Technology makes a difference : inclusiveness of technology in education

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Chapter 5

GENDER INCLUSIVENESS IN EDUCATIONAL TECHNOLOGY AND LEARNING EXPERIENCES OF GIRLS AND BOYS [1]

The use of technology (Information and Communication Technology, ICT) in secondary education is nowadays an important aspect of the curriculum and of teachers' pedagogy. Learning supported by computers is supposed to be motivating for students and is, therefore, assumed to have positive effects on learning experiences and results. However, the question remains whether these motivating effects are equal for all students. Although the gender gap in the use of ICT and knowledge about it has diminished, there are still indications that the use of technology in education works out differently for girls and boys.
The present empirical study focuses on the relationship between the inclusiveness of educational tools and the learning experiences of girls and boys. The results show that in educational tools gender scripts are embedded, which are reinforced in classroom practice and which affect learner experiences. A greater inclusiveness of the tools appears to improve participation of students, enhances positive attitudes towards learning and technology, and improves the learning effects as reported by girls and boys. Especially girls tend to benefit from the inclusiveness of educational tools

1. INTRODUCTION

> "I like working with computers at school. It is nice to be active, to determine your own way of working and to not have to listen to the teacher all the time." (boy)
>
> "It is nicer than the usual lessons, but it depends on the task that has to be done."(girl)
>
> "In the beginning it was difficult, because I was used to working with schoolbooks. Now it has become normal. It is not especially nicer, or better, to work with computers at school."(boy)

Students seem to be motivated by working with technology (Information and Communication Technology, ICT) at school (Becta, 2006; Ruthven, Hennessy, & Brindley, 2004). At the same time, as the quotations above indicate, students' ex-

[1] Heemskerk, I., Dam, G. ten, Volman, M., & Admiraal, W. (submitted). *Gender inclusiveness in educational technology and learning experiences of girls and boys.*

periences with technology in education vary and, more specifically, may be related to gender. Gender differences in students' appreciation of the educational use of ICT would be in line with the research continuing to show gender differences in computer attitudes, although the gender gap in the use of and knowledge about ICT has diminished (Cooper, 2006). Girls' attitudes are particularly found to be less positive when confidence in working with technology and the role of ICT in students' future plans are at stake (Colley & Comber, 2003; Volman, Van Eck, Heemskerk, & Kuiper, 2005).

However, it has also become clear over the past few years that we should differentiate between different types of ICT use, when making statements about gender differences in the use and appreciation of ICT. For example, boys play computer games more often than girls (Cassell & Jenkins, 1998) and girls take fewer technology classes than boys in high school (Pinkard, 2005), but girls use e-mail at school more often than boys (Volman et al., 2005). Girls tend to respond less positively than boys on items aimed at measuring computer attitude in general, while they report enthusiastically about applications for word processing and drawing (Volman & Van Eck, 2001).

Much has been written about the question on what determines the (gender) inclusiveness of educational technology (Heemskerk, Brink, Volman, & Ten Dam, 2005), and much is known about characteristics of computer games and educational software that appeal to girls. There are indications that girls prefer games and educational tools facilitating cooperation to more competitive tools, they generally tend to like games appealing to creativity more than tools that ask for dexterity, and appreciate detailed and colourful images in games and educational technological tools (American Association of University Women (AAUW) Educational Foundation, 2000; Fiore, 1999). In our own research on educational tools, we found that girls tend to appreciate clear instructions and an interesting subject more than boys, whereas boys appreciate pictures and competition more than girls (Heemskerk, Volman, Admiraal, & Ten Dam, submitted a).

The above mentioned differences support the idea that the use of a particular educational tool in class might work out differently for boys and girls. In other words, educational tools may be less inclusive to either boys or girls, which in turn might result in different learning experiences and different learning results. However, the relationship between the supposed inclusiveness of particular educational tools and the actual experiences of students with these has not been investigated systematically so far. Therefore, this study focuses on this relationship, by looking at both the inclusiveness of particular educational tools and the learning experiences of girls and boys when using these tools. In order to understand the mechanisms of inclusiveness of educational tools, we use the concept of 'gender scripts' as introduced by Oudshoorn, Seatnan and Lie (2002), based on the 'script' concept of Woolgar (1992).

2. SCRIPTS IN TECHNOLOGY

Designers and developers of educational technology have specific images of future users and future usage. Even when equal access to new technology is aimed at, these 'user representations' or scripts are unintentionally built in the design of technology. Scripts can be defined as assumptions about a supposed user, which become an integrated part of the entire process of technological development. These scripts may result in a design more suitable for a specific group of users and to the exclusion of other groups (Akrich, 1995; Oudshoorn, Rommes, & Stienstra, 2004). A study of Huff and Cooper (Huff & Cooper, 1987, as referred in Cooper, 2006), for example, demonstrated that educational software designed by teachers is often written with boys in mind, leading to tools which are more attractive to boys than to girls. On the other hand, users of technology do not necessarily need to adopt the scripts as constructed by the designers. In processes of 'domestication' they can modify the scripts, or they may reject them. Users of technology can also create new meanings and usage of the objects, and finally they can become non-users (Oudshoorn et al., 2004). These processes are situated in a cultural context, in which cultural codes are important. For example, gender codes play an important role in processes of domestication of the Internet (Van Zoonen, 2002). In the context of educational technology, teachers as well as students are active participants in domestication processes, and they are able to modify gender scripts in various ways. Gender scripts and, in a broader sense, social scripts in educational tools can be traced with help of the literature on gender-inclusiveness and cultural sensitivity in educational software. In educational software three different aspects may be distinguished in which such scripts can be found: the content, the visual and audio interface, and the instructional structure of the technological tool (Heemskerk et al., 2005).

Most teachers will agree that educational tools should not unintentionally discourage specific groups of students. Therefore, students should be offered optimal possibilities to identify with the subject matter and the way it is presented, and that each student should feel comfortable as well as challenged when working with an educational tool. Therefore, the content and the interface of the educational tools should be attractive for girls and boys. Moreover, the structure of the programme and the kind of learning processes that are facilitated should match the ability levels and the learning approaches of various groups of students. For the three clusters of scripts mentioned above (content, interface and structure) questions can be articulated to indicate whether social scripts are hidden in the tool, possibly causing less inclusiveness for particular social groups, for example either boys or girls. These questions have been elaborated as an index of inclusiveness, (see Table 1, Heemskerk, et al., 2005).

Table 1

Index of inclusiveness

1. Content		
1.1 Perspective		
	Presence of different groups	• Is there a balanced representation of diverse human groups (e.g. male/female; different cultural backgrounds, diversity of ethnicity/race; different social classes; urban/rural; diversity of religions/beliefs)?
	Representation of groups	• Are the groups presented in ways that are positive, equal and non-stereotypical (e.g. variety of living situations, variety of occupational tasks and other activities, variety in human responses, aggressive as well as sensitive, active as well as inactive)?
	Contributions of groups	• Are the groups represented in ways that reflect accurately their potential contributions to the subject of the program?
		• Are issues relating to groups routinely included within the content as opposed to being separated out as 'special concerns'?
		• Does the content avoid assuming that all people are operating from the same group, perspective and/or values?
		• Is it clear that decisions made in simulations may have different effects for different groups?
1.2 Respectful of values		• Is the content respectful and considerate of the values, manners and taboos of the different cultural groups?
		• Is the language free of biased terminology?
1.3 Real-life context		• Is the subject matter presented in an authentic context (e.g. by using the experiences of the students, actively involve the students in problem solving, addressing the usefulness of the subject in daily life, presenting a subject using different disciplines)?
1.4 Addressing different interests		• Does the material have the potential to attract the interest of all groups, not just represents a stereotype of the interest of one group?

2. Interface

2.1 Visual aspects

Presence and representation of different groups	• Is there a balanced representation of diverse human groups (e.g. male/female; different cultural backgrounds, diversity of ethnicity/race; different social classes; urban/rural; diversity of religions/beliefs)? • Are the groups presented in ways that are positive, equal and non-stereotypical (e.g. variety of living situations, variety of occupational tasks and other activities, variety in human responses, aggressive as well as sensitive, active as well as inactive)?
Respectful of values	• Is the visual interface respectful and considerate of the values, manners and taboos of the different cultural groups (e.g. in the use of colour, icons, pictures of animals and other images)?
Preferences of different groups	• Are the preferences of different groups taken into account in the visual interface (e.g. bright vs dark colours, detailed or not, clarity of images)?
Packaging	• Do the packaging and/or advertising show a diversity of groups rather than one group to the exclusion of others?

2.2 Audio aspects

Voice	• Does audio material include narrators from a range of group voices?
Music and sounds	• Does the sound track include a variety of styles of music/sounds?

3. Instructional structure

3.1 Prior knowledge

Initial level	• Is the material designed effectively and explained thoroughly enough so that all users can work with it, regardless of differences in
	  • ICT skills and knowledge
	  • Content knowledge and learning capabilities

Home language	• Does the material acknowledge that learners may have a variety of home languages and take that into account (e.g. by using dictionaries, the use of clear language, multilingual)?
3.2 Learning strategies	• Does the material acknowledge that learners may have a variety of learning strategies and take that into account
3.3 Learning activities	
Collaboration	• Does the program accommodate learning together as opposed to competition? If working in groups is required does the program: • Accommodate multiple roles and tasks • Provide all students with the opportunity to do different tasks and practice different roles
Communication	• Does the program accommodate ways of communication with other people, e.g. experts, students? If communication is required does the program: • Acknowledge that some students may have difficulty with asking (why-) questions, arguing with adults or formulating their ideas? • Acknowledge that differences in communication styles exist between different groups or different languages (e.g. differences may occur in frequency, length or tone of messages)?
Skills	• Are different kinds of skills addressed (e.g. writing, drawing)?
3.4 Help	
Scaffolding	• Does the program offer scaffolding support, i.e. an apprenticeship approach helping the student to develop the necessary skills?
Feedback	• Is the feedback to the student positive and direct?
Self-esteem	• Does the program offer support in a way that promotes the self-esteem of the student? • Does the program offer ways for students to function as teacher or expert to other students?
3.5 Students input	
Choice	• Does the program offer possibilities for students to have choice in how to work (e.g. are there different ways to use the program, different solutions to the assignments)?

	• Is the student treated as an active participant with responsibility for their learning process?
Flexibility	• Is the program made in such a flexible manner that students can alter parts to their preference?
	• Can students add their own information and experiences into the material?

The index of inclusiveness was developed on the basis of literature on gender inclusiveness and socio-cultural sensitivity of technology. Here we focus on the literature on gender and technology. Regarding the *content* of educational tools, many authors have argued that there should not be any obstacle to students giving personal meaning to the subject matter. Taking a non-sexist and non-stereotypical perspective is assumed to contribute to this (Adler, 1999; Gillani, 2000; Larson, 1999). This implies, for example, that the content of educational tools avoids sexist language. The literature on gender-inclusive education has also pointed out the importance of presenting the subject matter in a 'real-life' context, which appeals to girls (Agosto, 2001; Volman, 1997). A final issue regarding the content of educational tools is the importance of creating applications that address students' different interests. It was found that the learning results of girls improve when the educational tool fits in with their interests, whereas this effect was not found with boys (Joiner, Messer, Littleton & Light, 1996).

Discussions on the characteristics of an inclusive *visual interface* in educational technology largely address similar issues as those concerning the content. Questions which can be asked are: 'Do the illustrations and graphics of the program represent male and female persons, and are they represented in a non-stereotypical way?', Are the preferences of girls and boys taken into account in the visual interface?' etc. Regarding the *audio* aspects of educational technology, it is important to include narrators from different sexes and a variety of styles of music and sounds (Fiore, 1999; Gillani, 2000; Royer, Greene & Anzalone, 1994). Using a variety of visual and audio features in educational tools can make these tools more attractive to both boys and girls.

The inclusiveness of the *instructional structure* of an application refers to whether the way the learning process is structured or supported by the tool matches the ability levels and learning approaches of different students. Several issues can be addressed. Firstly, in order to be inclusive, the instructional structure of an educational tool should be based on the prior knowledge of students. This concerns both the skills of students necessary for using ICT and their knowledge of the particular subject matter. Generally, girls report fewer ICT skills and less ICT knowledge than boys do (Volman & Van Eck, 2001). The second issue concerns differences in learning strategies. Programmes should accommodate students' learning strategies (Adler, 1999), which can be related to gender. For example, boys are found to like programmes with lots of choices and like to try out things, while girls like to have an explanation first (Volman et al., 2005). The third issue regarding the instructional structure of educational tools refers to the kind of learning activities that are ad-

dressed in a software program or tool. The issue of social interaction is considered to be particularly relevant. Preferences for collaboration or competition in general, and for applications facilitating communication in particular, have been found to be related to gender. For instance, research on gender reveals that girls prefer collaboration to competition (Agosto, 2001; De Jean, Upitis, Koch, & Young, 1999; Fiore, 1999, Heemskerk et al, submitted a). The fourth aspect of the instructional structure of educational tools that is relevant to inclusiveness is the opportunity for students to receive help. Many authors mention the importance of clear and immediate feedback and scaffolds (Gillani, 2000; Selby & Ryba, 1994), which appear to be particularly important for girls, who tend to be less self-assured in ICT matters (Agosto, 2001). The fifth issue that is supposed to affect the inclusiveness of educational tools is the extent to which students are allowed to have their own input or take responsibilities when working with the educational tool (e.g. DeVoogd, 1998; Maurer & Davidson, 1999). Girls have been found to prefer programs that allow multiple paths and many possible answers (Agosto, 2001).

The present study aims to improve our understanding of the functioning and effects of gender inclusiveness in educational software. Although a few empirical studies have been carried out, thus far, the literature on this issue is mainly of a theoretical and reflective nature. For an analysis of the gender inclusiveness of educational technology, the distinction between manifestations of the curriculum made by Goodlad, Klein, and Tye (1979) is relevant. In this study we look at three levels of the curriculum: the formal, the operational, and the experiential curriculum. The analysis of the formal curriculum concerns the inclusiveness of the design of the tools. However, curricula are not just delivered by teachers, and educational tools are not just used in a neutral way. In the literature on educational technology it has been shown that teachers tend to adopt technology in ways that are consistent with their personal perspectives on curriculum and instructional practice (Niederhauser & Stoddart, 2001). This might also apply to the way they handle the inclusiveness of educational tools in the classroom. Therefore, the analysis of the operational curriculum focuses on the way the inclusiveness of the tools is enacted in the classroom: how do teachers use the tools in their class. Inclusiveness at the level of the experiential curriculum is analysed by focusing on learning experiences of students while using particular educational tools in class, in particular on differences between girls and boys.

In this study we focus on the relationship between the inclusiveness of educational tools at the formal and operational curriculum level on the one hand, and the inclusiveness in terms of different learning experiences of girls and boys on the other hand. The main research question is: In what way is the inclusiveness of educational tools as enacted in classes related to the learning experiences of boys and of girls?

3. METHODS

3.1 Participants

The participants of this study are 81 9th grade students (age 14-15) in four schools for secondary education. The following criteria were used in order to select the four schools:

- 13-50% of the students from ethnic minorities[2]
- A diverse student population in terms of gender, and
- Innovative use of ICT in education.

The selected schools are situated in two large cities and a small town in the Netherlands, and vary in size and denomination. These schools work with laptop classes or e-learning, and use a virtual learning environment.

In these schools, four lessons of one group of students have been observed; two lessons of two different courses in which educational tools have been used. In total 7 educational tools have been examined. The teachers were experienced in their subject and in the use of ICT. In table 2 the distribution of students over schools and observed courses, and student characteristics are shown.

Table 2

Students in participating schools and observed courses.

Students in %	School A N=13	School B N=21	School C N=27	School D N=20
Courses	German History	English Geography	German Geography	French History
Gender				
Girls	53.8	54.5	63.0	60.0
Boys	46.2	45.5	37.0	40.0

3.2 Data

In order to define the gender inclusiveness of particular educational tools, the design of the tools (the formal curriculum level) was independently coded by two researchers. Then, we checked how the inclusiveness of the tools was affected by the teachers' behaviour. This level (the operational curriculum) was investigated by means of observations of teaching and classroom interaction during the use of ICT in class.

[2] For determining the percentage of students from ethnic minority backgrounds we used the instructions of CFI, an organization responsible for financing educational institutions and disseminating government information on education in the Netherlands.

The observations were performed by two researchers. Video- and audio records were supplemented by field notes (Adler & Adler, 1994). The reported learning activities and learning effects (the experiential curriculum level), have been investigated by student interviews, class observations, and learner reports. In each class, four students (2 boys and 2 girls) were selected for observations and interviews. The interviews and observations were transcribed into verbal protocols and analyzed with code-and-retrieve software. Learner reports were obtained from all students of the participating classes.

3.3 Instruments

In table 3, we summarize the variables, data, and instruments. We distinguish between three levels of curriculum: the formal, the operational, and the experiential. For each level we indicate the investigated research materials/actors (research objectives), the relation to inclusiveness, the research instruments, the variables and whether the variables are independent or dependent in the present study.

Table 3

Summary of research data and instruments.

	Formal curriculum level	Operational curriculum level	Experiential curriculum level
Research objectives	Design of tools	Teacher behaviour	Students' experiences
Relation to inclusiveness	Inclusiveness of social scripts	Enacted inclusiveness	Affect of inclusiveness on learning experiences
Variables	Items of the index of Inclusiveness (Independent variable)	Teaching behaviour in terms of the index of Inclusiveness. (Independent variable)	Learning experiences; Attitude Participation Learning results (Dependent variables)
Instruments	Operationalization of the index of Inclusiveness	Teacher/ class observational instrument	Learner reports Student interviews Student observational instrument

In this section, we first describe the way in which we have determined the inclusiveness of the educational tools. After scoring the gender inclusiveness of the educational tools at the formal curriculum level, we have examined whether or not the inclusiveness of the tool was modified at the operational level. As teachers' actions

hardly appeared to modify the scripts in the tools, we have used the score of gender inclusiveness at the formal curriculum level in order to investigate the relationship between the inclusiveness of educational tools and the learning experiences of girls and boys.

Inclusiveness at the formal curriculum level

The social scripts in seven educational tools (the formal curriculum level) have been measured, using an operationalization of the index of inclusiveness (see Table 1). Each subheading (1.1, 1.2, 1.3 etc.) was scored by two researchers, with the help of questions focusing on whether attention was paid in the tool to that particular theme, for example: 'Are men and women presented in ways that are positive, equal and non-stereotypical' (with 0= no or little attention, and 1=clear attention). The scores of the aspects Content (with a range of 0-4), Interface (0-2), and Instruction (0-5) were summed (0-11). The inter-observer agreement between the two observers in terms of Cohen's κ is 0.91. In Table 4, we summarized the inclusiveness of the gender scripts of the educational tools at the formal curriculum level, for the three clusters of the index of inclusiveness separately (content, interface and instruction). We distinguish two types of tools for further analyses: the less inclusive educational tools (tool 1, 2 and 3), and the more inclusive tools (tool 4, 5 and 6).

Table 4

Inclusiveness of the gender scripts of the educational tools

Application	Content (range 0-4)	Interface (range 0-2)	Instruction (range 0-5)	Total (range 0-11)
Tool 1 Geography (B)	1	0	0	1
Tool 2 Geography (C)	1	0	0	1
Tool 3 English (B)	1	1	0	2
Tool 4 History (A)	4	1	2	7
Tool 5 History (D)	3	1	4	8
Tool 6 French (D)	3	2	5	10

Compared to the three tools with low scores on inclusiveness, the three tools with high scores generally include assignments in a real-life context, address different

interests of students, and present both textual and visual materials. The instructions of these tools match with students' prior knowledge and skills, address various skills, accommodate cooperation, and offer support by, for example, a glossary or help function (see for more details Heemskerk, Volman, Ten Dam, & Admiraal, submitted b

Inclusiveness at the operational curriculum level

At the operational curriculum level, we checked whether teacher behaviour changes the inclusiveness of the educational tools. The video tapes and researcher's notes of the observations were transcribed in written protocols. From these protocols, assertions and descriptions were selected which were related to the index of inclusiveness. This process resulted in summaries and reflections on actions and behaviours which diminish or reinforce the inclusiveness of the educational tools. For each combination of class and tool, these text selections were ordered. Four observers analyzed these data from scratch and negotiated disagreements until the outcomes were agreed upon or disagreements were understood and reflected as such (cf. Marble, 1997).

We found that teachers generally reinforce the inclusiveness of the more inclusive tools and they do not affect the inclusiveness of the less inclusive tools. In table 5 the counts of inclusiveness diminishing and inclusiveness reinforcing teacher behaviour are presented for the less inclusive tools and the more inclusive tools separately. The differences between the tools are most prominent in teacher behaviour with regard to prior knowledge, students learning activities and providing help (see for more details Heemskerk et al., submitted b).

Table 5

Scores on teacher behaviour in relation to the index of inclusiveness. (Range 0-3, indicating the number of teachers showing the specified type of behaviour.)

Item of the index		Less inclusive tools		More inclusive tools	
		Further diminishing inclusiveness	Reinforcing inclusiveness	Diminishing inclusiveness	Further reinforcing inclusiveness
Content	Perspective				
	Respectful of values				+1
	Real-life context		+1		+1
	Addressing different interests				+2
Interface	Visual aspects			-1	
	Audio aspects				
Instruction	Prior knowledge,				
	ICT		+3	-1	+1
	Content	-2	+1		+3

Learning strategies	-2			+2
Learning activities				
Cooperation				+2
Communication	-1	+1		+3
Skills				+2
Help				
Scaffolding		+2		
Feed back	-1	+1	-1	+2
Self-esteem	-2	+1	-1	+2
Students input; choice and flexibility				+2
	-8	+10	-4	+23

Our analyses show that the categorization of the educational tools at the formal curriculum level in terms of gender inclusiveness needs no re-adjustment with regard to the operational curriculum level. For investigating the experiential curriculum level we, therefore, decided to maintain the categorization into three less and three more inclusive tools.

Inclusiveness at the experiential level

The analysis of learning experiences of students uses the data from the student interviews and the learner reports, partly supplemented by class and student observations. The observational instrument is focused on student behaviour, in terms of how and to what extent students participate in learning activities. We looked at students' concentration, involvement, and effort. We considered how much time students were working concentrated and actively involved during the observation intervals, and the duration and amount of times of distraction from their work. We also looked whether students were working on task, or whether they were chatting or Googling off task. This information provided insight in the extent of students' participation. Students were interviewed directly after the observations, discussing particular events from the previous lesson. Questions in the interviews dealt with students' participation, their attitude towards technology in education, how they experienced working with the particular tool and how they perceived what they have learned. Moreover, all students completed a learner report about the educational tools they worked with. Students were asked to write down their learning experiences by completing a sentence ("I have learned from the programme that……".), which they could fill in three times. The learner report also included closed questions like "Did you like to work with the tool?", "Was the tool easy to work with?" and "Did you learn much by working with the tool?" with a four point scale ranging from 1 (not nice at all/ very difficult/ learned very little) to 4 (very nice/ very easy/ learned very much).

3.4 Analysis

The analysis of the student observations and interviews followed the process of content analysis according to Huberman and Miles (2002). The video and audio tapes and researcher's notes of the observations and interviews were transcribed in written protocols. From these protocols, assertions and descriptions were selected which were related to students learning experiences. After the process of data reduction the relevant fragments were sorted into appearance related to gender, and related to whether less inclusive or more inclusive tools were used (data matrix). In the third phase, the conclusion drawing and verification phase, conclusions were drawn on whether student behaviour and student articulations were meaningful in terms of learning experiences. These conclusions were verified by another researcher going through the data again and looking for counterexamples. These researchers negotiated disagreements until the outcomes were agreed upon or disagreements were understood and reflected as such (cf. Marble, 1997).

Differences in the quantitative data of the learner reports between the three less inclusive tools and the three more inclusive tools were analysed using t-tests and Pearson Chi-Square. In the first round of analysis of students' completed sentences, one researcher developed categories and scored the answers. Then, a second researcher scored the answers independently. The categories were "related to exercise and repeating", "related to the content of the course", "related to learning in general", "related to ICT skills", and "other". The inter-observer agreement between the two observers in terms of Cohen's κ is 0.95. For each of the categories the learner reports were analysed with a view on gender-specific elements: which differences in learning experiences between girls and boys emerge?

4. EXPERIENTIAL CURRICULUM LEVEL: STUDENTS' LEARNING EXPERIENCES

The analysis of students' learning experiences is based on four types of data: completed sentences and answers at closed questions from the learner reports, student interviews, and observations at class and student level. The results of the closed questions in the learner reports are shown in Table 6. Students generally report more positively about their learning experiences when they worked with the more inclusive tools. This is especially the case for girls.

Table 6

Differences between tools in learner reports. (Range 0-4)

	Less inclusive tools Mean (SD)	More inclusive tools Mean (SD)
Did you learn much by working with the tool?		
Girls (n=65)	2.09 (0.668)	2.61 (0.558)*
Boys (n=46)	2.00 (0.849)	2.35 (0.745)
All students (n=111)	2.05 (0.746)	2.51 (0.644)*
Was the tool easy to work with?		
Girls (n=66)		
Boys (n=48)	2.97 (0.747)**	3.32 (0.475)*
All students (n=114)	3.41 (0.628)	3.47 (0.513)
	3.17 (0.725)	3.38 (0.490)
Did you like to work with the tool?		
Girls (n=62)	2.78 (0.591)	2.92 (0.392)
Boys (n=49)	2.66 (0.814)	2.95 (0.686)
All students (n=111)	2.72 (0.696)	2.93 (0.533)

** Significant difference between less inclusive and more inclusive tools (p<0.05).*
*** Significant difference between boys and girls (p<0.05).*

Below, we will discuss students' learning experiences in more detail on the basis of the qualitative data. We organize the analysis under three themes: students' perceived learning effects, their attitude towards the tools, and student participation in class.

4.1 Reported learning effects

Table 6 shows that girls report to learn significantly more from inclusive tools than from non-inclusive tools.

In the sentences in which students answered what they had learned from the programme, 60% of the reported learning effects concern the more inclusive tools. Girls more often mention general learning effects such as learning to listen carefully in order to be able to answer questions, to have different ways of working, to search for

information, and to learn more from drawings. Boys more often mention specific learning effects that relate to the content of the course in which the tool was used, such as to write sentences, to learn Grammar, to translate, and to learn about the Second World War.

In the interviews, girls more than boys reported learning effects with regard to the 'technical' use of the computer and the handling of the tool. This was the case for both the less inclusive tools and the more inclusive tools. For example, one girl stated that she learned how to do search on the computer, and that this is something one needs to know. Another girl said she learned how to search for information, which she calls important knowledge for the future. A final example of learning effects pertaining to computer skills, concerns the girl who mentioned in the interview to have learned how to handle computers in the case of looking for a word in a dictionary. Of course, there were also girls who report that they knew the necessary computer skills already, and that the same features are used all the time. It is striking, however, that almost all boys state that the tools were easy to work with, so they did not learn much about computers. Only one boy mentioned he has learned a little how to use a computer. He thought the use of the tool was a good way for learning this. Another boy mentioned that he learned to make a PowerPoint presentation. These two boys were exceptions to the rule that boys report to have learned little about computer-use.

With regard to the subject matter of the content of the tools, most students were positive about what subject matter and skills they had learned. For example, from working with the English language tool they learned to read and understand English texts, and from the History tools they learned about the Second World War and European history. In the interviews, we only detected one gender difference: for the most gender inclusive tools girls gave more positive descriptions of what they have learned than boys did. For example, about the History tools girls report that they remember important terms better since they had to search for answers, that the tool helped them to understand the content, and that it helped them to get a better picture of how people lived during the Second World War.

In the interviews we also asked the students to compare 'learning with the help of educational tools' with 'learning with the help of schoolbooks'. Pertaining to this issue, we found no gender differences with respect to the less inclusive tools. Both boys and girls mentioned that the English language tool provides authentic English, in contrast to the schoolbooks which offers English for students. They also mentioned that they remind better what they have learned with the tool. With respect to the more inclusive tools, however, we did find differences between girls ands boys in learning experiences. Girls reported more, and produced more different, positive learning effects than boys (and compared to the girls who worked with the less inclusive tools). Girls mentioned that they understood the content better, and that they noticed whether they understood the content in the right way. Girls also mentioned that they learned better because the tasks were different from the regular schoolwork, and that they knew better whether they performed the tasks in the right way. One of the girls was really enthusiastic and mentioned that she saw only advantages in working with the tools. The fact that particularly girls reported more positive learning effects than boys does not mean, however, that boys did not mention posi-

tive effects of learning with educational tools. Boys also mentioned that they remember the information better because they had to actively search for information, and that they had more options to choose from than in regular lessons. However, boys and girls also remarked several less positive aspects while working with educational tools, for example, they mentioned that reading and learning texts from the screen is more difficult and computers are in their opinion more suitable for the performance of specific tasks.

To summarize, it appears that girls' experiences are more positive when they worked with the more gender inclusive educational tools. They show more enthusiasm about what they have learned and about the advantages of the tools, not only compared to boys but compared to the girls who worked with the less gender inclusive tools as well.

4.2 Attitude

Under the heading of 'attitudes of students towards educational technology' we will discus two aspects: attitudes towards working with the particular educational tools in class and attitudes towards ICT as an educational tool at school.

Girls report that they work easier with the more gender inclusive tools compared to the less gender inclusive tools (see Table 6), whereas boys work equally easy with both types of tools. Another result (table 6) is that we found a significant difference between boys and girls in reported easiness of working with the less inclusive tools, which is not found in the more inclusive tools. These results suggest that girls are bothered more than boys, by working with the less inclusive tools. In contrast to the results from the learner reports, we did not find differences between boys and girls in the interviews. In general, most students found it quite easy to work with the specific tools whether gender inclusive or not. At the same time, also some difficulties were mentioned. For example, with regard to the less inclusive tools both boys and girls have difficulty with finding the answers to the questions if the tool shows a lot of text (in assignments, instructions, questions, etc.). Some boys report that they found it difficult and annoying to have to work with several screens at a time (a Word document for the answers, the Internet source, a separate document with questions). Students who worked with the French language tool (one of the more inclusive tools) mention that they have difficulties with the content such as tests on grammar.

We did not find a significant difference between the more inclusive tools and the less inclusive tools in the extent students liked to work with the specific tool (see Table 6). In the interviews most students reported to like the specific tool they worked with. However, girls who worked with the less inclusive tools, are less explicit about their feelings on the tools they used, compared to girls who worked with the more gender inclusive tools. For example, a girl working with one of the less inclusive tools reported that the tool was nice "for a change". In contrast, the girls working with the more inclusive tools report these tools to be interesting and attrac-

tive. They report to like the pictures, and to like the tools even more than the games they play at home. The boys reported on both type of tools with equal enthusiasm. They say that the tool was relaxed and that it was nice to work with. They report to like all parts of the tool and to like it for a change. One of the boys reports a tool to be "state of the art".

With respect to whether students prefer educational tools or schoolbooks, we see a difference between the less inclusive tools and the more inclusive tools. For the less inclusive tools boys are more explicit in their preference of educational tools above schoolbooks, than girls are. Boys report that they like to work with the tools and that it is easier than working with schoolbooks. In contrast, both boys and girls prefer working with the more inclusive tools to schoolbooks. For example, girls mention these tools to be nicer to work with, to be more attractive and captivating, to be more interesting, and there is more variation than when working with schoolbooks.

Finally, when it comes to working with technology at school in general, most students report they like it. Boys and girls agree in their opinions. One student mentioned that she likes working with technology because it is something else than regular classes, where she has to listen to the teacher all the time. Another student mentioned that it is important that the tools are related to the schoolbooks, otherwise being superfluous. Neither boys nor girls report difficulties in working with technology in school, although they do differ in the way they report this to the researcher. Generally boys say straight away they are good in working with computers, whereas girls seem to be a bit shy in first instance.

In conclusion, there are indications that girls' attitudes are less positive than the attitudes of boys with respect to the less inclusive tools. It seems that girls like these tools less than boys, and they find these tools less easy to work with than boys. The girls' attitudes are more positive towards the more inclusive tools, compared to the less inclusive tools.

4.3 Participation

Based on the observations and interviews, we analysed students' participation in class. The overall classroom observations show that students working with less inclusive tools are less involved and actively participating, compared to students working with more inclusive tools. For example, some of the students using less inclusive tools are chatting on-line (MSN), talking more loudly or asking irrelevant questions, although students generally were rather concentrated and seriously working with the applications. Student observations and interviews confirm these general class observations; in the classes with the more inclusive tools students' participation is better. Moreover, differences between boys and girls appear. Girls' participation is better in lessons where more gender inclusive tools are used, compared to lessons in which less inclusive tools are used. Boys' participation is about the same in both types of tools.

Student observations of the less inclusive tools show only one of the girls working well and being concentrated. The other girls were not really concentrated and not very actively involved in working with the tools. These girls seemed to be busy with other off-task matters such as, writing e-mails or chatting with other students, looking away, working on another course or talking with their peers. In the interviews, these girls indeed are not very positive about the specific contribution of the educational tool to their participation. For example, two girls say they can concentrate well because they never have problems with concentration and that this has nothing to do with the tool they are working with. Two other girls argue that their concentration is influenced by more or less buzz and noise in the classroom, which distracts them from their work. One of them says she is able to concentrate better in regular lessons. Only one of the girls is more positive about the contribution of the educational tool to her participation. In contrast, most boys working with the less inclusive tools, were observed to be on-task, sometimes collaborating with their peers. Only one of the boys clearly had problems to concentrate and work well; he walked away from the computer to look what other students were doing, he talked loudly and made fun, interfered with other matters and used Google, which was not part of the task.

The better participation of boys was reflected in the interviews. Boys are more positive about their concentration and involvement with the tool, than girls are. Most of the boys say they can concentrate well while working with the tools. They mention to like to work independently and to search for answers on the Internet, and to work concentrated in order to finish the task faster and to avoid homework. Only one boy is a bit less positive reporting that he starts to talk with peers and looses concentration when it becomes boring.

The results concerning the more inclusive tools show remarkable differences compared to the results as shown in the less inclusive tools. Now, the participation of girls is about the same as the participation of boys. Most boys worked hard and concentrated on the task, and girls were also working actively, concentrated and involved. Some girls collaborated with their peers, others worked individually with only some minor interruptions from their neighbours. Again, the class observations are confirmed by the student interview data. The girls report that their concentration is better while working with the tools than while working with the instruction and exercise books. Girls say to like and be captivated by working with the tools, as they can work independently and search for information actively. The opinions of boys vary a bit depending on the subject. Overall they do say they can concentrate well while working with the tools. While some boys are not captivated, others are interested.

To summarize, we found differences in student participation. More specific, girls who worked with the more inclusive tools participated more actively in class and were able to concentrate more than girls who worked with the less inclusive tools. The results in participation of boys do not show differences between the tools.

5. CONCLUSIONS AND DISCUSSION

In the present study, we used the concept of gender scripts, which refers to the gendered user representations that are unintentionally built in the design of technology, in order to understand mechanisms on gender inclusiveness at the experiential curriculum level. Although learning supported by computers is supposed to be motivating for students (Becta, 2006; Ruthven et al., 2004) and is, therefore, assumed to have positive effects on learning experiences and results, there are indications that the use of technology in education still works out differently for girls and boys. In this study we investigated the relationship between the inclusiveness of educational tools at the formal and operational curriculum level on the one hand, and the inclusiveness in terms of different learning experiences of girls and boys on the other hand.

The results show some gender differences in learning experiences, when boys and girls use educational tools in class. Both boys and girls seem to benefit more from inclusive tools than from non-inclusive tools, but for girls the difference is more prominent. In our study we found gender differences in the attitudes of boys and girls towards educational tools and towards learning in relation to the inclusiveness of the tools. Girls working with the non-inclusive tools, were the least enthusiastic about the tools, compared to the other girls, and to the boys. Moreover, girls worked more easily with the inclusive tools. These gender differences in attitudes might have larger consequences as girls' learning performances have found to be improved when educational tools fit in with their interests (Joiner et al., 1996). To work easily with educational tools is in particular important for girls as they report less ICT knowledge than boys (Volman & Van Eck, 2001), and generally show a lack of self-confidence on ICT matters (Agosto, 2001). Furthermore, our study shows that girls are more concentrated and actively involved in working with inclusive tools, compared to girls working with the less inclusive tools. It is striking that the inclusiveness of the tool does not seem to affect boys in this respect: they do not show much difference in participation between inclusive and non-inclusive tools. The final result from our study is that girls who worked with the inclusive tools report to have learned more, and showed more enthusiasm about what they have learned, compared to girls who worked with the less inclusive tools, and to boys. Girls seem to value inclusive tools more because of the feedback and support of self esteem these tools provide. These results show similar patterns as pointed out by Joiner et al. (1996) in learning performances of boys and girls in relation to interesting subjects in educational tools. Learning performances of boys are not different whether they are interested in the subject or not, while girls' learning performances improve when an interesting subject is provided.

We would like to point out that our study is small-scale, with data from 6 teachers working with 6 tools in 4 classes with some 81 students. Moreover, we selected our schools for this study on the basis of some criteria, one of which was the experience with the use of educational tools. It might be that the gender differences we found can not be replicated in a study with a larger, more representative data set. The idea behind the selection has been that we need some experience at school with educa-

tional tools in order to be able to study gender differences in the use of educational tools. Having a larger data set provides the possibility to study gender differences in schools which use technology less extensively. For the time being, however, we don't have reason to believe that our results are only valid for schools who are forerunners of ICT. But an important advantage of a study of larger and a more heterogeneous data set of schools, do give the opportunity to look closer and more precisely at differences between students. Gender is just one axis that students differ from each other.

Secondly, we would suggest to focus future studies on the explanation of design principles or elements of the educational tool which cause gender differences. For example, a design study or a design experiment of various educational tools might give us more possibilities to explain (minor) changes in the formal and/or the operational curriculum level being responsible for differences in learning and learning experiences between boys and girls. In an earlier study (Heemskerk, et al., submitted) we explored appreciations of students in relation to technology in education showing that girls value an interesting subject more than boys, and they appreciate tools which are easy to work with, including clear, step-by-step instructions, and clear help functions. Boys, more than girls, appreciate pictures in the tool, and the possibility to compete. However, more research is needed to understand the nature of the relation between the inclusiveness of the educational tools and learner experiences. Moreover, the relation of inclusiveness of educational tools and learning results remains unknown.

Finally, we limited our study to the investigation of educational tools in language and social courses, in order to avoid obvious differences between boys and girls related to more technical courses. As we do know, inequalities between boys and girls are still more prominent in mathematics or science courses, which might reinforce differences in relation to the use of educational technology. Research on inclusiveness of educational tools in these courses, however, may be interesting and relevant in relation to differences between boys and girls in their choices of courses or studies.

We would like to finish with the conclusion that students' learning experiences can be improved by the use of more inclusive educational tools. The results of our study indicate that the extent of inclusiveness of the tools does not matter much to boys, whereas learning experiences of girls are positively affected by the use of more inclusive tools. This is remarkable, because gender inclusiveness of educational tools is supposed to imply that the tools are attractive and challenging to both girls and boys. In the index of inclusiveness we distinguish between the inclusiveness of the content, the visual and audio interface and the instructional structure of educational technology. Generally, we considered educational tools to be more inclusive if they provided more ways for students to identify with the subject matter and different ways of working and learning. The results support the idea that less inclusive tools bother girls, and might address mainly the needs of boys. Some authors indeed argue that computers and software are predominantly male artefacts (Li & Kirkup, 2007), and that educational software is often unintentionally tailored to the interest of boys

(Huff & Cooper, 1987, as referred in Cooper, 2006). The more inclusive tools, in contrast, might address both boys and girls. Therefore, we propose that inclusive tools are an improvement for girls but not for boys.

There seems to be room to improve the inclusiveness of educational tools, by changing the gender scripts in the design and/or by modifying the inclusiveness of the tools in educational practice. As it is common practice in Dutch secondary education that teachers design or at least choose the educational tools that they use in class, teachers should be aware of gender scripts of tools. The index of inclusiveness might help teachers to increase their awareness and, consequently, adjust their teaching.