

Resources and Filters - Analysing the Digital Divide in a 1:1 Environment

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Abstract

Digital literacy is a priority of the European Commission and it is a priority for schools [17]. To bridge digital divides, schools have ongoing projects implementing ICT and developing digital skills. One way of implementing the use of ICT in education is through lesson designs that integrate ICT.

The findings in this paper come from an intervention study conducted in a Swedish upper secondary school in 2013; a group of teachers designed and implemented an ICT-rich lesson design. The school have an ongoing 1:1 project i.e. every student has an individual laptop. The laptop is identified as a tool for learning in accordance to The Ecology of resource Model [10]. For this paper focus group interviews, teacher interviews and results from two student surveys were used. The results are consistent: there is a difference in frequency of use of the computer between different types of programmes, i.e. between students attending higher education preparatory programmes and vocational programmes. 34% of the students attending a higher education preparatory program answered that they use their computer at school for schoolwork every day, the corresponding percentages for the vocational programs were 3%. These results raise questions about access, use and digital divide.

1. Introduction

Modern technology pervades our society at several levels [12]. We pay our bills on the Internet, communicate with friends on Facebook and book our next family holiday on Internet. We can vote online, take a course online or have access to our office in the kitchen. We can listen to music, watch movies and play games online. Younger and younger children use modern technology and more households get access to modern technology. In Sweden 2014, 91% of the population over 18 years old has access to a computer and 91% have Internet access [3]. Sweden is today a leading IT nation [12]; Sweden ranks high in terms of Internet usage among both individuals and businesses [3]. But there are different types of digital use, digital competence and

there are differences related to the access of modern technology.

Digital literacy is a priority of the European Commission and it is also a priority for schools [17]. In order to ensure that students have access to modern technology and at the same time bridge the technological divide, many countries have ongoing projects for the implementation of ICT (Information and Communication Technology) in schools. These projects are usually some form of a 1:1 initiative.

The implementation of computers and other types of information technology in Swedish schools has been an ongoing process for almost 30 years [14, 20]. Several initiatives were conducted during the 1990s in order to expand and develop the use of ICT in Swedish schools e.g. IT in school (ITiS) and different projects initiated by the Knowledge foundation [20]. There is a history of building up infrastructures in educational settings which involves pedagogical questions, content and teacher competence.

The use of modern technology is today mandatory in the curricula for both compulsory and upper secondary schools in Sweden [18]. Over 250 municipalities have 1:1 projects or are planning one. These initiatives often involve that the school provides teachers and students with a digital device, usually a laptop or a tablet. Hence, once the schools have bridged the digital divide concerning access and have a functional infrastructure, then the schools can take on the important role of developing students' digital skills [15, 17]. Several national studies have been conducted around these 1:1 initiatives [4, 9, 15, 16].

Although there is a high density of computers in Swedish classrooms, from a European view, there are still significant differences among Swedish schools [8]. According to Samuelsson [15] it is not enough that the schools provide the students with a computer to use for schoolwork; digital (in)equality still remains. Studies have also shown that there is a difference among students in their digital competence or digital literacy [1, 7]. In a report from the Organisation for Economic Co-operation and Development [13] these differences are described as 'new digital divides' and the report states that "the

more educated, the more the use of Internet” (p.44). Other studies and reports emphasize that adopting stereotypes, such as ‘digital natives’ and ‘net generation’ is problematic, since these can make us believe that these are representative of all young people [13]. Erstad [2] warns that there is a risk in over-generalization, since there is such a big difference “both within and between different cultures and countries how young people relate to and use digital media” (p.58). The educational system in Sweden, as in other countries, is meant to have a compensating role. A report from the Swedish National Agency for Education points out the important role schools play in order to “ensure pupils’ and students’ digital skills” [17] (p.45). One way of implementing ICT in schools is through lesson designs that integrate ICT. An intervention study concerning an ICT-rich lesson design was conducted to observe both the design phase and the implementation phase.

In order to change teaching practices in 1-1 environments, there is a need to build an infrastructure that is functional and suitable for this context, as well as a need to develop pedagogical content. A student survey conducted during the intervention study showed that 78% of the students attending a higher education preparatory programme brought their computers to school every day and the corresponding percentages for the vocational programmes were 26%. 38% of the students attending a higher education preparatory programme stated that they used the computer every day in school for schoolwork. The corresponding percentages for vocational programs were 3% [6].

In this paper the The Ecology of Resource Model (EoR) is being used. The Ecology of Resource Model contains concepts to analyse both questions about infrastructure, content in relation to subjects and content in relation to pedagogical issues [10, 11].

The questions asked in this paper are; Is given equal access to an artefact enough to bridge digital divides which relate to digital competence that entails using technology which has high complexity? What are the conditions when implementing an ICT-rich lesson design in a technology-rich environment?

2. The Ecology of Resource Model

The Ecology of Resource Model (EoR) by Rosemary Luckin is a framework for both evaluating and designing educational technology in technology-rich environments [10]. The framework is based on Vygotskys’ the Zone of Proximal Development.

“The Ecology of Resources model of context /.../ describes the people, artefacts and environments with which the learner interacts as resources. These resources have the potential to offer the learner the assistance

required by the Zone of Proximal Development (ZDP): they offer the partial descriptions of the world that need to be connected and built into a meaningful learning narrative through the process of internalization” [11] (p.36).

The framework uses the concept of The Zone of Collaboration which contains ZAA (Zone of Available Assistance) and ZPA (Zone of Proximal Adjustment). ZAA describes the different available resources “within a learner’s world”. ZPA describes subgroups in ZAA [10].

The EoR model consists of three resource categories (resource elements); *Knowledge & skills*, *Tools & people* and *Environment*. *Knowledge and skills* concern the knowledge and skills that are in focus for the learning activity. *Tools and people* relate to the resources that the learners have around them; e.g. books, pens and paper, computers, mobile phones and MAP (More Able Partners). *Environment* here concern the place and surrounding environment with which the learner interacts e.g. a classroom, a museum or a park [10].

There are filters between the learner and the resources. These filters are often positive, but they can also have a negative effect. For example; the curriculum can be a resource filter for *Knowledge and skills*; access to artefacts or digital skills can be resource filters to *Tools and people* and the schedule or Wi-Fi access can be resource filters to *Environment*. For example, a well-functioning Wi-Fi is fundamental for the students to be able to use the Internet in a satisfactory way. Hence, if the Wi-Fi access is limited or not good enough, this can be seen as a negative resource filter.

Designing a learning activity is important to identify the resources and the filters. It is also important to identify what or who constrain the access to the resources. [10]. Different types of resources are often connected to each other and these relations need to be identified and understood in order to support learning.

3. Method

The study has been carried out in a mid-sized Swedish city. The school has about 1500 students attending different programmes, both vocational programmes and higher education preparatory programmes. The school in the study is a 1:1 school, e.g. the school has provided the teachers and the students with their own school computer (a small laptop). The school has a digital infrastructure and different kinds of technology devices in some of the classrooms (e.g. projectors and document cameras). The students also have personal mobile phones and some of them use it for schoolwork both at school and at home. [6]. Since the access to digital devices

is high, the school can be identified as a technology-rich environment.

Six teachers worked together from February to June 2013 designing and implementing a lesson design with integrated ICT. It was optional for the teachers to participate in the study. The six teachers teach Swedish but in different programmes. The group of teachers decided to make a lesson plan in the course Swedish 1 which is a compulsory course for all students attending upper secondary school in Sweden. They chose the topic sociolinguistics. Opportunities and hindrances in the implementation of the design were discussed during the construction of the lesson design. Several aspects were raised, such as; whether or not the teacher could expect the students to bring their computers to school, if the students use the LMS (Learning Management System) or not, and how much digital competence both the teachers and students have.

In the study 139 students in their first year in upper secondary school participated. The students attended six different programmes: the Business Management and Economics Programme (EK); the Social Science Programme (SA); the Technology Programme (TE); HVAC - the Property and Maintenance Programme (VF); the Health and Social Care Programme (VO); and the Vocational Introduction Programme towards Health and Social Care (VI). The Business Management and Economics Programme, the Social Science Programme and the Technology Programme are higher education preparatory programmes, while the Property and Maintenance Programme, the Health and Social Care Program and the Vocational Introduction Programme towards Health and Social Care are vocational programmes.

In order to document the design process and establish a methodological triangulation, different kinds of data has been collected at different times. The data in this paper is part of a larger data collection and selected parts were chosen. The results from the diverse data units are consistent, since they all give the same picture and, used together, they give a thick description of both the context and the problematic issues which this paper intends to illuminate. The data being used in this paper are from twenty student focus groups interviews with a total of 62 students (35 females and 27 males), two students surveys and the interviews with the six teachers.

3.1 The focus groups

The largest classes in the study had 31 or 32 students and the working groups (for the sociolinguistic project) consisted of 3-4 students which mean about 8 groups per class. To get a representative sample, 4 groups per class were requested. The teachers in the study chose which

working groups in their own class that were selected for the focus groups with the aim to get an equal number of females and males in the groups.

In the focus groups interviews, the questions concerned four themes and one of these themes are in focus in this paper. The theme in focus concerns frequency of use and usage area for the students laptops.

- Do you use the computer a lot at school?
- What do you use the computer for?
- Do you bring the computer with you to school? Why? Why not?
- If you forget your computer, do you use your mobile phone instead?

Table 1 below shows focus groups distribution according to gender and programmes.

Table 1. Focus groups

		<i>Groups</i>	<i>Total</i>	<i>Females</i>	<i>Males</i>
F1-4	Health and Social Care Program (VO)	4	15	15	0
F5-8	HVAC and property Maintenance Program (VF)	4	10	1	9
F9-12	Social Science Program (SA)	4	12	7	5
F13-16	Technology Program (TE)	4	12	3	9
F17-19	Business Management an Economics Program (EK)	3	7	4	5
F20	Vocational Introduction Program (VI)	1	6	5	1
		20	62	35	27

3.2 The interviews with the teachers

The teachers were interviewed individually. The questions in the teachers' interviews concerned eight themes and for this paper questions from one of the themes were used. The questions used for this paper were similar to those asked in the focus group interviews with the students:

- Do you think that the students use the computer a lot at school and for what do they use it?
- Do the students use their mobile phones instead if they have forgotten their computer?
- When the students use the computer in the classroom, is it because you tell them to, or is it on their own initiative?

3.3 The student surveys

In the end of the intervention study, a student survey was conducted with the participant students. 2014 the survey was conducted again with the same students and in 2015 the survey will be conducted (for the last time) with the same students before they leave upper secondary school.

The 2013 student survey was distributed in the classroom during a lesson. The survey was structured and contained of 24 questions, with mostly set responses. 109/139 students (61 females and 47 males) answered the survey which generates a response rate of 78%.

The 2014 student survey was also distributed in the classroom during a lesson. The survey was structured and contained of 21 questions. Most of the questions in the survey had set responses. 125/150 students (69 females and 55 males) answered the survey which generates a response rate of 83%.

For this paper results from four of the questions are being used:

- Are you a female or male?
- What programme do you attend?
- How often do you have your computer with you at school?
- How often do you use the computer for schoolwork in school?

4. Results

4.1 The teachers' perspectives on students frequency and range of use of the school computer

There are six teachers in the study working on different programmes, hence six different programmes are represented. In this paper the teachers will represent the program that they teach, i.e. the teacher in the Health and Social Care Programme class, will represent the Health and Social Care Programme.

Table 2. The teachers and their programmes

<i>Teacher</i>	<i>Programme</i>
Teacher 1 (T1)	the Health and Social Care Programme
Teacher 2 (T2)	the HVAC and property Maintenance Programme
Teacher 3 (T3)	the Vocational Introduction Programme
Teacher 4 (T4)	the Technology Programme
Teacher 5 (T5)	the Business Management and Economics Programme
Teacher 6 (T6)	the Social Science Programme

Teacher 1 (the teacher in the Health and Social Care Programme) stated that there is a difference among the programmes, and classes attending the Health and Social Care Programme and the HVAC and Property Maintenance Programme use the computer less often for schoolwork than other classes. Furthermore this teacher said that the students use their computer quite a lot, but not always for schoolwork. Instead, the students use the computer for Facebook and gaming amongst other things.

"/.../ so the question is what they do with the computer, it is not always what we think that they do. /.../ it is a lot of Facebook and browsing the net and gaming and such. It is different in different classes. The Health and Social Care Programme classes that I teach, a lot of the time they do not even have their computer with them and if they do – they do not use it /.../ if you do not ask them to do something particular (like): go there and do that and seek there and give them and show them links and show them ways – then they do not use the computer as we think that they can /.../.”(Teacher 1 interview 2013-06-17).

According to this teacher the students sometimes use their mobile phones to take a picture of the whiteboard, if they have forgotten their computers.

” It is very ineffective with the mobile phones but they takes picture of the whiteboard /.../ not everybody thinks that it is ok, some of our colleagues have said that they (the students) are not allowed to take pictures and then (the students) have neither the computer nor notes or anything and when the teachers clean the whiteboard they do not have the information that they need.” (Teacher 1 interview 2013-06-17).

Teacher 2 (the teacher in the HVAC and property Maintenance Programme) stated that there is a difference between vocational programmes and higher education preparatory programmes. The students in the HVAC and property Maintenance Programme group that she taught do not use the computer very much for schoolwork. They do not use their mobile phone either. She used to text the students reminding them to bring the computer to school.

”/.../ in my subjects they (students in general) use the computer a lot. But I have two classes, a vocational program and there I feel that they do not use the computer much at all.

I have been sending text messages to remind them to bring the computer tomorrow to the Swedish lesson, and if I do not do it, they do not have their computers with them, perhaps one (otherwise). But in my more theoretical program it feels like you (the students) are using the computer more even though they say that it is only for Swedish and English that they use the computer. But then I do not know if this is true or if it is actually so.” (Teacher 2 interview 2013-06-11).

Teacher 3 (the teacher in the Vocational Introduction Programme) said that some of the students have their computer with them and some of them do not. Furthermore the teacher said that the students do not use their mobile phones if they have forgotten their computer at home (Teacher 3 interview 2013-06-17).

“It varies a bit, some students of course forgets their computer at home. But in the subject of Swedish we always write the texts on the computer, or I want it to be that way and that they submit the texts after (on the LMS) – because I do not want papers. But then it is also obvious that they look at Facebook, YouTube clips and gets music during lesson, the do /.../.”

Teacher 4 (the teacher in the Technology Programme) answered that the students use the computer with high frequency and if they have forgotten the computer, they might use their mobile phones instead.

“I think that they most often use the computer a lot, yes. /.../ It is unusual that anybody do not have the computer with them.” (Teacher 4 interview 2013-06-13).

Teacher 5 (the teacher in the Business Management and Economics Programme) stated that the students use the computer a lot in school and that this it is natural for them. They take notes, seek information, and write on the computer. To seek information, they could as well use their mobile phones according to the teacher.

“Yes, I think that they use it (the computer) a lot in school. Both the students in year one and two. But then I have also had some students in their third year and there (in those groups) it looks totally different. A lot of the time they do not have the computer with them”. (Teacher 5 interview 2013-06-13).

Teacher 6 (the teacher in the Social Science Programme) stated that the students use the computer

to some degree in school, but that they usually bring it with them. This teacher also stated that 50% of the students use their mobile phones if they have forgotten their computers.

”It (the lesson) usually begins with me telling them to turn off the computers and then they are allowed to turn them on again when it is time. If they take up the computer and turn it on, on their own initiative, then I think that (what they are doing) it is not connected to schoolwork”. (Teacher 6 interview 2013-06-13).

In summary; the teachers describe that there is a difference between different types of programmes. This is especially pointed out by the teachers who teach both vocational programme and higher education preparatory programme, they can compare the different programmes. One of the teachers states that there is a difference between students in year 1 and in year 3 within the same programme. The teachers also describe the computer as a distraction which is in turn discussed as a problematic aspect.

4.2 The students’ perspectives on their frequency and range of use of the school computer

Analysing the data from the focus groups regarding questions about if they bring the computer to school and if they use the computer with high frequency for schoolwork, three levels of frequency of use were identified: “low frequency”, “medium frequency” and “high frequency”.

Table 3. The definitions concerning frequency of use

<i>Low frequency of use</i>	<i>Medium frequency of use</i>	<i>High frequency of use</i>
the students seldom bring their computers to school	whether or not they bring their computer to school depend upon the subjects they have that day	they bring their computers on a regular basis
the computers are used to a low extent	they do not use the computer in all subjects	the students use the computer a lot, in most of their subjects
the use of their computers varies between subjects	they do not like to carry around their computers all day if they are not going to use them	they see the computer as part of school and education

No groups in the higher education preparatory programmes were found to have “low frequency of use”, but four of nine groups attending the vocational programmes had this frequency level. No groups from the vocational programmes were found to have “high frequency of use”, but this frequency level was found in nine of eleven groups from higher education preparatory programmes. Five of nine groups from the vocational programs were found to have “medium frequency of use” and the corresponding figure for the higher education preparatory programmes were two of eleven. Thus, the focus groups from the vocational programmes generally have low to medium frequency of use and most of the focus groups from the higher education preparatory programmes use their computers with high frequency. All of the focus groups from the Social Science Programme (SA) and from the Business Management and Economics Programme (EK) were defined as having “high frequency of use”. Table 4 below shows the distribution between the different levels of frequency of use in accordance to what programme the students attend.

Table 4. The distribution of level of frequency according to programme

<i>Low frequency</i>	<i>Medium frequency</i>	<i>High frequency</i>
VO - 1 group	VO - 3 groups	SA - 4 groups
VF - 3 groups	TE - 2 groups	TE - 2 groups
	VI - 1 group	EK - 3 groups
	VF - 1 group	
4	7	9

Almost 50% of the groups (9/20) can be found in the highest category and 20% are in the lowest category (4/20). Since all of the students in groups in the Health and Social Care Program (VO) were females, and all but one in the groups in the HVAC and property Maintenance Program (VF) were males, gender does not appear to be relevant. The other groups are more or less mixed in relation to gender.

The students attending the HVAC and property Maintenance Program (VF) use their computers the least of all of the groups in the study. These students do not bring their computers to school every day and they do not use them very much for schoolwork. These findings are consistent in the study, regardless of whether the analyses are based upon student surveys, teacher interviews or participant observations during the implementation of the design. In the student survey [6] and in the focus groups, the students attending the HVAC and property Maintenance Programme (VF) state that they basically use their computers in the subject of Swedish, which they have twice a week. They use the computer for other things than schoolwork “you do other things in the lessons when you have the computer with you, like games and such” (Focus group interview 7, F7).

The students who attend the Health and Social Care Program (VO) have a higher frequency of use than those in the HVAC and property Maintenance Program (VO). One reason for this may be that besides using the computer in the subject of Swedish, they also use it for their specific subjects in health and care. This group of students also talks about taking notes on the computer or getting material from the Learning Management System (LMS). But the results from the focus groups interviews with the students from the Health and Social Care Program, gave a somewhat varied picture. One group stated that “you should always have the computer with you /.../ everybody always have their computer with them” (Focus group interview 2, F2) and another group that “most people do not bring their computers” (Focus group interview 3, F3). Table 5 below shows the frequency of use for the vocational programmes with quotations.

Table 5. The frequency of use for Vocational programs with quotations

<i>Focus group</i>	<i>Defined frequency</i>	<i>Quotations</i>
F1=VO	Middle high	“If you know you have a class where you know you do not need the computer – you don’t bring it because you don’t want to carry it around.”
F2=VO	Middle high	“We have almost never used it in maths, but in health and social care subjects we use it every day writing and such.”
F3=VO	Low	“We never use the computer in mathematics /.../ we have never done that /.../you don’t even bring the computer there (to that lesson) “
F4=VO	Middle high	“Much is about go to Fronter (the LMS) because the teachers upload their material there, you go in and check, write, seek information, PowerPoints.”
F5=VF	Middle high	“It is easier, so we mostly write on the computer.”
F6=VF	Low	“No, I think you use them too little for having a personal computer, it is a bit unnecessary.”
F7=VF	Low	“Everything besides schoolwork /.../entertainment during breaks /.../.”
F8=VF	Low	“No I agree, it is not used very often and it is mostly to check something out or to have something to do in the breaks. I don’t, think it is used so much for schoolwork.”
F20=VI	Middle high	“We use it but many in the group forget the computer at home”.

The focus groups from the Social Science Program, the Business Management and Economics Program and the Technology Program have a higher level of frequency of use, eg. they bring their computers every day, or almost every day to school. The students with a high frequency of use have a different perception of the computer in education compared to the other groups. Table 6 below shows the frequency of use for higher education programmes with quotations.

Regarding the question about if they would like to use the computer more at school, there were no differences between programmes. All of the focus groups answered that they were satisfied with both the frequency of use and range of use.

Table 6. The frequency for higher education preparatory program with quotations

Focus group	Defined frequency	Quotations
F9=SA	High	"We do not write as much notes on paper, it's mostly on the computer /.../it is easy and you don't lose it (the notes)/.../"
F10=SA	High	"(I) use it a lot almost in every lesson, you take notes if you need to and if it is a lesson were you don't use it then you do something else on the computer."
F11=SA	High	"We use it quite often, for everything."
F12=SA	High	"All kinds of schoolwork. Sometimes it happens that you go to Facebook and pages like that".
F13=TE	Middle high	"Mostly on technology studies I would say /.../ like the subjects where you need to write and look for information /.../ not so much in math's but a lot in physics". "I only take it with me if we have technology if we don't need it for another subject, but mostly (for the course in) technology".
F14=TE	High	"I use it for almost every lesson. 90-100 % I think and it is not always for schoolwork but the computer is with and on."
F15=TE	Middle high	"In Swedish you use it a lot, looking up things at the LMS and downloading it /.../ or if you need to seek information on the internet."
F16=TE	High	"You are asking technical students so the answer is quite obvious. At school I use it very much".
F17=EK	High	" Yes almost, but not if you like

		only have one lesson /.../. If it's like sports, then you don't take it with you." "I: So you use the computer a lot? "Yes. like depending on it /.../ it you don't have battery then it's chaos /.../ yes, yes."
F18=EK	High	"Yes we do. A lot. All of the time."
F19=EK	High	"Yes almost every day at school.", "Yes we do. Almost every lesson."

The findings indicate a variation in frequency both related to how often students bring their computer to school and to how much they use the computer in school for schoolwork. The findings also show that there is a gap between students bringing their computer to school and students using it at school for schoolwork.

4.3 Results about frequency and use from the student survey

In the student survey 2013, 78% of the students attending a higher education preparatory program answered that they bring their computer to school every day, the corresponding percentages for the vocational programs were 26,5%. In the student survey 2014, 57% of the students attending a higher education preparatory program answered that they bring their computer to school every day, the corresponding percentages for the vocational programs were 14%.

In the student survey 2013, 34% of the students attending a higher education preparatory program answered that they use their computer at school for schoolwork every day, the corresponding percentages for the vocational programs were 3%. (1 student). In the student survey 2014, 26% of the students attending a higher education preparatory program answered that they use their computer at school for schoolwork every day, the corresponding percentages for the vocational programs were 5% (1 student), see Figure 1.

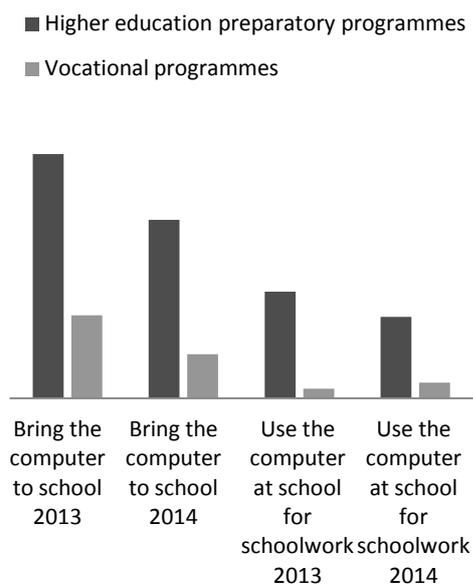


Figure 1. Frequency and use every day 2013 and 2014

Regardless from what perspective the students bring their computer and use it at school for schoolwork with lower frequency 2014 (in their second year at upper secondary) than in 2013 (in their first year at upper secondary school).

Table 7. Frequency and use every day on programme level

	<i>Bring the computer to school</i>		<i>Use the computer at school for schoolwork</i>	
	<i>2013</i>	<i>2014</i>	<i>2013</i>	<i>2014</i>
EK	18 (N.29)	13 (N.26)	15 (N.29)	8 (N.26)
TE	15 (N.17)	12 (N.25)	2 (N.17)	4 (N.25)
SA	25 (N.28)	16 (N.30)	11 (N.28)	11 (N.30)
VF	0 (N.12)	0 (N.8)	1 (N.12)	0 (N.8)
VO	5 (N.11)	3 (N.13)	0 (N.11)	1 (N.13)
VI	4 (N.11)		0 (N.11)	
	67	44	29	24

The results from the student survey conducted in 2013 show that some of the students bring their computer to school every day even though they do not use it for school work every day. 67 students state that they bring their computer to school every day, only 29 that they use it for schoolwork every day. So there is a gap between access and use. For example 15 students attending the Technology programme have their computer with them every day and 2 use it for schoolwork in school every day. 25 students attending the Social Science Programme bring their computer to school every day, 11 uses it for schoolwork every day (see table 7). Looking at the results from the student survey 2014 the numbers of students bringing their computer to school have reduced. 44 students stated that they bring their computer to school every day and 24 students stated

that they use it every day at school for schoolwork. A probable explanation for this can be the need to use the computer for schoolwork.

5. Discussion

The Swedish National Agency for education points out the important role that schools have developing students digital skills and digital competence in a formal setting [17]. The municipalities have implemented 1:1 initiatives which provide the students with digital devices. Riis [14] states that the implementation of new technology in Swedish schools often have been driven by a technology push. The concepts technology push and technology pull are used to describe technological change. Technology pull is when the development is driven by needs and demands (the needs and demands comes first). Technology push is when the products give rise to needs and demands (the product come first). According to Riis [14] the introductions of ICT in Swedish schools also have been driven by external actors, and not by the schools or the teachers. This could be an explanation for the gap between access and use in Swedish schools today. Reports show that teachers ask for professional development in how to use digital tools pedagogically [19]. Grönlund [5] states that it is important to “establish working in schools that make all the teachers digital literate and maintain and further develop this literacy” (p.41). National evaluations show that students use their computers mostly for seeking information, taking notes and to write texts, which means that digital tools are applied onto traditional school tasks [4, 5, 6, 9].

The school in this study is a 1:1 school. The students have their own school computer and they bring their mobile phones to school and they use it to some extent to schoolwork (the teacher interviews and other data collection from the study). The teachers have computers and there is an infrastructure with an LMS. Therefore, the school can be identified as a technology-rich environment. The Ecology of Resource Model (EoR) is a framework for both evaluating and designing in a technology-rich environment [10]. It identifies available resources to the learner, e.g. tools or people. It also identifies filters which can be both positive and negative. Identifying a negative filter is identifying a problematic area, something that needs to be investigated and further developed. The computers are identified as a resource and when the students do not bring them to school or use them at school for schoolwork, this is identified as a negative resource filter, in accordance with The Ecology of Resource Model (EoR). The findings of Håkanson Lindqvist [9] concerning students’ reasons for not bringing the computer to school, coincide with

findings in this study; students state that the computer is too heavy to carry and taking it or not depends on which subjects the students have that day

The results show that there is a difference in accordance to what type of programme the students attend. 2013, 78% of the students attending a higher education preparatory programme bring their computer to school every day and the corresponding percentages for the vocational programmes were 26%. No group from the vocational programmes was defined as high frequency of use and no group from the higher education preparatory programs were identified as low frequency of use. Students attending a vocational programme use the school computer with lower frequency and students who attend a higher education preparatory programme use the computer with higher frequency. Students who attend a higher education preparatory programme bring their computers to school and use it as a tool for schoolwork almost every day, and they can identify the benefits of having their own school computer, they see it as a tool for school and schoolwork. They identify different areas of use and they take initiative regarding when and how to use them. The findings in this are consistent within in the data collection.

However, these students appear to bring their computer to school whether the use it for schoolwork or not since 67 students state that they bring their computer to school every day, only 29 that they use it for schoolwork every day (2013). The corresponding numbers in the 2014 student survey was that 44 students stated that they bring their computer to school every day and that 24 use it for schoolwork every day.

6. Conclusion

The Ecology of Resource Model identifies available resources for the learner. One category of resources is *tools and people* and a digital device is a central tool in a 1:1 environment. To gain access to computers could be seen as a filter connected to the resources. In this study this tool is distributed by the school for students to use for schoolwork both in school and at home. So access to the tool is provided for them. Still most of the students do not bring their computer to school every day or use it at school every day for schoolwork. The findings indicate, that in this 1:1 environment where the school has provided the students with their own school computer, the students do not need to use the computer every day to accomplish their daily schoolwork. That student neither brings their computer to school, nor uses it for schoolwork leads to other implications or consequences. The teachers (to some extent) take this into account when creating their lesson designs. This can be a hindrance in implementing an ICT-rich lesson design. The

teachers might design their lessons so that they do not involve a digital tool. This affects both the teacher and the students; how the lessons are being designed and how they are implemented in the classroom. The teacher does not get into the habit of using digital tools. This also means that the lessons cannot be designed to evolve the students' digital competence in relation to formal learning. Furthermore, this creates a vicious circle as the students then do not need digital tools to solve school tasks. However, the variation in the data implies that some students get more opportunities in developing their digital competence through their education.

So is the access to digital devices supplied by 1:1-initiatives enough for an environment to be called a technology-rich environment? And if the use of digital devices differs between students attending different types of programmes is the divide diminished or expanded? This paper identifies the computer as a tool that integrates ICT into the lesson design that can lead to technology enhanced learning and increased digital competence in a formal setting. In this paper it is argued that the concept digital divide can be seen through two perspectives; (1) concerning the access to digital devices and (2) concerning the development of digital skills, digital competence or digital literacy.

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