly do not participate in the (re)design of their learning environment. A first step to increase the involvement of students in the design process is to determine their perceptions of an innovative learning environment, their desires, and their (dis)satisfaction. This is the main goal of the study. The participants were 1146 tenth graders of five schools for secondary education in the Netherlands. Data about students' perceptions, desires, and dissatisfaction, as well as learning-related student characteristics were collected using two questionnaires.

The results show that students perceive the new learning environment they are working in as only partially powerful. They do not find the learning contents very fascinating, they recognize little emphasis on productive learning, they experience limited possibilities for student autonomy during learning, and they perceive little differentiation. With regard to students' desires, it shows that students are very positive about all specified characteristics of powerful learning environments, except for differentiation among students. Overall, students desire a much more powerful and innovative learning environment than they currently perceive: they are dissatisfied and want more powerful features! Furthermore, perceptions as well as desires and dissatisfaction scores are related to student characteristics. If students report a more personally interested learning orientation, they perceive the learning environment as more powerful. The same is true for holding the conception of learning as the construction and use of knowledge, and for the use of external regulation strategies. Reporting problems with motivation and concentration, and lack of regulation strategies, relate to lower perceptions of the environment and higher dissatisfaction. In contrast, a personally interested learning orientation relates to lower dissatisfaction (i.e., high satisfaction).

Chapter 5 describes a study focusing on teachers' perspectives on the same learning environment students reported on in the study described in Chapter 4. Teachers implement 'powerful learning environments' developed by educational designers. Due to a lack of communication and cooperation between designers and teachers, designers may receive limited feedback on the quality of their design and the way it is implemented. This study focuses on teachers' perceptions of the Second Phase, as well as their desires and their (dis)satisfaction with this environment. The participants were 142 teachers of five schools for secondary education, who were all teaching tenth graders.

The results show that teachers perceive a predominantly powerful learning environment, except for student autonomy and differentiation. It is particularly

remarkable that student autonomy is not perceived as pronouncedly present in the learning environment, because this is one of the central characteristics of its underlying educational design. The desires show that teachers positively value almost all measured elements of a powerful learning environment, including student autonomy. Teachers are neutral about the desirability of differentiation and productive learning. Except for productive learning, the dissatisfaction scores show that teachers desire a more powerful learning environment than they perceive at the moment. Teachers prefer less emphasis on productive learning than they currently experience in the learning environment, formulated otherwise, they prefer more reproduction of knowledge than they perceive. This is clearly not in line with constructivist ideas, which stress the importance of learners actively constructing knowledge (Jonassen, 1991). Moreover, teachers' perceptions are related to their approaches to teaching. Teachers reporting the conceptual-change/student-focused (CCSF) approach perceive a more powerful learning environment, while teachers reporting the information-transmission/teacher-focused (ITTF) approach perceive a less powerful environment. Teachers reporting a CCSF approach desire a more powerful learning environment. The direction of the relation between desires and the ITTF approach is equivocal. Dissatisfaction is totally independent from approaches to teaching: teachers with a CCSF approach and an ITTF approach are equally dissatisfied with the environment. This is remarkable, because the design characteristics of the Second Phase fit the CCSF approach better than the ITTF approach.

There is no relation between years of teaching experience and teachers' perspective. This indicates that teachers who just graduated and enter practice (mostly young teachers) do not perceive the learning environment as more powerful, or are more dissatisfied with the perceived learning environment, than more experienced teachers. Consequently, young teachers are probably not more inclined to innovate than their experienced colleagues. The findings of this study provide useful feedback for designers and a starting point to intensify their cooperation with teachers.

Chapter 6 presents the results of a direct comparison between student and teacher perspectives on the learning environment of the Second Phase. Teachers and students have their own perspectives on a learning environment. Congruent perspectives contribute to optimal teaching-learning processes in the environment and help to achieve optimal learning outcomes. The participants were 10th graders in their first school year in the Second Phase of four secondary schools ($N = 994$) and their teachers ($N = 136$). They filled out a questionnaire about their perceptions, desires, and dissatisfaction with regard to the eight characteristics of the learning environment.

Results predominantly show higher teacher perceptions than student perceptions. Teachers have much more favorable perceptions than students with respect to clarity of goals, personalization, fascinating contents, integration, and productive learning; there is no difference between students and teachers with respect to student autonomy. In general, teachers have higher desires for the design of the learning environment than students. Students' desires only exceed teachers' desires with regard to productive learning and student autonomy. Finally, students are more dissatisfied than teachers, that is, their perceptions of the environment are more incongruent with their desires. Because dissatisfaction jeopardizes student motivation (Eccles et al., 1993), these results not only stress the need for interventions reducing incongruity between students' and teachers' perspectives, but also call for interventions decreasing student dissatisfaction. Discourse between teachers and students about (re)design of the learning environment is proposed. This study clearly indicates on which characteristics of the learning environment students' and teachers' perspectives differ most. Interventions should give priority to changing those characteristics.

Chapter 7 describes a study exploring the possibility to implement participatory design in an educational context. Participatory design aims at the active participation of users in the design process and in making decisions that will affect them (Kensing & Blomberg, 1998; Mankin, Cohen, & Bikson, 1997). Participatory design might be a helpful approach to reduce discrepancies between students' and teachers' perspectives and eventually improve the design of the learning environment, because it is a proven approach to optimize designs in other domains. Students and teachers in the Second Phase were interviewed about their opinions on participatory design of a learning environment, their willingness to engage in such a participatory (re)design, and their preferences for the way of implementing it. Both students and teachers display predominantly positive opinions towards engaging in participatory design, supporting its desirability and feasibility. The study also yields seven practical guidelines or preferences for implementation: (1) pedagogies should be emphasized; (2) cooperation between a teacher and a small group of students, rather than a whole year group, is desirable; (3) both students and teachers prefer planning discussions with a frequency of about three times a year, whereas part of the students prefer more frequent discussions; (4) students prefer implementing participatory design especially for difficult subjects and courses which are important for them; (5) teachers should try to have an open and tolerant attitude; (6) a group of students participating in the (re)design process must be heterogeneous with regard to motivation, and (7) the format of participatory design activities does not need to be adapted to high- or low-perception students and teachers.

Chapter 8 describes a study evaluating the effects of a discourse between students and teachers, taking the form of a participatory redesign of their learning environment. Students and teachers have different perspectives on a learning environment and they have limited insight in each other's perspectives. This is likely to threaten the effectiveness of the environment. Participatory design is used in this study as an approach to take students' perspectives better into account and to include students as actors in the instructional (re)design process. It is implemented by six teachers with one of their tenth-grade classes, from which seven students participated in a design meeting. The discourse between the teacher and these seven co-designing students resulted in collaboratively formulated action points, which the teacher tried to implement in subsequent lessons. Students' and teachers' experiences with the meeting are investigated, as well as effects of the adaptation of the environment on students' and teachers' perspectives and the magnitude of the discrepancy between both.

The results show that both students and teachers are positive about the quality of the discussion in the participatory design meeting and the ideas for redesign; the newly developed techniques of participatory design for use in secondary education work well. Effects of the implementation of the redesign are not unanimously positive for all students. For co-designing students, increases are found in perceptions of the learning environment, and decreases in dissatisfaction and discrepancies between students' and teacher's perceptions. However, for the non-co-designing students (i.e., the rest of the class) effects are limited and dissatisfaction with the environment even increases. Possible causes for this unexpected result are discussed. Teachers' perspectives on the learning environment become more positive by the intervention. Participatory design has shown to be a promising initiative for instructional (re)design, but further research is needed, especially to find ways to reach positive effects for the rest of the class.

Chapter 9 provides a general discussion of findings of the conducted studies. It summarizes the main results and conclusions of Chapters 3 to 8, and in turn relates them to the COOP model presented in Chapter 2. The studies show that perspectives of different stakeholders differ considerably. There is variation of perspectives within each group of stakeholders (i.e., teachers or students), partly due to individual learning-related and teaching-related characteristics. Existing discrepancies between students' and teachers' perspectives, and between students' perceptions and desires, are likely to cause suboptimal functioning of teaching-learning processes in the learning environment. When students become more involved in the instructional (re)design process, more congruence between different perspectives can be realized so that students' dissatisfaction will decrease. Participatory design is a feasible and useful approach to involve students in

secondary education in the design process. Indeed, it yields decreases in discrepancies and fosters more positive student perspectives, but, unfortunately, only for those students who are directly involved in the redesign process.

Furthermore, implications for educational practice in schools are discussed. Students should get the chance to discuss their ideas with teachers and to contribute to the instructional design of their courses. They appreciate to take co-accountability for educational processes. Discourse yields better mutual understanding and insight in each other's experiences and preferences. The optimal design of a learning environment is best defined collaboratively. However, student involvement in instructional (re)design requires changes in the school culture: teachers must trust co-designing students as "experts" because of their experiences with education. Mutual trust and respect are preconditions for effective cooperation on improving educational designs. An independent chair for participatory design meetings may help teachers and students to act as equal partners in the discourse. Standard procedures need to be developed and implemented in schools to regularly include students in instructional (re)design processes.

Finally, suggestions for further research are provided. It should be determined why participatory design has such different effects for co-designing students and non-co-designing students. Prominent research questions in this respect are: What are the underlying causes of the positive effects for co-designing students? And what are possible causes of the negative effects (i.e., increased dissatisfaction) for the rest of the class? Furthermore, the implementation of the redesigned learning environment can possibly be optimized by an appropriate coaching of the teachers. Effects of such coaching should be evaluated by closely observing teacher behaviors in the redesigned environment. A next step after optimizing the effectiveness of participatory design would be to extend its application to other contexts. In the reported study, it was applied to redesign an existing learning environment, in order to decrease students' dissatisfaction and discrepancies between perspectives of students and teachers. Another possible application of participatory design would be to involve students right from the start in the development of completely new educational programs.

Samenvatting

Onderwijsinstellingen investeren tegenwoordig veel energie en moeite in het vernieuwen en verbeteren van de kwaliteit van hun onderwijs. Dit blijkt een moeilijk proces te zijn. Een deel van de problemen is te wijten aan de mate waarin de verschillende betrokkenen in het onderwijsproces ervaringen en ideeën met elkaar delen. De communicatie tussen verschillende betrokkenen is vaak beperkt. Een eerste punt van overweging is dat onderwijsontwerpers zelden mede-verantwoordelijk dragen voor de vertaling van hun ideeën naar de onderwijspraktijk (Staub, 2004). De implementatie heeft hier mogelijk onder te lijden. Daarnaast kan het ontwerp niet aangepast en verbeterd worden op basis van ervaringen van docenten als de communicatie tussen ontwerpers en docenten zo beperkt is. Een tweede punt is dat de leerlingen of studenten meestal niet betrokken worden bij het ontwerpen van hun leeromgeving (Cook-Sather, 2001, 2006). In feite worden ze vaak gezien als consumenten van onderwijs. Human-factors engineering benadrukt echter dat ontwerpers en gebruikers min of meer dezelfde interpretaties moeten hebben van een systeem of ontwerp om uiteindelijk de doelen van de ontwerpers te kunnen bereiken (Norman, 1986, 1988). Anders is een daling in de effectiviteit van het ontwerp te verwachten (Bartholomew, Parcel, Kok, & Gottlieb, 2001). Dus als er geen of nauwelijks communicatie met leerlingen of studenten is over de leeromgeving, blijven hun 'afwijkende' percepties waarschijnlijk onopgemerkt. Desalniettemin ondermijnen deze de effectiviteit van de leeromgeving.

Meer congruentie tussen de perspectieven van ontwerpers, docenten en hun leerlingen of studenten kan de effectiviteit van een leeromgeving verhogen. Samenwerking en het geven van feedback aan elkaar is nodig. Zo kan rekening gehouden worden met de verschillende gezichtspunten van betrokkenen en kunnen perspectieven op één lijn worden gebracht.

De Tweede Fase in het Nederlandse Voortgezet Onderwijs is een innovatieve leeromgeving die te lijden heeft gehad onder de verschillen in perspectieven en het gebrek aan communicatie en samenwerking tussen de verschillende betrokkenen. Scholen en docenten hebben talrijke problemen ervaren bij het implementeren van de Tweede Fase en leerlingen mopperen over een overladen curriculum en lesprogramma (Veugelers, de Jong, & Schellings, 2004). Deze leeromgeving is de onderwijskundige context van het onderzoeksproject beschreven in dit proefschrift. Het hoofddoel van het gerapporteerde project is tweeledig. Ten eerste wil het inzicht geven in de verschillende perspectieven van de betrokkenen in het onderwijsproces. Ten tweede worden effecten van participatief ontwerpen bestudeerd als een benadering om de congruentie tussen de perspectieven van docenten en leerlingen te verbeteren.

In **Hoofdstuk 2** wordt het COmbinatie-van-Perspectieven *[COmbination-Of-Perspectives]* (COOP) model beschreven. Het brengt de in de literatuur gerapporteerde bevindingen samen over perspectieven van onderwijsontwerpers, docenten en studenten in een leeromgeving. Het perspectief van onderwijs-ontwerpers omvat de doelen en kenmerken van het moderne onderwijs (de Corte, 1990, 2003; Merrill, 2002; van Merriënboer & Paas, 2003; Vermunt, 2003) zoals zelfstandig leren, interactief leren en differentiatie. Docenten hebben hun eigen perspectief op het onderwijs, hetgeen beïnvloed wordt door hun opvattingen over leren en onderwijzen (Pratt, 1992; Trigwell, Prosser, & Waterhouse, 1999). Zij geven in de praktijk vorm aan de ontwerpen van vernieuwende leeromgevingen zoals bedacht door onderwijsontwerpers. Maar omdat de communicatie en samenwerking tussen ontwerpers en docenten vaak ontbreekt (Keys & Bryan, 2001; Pedersen & Liu, 2003; Staub, 2004) is het te verwachten dat er verschillen bestaan tussen de perspectieven van docenten en ontwerpers. Daarom bevat het model een feedbacklus tussen percepties van docenten en opvattingen van de onderwijsontwerpers.

Tenslotte hebben ook studenten hun eigen perspectief op een leeromgeving. Dit perspectief is het resultaat van de interactie tussen de omgeving en de student met zijn voor-leren-relevante kenmerken (Luyten, Lowyck & Tuerlinckx, 2001; Wierstra & Beerends, 1996) zoals een bepaalde motivationele oriëntatie, opvatting over leren en affectieve verwerkingsstrategie. Het studentperspectief op een leeromgeving is van cruciaal belang omdat dit direct het leer- en studeergedrag beïnvloedt en dus de kwaliteit van leren (Entwistle & Tait, 1990). Een leeromgeving heeft echter geen directe invloed op het leren van studenten. Daarom moet het studentperspectief een veel prominentere plaats innemen in de onderwijsontwerpprocessen dan op dit moment het geval is. Het model visualiseert

dit door de feedbacklussen tussen percepties van studenten en de opvattingen van docenten en onderwijsontwerpers.

Voortbouwend op het COOP-model zoals beschreven in Hoofdstuk 2 richten de verdere hoofdstukken zich op de perspectieven van de leerlingen in het Voortgezet Onderwijs (Hoofdstuk 3 en 4), hun docenten (Hoofdstuk 5), de verschillen tussen beide (Hoofdstuk 6), en het vinden van manieren om de verschillen tussen perspectieven te verkleinen (Hoofdstuk 7 en 8). In de meeste studies worden drie aspecten van perspectieven nader bekeken: percepties van de leeromgeving, wensen ten aanzien van het ontwerp van een omgeving en (on)tevredenheid met de gepercipieerde omgeving.

Hoofdstuk 3 beschrijft een grootschalig longitudinaal onderzoek naar de verwachtingen en percepties die leerlingen in het Voortgezet Onderwijs hebben ten aanzien van een voor hen nieuwe leeromgeving: de Tweede Fase. Leerlingen worden in hun leven herhaaldelijk geconfronteerd met nieuwe leeromgevingen (bijvoorbeeld ook de overgang van het Basisonderwijs naar het Voortgezet Onderwijs), maar er is weinig aandacht voor de verwachtingen die leerlingen hebben van een nieuwe leeromgeving. Dit is echter wel van belang, omdat verwachtingen invloed hebben op percepties en motivatie, hetgeen vervolgens invloed heeft op de effectiviteit van een situatie. Een vragenlijstonderzoek onder 1335 leerlingen bestudeert de verwachtingen en daaropvolgende percepties van de leerlingen met betrekking tot acht kenmerken van de leeromgeving. Ook de wensen en de (prospectieve) ontevredenheid van de leerlingen ten aanzien van die kenmerken is gemeten. De acht onderzochte kenmerken (boeiende leerstof, productief leren, integratie, zelfstandig leren, interactie, differentiatie, helderheid van doelen en personalisatie) beslaan elementen die als belangrijk worden beschouwd in krachtige leeromgevingen. De derde klassers vulden de vragenlijst over de verwachtingen ten aanzien van de Tweede Fase in kort voor ze instroomden in deze leeromgeving. In de twee hierop volgende jaren vulden deze leerlingen opnieuw een vragenlijst in om te rapporteren over hun ervaringen in deze leeromgeving.

Resultaten tonen aan dat leerlingen teleurgesteld zijn ten aanzien van de meeste kenmerken van de nieuwe leeromgeving. Deze voldoet niet aan de verwachtingen die leerlingen vooraf hadden. Dit gaat samen met onwenselijke veranderingen in leerlingkenmerken zoals een toename in faalangst. Productief leren is het enige aspect waarvoor de percepties hoger zijn dan de verwachtingen. De wensen van leerlingen zijn redelijk stabiel over tijd en vertonen alleen kleine veranderingen. Alleen voor zelfstandig leren was een duidelijke daling in de wenselijkheid te zien. De ontevredenheid met de leeromgeving stijgt, vooral tussen het eerste en tweede

meetmoment. De leerlingen zijn teleurgesteld over de nieuwe omgeving behalve over de nadruk op productief leren.

Verwachtingen hangen positief samen met latere percepties. Hoe hoger de verwachtingen voor een bepaald aspect van de omgeving, hoe hoger de latere percepties van dit aspect zijn. En hoe lager de verwachtingen vooraf zijn, hoe lager ook de latere percepties zijn. Ook de wensen op verschillende meetmoment hangen met elkaar samen. Ditzelfde geldt voor de ontevredenheid.

De verwachtingen, de wensen en de prospectieve ontevredenheid, gemeten aan het eind van het derde schooljaar, zijn gerelateerd aan leerlingkenmerken. Het hebben van een persoonlijk geïnteresseerde motivationele oriëntatie en een opvatting over leren als constructie en gebruik van kennis zijn beide gerelateerd aan hoge verwachtingen. Motivationele problemen en faalangst blijken duidelijke risicofactoren bij onderwijsinnovaties. De bevindingen van deze studie benadrukken het belang van een goede voorbereiding van leerlingen op veranderingen in het curriculum en de noodzaak om extra ondersteuning te bieden aan leerlingen met motivationele problemen en faalangst.

Hoofdstuk 4 rapporteert een studie naar de perspectieven die leerlingen hebben op de Tweede Fase, wanneer zij hierin deelnemen. De perspectieven van leerlingen op een leeromgeving beïnvloeden hun leerprocessen. Alhoewel het belangrijk is om rekening te houden met deze perspectieven participeren leerlingen meestal niet in het (her)ontwerpen van hun leeromgeving. Een eerste stap in het verhogen van de betrokkenheid van leerlingen in het ontwerpproces is het vaststellen van hun percepties van de leeromgeving, hun wensen en hun (on)tevredenheid. Dit is het hoofddoel van deze studie. De deelnemers waren 1146 vierde klassers van vijf scholen voor Voortgezet Onderwijs. Gegevens over hun percepties, wensen en ontevredenheid, als ook aan-leren-gerelateerde leerlingkenmerken, werden verzameld met twee vragenlijsten.

De resultaten tonen aan dat leerlingen de nieuwe leeromgeving slechts gedeeltelijk als krachtig ervaren. Ze vinden leerinhouden niet erg boeiend; ze ervaren weinig aandacht voor productief leren, een beperkte mogelijkheden tot zelfstandig leren en ze percipiëren weinig differentiatie. Met betrekking tot de wensen van leerlingen blijkt dat leerlingen erg positief zijn over alle gespecificeerde kenmerken van krachtige leeromgevingen, behalve voor differentiatie tussen leerlingen. Over het algemeen wensen leerlingen een veel krachtigere en innovatievere leeromgeving dan zij op dat moment waarnemen: ze zijn ontevreden en willen meer krachtige elementen. Verder zijn percepties, wensen en ontevredenheid gerelateerd aan leerlingkenmerken. Wanneer leerlingen een meer persoonlijk geïnteresseerde leeroriëntatie rapporteren, percipiëren ze de leeromgeving als krachtiger. Hetzelfde geldt voor het hebben van de opvatting over

leren als kennisconstructie en gebruik van kennis, en voor het gebruik van externe regulatiestrategieën. Problemen bij motivatie en concentratie, en gebrek aan regulatiestrategieën relateren aan lagere perceptie van de omgeving en hogere ontevredenheid. Daartegenover hangt een persoonlijk geïnteresseerde leeroriëntatie samen met lagere ontevredenheid (d.w.z. hogere tevredenheid).

Hoofdstuk 5 beschrijft een studie naar de perspectieven van docenten op de leeromgeving waarover leerlingen rapporteerden in de studie beschreven in Hoofdstuk 4. Docenten implementeren 'krachtige leeromgevingen' die ontwikkeld zijn door onderwijsontwerpers. Door gebrek aan communicatie en samenwerking tussen de ontwerpers en docenten krijgen de ontwerpers beperkte feedback op de kwaliteit van hun ontwerp en op de manier waarop dit is ingevoerd. Deze studie richt zich op de percepties die docenten hebben ten aanzien van de Tweede Fase, en hun wensen en (on)tevredenheid met deze omgeving. De deelnemers waren 142 docenten van vijf scholen voor Voortgezet Onderwijs, die allen lesgaven aan vierde klassers.

Uit de studie blijkt dat docenten hoofdzakelijk een krachtige leeromgeving waarnemen, behalve voor wat betreft zelfstandig leren en differentiatie. Het is opmerkelijk dat docenten aangeven dat zelfstandig leren niet uitgesproken aanwezig is in de leeromgeving, daar dit één van de centrale kenmerken is van het onderliggende onderwijsontwerp. Docenten wensen en waarderen de meeste elementen van een krachtige leeromgeving positief, inclusief zelfstandig leren. Ze reageren echter neutraal over de wenselijkheid van differentiatie en productief leren. Uitgezonderd voor productief leren tonen de resultaten met betrekking tot ontevredenheid dat de docenten een krachtigere leeromgeving wensen dan zij op dat moment ervaren. Docenten prefereren *minder* nadruk op productief leren dan ze waarnemen in de omgeving. Anders geformuleerd prefereren zij meer reproductie van kennis dan ze ervaren. Dit is duidelijk niet in lijn met constructivistische ideeën die het belang benadrukken van actief kennis construeren door studenten (Jonassen, 1991). Verder blijken percepties van docenten samen te hangen met hun opvattingen over onderwijzen. Docenten die gericht zijn op betekenisvol leren en de leerling centraal stellen (BLLC-benadering) percipiëren een krachtigere leeromgeving dan docenten die meer gericht zijn op kennisoverdracht en de docent centraal stellen (KODC-benadering). Docenten met een BLLC-benadering wensen een krachtigere leeromgeving. De richting van de relatie tussen wensen en de KODC-benadering is niet eenduidig. De ontevredenheid is totaal onafhankelijk van de benadering ten aanzien van onderwijzen: docenten met een BLLC-benadering of een KODC-benadering zijn even ontevreden met omgeving. Dit is opvallend omdat de ontwerpkenmerken van de Tweede Fase beter aansluiten bij de BLLC-benadering dan bij de KODC-benadering.

Er is geen relatie tussen het aantal jaren onderwijservaring en de perspectieven van docenten. Dit indiceert dat de docenten die pas zijn afgestudeerd en toetreden tot de onderwijspraktijk (meestal jonge docenten) de leeromgeving niet als krachtiger ervaren of ontevredener zijn met de waargenomen omgeving dan meer ervaren docenten. Dit heeft tot gevolg dat de jonge docenten waarschijnlijk niet meer geneigd tot innoveren zijn dan hun ervaren collega's. De bevindingen van deze studie leveren bruikbare feedback op voor de ontwerpers en zijn een startpunt voor het intensiveren van een samenwerking met docenten.

Hoofdstuk 6 beschrijft de resultaten van een directe vergelijking tussen de perspectieven van leerlingen en docenten omtrent de Tweede Fase. Docenten en leerlingen hebben hun eigen perspectieven op een omgeving. Congruente perspectieven dragen bij aan optimale onderwijsleerprocessen in de leeromgeving en helpen mee om optimale leeruitkomsten te bereiken. Vierde klassers van vier scholen voor Voortgezet Onderwijs in hun eerste schooljaar in de Tweede Fase (N = 994) en hun docenten (N = 136) vulden een vragenlijst in over hun percepties, wensen en ontevredenheid met betrekking tot de genoemde acht kenmerken van de leeromgeving.

De resultaten tonen hoofdzakelijk hogere percepties bij docenten aan dan bij leerlingen. Docenten hebben veel positievere percepties dan leerlingen met betrekking tot de helderheid van doelen, personalisatie, boeiende leerinhouden, integratie en productief leren. Er is geen verschil tussen leerlingen en docenten met betrekking tot zelfstandig leren. Over het algemeen hebben docenten hogere wensen ten aanzien van het ontwerp van de leeromgeving dan leerlingen. Alleen met betrekking tot productief leren en zelfstandig leren zijn de wensen van leerlingen hoger dan de wensen van docenten. Tenslotte zijn leerlingen ontevredener dan docenten, dat wil zeggen dat hun percepties van de omgeving incongruenter zijn met hun wensen. Omdat ontevredenheid de motivatie van leerlingen in gevaar brengt (Eccles et al., 1993) benadrukken deze resultaten niet alleen de noodzaak voor interventies die de discrepantie tussen de perspectieven van leerlingen en docenten verkleinen, maar ook voor interventies die leiden tot een daling van de ontevredenheid van leerlingen. Communicatie tussen docenten en leerlingen over het (her)ontwerp van de leeromgeving wordt als mogelijke oplossing gesuggereerd. Deze studie geeft duidelijk aan op welke kenmerken van de leeromgeving de perspectieven van leerlingen en docenten het meest verschillen. Interventies moeten voorrang geven aan het veranderen van deze kenmerken.

Hoofdstuk 7 beschrijft een studie die de mogelijkheid onderzoekt tot het implementeren van participatief ontwerpen in een onderwijscontext. Participatief ontwerpen heeft als doel om gebruikers actief te laten participeren in het

ontwerpproces (Kensing & Blomberg, 1998; Mankin, Cohen, & Bikson, 1997). Participatief ontwerpen zou een bruikbare benadering kunnen zijn voor het reduceren van de discrepantie tussen de perspectieven van leerlingen en docenten, en uiteindelijk voor het verbeteren van het ontwerp van een leeromgeving. Deze benadering is beproefd gebleken voor het optimaliseren van ontwerpen in andere domeinen. Leerlingen en docenten in de Tweede Fase werden geïnterviewd over hun mening omtrent de mogelijkheid van het participatief ontwerpen van hun leeromgeving, hun bereidheid om deel te nemen aan zo'n participatief (her)ontwerp en hun voorkeur voor de manier waarop dit wordt uitgevoerd. Zowel de leerlingen als docenten uitten hoofdzakelijk positieve meningen over mogelijke deelname aan participatief ontwerpen hetgeen de wenselijkheid en haalbaarheid ervan ondersteunt. De studie leidde ook tot zeven praktische richtlijnen voor implementatie: (1) didactiek moet benadrukt worden als onderwerp voor discussie; (2) samenwerking tussen een docent en een kleine groep leerlingen is wenselijk, in plaats van met de hele klas; (3) organiseer discussies met een frequentie van ongeveer drie keer per jaar; (4) voer participatief ontwerpen vooral in bij moeilijke vakken en vakken die voor leerlingen belangrijk zijn; (5) docenten moeten proberen een open en tolerante attitude te hebben; (6) de groep leerlingen die deelneemt aan het (her)ontwerpproces moet heterogeen zijn met betrekking tot motivatie voor leren, en (7) bij de opzet van participatieve ontwerpactiviteiten kunnen leerlingen en docenten met verschillende percepties (hoog of laag) deelnemen.

Hoofdstuk 8 beschrijft een studie die de effecten evalueert van een discussie tussen leerlingen en docenten over hun leeromgeving, in de vorm van participatief herontwerpen. Leerlingen en docenten hebben verschillende perspectieven op een leeromgeving en ze hebben beperkt inzicht in elkaars perspectieven. Dit kan de effectiviteit van de omgeving ondermijnen. Participatief ontwerpen wordt in deze studie gebruikt als een benadering om beter rekening te houden met de perspectieven van de leerlingen, en om leerlingen op te nemen als actoren in het onderwijs(her)ontwerpproces. Dit werd geïmplementeerd door zes docenten met één van hun vierdejaars klassen, waarvan zeven leerlingen participeerden in een ontwerpbijeenkomst. De discussie tussen de docent en deze zeven co-ontwerpers resulteerde in gezamenlijk geformuleerde actiepunten die de docent probeerde te implementeren in de daaropvolgende lessen. De ervaringen van leerlingen en docenten in deze bijeenkomst zijn onderzocht, als ook de effecten van de aanpassing van de omgeving op de perspectieven van leerlingen en docenten, en de grootte van de discrepantie tussen beide.

De resultaten laten zien dat zowel leerlingen als docenten positief zijn over de kwaliteit van de discussie in de participatieve ontwerpbijeenkomst en over de

ideeën voor herontwerp. De effecten van de implementatie van het herontwerp zijn niet unaniem positief voor alle leerlingen. Voor co-ontwerpers worden stijgingen gevonden in de percepties van de leeromgeving en dalingen in de ontevredenheid en de discrepantie tussen percepties van leerlingen en docenten. Echter voor niet-co-ontwerpers (d.w.z. de rest van de klas) zijn de effecten beperkt. De ontevredenheid met de omgeving stijgt zelfs. Mogelijke oorzaken voor dit onverwachte resultaat worden beschreven in het hoofdstuk. De perspectieven van de docenten op de leeromgeving worden positiever door de interventie. Participatief ontwerpen lijkt een veelbelovend initiatief voor onderwijs-(her)ontwerpen, maar verder onderzoek is nodig om manieren te vinden om ook positieve effecten te bereiken voor de rest van de klas.

Hoofdstuk 9 bevat een algemene discussie van de bevindingen van de uitgevoerde studies. Het geeft een samenvatting van de belangrijkste uitkomsten en conclusies uit Hoofdstuk 3 tot en met 8 en koppelt deze aan het COOP-model uit Hoofdstuk 2. De studies laten zien dat de perspectieven van de verschillende betrokkenen aanzienlijk verschillen. Binnen elke groep van betrokkenen (d.w.z. docenten of leerlingen) is er variatie in perspectieven die gedeeltelijk te wijten is aan individuele kenmerken. De bestaande discrepanties tussen de perspectieven van leerlingen en docenten, en tussen percepties van leerlingen en hun wensen, leiden waarschijnlijk tot suboptimale onderwijsleerprocessen. Als leerlingen meer betrokken worden in het onderwijsontwerpproces kan meer congruentie worden gerealiseerd tussen de verschillende perspectieven zodat de ontevredenheid bij leerlingen zal dalen. Participatief ontwerpen is een goede en haalbare benadering om leerlingen te betrekken in het ontwerpproces in het Voortgezet Onderwijs. Het blijkt zoals verwacht te leiden tot het verkleinen van discrepanties en tot positievere perspectieven bij leerlingen, maar helaas alleen voor de leerlingen die direct betrokken zijn bij het herontwerpen.

Tevens worden de implicaties beschreven voor de onderwijspraktijk op scholen. Leerlingen moeten de kans krijgen om met docenten over hun ideeën te discussiëren en om bij te dragen aan het onderwijsontwerp van hun cursussen of lessen. Ze nemen graag de medeverantwoordelijkheid voor onderwijsprocessen. Communicatie leidt tot beter wederzijds begrip en inzicht in elkaars ervaringen en behoeften. Het optimale ontwerp van een leeromgeving kan het best gezamenlijk worden vormgegeven. Het betrekken van leerlingen in onderwijs(her)ontwerpen vereist echter wel veranderingen in de schoolcultuur: docenten moeten co-ontwerpers vertrouwen als “experts” in hun ervaringen met onderwijs. Wederzijds vertrouwen en respect zijn een voorwaarde voor een effectieve samenwerking aan de verbetering van een onderwijsontwerp. Een onafhankelijke voorzitter van participatieve ontwerpbijeenkomsten kan docenten en leerlingen helpen zich op te

stellen als gelijkwaardige partners in het gesprek. Er zouden procedures ontwikkeld en ingevoerd moeten worden om leerlingen standaard te betrekken bij onderwijs-(her)ontwerpprocessen.

Tenslotte worden er suggesties voor toekomstig onderzoek beschreven. Er moet nader worden bekeken waarom participatief ontwerpen verschillende effecten heeft voor co-ontwerpers en de rest van de klas. Prangende onderzoeksvragen zijn: Wat zijn de onderliggende oorzaken van de positieve effecten voor co-ontwerpers? En wat zijn de mogelijke oorzaken van de negatieve effecten (met name de toename in ontevredenheid) voor de rest van de klas? Verder kan de implementatie van de herontworpen leeromgeving mogelijk verbeterd worden door het coachen van docenten. De effecten van een dergelijke coaching moeten worden geëvalueerd door nauwkeurige observatie van het gedrag van de docent in de herontworpen omgeving. Na het optimaliseren van de effectiviteit van het participatief ontwerpen zou het uitbreiden van de toepassing hiervan naar nieuwe contexten een volgende stap kunnen zijn. In de beschreven studie werden bestaande leeromgevingen herontworpen om de ontevredenheid van leerlingen te verminderen en de discrepanties tussen perspectieven van leerlingen en docenten te verkleinen. Een andere toepassing van participatief ontwerpen zou zijn om leerlingen vanaf het begin te betrekken bij de ontwikkeling van compleet nieuwe onderwijs-programma's.

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Curriculum vitae

Karen Könings werd geboren op 1 mei 1975 te Heerlen. Na het behalen van haar gymnasium-β diploma in 1993 aan het Bernardinuscollege te Heerlen, studeerde ze van 1993 tot 1997 aan de Pedagogische Academie Basisonderwijs van Hogeschool Zuyd (destijds Hogeschool Limburg). Naast deze studie volgde ze een vooropleiding voor het conservatorium. Vanaf 1997 studeerde ze psychologie aan de Universiteit Maastricht en in 2001 rondde ze deze studie cum laude af. Ze volgde de specialisatie cognitieve psychologie en studeerde af op een onderzoek naar de effecten van probleemgestuurd onderwijs op het zelfvertrouwen van lichamelijk gehandicapte tieners en hun attitudes ten opzichte van school en leren. Daarna werkte ze een jaar als onderwijskundige aan dezelfde universiteit. In de periode van 2002 tot 2007 werkte ze bij het Onderwijstechnologisch Expertisecentrum van de Open Universiteit Nederland aan een onderzoeksproject over de verschillen tussen de perspectieven van ontwerpers, docenten en leerlingen op een leeromgeving, in het bijzonder het onderwijs in de Tweede Fase. Tevens is onderzocht hoe leerlingen betrokken kunnen worden bij het (her)ontwerpen van hun onderwijs met als doel om de verschillen in perspectieven tussen leerlingen en docenten te verkleinen. De resultaten van dit onderzoeksproject zijn beschreven in dit proefschrift. Daarnaast was ze in deze periode betrokken bij de masteropleiding Actief Leren, waar ze docent en tentaminator was bij één van de cursussen en tevens de cursusevaluaties coördineerde. Momenteel is ze als universitair docent werkzaam bij de faculteit Psychologie van de Open Universiteit Nederland.

Karen Könings was born on the 1st of May 1975 in Heerlen, the Netherlands. After graduating from secondary education at the Bernardinuscollege in Heerlen in 1993, she studied at the Pedagogical Academy Primary Education at Hogeschool Zuyd for becoming a primary school teacher from 1993 until 1997. Additionally to this study, she followed a preparation program for the Academy of Music. In 1997 she started to study psychology at Maastricht University and in 2001 she graduated with distinction. She specialized in cognitive psychology and completed her study with a research project on effects of problem-based education on self-efficacy and school-related attitudes in physically disabled teenagers. After her graduation, she worked as an educationalist at the same university, for one year. In the period from 2002 until 2007 she worked at the Educational Technology Expertise Center of the Open University of the Netherlands on a PhD-project about discrepancies between

perspectives of educational designers, teachers, and students on a learning environment, especially in secondary education. Additionally, it is studied how students can get involved in (re)designing their education, aiming at diminishing the discrepancies between students' and teachers' perspectives. The results of this research project are described in the present dissertation. In this period, she also worked for the master Active Learning. She was a teacher and examiner in one of the courses and coordinated course evaluations. Presently, she works as an assistant professor at the faculty of Psychology of the Open University of the Netherlands.

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