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Girls and ICT in education

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Samenvatting

Dit paper is een beknopte versie van de module die de cursus Informatievaardigheden van het Ruud de Moor Centrum van de Open Universiteit Nederland afsluit. Deze cursus is bedoeld voor leerkrachten: wat kunnen zij doen, gegeven het belang van informatievaardigheden voor leerlingen, om hun onderwijs op dit domein te versterken? De nadruk in deze module ligt echter op het aspect 'meisjes en ICT in het onderwijs'. De achtergrond hiervan is dat te weinig meisjes voor een ICT-gerelateerde opleiding kiezen. Er zijn voldoende redenen om dit verschijnsel te doorbreken. De volgende aspecten komen aan de orde: genderspecten, intrinsieke motivatie, de rol van de leerkracht en van educatieve software.

Keywords

gender, teacher competences, educational software

Introduction

These days there is a huge difference in participation in ICT-related education between girls and boys in the Netherlands. A conservative estimate is that there are about eight times as many boys than girls in this kind of education. There are, however, no apparent reasons for the fact that only few girls choose

an ICT-related education. Overall, the Netherlands have the lowest number of female alumni in the domain of science and technology in Europe (OECD, 2005 and 2006). Table 1 provides some insight in the misdistribution of girls and boys in science and technology education. Unfortunately there are no figures available for ICT-related education.

Dutch educational system	Sector or Profile	girls	boys
Preparatory Vocational Education (vmbo), 14 – 16 year old	Technology	4,5	49,1
Senior General Secondary Education (havo), 16 – 17 years old	Nature and Technology (Natuur en Techniek)	1,4	18,0
Senior General Secondary Education (havo), 16 – 17 years old	Nature and Health (Natuur en Gezondheid)	17,2	16,5
University Preparatory Education (vwo), 17 – 18 years old	Nature and Technology (Natuur en Techniek)	3,5	25,1
University Preparatory Education (vwo), 17 – 18 years old	Nature and Health (Natuur en Gezondheid)	34,5	24,0
Senior Secondary Vocational Education (mbo)	Technology	7,9	47,3
University of professional education (hbo)	Technology, Industry, Architecture (Techniek, Industrie, Bouwkunde)	1,7	13,4
University of professional education (hbo)	Science, Mathematics en Computer science (Natuurwetenschappen, Wiskunde en Informatica)	1,2	12,6
University (wo)	Technology, Industry, Architecture (Techniek, Industrie, Bouwkunde)	2,7	14,7
University (wo)	Science, Mathematics en Computer science (Natuurwetenschappen, Wiskunde en Informatica)	6,4	13,2

Table 1 Participation girls and women in science/technical education (in percentage of the total female population, respective boys in the sectors of Dutch educational system)

There are more than enough reasons to try to change this state of affairs. The present-day society is transforming into a knowledge-based society and ICT is one of the most important enabling forces in this transformation process. In order to be able to function in this transformation process and, more importantly, to determine its course, all citizens, female and male, should have a more than superficial knowledge about ICT and skills to use ICT and the concepts related to it.

This paper summarizes the reasons for involving more girls in ICT-related education. Furthermore, we focus on the way teachers in primary and secondary education should use ICT in their lessons, assuming that their (competent) way of using ICT in their teaching can draw more girls to ICT-related education.

ICT is the abbreviation of information and communication technology, that is the technology to make all kinds of information available and to facilitate and support communication between people, between people and machines and between machines. The scope of this paper is the use of ICT by teachers in order to support the learning of students. ICT is here defined as computers and other hardware, software, networks of computers, and especially the internet. This means that our main focus is not on the technical or technological aspects, but on searching, evaluating, processing and incorporating information, and on the interactive and social aspects of human communication.

The Ruud de Moor Centrum of the Open Universiteit Nederland is responsible for a

chapter of a course on e-literacy for teachers, with special attention for the role of girls. This paper is a summary of that chapter. The course will be published in September 2007. The work is part of the project ICT-STER subsidized by the European Equal Project ESF.

Context

Schools nowadays are developing from 'closed' institutions where the dominant characteristic is transfer of (mostly) theoretical knowledge by the teachers to 'open' organizations with a new population of self conscious students. Schools have to cope with the demands of parents, enterprises and the society at large. From a very young age children are confronted with ICT so that it is a part of their natural environment. The generation gap can these days be defined as the degree to which people participate in the digital world. Young people have mobile phones, mp3-players, computers with internet connection, they use msn and communicate with each other worldwide whereas their elders have problems with keeping up with all new developments in this field. What is also changing is the relation to the virtual world. Instead of passively looking at a screen, the screen is a means for active involvement and interaction with others, for instance by chatting and gaming.

Although ICT is an accepted part of citizenship and the working environment, the possibilities of ICT in teaching are not used to the full extent. The internet as a source of information is well known, the most frequent use of this information is cut and paste without reflection on the meaning and

value of the information found. It is suggested by some that this is due to the lack of knowledge and skills of the teachers with respect to ICT. Introduction of ICT in teaching as one more source of information has no added value. Instead, ICT should lead to a rethinking and adaptation of the teaching program, the pedagogy and the learning process of the teachers involved.

Impact of ICT

Pupils and students don't learn for the school but for their lives as citizens and workers within the knowledge-based society which demands, as previously said, more than superficial knowledge and skills of ICT. In that society informatization, automatization, communication and knowledge are inter-

twined. But at the center of that society are the people with their creativity, and their initiatives. Moreover, ICT has a strong influence on the way in which people work, communicate and learn. ICT has a great influence on almost all aspects of our society: from health care to defense, from entertainment to science, from transport to agriculture. Another very important aspect of ICT is that it is, evidently, not a mono-discipline, but that it has alpha, beta and gamma aspects, in fact maybe it should be seen as a fourth discipline: delta.

In table 2 a global overview is given of the ICT-background of particular groups in our society.

Generally speaking, learning does not end after completing school or university, every

group	ICT-background
All citizens	Have sufficient ICT knowledge and skills to use the ICT tools most accepted
Pupils and students	Leave school being confident, creative and productive users of ICT
Teachers	Have insight in meaning, opportunities and risks of ICT
Managers	Have insight in the impact of decisions through their insight in ICT-driven systems, processes and innovations
ICT-specialists	Have creativity in using ICT, deep insight in ICT and are competent in disseminating their knowledge

Table 2
Necessary ICT-back-
ground of particular
groups

person faces life long learning. This applies especially to ICT, because ICT has absolutely not reached the end of its possibilities yet. It is the task of the schools to make a good start with this lifelong learning.

How schools implement their vision on ICT in their teaching program is their own choice. Not all aspects of this process can be treated in this paper, due to time restrictions. In this paper we focus on the issue how to interest more girls for ICT-related education and what schools can do to get the girls involved.

Motivation

These days many educational innovations aim at student-centered learning. Frequently used terms are: active learning, selfregulating learning, authentic learning, collaborative learning using real life problems and situations. ICT enables such forms of learning. The intended student behavior resembles strongly what in research is called intrinsic motivation. This means that students perform their jobs in school because they like them and not because they are urged to do them. In the research literature there two complementary lines of research with respect to intrinsic motivation: the Self-determination Theory (Ryan & Deci, 2000) and the Dual Processing Self-Regulation Model (Boekaerts, 2005). The essence of both lines of research is a learning environment that enhances the autonomy of the students, that offers a safe social environment and that gives students the feeling that they are developing their own competencies. Students conceive the learning environment as being in agreement with their learning goals. Martens and Bastiaens (2006)

investigate the relation between autonomy of the learners and their intrinsic motivation. If the learning environment is very directive and supplies only a small amount of control to the students, the intrinsic motivation of the student is disturbed. Their research question was which form of autonomy works best and when lack of control deteriorates into anarchy where no learning takes place. Their restricted research design gives no unambiguous answers, but the data they collected indicate that there is, indeed, a strong correlation between autonomy and intrinsic motivation. Also, there is the indication that autonomy for the students can improve their intrinsic motivation, but that it is better to give autonomy with respect to the subject matter and not to the way the teaching is organized. For primary and secondary education with well defined teaching programs it is not easy to translate this conclusion into a teaching practice. Applied to the use of ICT in teaching this could mean that the teacher has the final decision on how ICT will be used.

Gender aspects

From studies (see for instance Valkenburg (2006)) about the question what the main causes are for the differences between girls and boys, it is quite clear that girls have qualities that fit very well in the profile of an ICT-worker: communicative skills, strategic insight, readiness to listen, demanding high quality results, and being a motivating force for co-workers. Yet, ICT is a man's world. By mixing ICT and multimedia there will, hopefully, be more possibilities for women because this implies more attention to

creativity and social aspects.

There seem to be at least in two ways in which schools can do something to draw more girls to ICT-related education: less focus on the technical aspects and creating classes in which there are only girls and no boys. Also, teachers can change the way they use ICT in their classrooms. For instance, girls prefer the use of ICT when it supports collaborative learning instead of individual learning. Girls prefer rich interfaces with examples, images and sound. Puzzles, games and simulations without competition and with a non frustrating degree of difficulty are favored by girls. Teachers should be aware of their often unconscious ideas about girls and boys. If possible, schools should ask female role models to give lectures about the way their companies use ICT, schools should not tolerate a 'macho' culture.

ICT-competencies of teachers

A lot of publications aim to describe which are the competencies teachers should have with respect to the use of ICT in their teaching. This is a difficult job, because the field is very large: a primary school teacher is not the same as a secondary mathematics or English teacher. In the literature one can find recommendations on a high and abstract level or focusing on the procedural aspects of the implementation of ICT in teaching. Kirschner et al. (2002) made an inventory of the most relevant ICT-competencies for teachers, based on an international survey. This inventory was made for Dutch Inspectorate of Education. Kirschner et al list the following five types of ICT-competencies.

- ♦ personal and basic skills needed for Office applications
- ♦ ICT as a mind tool: teachers can use software that support meaningful thinking and working
- ♦ pedagogical use of ICT: ICT should support resource based learning and collaboration in a digital learning or working environment
- ♦ ICT in an educational setting: meaning, opportunities and restriction of the use of ICT in teaching
- ♦ social aspects: ICT influences the society, teachers should use this.

Hogenbirk (2006) of the Dutch Inspectorate of Education published a booklet with a bottom up approach: he gives a description of what individual teachers or school teams do with ICT. The conclusions are that the teachers are not very well aware of their own development in using ICT, - it is more informal than formal learning -, monitoring of and reflecting on the learning of teachers themselves is necessary and there is no explicit attention of the teachers for professionalization. To say the least, it is remarkable that there is a great difference between the attention for the learning of teachers and the learning of pupils or students with regard to ICT.

Teachers should design their teaching from answers to questions such as what to teach (goals), how to teach it (designing the teaching/learning process including tools, motivation, testing, procedures), to whom the teaching is aimed (prior knowledge of the students), why they should teach it (social and individual relevance of the choices). On another level the vision on the function of

teaching plays an important role. In the Netherlands there is a shift from the teacher as the one who is responsible for 'transfer' of knowledge and skills to the teacher as the adviser and the coach of the students. Students are more and more responsible for their own learning. Volman (2005) argues that this kind of teaching is unthinkable without ICT. Teachers should use ICT as a natural tool, but they should refrain from looking like 'ICT-nerds' to avoid negative effects on girls. Teachers should also be aware of well known pitfalls such as giving more attention to boys, having prejudices about girls, etc. The process of choosing continuing education should be carefully organized and monitored, especially with respect to ICT-related education.

Girls and ICT

ICT is often designed with strong emphasis on the technological possibilities. Important aspects are acceleration and simplification of processes, and providing a lot of information. How software and hardware will evolve in the future, given the knowledge-based society ICT will function in, is hard to forecast. Everyone, but specially young people, have to work with ICT. So, everyone is, in one way or another, part of the future evolution of ICT. It is not unlikely that a new generation of ICT-tools is not only based on technological principles but will respond to the way young people use ICT. A word processor hardly reflects the way young people communicate. In our view new generations of ICT-tools should to a greater extent reflect the way young people use ICT: ICT will offer a more open environment than the present ICT-tools.

The user can operate more autonomously and creatively. Interaction is another keyword. This supposes insight in meaning, opportunities and restrictions of these ICT-tools for the user. E-literacy for students is a good example of this open approach. The use of the interactive smart board is another. The students use a lot of ICT (internet, browser, word processor, presentation program, etc) in order to get insight in the subject matter and to show the result of the learning process. The teacher has to be competent to prepare for such a form of teaching. Awareness of what is possible with ICT in such teaching is one step for teachers, readiness to use ICT is the next step. But also it is important that teachers explore ICT with respect to a more open use as autonomy, creativity and interaction. My claim is that a more open use of ICT, and a fortiori more open ICT, can bridge the gap between young people and their teachers, and, more important, between girls and boys. Figure 1 illustrates the growth in ICT-competencies of teacher and the 'move' from more or less close ICT-tools to more open ones.

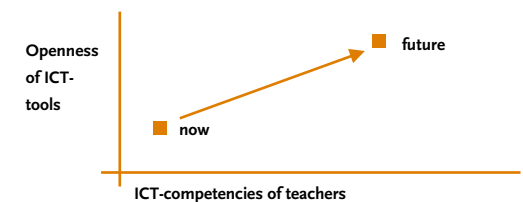


Figure 1
ICT-competencies of teachers
versus openness of ICT-tools

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