Technology makes a difference : inclusiveness of technology in education

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Chapter 4

INCLUSIVENESS OF ICT IN SECONDARY EDUCATION: STUDENTS' APPRECIATION OF ICT TOOLS [1]

This paper presents the results of a study on students' appreciation of ICT applications in schools for general secondary education. We investigate to what extent students from different gender and ethnic backgrounds appreciate various characteristics of ICT tools. The research question is, 'How are students' characteristics related to their appreciation of ICT tools in secondary education'. A survey was conducted on 495 students from schools in the Netherlands. A questionnaire was developed, based on the literature on socio-cultural sensitivity and gender-inclusiveness in educational software. The results of the study firstly show that the questionnaire is an appropriate instrument for distinguishing between tools which are positively and negatively evaluated by different groups of students. Secondly, regarding group differences, the results show that girls appreciate applications that deal with an interesting subject, are easy to work with and provide good support. Different appreciations between students from different origins were found in regard to language achievements and ICT skills. The results are discussed, as well as the possible educational implications for the design and selection of ICT tools

1. INTRODUCTION

Information and Communication Technology (ICT) in education is assumed to contribute to educational equality due to its motivating effects on students and the opportunities it offers for facilitating differentiation and individualization (Becta, 2002). However, there are indications that students do not benefit equally from the learning effects of ICT in education. These inequalities tend to be related to gender and to differences in socio-cultural background of students. Although the digital divide in access to ICT seems to be diminishing for some groups (De Haan & Huysmans, 2002; Steyaert & Gould, 2007), more subtle mechanisms of inequality in relation to ICT persist. For example, students from a lower SES and/or an ethnic-minority background tend to be mainly involved in ICT mediated drill and practice

[1] Heemskerk, I., Volman, M., Admiraal, W., & Dam, G. ten, (submitted). *Inclusiveness of ICT in Secondary Education; Students' Appreciation of ICT Tools*

activities, whereas other students are more likely to use advanced technology tools and the Internet (Volman, Van Eck, Heemskerk & Kuiper, 2005). These kinds of differences exist not only between, but even within schools (Schofield & Davidson, 2002; Solomon, 2002). Moreover, not all students perceive every ICT tool to be attractive and immediately suitable to work with, although ICT can be adapted to suit the background, experiences and needs of individual students (see, for example, DeVoogd, 1998; Gillani, 2000). Students' experiences with ICT outside school, and their interests, attitudes and learning approaches, which in turn are influenced by gender and socio-cultural background, largely determine how they experience working with a particular ICT tool (Chisholm, 1995; Damarin, 2000; Volman et al., 2005). In order to contribute to educational equality, it seems to be important that the design of educational ICT tools is both attractive and challenging to students with different social characteristics.

Mechanisms of inclusion and exclusion of different groups of students are enlightened by the concept of 'scripts' as introduced in gender and technology studies. 'Scripts' has been used to explain how assumptions about supposed users are built into technology. Social scripts make technological tools more, or less attractive to different groups of users (Woolgar, 1992). Even if ICT developers do not consciously intend to design software for a particular type of user, 'user representations' play a role in the design process, which may result in a design more suited to a specific group of users and hence in the exclusion of other groups (Akrich, 1995; Rommes, 2002). To support the contribution of ICT to educational equality, both developers and teachers must be sensitive to such scripts in educational software. We think educational-software developers should make their products inclusive for different groups of students in terms of gender, social class and ethnic background. Moreover, teachers should pay attention to inclusiveness when they select software for their classes. Sensitivity to social scripts that implicitly exclude particular groups of students presupposes insight into the elements that make software attractive and pleasant to work with for these students.

In this article we present an empirical study into secondary-school students' appreciation of the ICT tools they work with in school in relation to their gender and socio-cultural background.

2. INCLUSIVENESS OF ICT

Three main issues can be distinguished in the literature on socio-cultural sensitivity and gender-inclusiveness in educational software: the inclusiveness of the content of educational technology, the visual and audio interface, and the extent to which the instructional structure of the technological tool is inclusive (Heemskerk, Brink, Volman, & Ten Dam, 2005). In Table 1, we summarize elements of technology that are assumed to be relevant when analysing differences between students from different socio-cultural backgrounds, and between males and females.

Table 1

Elements of ICT tools affecting inclusiveness

Content

- Multicultural, non-sexist perspective, respectful of different social classes.
- Respectful and considerate of the values, manners and taboos of different cultural groups.
- Subject matter in a real-life context.
- Addresses different interests.

Interface

- *Visual aspects*
  Balanced representation of diverse groups of people in a non-stereotypical way.
  Cultural values, customs and taboos treated with respect
  Preferences of different groups taken into account.
  Packaging and advertising show a diversity of groups.
- *Audio aspects*
  Includes narrators from a range of group voices.
  Sound track includes a variety of styles of music/sounds.

Instructional structure

- *Prior knowledge*
  All users can work with the tool, regardless of differences in ICT skills and knowledge, content knowledge and learning abilities.
  Takes into account that learners may have different home languages.
- *Learning strategies*
  Accommodates students' preferred learning strategies.
- *Learning activities*
  Accommodates collaboration and communication.
  Addresses different skills.
- *Help*
  Clear and immediate feedback.
  Scaffolding support.
  Supports self-esteem.
- *Students' input*
  Students can choose how to work with the tool and are treated as active participants.
  Students are allowed to add their own information and experiences to the material.

Note: for details see Heemskerk et al. (2005)

Regarding the *content* of educational ICT tools, many authors have argued that there must not be any obstacles to students giving personal meaning to the subject matter.

They claim that this can be achieved by taking a perspective that is multicultural, non-sexist and respectful of different social classes (Adler, 1999; Gillani, 2000; Larson, 1999; Reeves, 1997; Roblyer, Dozier-Henry & Burnette, 1996). This implies that the content is considerate of the values, manners and taboos of different cultural groups, for example, avoidance of sexist or racist language (Lu, Walker & Huang, 1999). More specifically, the literature on gender-inclusive education has pointed out the importance of presenting the subject matter in a 'real-life' context (Agosto, 2001; Volman, 1997). Female students tend to be more interested in school subjects when they are dealt with in the context of their practical applications. A final issue regarding the content of educational ICT tools is the importance of creating ICT applications that address students' different interests (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 a diversity of groups of people?', 'Are these groups represented in a non-stereotypical way?', 'Are cultural values, customs and taboos treated with respect?', 'Are the preferences of different groups taken into account in the visual interface?', and 'Do the packaging and advertising show a diversity of groups rather than one group to the exclusion of others?' Regarding the *audio* aspects of educational technology, it is important to include narrators from different backgrounds and a variety of styles of music and sounds (Fiore, 1999; Gillani, 2000; Royer, Greene & Anzalone, 1994). Using a diversity of visual and audio features in ICT tools can make these tools more attractive to a wide range of students.

Several issues can be subsumed under the heading 'inclusiveness of the *instructional structure* of an ICT application'. These relate to whether the way the learning process is structured or facilitated by the tool is compatible with the ability levels and learning approaches of different groups of students. Firstly, the instructional structure of an educational ICT tool should be based on the prior knowledge of different groups of students. This refers to the initial levels of both using ICT and of knowledge of the subject matter in question (Novak & Hoffman, 1998; Volman & Van Eck, 2001). Moreover, prior knowledge also refers to students' language skills, which can be especially influential if students' home language differs from the instructional language of the program/tool. Not only the technical-language skills but also the cultural codes of students can be an obstacle to working effectively with a specific program (Ikegulu, 1997; Joo, 1999). A second issue is the cultural differences in learning strategies. Many authors claim that programs should accommodate students' preferred learning strategies, which may be related to their gender and/or cultural background (Freedman & Liu, 1996; Ikegulu, 1997; Irwin, Moore & Stevenson, 1994; McLoughlin, 1999). For example, researchers argue that a lot of educational software is unintentionally tailored to a Western approach to learning based on the Anglo-Saxon cultural values of independence and self-reliance in learning (cf. Chisholm, 1995) instead of, for example, on the Mexican-American and African-American values of cooperation and interdependence (cf. Adler, 1999). A related issue concerns the critical attitude towards teachers and knowledge, which is generally considered to be typically Western (Henderson, 1996; Reeves, 1996). A third issue

regarding the instructional structure of ICT tools is the kind of learning activities that are addressed 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 ICT applications facilitating communication in particular, have been found to be related to socio-cultural background and gender. For instance, research on gender reveals that girls prefer collaboration to competition (Agosto, 2001; De Jean, Upitis, Koch & Young, 1999; Fiore, 1999; Selby & Ryba, 1994). A fourth aspect of the instructional structure of ICT 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 are particularly important for students lacking self-confidence (Agosto, 2001). A fifth issue that is supposed to affect the inclusiveness of ICT tools is the extent to which students are allowed to make their own input or take responsibilities when working with the ICT tool (e.g. DeVoogd, 1998; Maurer & Davidson, 1999).

As the literature on socio-cultural sensitivity and gender-inclusiveness in educational software is mainly of a theoretical and reflective nature, more empirical research is needed particularly on the perceptions of students in relation to the educational applications which are used at school. In this article we present a descriptive empirical study into secondary-school students' appreciation of the ICT tools they work with in school in relation to their gender and socio-cultural background. The main research question is: How are students' characteristics related to their appreciation of ICT tools in secondary education? This question is divided into two sub questions:

1) To what extent do boys and girls differ in their appreciation of elements of ICT tools?
2) To what extent do students from different origins vary in their appreciation of elements of ICT tools?

ICT tools are defined in the study as educational ICT applications in the broadest sense.

3. METHOD

3.1 Respondents

A survey was made of 495 students in the 8th and 9th grade (age 13-15) in nine schools for general secondary education in various regions of the Netherlands. The schools selected meet two criteria.

- First, they have a diverse student population in terms of origin. In the Netherlands student population in most schools are either predominantly originating from the minority of the population, or predominantly originating from the ma-

jority of the population. In order to limit school effects we selected schools with 15-50% of their students from ethnic minorities, according to the CFI[2].

- Second, in classes participating in our study three or more different ICT applications had to be used in the last two years. This means that the participating students are familiar with different types of educational ICT tools.

We informed ICT school coordinators from schools selected by the first criterion by post about the aim and procedure of the survey. Shortly afterwards, we phoned them to invite them to participate in the survey. During this call the second criterion of ICT use was verified and we agreed which classes would participate.

In each school between 18 and 94 students (from 1 to 4 classes) completed a written questionnaire, after being given brief instructions by their teacher. In table 2 the response in relation to gender and origin of the students is shown. In this study, the students' origin was based on the country of birth of students and their parents, and the language they speak at home (see 'Variables and measures').

Table 2

Response in relation to gender and origin

	N	%
Gender		
Male	234	47.3
Female	256	51.7
Missing values	5	1.0
Total	495	100.0
Origin		
Western-Europe (Majority)	356	71.9
Surinam, Aruba & Netherlands Antilles	24	4.8
Turkey, Morocco & former Yugoslavia	79	16.0
Other	34	6.9
Missing values	2	0.4
Total	495	100.0

3.2 Variables and Measures

We developed a questionnaire that operationalized the variables central to this study. In a pilot study we tested if students understood the questions. The questionnaire consisted of two parts. The aim of the first part was to collect information on the independent variables 'gender', 'origin' and 'computer use'. The variable 'origin' was divided into four categories: the majority population and three minority groups. Following the policy of the Dutch government, students were classed as belonging

[2] *CFI is an organization responsible for financing educational institutions and disseminates government information on education in the Netherlands.*

to the ethnic-majority group if both parents were born in Western Europe, the United States, Australia, New Zealand, Indonesia or Hong Kong. Two minority groups comprises of the target groups of the Dutch educational policy on migrants and minorities; Surinamese/Antilleans (groups from the former Dutch colonies) and Turks, Moroccans and former Yugoslavian (predominately labour-migrant groups) (see Rijkschroeff, Ten Dam, Duyvendak, De Gruijter, & Pels, 2005). The third minority group consists of students born in Eastern Europe, South and Central America, Asia and Africa, and students with both parents born in these countries (mostly refugees). The three minority groups consist of first and second generations of migrant students. When one parent was born outside these countries, often in the Netherlands, the language spoken at home was the determining criterion. If Dutch is always or usually spoken, these students were defined as belonging to the majority population. If Dutch is spoken less often, they were classed as belonging to one of the ethnic-minority categories.

The co-variable 'computer use' focused on the extent of computer use at home, and was measured on a 3-point scale with (1) less than 6 hours a week, (2) 6 to 12 hours a week, and (3) more than 12 hours a week.

The second part of the questionnaire was based on the literature on cultural and gender sensitivity of ICT tools (Heemskerk et al., 2005), with the aim of collecting information on students' appreciation of ICT tools. Students were asked to choose two specific tools, which they had used in the classroom, one they appreciated the most and one they appreciated the least. We followed this procedure as we were interested in how the elements of the index of inclusiveness were appreciated. To complete the questions in this part, students had to name the specific ICT application they liked the most and they had to base their answers on their experiences with this application. In the same line they had to answer questions about the tool they liked the least.

For both types of applications (most and least appreciated) we asked some descriptive questions, such as which school subject the ICT application was used in, how much the student liked this subject (educational attitude) and about their learning achievements. Educational attitude was measured on a 4-point scale with (1) liked the course very much, (2) quite liked the course, (3) did not like the course much, (4) did not like the course at all. Learning achievements were measured in a self-report on school marks in the subject on a 3-point scale: (1) poor, (2) satisfactory and (3) good. Educational attitude and learning achievements were co-variables in this study.

For both types of applications, 40 items were formulated based on the literature on inclusiveness (see Table 3). These questions were grouped in four sections; content and interface (11 items), knowledge and skills (11 items), learning strategies and activities (9 items), and help and students' input (9 items). Students had to indicate whether the statement was correct, incorrect or not relevant to the application of their choice. Moreover, at the end of each section students were asked to select the three items which indicate best why they like the tool or not. Per student the items mentioned were calculated from the combination of both types of tools. This means that the score for each item varies from 0 (not reported as an indicator in both tools),

to 1 (reported as an indicator in only one of the tools) or 2 (reported as an indicator in both tools). The scores for each item is the dependent variable in our study.

Table 3

Questionnaire

Content & Interface

1. The people in the story were nice.
2. There were not any disturbing or insulting texts or images.
3. There were real-life subjects.
4. The subject was interesting.
5. You could choose from different subjects.
6. The images looked nice.
7. The tool was attractive.
8. I liked the colours used.
9. You could choose from different colours or images.
10. I liked the voices or sounds used.
11. You could choose from different voices or sounds.

Instructional structure

Knowledge and skills

1. You need to know a lot about computers.*
2. You need to be good at typing.*
3. You need to be good at language.*
4. The instructions in the application were easy to understand.
5. It was easy to work with the application.
6. The teacher helped me a lot.
7. I immediately understood what I had to do. .
8. I understood the content of the application.
9. The content was compatible with what I had learned before.
10. The text was in different languages or dictionaries were included in the tool.
11. The images explained a lot, which saved me from having to read much.

Learning strategies and activities

1. You have to read the text carefully, before you start.*
2. You have to experiment and find out for yourself.*
3. The teacher clearly explained the tool or the tool was self-explanatory.
4. It was possible to cooperate.
5. You could compete with each other.
6. When working in a team I had different tasks (typing, using the mouse, searching for sources, etc.) or roles (chairperson, making notes, etc.).
7. You could confer with other students.
8. You could "talk" with other people (mail, chat).
9. You could choose different things to do (reading, writing, drawing).

Help and students' input

1. The instructions in the tool helped me to progress step by step.
2. The help function was clear and pleasant to work with.
3. The feedback in the tool was helpful.
4. Mistakes were noticeable at once.
5. I felt confident about using the tool.
6. You could help and explain things to each other.
7. You could choose how to work with the tool.
8. You could choose the way you learn.
9. You could use your own experiences and information in the tool.

Note. The formulation of most of the questions was reversed when related to tool B. For example, Content & Interface question 1: The people in the story were not nice. The items marked with an asterisk were the same for tool B.

We checked the quality of the questionnaire in three ways.

1) Differentiation between students was tested by computing the variances of the dependent variables. Variances of all items were higher than 0.
2) The relevance of the items was checked. All of the items were mentioned as giving a good indication of why students like the tool or not. (The number of times each item was reported ranged from 5-54%)
3) Differentiation between the tools was tested with help of Cohen's Kappa, corrected according to the Bonferroni method. In this study we used Cohen's Kappa to indicate different evaluations of the most appreciated and the least ap-

preciated tool per student, in which case Kappa is low. We found a Kappa significantly different from 0 in only 12% of the questions with low Kappa values (ranging from 0.169 to 0.354). We conclude that the questionnaire is an appropriate instrument for distinguishing between tools which are positively and negatively evaluated by students.

3.3 Analysis

Linear regression analyses were performed with gender and origin as independent variables and the calculated scores (0, 1, 2) on each item as dependent variables. We used three covariates: computer use at home, learning achievements and educational attitude. The independent variables and covariates were added in a stepwise procedure with $p \leq 0.05$ of the F-to-enter and $p \geq 0.10$ of the F-to-remove, as we use the analysis for explorative purposes. The nine schools were included in the analysis as dummy variables. Although the structure of the data is nested (students within schools), this is an adequate alternative for multilevel analyses if the number of groups is low and if it is not necessary to separate the group effects and the effects of group-level variables (Rasbash, Steele, Brown & Prosser, 2004). In order to specify the effects of origin, we used contrast analysis with the majority of the population as reference category.

4. RESULTS

In the first part of this section we shortly present the indicators why students appreciate an ICT tool or not. We will focus in the second section on differences between groups of students in respect to gender and origin, in their appreciation of tools.

4.1 Students' appreciation of ICT applications

Students themselves reported that they learned more from positively evaluated tools than from negatively evaluated tools. This means that it is important to study students' appreciation of ICT tools and their elements. In table 4 the indicators why students appreciate an ICT tool or not, are listed in ascending order. The ten most important indicators range from all four sections of the questionnaire. As to 'content and interface' important indicators are the presence of an interesting subject and the attractiveness of the tool. In the section 'knowledge and skills' students report the importance of the ease of working with the application, the immediate knowing what to do and understandable instructions. As to 'learning strategies and activities', the possibility to cooperate or confer with other students is indicated as important. Also the possibility to experiment, a self-explanatory tool or clear explanation by the teacher are important indicators.

Table 4

Indicators why students appreciate an ICT tool or not. The score for each item per student varies from 0 (not reported as an indicator in both tools) to 1 (reported as an indicator in only one of the tools) or 2 (reported as an indicator in both tools) (n=495).

Items of the questionnaire	**Section[3]**	**Mean**	**SD**
Text in different languages, or dictionaries included	K&S	0,17	0,40
Nice people in the story	C&I	0,18	0,39
Nice voices or sounds	C&I	0,19	0,43
Choice of voices and sounds	C&I	0,20	0,43
Real-life subjects	C&I	0,31	0,51
Important to be good at language	K&S	0,34	0,55
Feedback helpful	H&SI	0,36	0,55
Help of the teacher	K&S	0,37	0,55
Nice colours	C&I	0,38	0,59
Important to know a lot about computers	K&S	0,38	0,60
Explanatory images, not necessary to read much	K&S	0,38	0,55
Competition possible	LS&A	0,41	0,61
Possibility to "talk" with other people (mail, chat)	LS&A	0,41	0,59
Important to be good at typing	K&S	0,41	0,61
Choice of colours and images	C&I	0,42	0,61
Different tasks or roles available	LS&A	0,42	0,61
Understanding the content of the application	K&S	0,42	0,61
Nice images	C&I	0,44	0,59
Content compatible to what is learned before	K&S	0,44	0,61
Choice of different things to do (reading, drawing etc.)	LS&A	0,47	0,63
Read the text carefully before starting with the application	LS&A	0,48	0,63
Choice of the way to learn	H&SI	0,49	0,63
Possible to help and explain things to each other	H&SI	0,49	0,63
Help function clear and pleasant to work with	H&SI	0,50	0,64

[3] *For abbreviations, see end of table*

No disturbing texts or images	C&I	0,56	0,65
Confident while using the tool	H&SI	0,57	0,68
Possible to use your own experiences and information	H&SI	0,60	0,70
Step-by-step instructions	H&SI	0,61	0,71
Choice of subjects	C&I	0,64	0,68
Choice how to work with the tool	H&SI	0,65	0,70
Possible to confer with other students	LS&A	0,66	0,70
Cooperation possible	LS&A	0,68	0,69
Immediately understand what to do	K&S	0,68	0,69
Experiment and find out yourself	LS&A	0,73	0,70
Mistakes noticeable at once	H&SI	0,75	0,71
Tool self-explanatory, or teacher explained clearly	LS&A	0,79	0,72
Instructions clear	K&S	0,81	0,73
Easy to work with the application	K&S	0,85	0,69
Attractive tool	C&I	0,85	0,74
Interesting subject	C&I	0,91	0,74

[3] *Content and Interface = C&I*
Knowledge and Skills = K&S
Learning strategies and activities = LS&A
Help and Students' input = H&SI

4.2 Differences between groups of students

In table 5 (boys and girls) and table 6 (ethnic origin) the results for the different groups of students are summarized. Only significant differences ($p \leq 0.05$) have been included, but their effects are small (partial eta squared ≤ 0.05). As to origin, only significant differences from minority groups compared to the majority group were included.

Gender differences were found in all four sections of the questionnaire. With regard to 'content and interface' we found two gender differences. Girls mentioned the importance of an interesting subject more often than boys, whereas boys mentioned the importance of nice pictures more often than girls. In the 'knowledge and skills' section girls referred more often than boys to the importance of understanding how

to work with the application, in particular, understanding the instructions, immediately knowing what to do, and the ease of working with the application. The 'learning strategies and activities' section also revealed group differences between the students' appreciation; boys considered the opportunity for competition more important than girls did. Finally, in the 'help and students' input' section, girls were found to appreciate step-by-step instructions more than boys, and girls mentioned the importance of a clear help function, which is pleasant to work with, more often than boys.

Table 5

Significant differences in importance of items for appreciating ICT tools between male and female students ($p<0.05$). The score for each item per student varies from 0 (not reported as an indicator in both tools) to 1 (reported as an indicator in only one of the tools) or 2 (reported as an indicator in both tools).

Subject and Item	**Mean Boys**	**Mean Girls**	**F**	**df**
Content & Interface				
Interesting subject	0.83	0.99	6.16	1,431
Nice pictures	0.52	0.37	8.86	1,431
Knowledge and skills				
Clear instructions	0.75	0.87	4.45	1,431
Easy to work with	0.79	0.91	5.51	1,431
Immediately understand what to do	0.61	0.75	5.21	1,431
Learning strategies and activities				
Competition possible	0.49	0.33	9.08	1,431
Help and students' input				
Step-by-step instructions	0.50	0.73	11.74	1,431
Help function clear and pleasant to work with	0.34	0.57	6.57	1,431

Differences between groups of students of different ethnic origin were only found in the 'knowledge and skills' section. Students from the third group of ethnic minorities (other countries) mentioned more often than students from the majority population the importance of explanatory images which reduce the amount of necessary reading. This could be related to the different home language of this group of students. The students from this minority group in our database use the Dutch language at home the least of all the ethnic groups.

Students originating from the majority population for their part reported more often than the Turkish/Moroccan minority the importance of immediately understanding what has to be done. In the questionnaire we asked about the importance of three kinds of skills: computer skills, typing skills and language skills. Students originating from ethnic minority groups, especially those from a Turkish or Moroccan background, mentioned more often than students from the majority population that these skills are important when working with an application. It is not clear from the data whether the different groups perceive this as a challenge or as an obstacle. We will return to this issue in the discussion section.

Table 6

Differences in importance of items for appreciating ICT tools between students from different origins. The score for each item per student varies from 0 (not reported as an indicator in both tools) to 1 (reported as an indicator in only one of the tools) or 2 (reported as an indicator in both tools).

Subject and Item	**Mean majority**	**Mean minorities**			**F**	**df**
	Majority population	Surinam, Aruba, Netherlands Antilles	Turkey, Morocco, former Yugoslavia	Other countries		
Knowledge and skills						
Know a lot about computers	0.29	0.50*	0.63*	0.59*	6.88	3,431
Good at typing	0.37	0.42	0.62*	0.41	2.83	3,431
Good at language	0.31	0.25	0.57*	0.18	3.56	3,431
Immediately understand what to do	0.72	0.75	0.46*	0.76	3.32	3,431

*significantly different from majority group ($p<0.05$)

5. CONCLUSIONS AND DISCUSSION

ICT in education is assumed to contribute to educational equality due to its motivating effects on students and the opportunities it offers for facilitating differentiation and individualization. Students' experiences with ICT outside school, and their interests, attitudes and learning approaches, which are influenced by gender and socio-cultural background, however, largely determine how they experience working with a particular ICT tool. In order to realize the potential of ICT in education, differences between groups of students must be taken into account. The literature on socio-cultural sensitivity and gender-inclusiveness in educational software differentiates three main topics: the inclusiveness of the content of educational technology, the visual and audio interface, and the extent to which the instructional structure of the technological tool is inclusive. The topics from the literature were formulated as an 'index of inclusiveness' (Heemskerk et al., 2005) to gain insight into why students from different ethnic origins and boys and girls may have different appreciations in relation to ICT tools. In this article we have used this index, which is largely based on theoretical and reflective literature, as the basis for a survey in order to get empirical information about perceptions of students in relation to educational ICT applications.

The main research question is; 'How are students' characteristics related to their appreciation of ICT tools in secondary education'. This is divided into two sub questions:

1) To what extent do boys and girls differ in their appreciation of elements of ICT tools?
2) To what extent do students from different origins vary in their appreciation of elements of ICT tools?

5.1 Students' appreciations

In this study we did not measure differences in learning achievements between more or less appreciated tools. However, students reported that they learned more when working with the tool they appreciated most. In general, students stated that all parts of the questionnaire were important in the appreciation of ICT tools, albeit of varying importance. From the list of most important indicators why students appreciate an ICT tool or not, we conclude that students appreciate applications with an interesting and attractive content and interface. They like to work with clearly designed tools with instructions that are easy to understand. Further, students appreciate to work in an exploratory and cooperative way with the opportunity to try things for themselves and consult their fellow students. On the other hand, the tool must be self-explanatory or thoroughly explained by the teacher and mistakes should be immediately noticeable.

5.2 Differences between boys and girls

In this study, we found several differences between boys and girls, and between groups of students from different origins. These differences indicate why different groups of students were attracted to ICT tools or not.

The girls seemed to be attracted to ICT tools with instructions that are easy to understand and work with. This result is in line with the literature on gender and ICT. Research shows that girls generally report fewer ICT skills and less ICT knowledge than boys (Volman & Van Eck, 2001). Similarly girls were found to appreciate step-by-step instructions and a clear, pleasant help function more than boys. Many authors mention the importance of clear, immediate feedback and good scaffolding support in general (Adler, 1999; Gillani, 2000; Selby & Ryba, 1994). According to Agosto (2001), however, boosting the self-confidence of students is especially important for girls to counteract gender-related self-doubt when working with computers. Another important element why girls are attracted to an application, according to our research results, is how interesting they find the subject. We consider this to be an important result because Joiner et al. (1996) found positive effects on girls' performance, when they could work with software they liked, a relationship that was not found in boys. Fiore (1999) formulated a number of recommendations on girls' preferences regarding software content. These preferences range from looking for solutions to complex social problems, designing interiors and clothes, to bungee jumping and travel. Girls also greatly appreciated opportunities for personal exploration. Large-scale research in the future could evaluate how attractive girls find software which implements these recommendations. Regarding the issue of social interaction, our study showed that girls find applications with a competitive element less attractive than boys. Earlier research on gender supports this result. Girls prefer collaboration to competition (Agosto, 2001; De Jean et al., 1999; Fiore, 1999; Selby & Ryba, 1994). Finally, we found that girls find attractive pictures in a tool less important than boys.

5.3 Differences between students from different origin

It is more difficult to understand which ICT tools students from ethnic minorities find attractive. We did find differences in appreciation, especially with regard to language achievements and ICT skills. The group of students classified as originating from other countries (Africa, Asia and others) were attracted to applications with explanatory images, requiring less reading. Minority students from a Turkish/Moroccan background felt it was more necessary to understand the language well. Both of these results indicate the importance of language skills when working with an ICT application and are understandable in the context of ethnic-minority students' language disadvantage. Students from the ethnic minority groups in our database speak significantly less Dutch at home than students from the majority population.

Furthermore, in our study all the minority groups stressed the importance of ICT skills. This can be explained by the continuing digital divide. Although this divide does seem to be diminishing and no significant differences were observed in com-

puter-time at home in our database, recent studies still observe ethnic differences in the presence and use of computers and the Internet at home (D'Haenens, 2003; Van Dijk, 2003). Families from the majority population use computers and the Internet more, while ethnic-minority parents have fewer computer skills. As D'Haenens (2003) claims, they stress the importance of learning these skills to their children. This stimulating parental attitude might be why students from ethnic minorities pay attention to this aspect. Perhaps this item is both an obstacle and a challenge at the same time.

To summarize, our study on students' appreciation of ICT tools showed that the gender differences we found generally confirm differences reported in the literature (Heemskerk et al., 2005): girls appreciate applications dealing with an interesting subject, which are easy to work with and provide good support. Some recommendations regarding the subject are made in the literature about what is interesting to girls, but we feel a certain choice of subjects may be preferable in order to serve both boys and girls. Although girls find it important that applications are supportive and easy to work with and understand, it seems obvious that such a design of the instructional structure is beneficial to all students. To make a tool more attractive to boys, a competitive element or a game could be included as an extra feature, as well as a choice of images.

The differences between ethnic groups in the Netherlands are more difficult to interpret and less extensively discussed in the literature. We found ethnic differences in appreciation of ICT tools in respect to language achievements and ICT skills in this study. To make a tool more inclusive to students from different ethnic backgrounds, our data indicates that it is important to take into account different levels of prior knowledge, especially regarding computer skills and language. In the literature several authors make a plea for anticipating differences in initial levels of prior knowledge and learning capabilities (Adler, 1999; Chisholm, 1995; Maurer & Davidson, 1999).

We conclude that the index of inclusiveness, described in the first section of this article, might be a helpful instrument for teachers and designers of ICT applications in selecting or designing gender-inclusive or culturally sensitive ICT tools. Differences between groups of students were found in all the main topics mentioned: content, visual and audio interface, and instructional structure. In other words: our questionnaire based on this index proved to be an appropriate instrument for distinguishing between tools which different groups of students had evaluated positively or negatively. Regarding 'content', we found differences in the extent to which different interests are addressed. We found differences in the 'visual interface' concerning the use of pictures. The 'instructional structure' shows several group differences regarding prior knowledge, learning activities and the help structure.

The differences we found between groups of students indicate important indicators why these students appreciate an ICT tool or not. Inclusiveness of the tools can be improved by paying special attention to these indicators while designing or selecting educational tools.

The results of our study clearly show that several index elements which are of importance to specific groups of students, are also important to students in general. While students report that they learned more while working with the tool they appreciated most, improvement of these elements of an ICT application would be useful for all students and in particular for girls and students from minority groups.