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An approach to participatory instructional design in secondary education: an exploratory study

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Background: Teachers have limited insight in students' perspectives on education, although these perspectives influence quality of learning. As students' and teachers' perspectives differ considerably, there is a need for teachers to learn more about students' experiences and ideas about education. Participatory design might be a good strategy for taking student perspectives into account in instructional design. In areas outside education, the positive effects of participation have already been demonstrated.
Purpose: The main goals of this exploratory study are to develop an approach – based on the principles of participatory design – for student participation in instructional design, and to evaluate how students and teachers experience the discussion about possible changes in the design and how they co-operate in designing lessons. Additionally, the study investigates whether the used approach is workable and suitable for use with a range of courses.
Sample: The sample consisted of six teachers (of mathematics, economics and English) from two secondary schools in the Netherlands and their 10th-grade pre-university students ($N = 139$; average age 16 years). In each class, a small group of seven co-designing students was selected as a representative sample of their class. All other students in these classes (i.e. those not directly involved in participatory re-design) were also included, as evaluators of the proposed changes.
Design and methods: A participatory design meeting was organised for each group separately. In all groups, the same approach for participatory design was used. The quality of the meeting and the agreement with the proposed changes were evaluated using open questions. The questions were answered individually by both teachers and co-designing students. The remaining students answered questions about their agreement with the proposed changes. The written answers were analysed using a coding scheme.
Results: Findings suggest that both teachers and co-designing students were largely satisfied with the meeting. The atmosphere was experienced predominantly as comfortable and enough opportunities were provided to express thoughts and ideas. Teachers, additionally, stated that the usability of students' suggestions was good. The remaining students predominantly agreed on the proposed changes discussed. No differences were found between the evaluation scores of students of different courses.
Conclusions: The main conclusion from this exploratory study is that participatory design appears suitable for use in education. The approach used

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for initiating and structuring the discussion between the teacher and his/her students was appropriate for designing lessons, according to all those involved. As this study suggests, the barriers to the inclusion of students in the instructional design process are not insurmountable, and there are compelling reasons for implementing participatory design in education.

Keywords: student perspectives; student participation; instructional design; student engagement; student–teacher interaction

Introduction

Teachers often do not have a good insight in students' perceptions of education and have limited sense of the desires and possible criticisms of students in their class (Holt et al. 2005; Watkins 2004). Nevertheless, it is common practice that teachers and educational designers develop lessons for students without including them in the instructional design process (Cook-Sather 2001; Könings, Brand-Gruwel, and Van Merriënboer 2005). Teachers and designers aim to directly influence students' learning processes by the teaching that is offered, but often neglect the fact that the effect of such teaching is mediated by students' interpretation of it (cognitive mediational tradition; Doyle 1977).

The student perspective should thus obtain a far more prominent place in the instructional design process – i.e. the process of designing learning activities from start to finish, including accounting for learning needs, the use of appropriate teaching methods and training materials, the planning of lessons, and choosing the best way for implementing learning activities in the lessons – than it currently has. A good design takes student perspectives into account and bridges possible gaps with teacher (or designer) perspectives. Therefore, the main goal of the current study is to develop an approach for student participation in the design of lessons and the teaching methods used in secondary education, and to evaluate how students and teachers experience this co-operation in designing.

Student perspectives on lessons and teaching directly influence its effectiveness, because perceptions influence the nature and quality of learning and study behaviour (Elen and Lowyck 1999; Entwistle and Tait 1990) and eventually the learning outcomes. Furthermore, students tend to adhere to learning preferences and habits, and only use those elements of the offered teaching that fit well with their habitual way of learning (Vermetten, Vermunt, and Lodewijks 2002). In addition, dissatisfaction with the perceived teaching 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 quality of learning and motivational processes actually taking place during learning. If teachers are not well informed about those perspectives, this might undermine the achievement of educational goals.

Making student perspectives explicit is also important because they appear to be very difficult for teachers to predict (Donaldson 1978; Kershner and Pointon 2000; Oldfather 1995a) and they do not automatically have good insight in students' perspectives (Holt et al. 2005; Watkins 2004). This is problematic, since teachers' and students' perspectives on education differ considerably. In general, teachers tend to perceive teaching more positively than their students do (Fraser 1982; Fraser and O'Brien 1985), students and teachers differ in their preferences with respect to the design of lessons (Doppelt 2004), and students feel more need to change the way the

lessons are given than their teachers (Könings, Brand-Gruwel, and Van Merriënboer 2007).

Despite the importance of student perspectives, the difficulty for teachers/designers to predict these and the existence of large differences between students' and teachers' perspectives, it is still the practice to exclude students from the instructional design process. A discourse between teachers and students about learning experiences is often lacking (Cook-Sather 2001; Rudduck 2006; Rudduck and McIntyre 2007).

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 (De Jong and Westerhof 2001). Mostly, however, the effects of sole student evaluations on the quality of lessons are rather limited (Marsh and Dunkin 1992). 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 (Cook-Sather 2001; Rudduck 2006; Rudduck and McIntyre 2007).

> '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, 124).

Thus, listening to students enables teachers to see the lessons through their students' eyes and gives them better insight in how students interpret their education. Students are the primary stakeholders of education and experts in their own experiences (Oldfather 1995b). Too often, 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, 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, 22).

Excluding students from the instructional design process is common practice, although it is likely to have negative effects on the learning process. On top of this, the sense of not being heard may have negative effects on student behaviours. It causes alienation, experiences of anonymity and powerlessness, which contribute to disengagement from school, with possible consequences such as truancy and dropping out of school (Mitra 2004; Smyth and Fasoli 2007). A feeling of not being in control is also related to academic goals: students who experience little control will adopt work-avoidance goals (Seifert and O'Keefe 2001), i.e. they minimise 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 et al. 2004).

The literature, however, remains vague in terms of answering the question of *in which way* students can best participate in the instructional design process and how 'listening to student experiences' can best be organised. Some preconditions for having a successful discussion are described. Teachers must be willing to listen to student experiences and honour 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, 87). It also requires trusting that

students having relevant knowledge and are 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 and Nicholls 1995). These preconditions do not, however, prescribe how to create in a school context a discourse fostering productive and effective student participation in the instructional design process. Therefore, the current study proposes a newly developed approach to elicit experiences from students and teachers, and to help them systematically discuss possibilities for improving the design of lessons.

The approach for including students in the design process is based on ideas from participatory design. Participatory design is an approach to design that supposes active participation of end users of any system in its design process, and in making decisions that will affect them, in order to help ensure that the final design meets the needs of its users (Berns 2004; Kensing and Blomberg 1998; Mankin, Cohen, and Bikson 1997). In many areas outside 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 et al. 2001; Meister and Enderwick 2002). Also, in designing technology for children, student involvement develops more and more from being only a user or a tester, to the child as design partner (Druin 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). In a participatory design process, participants analyse the current situation and assess its shortcomings, taking their own needs and desires into account (Cabana 1995). Then, they come up with ideas for design and finally devise a plan for implementing the new design. After making plans, these have to be implemented in practice. The current study focuses on the process of analysing the current way of teaching and making plans for improvements. Evaluating the implementation process is beyond the scope of this article.

It is a major challenge to adapt participatory design procedures in such a way that they can be used to involve secondary school students in the design of their instruction. Earlier explorative interviews with students and teachers to ask their opinions about a possible, future use of participatory design in (secondary) education yielded several pieces of practical advice, such as:

- Participatory design meetings should be organised for one teacher and a small group of students (rather than the whole year group);
- Selected students (i.e. co-designers) must be heterogeneous concerning their view on the lessons; and
- Participatory design meetings should not take too much time (Könings, van Zundert et al. 2007).

In respect of the heterogeneity of the selected group of students, it is highly important to include students with negative perspectives and high dissatisfaction in the group of selected students. Since their needs are not being met and their discrepancy to teachers' perspectives is largest, they are likely to benefit most from participating in instructional design.

In the current study, a newly developed participatory design approach is applied to improve the design of lessons. Students are included in a discussion with their

teacher and exchange positive and negative experiences about their lessons. Together with the teacher, they discuss possibilities for improving lessons and overcoming negative points, and they plan how these ideas can be implemented in practice. The participatory design process took place in six classes (with seven co-designing students in each class).

This study evaluates the process of the participatory design meeting and the discussion about possible changes in the instructional design of the lessons. By means of student and teacher evaluations, the study aimed to find out if the participatory design approach is adequate for use with students in secondary education across a range of school subjects. The following two research questions will be answered:

(1) How do co-designing students and teachers evaluate the participatory design meeting, and how does the remainder of the class (i.e. the students not involved in co-designing) evaluate the suggested points for designing the lessons formulated during the meeting?
(2) Is the evaluation of the participatory design approach similar in different school subjects?

Method

Participants

The sample consisted of six teachers (five male, one female) from two different secondary schools and their 10th-grade pre-university students. The students were approximately 16 years old and were following a six-year programme, preparing for university education. The students were taken from one class of each teacher (total $N = 139$). The teachers voluntarily decided to participate in this study. They were teaching mathematics (teachers 1, 2 and 3), economics (teachers 4 and 5), and English as a foreign language (teacher 6). In each class, a small group of seven co-designing students (called co-designers) was selected as a representative sample of their class. They did not express objections to being selected for participating in the experiment. Students who were not directly involved in participatory design will be called 'the rest of the class'. The selection procedure of co-designers is explained in more detail in the description of the Procedure. Table 1 summarises details of the participants.

The achievement level of the participating schools in terms of the general examination indicates that they are broadly representative of schools in the Netherlands, with one school scoring on national average and one school slightly below it (Onderwijsinspectie [Dutch Inspection of Education] 2009).

Materials

For evaluating the participatory meeting, the teachers, co-designing students and the remainder of the class were asked open questions about the quality of the meeting and/or the agreement with its proposed changes.

Co-designers were asked four questions:

(1) How was the atmosphere during the meeting?
(2) Did you have enough opportunities to say what you wanted to say?

Table 1. Details of the participants in the study.

School	A	A	A	B	B	B	Total *n*
Teacher	Teacher 1	Teacher 2	Teacher 3	Teacher 4	Teacher 5	Teacher 6	6
Subject	Mathematics	Mathematics	Mathematics	Economics	Economics	English as a foreign language	–
No. of co-designing students	7	7	7	7	7	7	42
No. of students in 'rest of the class'	15	15	20	15	18	14	97
Total no. of students participating in study							139

(3) Do you agree with the remarks made by other co-designers?
(4) Do you agree with the formulated action points (i.e. co-operatively formulated ideas for improving lessons)?

The open questions for the rest of the class, that is, students 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 question sequences:

(1) Do you agree with the content of the discussion? Are there remarks that you do not agree with? Did you miss important remarks?
(2) What is your opinion of the formulated action points? Are they good ideas? If not, why not?

Teachers were asked four questions that were slightly different from the questions posed to the students:

(1) How was the atmosphere during the meeting?
(2) Did you agree with students' remarks? Did students mention things that you experienced otherwise?
(3) To what extent do you think students' suggestions are useable in practice?
(4) What is your general opinion of the meeting?

Coding scheme for analysing data

For labelling the data, coding schemes were developed, based on the answers given on the open questions. Labels were only defined if more than one student or more than one teacher gave the same answer. The coding schemes are presented as labels in the response frequency tables (in the Results section).

Procedure

About two weeks before the participatory design meeting, students filled out a questionnaire about their perceptions of the current way lessons are given (i.e. Inventory of Perceived Study Environment Extended; Könings et al. 2008). Based on the results of this questionnaire, seven students from each class were selected to join in the participatory design meeting, together with their teacher. The aim of the selection procedure was to select a representative and heterogeneous sample of all students in a class, including students that are positive, neutral or negative about the lessons provided. The selection was done based only on students' questionnaire scores and without asking the teacher for any advice on the selection of students.

Within each class, students were ranked on the basis of their mean perception scores and divided in three equally sized groups: one third of students having most positive perceptions of the lessons, one third having the most negative perceptions and an intermediate group. In the case of high perceivers and low perceivers, two students were randomly selected from each group. Three students were selected from the group of moderate perceivers.

The participatory design meeting was arranged separately for each group (i.e. seven co-designers and their teacher) 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 briefly 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 of his/her lessons would not have any personal consequences for 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 co-operatively 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 lessons. For example, 'the teacher mostly explains the subject matter in a way that it is very understandable'. Students and the teacher 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 and negative points of the lessons had to be mentioned. For example, 'the teachers provide us with too few notes of the subject matter'. In this phase, starting a discussion about the positive and negative points that were articulated was not allowed.

During the second stage, group discussion of the main positive and negative points was the goal. The students and teacher individually described their most important comments. Three piles of small cards, coloured with the colours of traffic lights, were put down in the middle of the table: green cards with the emoticon ☺ for writing down a positive remark, orange cards with a 😐 for a doubtful or moderately negative remark, and red cards with a ☹ for writing down seriously negative remarks. Only one remark could be described on a card and everyone could take as many cards as desired. After everyone finished writing, the chair used a big display board for starting the group discussion about the cards. First, positive remarks, which were written down on green cards, were explored. 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 instruction (see Figure 1, for an example). For example, 'the difficulty of tests does not correspond to the complexity of tasks practiced during the lessons'. This was the starting point for the discussion about designing the lessons, or the exchange of ideas to overcome weaknesses.

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. For instance, students asked the teacher to provide them with exercises allowing them to better prepare for a test. 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 co-operatively to formulate action points for directing the changes in the forthcoming lessons. Finally, these action points were written down and stuck to the board. Different groups formulated action points like: 'provide more examples of daily life and news items to make the economics lessons and learning contents more interesting', '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', or 'more time should be given to practicing English speaking skills and pronunciation during the lessons'.

Figure 1. The board with a summary of the discussion in one of the participatory design groups.

A few days after the participatory design meeting, the evaluative questions about the quality of the meeting and the agreement with its proposed changes were sent by e-mail to teachers, co-designers and the rest of the class. All six teachers responded. Of the 42 students who had a co-designing role in this experiment, 28 students responded (67%). These students represent all groups, as from each mathematics group five students responded, from the economics groups three and four students responded, and in the English group six students answered the questions. For the rest of the class the response rate was 46% (45 of 97 students). The mathematics classes are represented by respectively five, 10 and 12 respondents, the economics classes by three and seven students and the English class by eight students who responded to the questions. The response rate did not differ between school A and B.

Data-analysis

For computing Cohen's Kappa (interrater reliability), a second experimenter independently coded the answers of five co-designers, five students from the rest of the class and three teachers. The Kappa was 0.89 for labelling the answers of co-designers, 0.78 for labelling teachers' responses and 0.81 for labelling the answers of the rest of the class.

For evaluating the participatory design meeting (i.e. first research question), the data 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 the co-designers, the rest of the class, and teachers. Chi-square tests were computed for testing possible differences in response frequencies between courses (i.e. second research question). This was done separately for co-designers of the six classes and the other students of these courses. For teachers, no analyses were conducted, since $n = 1$ in each class.

Results

Evaluation of the participatory design meeting

The frequencies of the labels of the coding scheme were counted to answer the first research question on the evaluation of the participatory design meeting and the proposed changes. The response frequencies of co-designers, the rest of the class and the teachers are presented as Tables 2, 3 and 4, respectively.

Table 2 shows the response frequencies of the co-designing students. Of the 28 responding co-designing students, the majority (24) of the students experienced the atmosphere during the meeting as comfortable. A few students (three) said the atmosphere was a bit uncomfortable in the beginning but got better during the meeting, experienced the meeting as a bit stressful (two), or indicated the activity with the coloured balls as childish (four). All students experienced enough opportunities to say what they wanted to say. The majority of the students (18) recognised all remarks of others and agreed with them; a quarter of them (seven) largely recognised the remarks of others and agreed with them, and some students (three) partly recognised the remarks of others and partly agreed and partly disagreed with them. All but three students (25) agreed on the formulated action points. These three students agreed but found one action point superfluous or disagreed with it. There were students who spontaneously remarked that they already saw their teacher implementing the action points (five), or that they expected the course to improve by the implementation of the action points (three).

Table 3 shows the response frequencies of the rest of the class. The rest of the class received a summary of the remarks and action points resulting from the meeting and reported on their agreement. Of the 45 responding students, the

Table 2. Response frequencies for co-designing students, by subject and overall.

	Mathematics, total $n = 15$	Economics, total $n = 7$	English, total $n = 6$	Total $n = 28$
Question 1 (atmosphere during the meeting)				
Pleasant/comfortable	14	7	3	24
In the beginning a bit uncomfortable, but later on better	0	2	1	3
Ok, but a bit stressful	1	0	1	2
The activity with the coloured balls was childish	3	0	1	4
Question 2 (enough opportunities to say what you wanted to say)				
Yes	15	7	6	28
Question 3 (agreement with others' remarks)				
Totally agree	11	3	4	18
Largely agree	3	3	1	7
Partly agree/partly disagree	1	1	1	3
Question 4 (agreement with formulated action points)				
Totally agree	14	6	5	25
Agree, but disagreement with one action point or one point is less relevant	1	1	1	3
Spontaneous remarks				
I already saw the teacher implementing it	4	1	0	5
I hope it will be implemented, since it would improve the course	1	1	1	3

Table 3. Response frequencies for the rest of the class, by subject and overall.

	Mathematics, total $n = 27$	Economics, total $n = 10$	English, total $n = 8$	Total $n = 45$
Question 1 (agreement on the content of the discussion)				
Totally recognisable and agreement	17	7	7	31
Agree, except on one remark	1	2	1	4
Disagree on more than one remark	4	0	0	4
Question 2 (agreement on the formulated action points)				
Good/totally agree	13	6	4	23
Totally agree and adding a suggestion	1	0	1	2
Agree, but disagree on one action point, or one point is superfluous	9	4	2	15
Disagree on more than one action point, or more than one point is superfluous	3	0	0	3
Spontaneous remarks				
I already saw the teacher implementing it	6	1	0	7
I hope it will be implemented, since it would improve the course	3	1	2	6

Table 4. Response frequencies for the six teachers.

	Mathematics, total $n = 3$	Economics, total $n = 2$	English, total $n = 1$	Total $n = 6$
Question 1 (atmosphere during the meeting)				
A pleasant atmosphere	2	2	1	5
Students were able to express themselves fully	1	0	1	2
Students were reserved at the beginning but became more talkative later on	0	2	0	2
Question 2 (agreement on the formulated action points)				
Agree on most of the students' remarks	3	2	1	6
Students also made an unexpected remark	1	1	1	3
Question 3 (usefulness of students' suggestions)				
Good	3	2	1	6
I need some time to think about how it could be implemented and/or think one of the suggestions is difficult to implement	0	1	1	2
Question 4 (general opinion of the meeting)				
Positive	3	2	1	6

majority (31) fully agreed with the summary and all remarks or largely agreed but disagreed on one remark (four). Some students (four) disagreed on more than one remark. In response to the question about the formulated action points, half of the students (23) totally agreed; one third of them largely agreed but disagreed on one action point or found it superfluous, and only a small minority (three) disagreed on more than one action point or found them superfluous. Seven students spontaneously remarked that they already saw their teacher implementing one or more of the action points and six students expected the course to improve if action points were implemented.

Table 4 shows the response frequencies of the six teachers. All but one of the teachers (five) reported a pleasant atmosphere during the participatory design meeting. Two of them stated that the students were able to express themselves fully. Additionally, two teachers remarked that students were reserved at the beginning of the meeting but became more talkative later on. All teachers answered they agreed on most of the students' remarks, but half of them reported that students also made an unexpected remark. The usability of students' suggestions was good according to all teachers (six). Two teachers reported they needed some time to think about how it could be implemented and/or found one of the suggestions difficult to implement. The general opinion of the meeting was positive for all teachers.

The second research question concerned possible differences between the evaluation scores of students of different courses. It focused on the generalisability of the used approach for application in different subject matters. Our hypothesis was that the approach is equally suitable and workable in designing different courses. Indeed, no single substantial difference was found between evaluation scores of co-designers involved in designing either mathematics, economics or English. Also, for the rest of the class, the evaluation scores did not differ depending on the subject matter in which participatory design was applied.

Conclusions and discussion

This small scale, exploratory study investigated students' and teachers' experiences with the use of a newly developed approach for participatory design in the context of secondary education. Student participation in instructional design was a new initiative for both teachers and students. The main goal of this study was the evaluation of the participatory design meeting by co-designers and teachers, and the evaluation of the proposed changes by the rest of the class. Results revealed that co-designers and teachers were predominantly positive about the meeting. Students experienced the atmosphere as pleasant, although some students understandably found it a bit stressful and uncomfortable, especially in the beginning. Students experienced enough opportunities to express their comments and suggestions. Also, teachers were positive about the atmosphere during the meeting. They saw the students as able to express themselves and agreed with most remarks students made. The fact that some remarks were unexpected for the teachers underlined the need for student participation in the design process of lessons. Teachers were predominantly positive about the usefulness of student suggestions.

The rest of the class evaluated the meeting by commenting on a written summary of the points discussed. The other students predominantly agreed with the remarks discussed in the meeting and the majority totally or largely agreed with the formulated action points. The proposed changes to the design of the lessons were largely accepted by the whole classes. The inclusion of seven co-designers from each class thus seemed to provide a good representation of all student perspectives in that class, although it is impossible to cover all opinions completely. The newly developed approach for participatory design in secondary education worked effectively, and both teachers and students were satisfied with it.

Participatory design was applied for designing the lessons in three different subject areas. Evaluations did not differ between these courses, indicating that students' experiences with the use of this approach was equally positive (although the unequal numbers of respondents across subject groups and the small numbers

involved need to be borne in mind). This suggests the potential usefulness of the participatory design approach in different courses within the whole curriculum.

An implication of our study is that participatory design seems to be well suited to education. Procedures used in domains outside the field of education, such as cognitive engineering and health promotion, can be successfully adapted to education. Excluding students from instructional design processes, it would seem, is unnecessary and undesirable. Students in secondary education around the age of 16 are able to participate in a constructive way in the design process of their lessons. Possibly, resistance of teachers and educational designers (Cook-Sather 2002, 2003; Rudduck and McInyre 2007; Oldfather 1995a) is the result of anxiety or hesitation caused by giving up some of their authority when asking students for feedback. Our study, however, suggests that this is needless. The atmosphere during the discussion can be pleasant and safe for both teachers and students, as in our study. If unwillingness to invite students to participate in instructional design is related to the idea that students do not have enough expertise to give meaningful feedback or because they would require unrealistic changes (Cook-Sather 2002; Lincoln 1995), it has been shown that teachers largely agree on students' remarks and judge students' suggestions as very useful in practice. This study suggests that the barriers to the inclusion of students in the instructional design process of daily classes in secondary education are not insurmountable. There are, we suggest, compelling reasons for implementing participatory design in education.

Future research has to explore further best practices of participatory design approaches in education, as the current study evaluates only one approach. Thought should be given to alternative approaches, which have to be tested too. We suggest that developing approaches for other educational settings, like vocational education, should be encouraged. Moreover, the possible benefits of participation for less academic students are worth investigating. Possibly, they may take advantage of it even more, since their needs are not being met in school.

Clearly, this study is exploratory and limited primarily by the small sample size. A further limitation is that analysis of the effects of the co-operatively formulated design changes was beyond our scope. It would be interesting to study short- and long-term effects of participatory design meetings and subsequent design activities on learning outcomes and the effectiveness of instruction. Additionally, it would be valuable to examine, in more detail, the effects of student participation on students' sense of belonging, sense of control, and engagement with school. Future initiatives might also broaden the study of participatory design from *re*designing existing 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. The need to redesign afterwards, or make revisions to repair suboptimal design decisions, might then possibly be reduced. When students are co-designing a new environment, however, it should be borne in mind that 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.

In conclusion, this exploratory study suggests that participatory design can be adapted for use in education as a promising approach to better account for students' perspectives in the instructional design process in different school subjects. In our

study, both students and teachers were positive about the quality of the discussion in the participatory design meetings and the formulated ideas for redesign. This study is offered as a starting point for further research in this domain.

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