Consumption of Digital education – A Cross-cultural Study of Students' Attitudes towards Digital Tools for Language Learning

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Introduction

Information and Communication Technology (ICT) is becoming an increasingly valued and utilized feature within education. Today, children across the globe have access to several learning platforms in which they interact with educational resources using predominately digital tools. In 2006, the European Commission identified eight common key competencies for life-long learning (European Commission, 2010). Five of these key competencies are Communication in a foreign language; Digital competence; Learning to learn; Sense of initiative and entrepreneurship; and Cultural awareness and creativity, all important for the digitalization of education. Research studies conducted on ICT implementation in school education point out that, despite ICT being around us for so long, there is a serious dearth of knowledge on how ICT impacts learning at the school level, why it is important, and how it impacts the quality of school-level education. To answer this issue various multifaceted studies are required that explore the use of ICT at various points of student and school interaction (Cox and Marshall, 2007). It is important to know if digital interactions could affect student attitudes towards digital learning and if in turn, this could affect the learning methodology, progression, and motivation. Over the last decade, discussions concerning students as "consumers" are gaining increasing attention as the consumption of education is connected to strategic choice-making that will impact their future careers. This strategic decision-making is observed not only at university and at higher education levels, but also at the school level as both parents and students nowadays want more information about the teaching and learning strategies of the school. Therefore, the strategic and commercial side of the education sector is, placing more emphasis on understanding the needs of students as consumers of education. Consequently, there is a focused approach to provide such education and learning tools that will enable schools to offer better opportunities for higher education leading to more promising employment opportunities. Since the modern world is so dependent on technology, it is but evident that the use of ICT in school level education is imperative. Cox and Marshall (2007) further point out, that in the use of ICT, what students learn depends largely on the type of resource used, and the subject for which it is being used. Therefore, it is critical that for any research on ICT and learning, the actual types and uses

https://doi.org/10.15626/hn.20204511

of ICT should be measured as accurately as possible to determine the attitude of its users and their related experiences with it. As the use of integrated and digital technology is constantly increasing in contemporary schooling, it is of academic interest to know the extent of digital penetration in schools, the awareness among students and teachers, and related expectations of the use of digital technology in learning and teaching. It is important to have an in-depth insight into questions such as; to what extent are schools equipped with digital tools and ICT? What ICT related programs and technical devices are available in schools? What influence does the ICT infrastructure have on students' choices and attitudes?

An important area of learning at the school level is languages (native and foreign) and this is being increasingly supported by digital tools and ICT platforms. Even though there are studies on the use of digital tools and their effects on language learning, there is still a lack of studies on what kind of digital learning tools are used and how these influence attitudes towards digital learning among school-students (Tafazoli et al. 2018). Another conclusion was, that learners' positive attitudes will encourage them to use technology more frequently (cf. Liaw 2002, Na 2007). However, the cross-cultural dimension in studies of learners' attitudes still needs more investigation (Tafazoli et al. 2018). Abidin, Pour-Mohammadi, and Alzwari (2012) studied the behavioral, cognitive, and attitudinal aspects of school students in Libya towards language learning and concluded that most students exhibited a negative attitude towards English and recommended that the use of varied tools could be a probable solution towards a positive outcome.

This study examines the use of and attitudes towards digital tools in an English language learning context among students in German and Swedish high schools. Further, we look into the official policies concerning digitalization in schools in both countries. Sweden and Germany are close neighbors and share many connections historically. Today these countries are important business partners and share common agendas and interests under the umbrella of the European Union. In both countries, there is a new national strategy (2017–19) with proposals for actions to better exploit the potential of ICT in schools. These proposals aim at supporting all students and teachers to develop the digital skills they need to improve results and to prepare students for an increasingly digitalized society. Nevertheless, the situation concerning digitalization differs between the two countries. For example, in Sweden, almost every student receives a laptop from his or her school and this started more than 10 years ago (Åkerfeldt et al., 2013). In March 2017, the Swedish Government (*Regeringskansliet*) decided that as a result of the rapid technological development in our society, changes to the current curriculum are necessary to ensure and enhance the digital competence amongst Swedish students and the professional competence of the teachers as well (*Regeringskansliet*, 2017). In 2016, the German Minister of Education and Research planned to invest "5 billion euros over the next five years to

equip more than 40,000 schools and colleges with faster internet, wireless access points and tablet computers" (Reuters, 2016). As the federal parliaments are not allowed to receive money from the government for school financing, the digitalization of German schools was challenged by the absence of a uniform policy across the country. The law was finally changed and each state was granted funds for digitalization to impact the quality of digital technology in German schools. The project "DigitalPakt Schule" was implemented in May 2019 (Bundesministerium für Bildung und Forschung[1], 2019). At the same time, there is an ongoing discussion in Germany whether every student needs a laptop.

The earlier conducted pilot study on this subject investigated the difference in the treatment of and attitudes to digital tools among Swedish and German teachers and students (12-year-olds) in grade 6 in Sweden and Germany, including the evaluation of an English language learning game (Billore and Rosén, 2017). Results showed that the extent of, and attitudes to digitalization in education differed between the two countries and that Sweden is much ahead in the use of digital devices and digital learning tools in education. The equipment regarding technology and digital learning tools in Swedish schools is much better than in Germany, and Swedish teachers use a variety of tools such as learning platforms, interactive whiteboards, and iPads. On the other hand, many German private schools have the equipment, but most municipal schools have not received this support (Ministerium für Bildung, Wissenschaft und Kultur, 2019). This follow-up study investigates the presence of digital tools in the language classroom and analyzes the use of and attitudes towards ICT among high school students. Further, we compare the official policies and their consequences concerning digitalization in such schools Sweden and Germany. As English is the first compulsory foreign language in both countries, the focus is on the use of digital tools for learning English. The number of informants in both countries is increased and the questionnaires are adapted to include newer perspectives. The results and analyses in this article are based on an empirical study conducted at five schools in Germany and four in Sweden from 2017 to 2019. Smaller groups of English teachers (with 3–4 informants) were interviewed and every English teacher was required to fill in an electronic questionnaire. Student perspectives were collected from 16-year-old students in three different schools in Germany in the region of Schleswig-Holstein and two different schools in Mecklenburg-Vorpommern through questionnaires as we wanted to compare two different *Bundesländer* (states) (see chapter 2 for more background information). The results from Germany will be compared to the results from the corresponding survey in four different schools in the southern part of Sweden). This paper focuses mainly on the result of the questionnaire answered by the 16-year-old students in Sweden and Germany.

1 Hence (Bmbf)

Aim and research questions

This study aims to investigate and compare the attitudes towards ICT and the use of digital learning tools in the English language classroom among 16-year-olds in the southern part of Sweden and in two different states Germany. When treating students as consumers of language education and consumers of digital technology in schools it is important to explore the following aspects:

a. To what extent are digital tools used in school and at home?
b. What are the attitudes toward using digital tools in school?
c. What equipment and what digital learning tools are used when learning English?
d. What differences can be found between Sweden and Germany concerning the use of digital tools in the language classroom and official policies concerning digitalization?

Results from the study will provide a cross-cultural comparative insight into digitalization policies and the use of ICT in schools with the possibility of opening up new avenues for future research in the area. This is important in a context where students as consumers of education are dependent on schools as an agency to provide them with the right skills and knowledge for a better future.

The paper begins with a background on digitalization in Swedish and German schools. Next, the contextual and theoretical backgrounds for this study are discussed. Following this, the research approach is discussed and data from Sweden and Germany are represented. The final part of the paper presents a discussion, conclusions, and future research directions.

Contextual background

This chapter presents the policies regarding digitalization in Sweden and Germany and the use of digital tools in schools. It also compares the Swedish and German school system and the situation regarding English as the first foreign language in both countries.

Digitalization in Swedish schools

The school system in Sweden: The Swedish National Agency for Education has the task to ensure that all children and students have access to the same high-quality standard of education and activities. Dramatic changes to the education system came during the 1990s. Control shifted from the central government to the municipalities and private schools (*friskolor)* received public funding in return for following the national education policy. In 1992, the free choice of school (*fria skolvalet*) was introduced, allowing parents to freely choose the school their child attended and designing a funding model based on the number of students enrolled (see Edwards, 2018). The Swedish

compulsory school consists of four stages: pre-school year (*förskoleklass*), years 1–3 (*lågstadiet*), years 4–6 (*mellanstadiet*), and years 7–9 (*högstadiet*). Every municipality in Sweden is required by law to offer upper secondary education to all students who have completed the compulsory secondary school. After grade nine (age 15/16), children can opt to continue into the 3-year upper secondary school/high school (*gymnasiet*) program. There are eighteen regular national programs of three years to choose from, six of which are preparatory for higher education such as the university.

ICT in Swedish schools: Already in 1984, the first investment in ICT was carried out in Swedish schools. The next major change was the implementation of laptops and tablets being available not only to teachers but also to all students, which began about ten to fifteen years ago. In 2011, 97% of all Swedish 15-year-olds had access to a computer at home while in 2018 almost 100% of all Swedes aged 16–24 had access to a computer at home (SCB, 2019). In Sweden, every school has access to the internet and in most schools, students get a laptop or an iPad either from the age of 7 or from the age of 12. This differs between the different municipalities in Sweden, depending on how much money they have. In high school though, every student gets a laptop. This is often referred to as having a 1:1 computer system, meaning that every student should have his or her laptop. In Sweden, all schools are free, (also the private ones) with finances from the state, and students are free to choose which school to attend. When laptop-based education was implemented schools started competing and 'selling themselves' to attract more students by offering 'better computers' or iPads on their homepage, for example, some private schools offered students a Mac computer if they chose their school. As there are still differences between Swedish schools concerning the number of laptops/iPads available to students, the Swedish government took a new decision in 2017 (Regeringskansliet, 2017), meaning that every student would get their digital device. In 2019, a decision was also taken to revise the curriculum for pre-schools and since July 2019, it is compulsory to use iPads for all children from the age of one as part of the national digitalization strategy for the school system. The Swedish National Agency for Education (*Skolverket*) describes four aspects of digital competence and digital tools in pre-school (Skolverket 2019, *Digital kompetens och digitala verktyg i förskolan*) (our translation). These are:

- To understand the impact of digitalization on society
- To be able to use and understand digital tools and media
- To have a critical and responsible approach
- To be able to solve problems and put ideas into action

Many researchers are critical to starting this early and there is also a lack of research on small children and digital technology. Even so, Swedish children

are already among the most connected in the world. 26% of infants up to 12 months and 37% of the one-year-olds use the internet, while by the age of four, this reaches almost 96%. Over time, internet use has increasingly younger consumers and 79% of the 2-year-olds use the internet now. 75% of the 2-year-olds use the internet via a tablet. In the age groups from 7 years and up, over 90% of the children use the internet, according to a compilation study of 597 children's internet usage (*The Swedes and the Internet* from Internetstiftelsen (2018:61). In a timeline study since 2005, Statens medieråd[2] (2019) in a sample of 2000 children aged 9–12 and 2999 aged 13–18, reported high usage of internet-based tools by school students to do homework, play games, use social media, etc. Among the 13–16-year-olds, 68% used their digital devices for playing games. When asked how often they used the internet in their spare time, 96% said: "every day" (ibid.: 45). A change compared to earlier studies is that, with the increasing use of digital tools, Swedish young people have become more critical. Among the 13–16-year-olds, 38% said that they use social media too much (ibid.: 74) and 33% said that their use of digital media had a negative influence on their sleep (ibid.: 67).

No doubt, the use of digital tools in Sweden is intense. But even if Sweden is far ahead of Germany in the private use of computers and the use of computers in education, teachers' lack of training in using digital media has been reported in Sweden (cf. Gagnestam, 2010; Fredholm, 2016). The article *Världsbäst på att dela ut datorer – sämst på att använda dem* (Best in the world at handing out computers – worst at using them) (Jelmini and Brandel, 2014) highlights the fact that Swedish schools are very good at handing out computers to their students, but insufficient in implementing them as educational tools. The OECD report from 2015 on Students, Computers, and Learning shows the ICT equipment and its use in school in the first 38 OECD countries concerning the number of students per school computer. Sweden is listed in the upper half of this list and Germany in the lower half (OECD, 2015: 20).

The presence of English in Sweden: English has been taught as a foreign language in Swedish schools since 1946 and in 1969 it became a compulsory subject from grade three (Malmberg, 2000). Today English is introduced in primary school between the first and fourth grades. This early introduction of English reveals that English has a stronger position in the Swedish education system compared to other foreign languages (Lainio, 2001; Skolverket 2011). The English language has gained an ever-increasing role and has sometimes begun replacing Swedish in some fields, especially in higher education. In Sweden English is even considered a 'second' and not a foreign language.

2 The Swedish Media Council is a government agency whose primary task is to promote the empowering of minors as conscious media users and to protect them from harmful media influences.

Digitalization in German schools

The school system in Germany: In Germany, there are 16 partly sovereign federal states, *Bundesländer*. The reunification in 1990 meant that the states of Mecklenburg-Vorpommern, Brandenburg, Berlin, Sachsen, Sachsen-Anhalt, and Thüringen, the area of the German Democratic Republic (East Germany) became part of the Federal Republic. Schools in Germany are not centrally organized but are the responsibility of the regional ministries of education and culture in the 16 *Bundesländer.* This means that school systems across the country are not quite alike. Publicly run schools are free-of-charge in Germany and financed by taxes. Only about nine percent of pupils are taught at private schools that charge fees. In Germany, school is compulsory for nine or ten years. From grade one to four, children attend elementary school (*Grundschule*), where the subjects taught are the same for all. After the 4th grade, they are separated according to their academic ability and the wishes of their families and choose one of three kinds of schools: *Hauptschule*, *Realschule,* or *Gymnasium*. The *Hauptschule* prepares pupils for vocational education and finishes with the final examination *Hauptschulabschluss* after grade nine. In many states, the *Hauptschule* has been abolished as an independent school form. *Realschule* (grades 5-10 in most states) leads to part-time vocational schools and higher vocational schools. Students with high academic achievement at the Realschule can switch to a *Gymnasium*. The *Gymnasium* leads to a diploma called the *Abitur* and prepares students for university studies. Curricula differ from school to school. The *Gesamtschule*, or comprehensive school, is only found in some of the states, usually governed by the SPD (Social Democratic Party). Beginning in the late 1960s, the *Gesamtschule* was introduced as an alternative to the traditional three-tiered secondary education system. The aim was to reform the system by creating a more inclusive kind of secondary school, more like the Swedish one.

In each state, it is a matter of funding, and how the school is sponsored by the state largely influences the quality of digital technology in schools. Each school has to apply for funding for digitalization. German students do not get a computer from their school and there is an ongoing discussion about whether every student needs a laptop. Thus, the digitalization plans and resulting infrastructure is largely the effort of the schools' initiative and their ambition to integrate digital technology into the learning process. The system is challenged by the absence of a uniform policy across the country such as financial resources, human capital, and relevant teacher training.

ICT in German schools: To discover possible differences between different German states, we decided to conduct our research in the two neighbouring states Mecklenburg-Vorpommern and Schleswig-Holstein (see research approach).

In Schleswig-Holstein, the ICT equipment of the schools is improving slowly as seen from the latest figures on Internet connections and permanently

installed WLAN. The proportion of fast Internet connections increased from 29.7% (2016) to 51.3% (2018) and Wi-Fi is provided to 77% of the schools. Almost half of all devices are used in computer rooms, but there is a trend towards mobile terminal equipment, as the proportion of tablets is growing (Ministerium für Bildung, Wissenschaft und Kultur, 2019). In one of the schools we visited, there was a so-called BOYD class (Bring Your Device), which means that the students bring their own laptop/tablet. In 2018, such classes existed in 68% of the schools in Schleswig-Holstein (ibid.). This concept is not allowed in Sweden, as every student according to Swedish law must have the same possibilities and access to learning tools in school. It may not be dependent on parents' economic resources.

The state government in Mecklenburg-Vorpommern has developed a plan "Digitale Kompetenzen" (digital competencies) for implementing digitalization in school. This plan not only addresses the opportunities of digitalization but also addresses the risks. During 2019–2020, the state government wants to introduce the subject "computer science and media education" at all secondary schools. During 2019, twenty-one so-called model schools are on the timetable. For grade 7 there will be a new topic, "Developing Games and Presenting Multimedia" (Medienkompetenz in Mecklenburg-Vorpommern 2018).

In Germany ifo Bildungsbarometer[3] (2017) focused on digitalization in one part of the study. The study, *Fürchten sich die Deutschen vor der Digitalisierung?* (Are the Germans afraid of digitalization) was conducted by Wößmann et al. (2017) (cf. Internetstiftelsen (2018) above). 4078 persons took part in this opinion poll and results showed that the majority (65 %) of the Germans think that schools should use digital communication channels to inform parents and students about tests and exam results. (This has been the case in Sweden for several years). Further, the use of digital tools should be taught in elementary school. In contrast, the Germans are more critical of using smartphones in school and teaching digital skills in kindergarten (ibid. 2017: 17). Again, the comparison with Sweden is interesting, where the use of digital tools will be compulsory also in kindergarten from the first of July 2019 (Regeringen, 2017). Another interesting comparison is with Estonia, where children start programming in the first grade (Wößmann et al., 2017: 22). Overall, 44% of the respondents in the study agreed with the statement that digitalization will lead to greater inequality in the German education system. When asked, how much lesson time secondary school students should spend on working with teaching material on a computer, 25% of the respondents answered that at least half the lesson time should be used for this. 63% answered at least 30%. Only 4% thought that no lesson time should be used for independent work on the computer. An overwhelming majority of the German population (80%) is in favor of the federal government equipping

3 The ifo Bildungsbarometer is an annual, representative opinion poll among the German adult population on educational issues, conducted since 2014.

all schools with broadband and internet access, WLAN, and computers. Only 14% are against (ibid. 2017: 21). When asked if the federal government should equip each student in secondary schools with a laptop or computer, 67% said yes, and 25% objected to this. At the university level in Germany, the situation looks different, and here digital tools are used more intensely. The German Minister of Culture, interviewed in the German newspaper Stuttgarter Zeitung, says, that "technology must follow pedagogy and not vice versa[4]. […] Replacing a book with a laptop or a tablet is no pedagogy. We still need scientific insights" (our translation) (Czimmer-Gauss, 2017). The DigitalPakt Schule follows the principle "No equipment without a concept". It is also emphasized that the federal states are to provide all teachers with appropriate further education (Bmbf, 2019). This discussion is missing in Sweden (see also Brandel and Jelmini, 2014 above).

The presence of English in Germany: In Germany English was introduced as a compulsory subject in 1964/65 in the *Haupt-* and *Realschulen*, in 2004 also in all elementary schools in 15 states. There are differences between the states: In Bayern, Mecklenburg-Vorpommern und Schleswig-Holstein, for example, English is taught from grade three, in Nordrhein-Westfalen und Baden-Württemberg from the first grade (Merkur 2019). German students' exposure to English outside school is more limited than in Sweden. One reason is that all films in Germany are dubbed, which means that Germans seldom hear spoken English.

Theoretical background

In this chapter, we present earlier studies on the use of digital learning tools and students as consumers in education.

Digital learning tools in education

Haelermans (2017) discusses ICT in education and how it is possible to bridge the gap between research and practice. Most schools and teachers make their decision based on their intuition or based on what others are using.

> Simply having access to ICT in education will not necessarily lead to its effective use, and might even lead to negative results if ICT is merely a distraction and not applied in an effective way (ibid.: 17).

In a further comparison between the Dutch and Swedish educational systems it was seen that the Netherlands and Sweden are similar in international comparative research reports on computer and internet use, both at school and home (cf. OECD, 2015 and 2.2 above). In both countries, virtually all students had a computer at home in 2012, but in Sweden, almost 75% of the students had three or more computers at home, compared to 69% of the Dutch students (ibid.: 61); but the share of students using a computer in school was higher

4 „Technik folgt Pädagogik, nicht umgekehrt" (Original quote).

for the Netherlands (94%) than for Sweden (87%). Both the Netherlands and Sweden were disappointed by the results in the PISA report 2012, as their ranking had decreased since 2009, but it could not be attributable to the differences in the ICT use in education between countries. The study concludes that much of the potential effectiveness depends on teachers' and students' efficiency in using ICT tools. Students need the motivation to practice, and for this, actors as teachers or parents are needed. Haelermans (ibid.: 14) further refers to an interesting study by Bando et al. (2016) that studied the effect of replacing traditional textbooks with laptops (digital textbook provision) in schools with altogether 9600 students in high-poverty communities in Honduras in 2013. The study found no effects of substituting textbooks with laptops but argued that the policy might be cost-effective since textbooks are expensive. Barera-Osorio and Linden (2009) conducted a randomized experiment among 97 schools and more than 500 students in Colombia where the private sector had donated computers to public schools for teaching language. They concluded that computers were not effectively incorporated into the educational process. A study by Wesley and Plummer (2017) focused on computer-assisted language learning (CALL) in schools. Teacher interviews, classroom observations, class documents, and websites suggested that the teachers rarely altered their pedagogy or their curriculum to integrate technology. Tafazoli et al. (2018) compared Iranian and non-Iranian English language students' attitudes towards CALL and found no differences in attitudes for variables such as ethnicity, gender, age, and education**.** A study conducted by Lärarnas Riksförbund (2016), the Swedish National Union of Teachers, with a sample of 691 teachers confirms the importance of useful, relevant digital learning tools. As many as 52% of the teachers answered that they produce their digital learning tools because the ones in their subjects were either of low quality or not available (ibid.: 9–11).

Students as consumers of digital education

Over the last decade, there have been different discussions concerning students as 'consumers'. Schwartzman (2017) advocated how research as early as 1973 showed that students wanted educational institutions "to be more responsive to their perceived needs and to improve the quality of instruction*"* (ibid: 336). Students today make careful decisions about which school to attend, what subject to study, etc. Most studies concerning students as consumers focus on higher education (cf. Tomlinson 2017). School graduates desire access to all support that will enable their entry to competitive university education in a smooth manner. This increased engagement of students towards a conscious decision process regarding schools, learning content, and access to competitive skill development has led to increased concerns among educational service providers to offer the best possible educational resources. Schools are also becoming increasingly reactive to the enhanced use of digital technology in society which is why

more and more schools are bringing in digital tools as a regular feature of learning.

As far as educational methods are concerned, there is an increasing movement of students towards the consumption of digital tools (Beach, 2012). Examining the attitudes of young consumers towards digital tools for language learning and their subsequent perceptions regarding impact on their language use and proficiency in therefore important. Here the term attitude is defined as per Montano and Kasprzyk (2008: 71):

> Attitude is determined by the individual's beliefs about outcomes or attributes of performing the behavior (behavioral beliefs), weighted by evaluations of those outcomes or attributes. Thus, a person who holds strong beliefs that positively valued outcomes will result from performing the behavior will have a positive attitude toward the behavior. Conversely, a person who holds strong beliefs that negatively valued outcomes will result from the behavior will have a negative attitude.

Yolageldili & Arikan (2011) emphasize that language learning is a constant effort for young learners. When it comes to digitalization in language learning, Jensen (2017) found that consumers of digital technology engage in different tools for language learning depending on their motivation for engagement. However, users are sometimes unaware of the potential benefits different tools could have in the growth of language learning and communication. Gee and Hayes (2011) highlighted the increasing importance of digital technology in school education especially in developed countries. Arthur, Sherman, Appel, and Moore (2006) found some key factors that explained why young consumers were interested in the consumption of digital interactive tools. Accordingly, they valued factors such as immediacy and constant entertainment, socially interactive environments, knowledge discovery, ability to create and record content and the opportunities to express their identity. In the current digital era, it is necessary to provide students with meaningful tools that serve the function of teaching. At the same time, it is also critical to integrate elements of fun and surprise through an optimal consumption of digital technology. In a classical study McCallum(1980), proposed specific benefits of integrating technology in gaming for young language learners such as increased participation, custom-built levels of expertise depending on the user's proficiency, immediate review and feedback, and the possibility to redo activities for practice and language proficiency.

In a project financed by the Swedish Knowledge Foundation (KK-Stiftelsen), interviews were conducted with lecturers and language learners at universities in Sweden (Gagnestam, 2010) to find out how they worked with digital tools in language learning. The study revealed that teachers were more positive than the students were even though all of them were computer-literate. The Swedish teachers further reported that, in spite of good access to

a digital environment, the lack of time for using the digital tools in language teaching and lack of training in the use of digital learning tools were main obstacles for digital learning implementation. On the other hand, students emphasized that the teacher was very important in language teaching and that computers were only regarded as a supplementary learning aid (Gagnestam, 2010: 46). This observation is also supported by Blomgren (2016), who concluded that student motivation is encouraged by varied teaching methods, a clear task structure, the practice of formative assessment, and a social environment characterized by cooperation and good relations with peers and teachers. Conversely, student motivation is restrained by a low variety of teaching strategies, teachers' lack of competence, and deficiency in agreements regarding the distribution of assignments and the use of digital resources (Blomgren, 2016: 5). In the same study students assessed that better quality of existing processes and routines makes it easier for them to access and submit exercises in a multimodal manner (Blomgren, 2016: 247).

Methodology and data

Research framework

Our complete research framework is presented in Figure 1 below. The collection of data has been conducted through group interviews with teachers and questionnaires answered by teachers and students in Sweden and Germany. A future step will be interviews with entrepreneurs in digital tools.

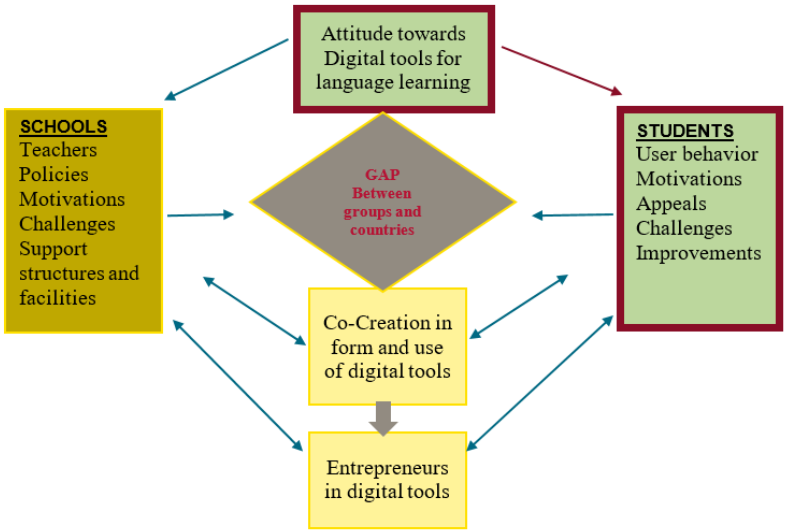


Figure 1: A holistic framework for the study.

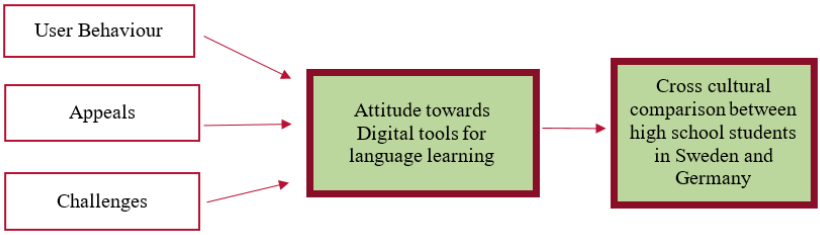


Figure 2: Research framework to investigate the attitudes of students for digital tools in language learning.

In this article, we will present the results from the questionnaire answered by the 16-year-old students, and therefore, this article is based on the relationship between students and attitudes (boxes framed in red). The method is mainly quantitative, with descriptive statistics, but also qualitative, as the answers to the open questions will be analyzed and compared in a contrastive and cross-cultural aspect.

Research approach

In this study, two different questionnaires were sent to teachers and students in Germany and Sweden. Teachers in a total of nine schools (four in Sweden, five in Germany) were contacted to distribute the electronic questionnaires. Participation was mandatory and confidential and ethical regulations were observed.

Data collection in Sweden: In Sweden, the Swedish government is responsible for digitalization in school education as part of the national digitalization strategy (Regeringskansliet, 2017). This ensures a uniform policy implementation across the country. The data for Sweden for this study was therefore based on convenience sampling. We contacted teachers in four compulsory secondary schools in the southern part of the country during 2017–2018 through email. They were informed about the research, GDPR[5] , and permission was obtained from each headmaster to conduct our study.

Data collection in Germany: In Germany, the system was more complex than in Sweden. First, we had to apply for permission from the educational authorities in each state (*Bundesland*), the German Institute responsible for quality in schools (*Institut für Qualitätsentwicklung an Schulen*). This institute checked all the questions in the survey and the data collection methodology. Next, permission was acquired from the state institute for data privacy control (*Unabhängiges Landeszentrum für Datenschutz*) who checked the electronic questionnaires for teachers and students. Data collection started in Schleswig-Holstein (S-V) during 2017–2018 and in Mecklenburg-Vorpommern (M-V) during 2018–2019. In M-V, the

5 General Data Protection Regulation.

educational authorities[6] required that we submit the complete questionnaires, a data protection declaration, information to the parents, a letter to the students, a project description, and a list of the schools we planned to visit. We were also informed that our research could not be conducted during school time. Having completed all formalities, the final approval from the authorities for conducting the research was obtained in December 2018.

In Germany, we visited three *Gymnasien* (high-schools) in Schleswig-Holstein in the autumn of 2017 and two *Gesamtschulen* (schools) in the Mecklenburg-Vorpommern region during winter 2018 (see 2.3). The reason for collecting data in two states in Germany was that the responsibility for the education system in Germany lies primarily with the states (*Bundesländer*), while the federal government plays a minor role. We, therefore, wanted to find out, if digitalization in schools differs between different states.

Questionnaire design and responses

A questionnaire with open- and closed-item questions was constructed in English based on earlier national and international studies (e.g. Teo, 2008). As Google docs are forbidden in German schools the questionnaire was created in an electronic platform called Survey & Report as this platform is accepted in both Germany and Sweden (as regards GDPR). The survey link was first sent to the teachers who then further distributed it to their respective students. Before the distribution of the survey, the questionnaire was pre-tested on the teachers to ensure that all questions were understandable by the students at the school. The period of data collection was from November 2017 until February 2019. The questionnaire was divided into 4 main clusters:

1. Demographics
2. User behavior
3. Appeal factors
4. Challenging factors

A look into the country-based tablet sales in Sweden and Germany showed that the Apple iPad was the most popular brand[7]. For this reason, the term iPad was used in the questionnaire more as a generic term for tablets. Also, the questionnaire did not include mobile phones since most European countries ban the use of mobile phones in schools for various reasons (thelocal.se, 2018). Two-thirds of young people in Germany are forbidden to use mobile phones during school lessons (netzwerk-digitale-bildung.de, 2017). Altogether 181 German students and 185 Swedish students participated in the study, as shown below:

6 Ministerium für Bildung, Wissenschaft und Kultur M-V.
7 https://www.scientiamobile.com

Germany:

a. 155 answers from German students - three high schools in Schleswig-Holstein
b. 26 answers from students in one high school (*Gesamtschule*) (out of two) in Mecklenburg-Vorpommern

Sweden:

185 answers from Swedish students - four compulsory schools (grade nine) in the the southern part of Sweden.

As the school systems differ, data was collected from students of the same age (16-year-olds), having approximately the same amount of English teaching (see 2.3). In almost all European countries, students learn their first foreign language at the age of eight or nine. In Sweden, students start learning English in the third grade from the age of 8 or 9 years. In Germany, the age at which students start with English depends on the state in which they live. As a rule, they start in the third grade at the age of eight, but in a few states, they begin in the first grade (Merkur, 2019).

Problems and limitations

We only received 26 answers from students in M-V. Even though the response rate was so low, it was decided to incorporate them in the study, to highlight problems and possible existing differences between different states in Germany. We contacted five schools in M-V, but three did not want to take part in the study. When visiting the remaining two schools, it was seen that school one (600 students) had one computer room and no Wi-Fi while school two (780 students) had three computer rooms but only 16 computers in each room. This low level of digital equipment is assumed to explain the low response rate from these schools. When asked if students could fill in the questionnaire at home the teachers explained that the majority of the students in this area did not have any digital devices or Wi-Fi at home. After having reminded the schools three times to answer our questionnaire we got 26 answers from school one and none from school two with a remark that "the link does not work". This response was also questionable for the authors as the same link worked in other schools. It was also checked by the university IT department and certified as functional.

As Germany consists of 16 different states, it is also important to say that we might have received different results, had we conducted our research in some of the other 14 states. Still, we have been able to show differences between the German *Bundesländer* and between the two countries concerning digitalization in school.

Results and Data analysis

The following section presents the empirical results of the study in 4 sections - Demographic details, User behavior, Appeal factors, and Challenges and improvements. The data from M-V will be presented separately, followed by comments on and a comparison to the answers from the other response groups.

Demographic details

Table 1: Demographic details

Respondents	**Swedish students**	**German students S-H**	**German students M-V**
Female	82	85	15
Male	102	66	11
Diverse	1	4	0
Total	185	155	26

User behavior

The user behavior of the respondents was mapped for the following aspects:

a. Usage of computer/iPad
b. Usage of computer/iPad at home per week
c. Usage of computer/iPad in school per week
d. Purpose of using the computer at home
e. Usage of computer/iPad for language learning
f. Programs used for English language learning in school.

The descriptive statistics for the above aspects are presented in the tables and figures below**.**

a. Usage of computer/iPad

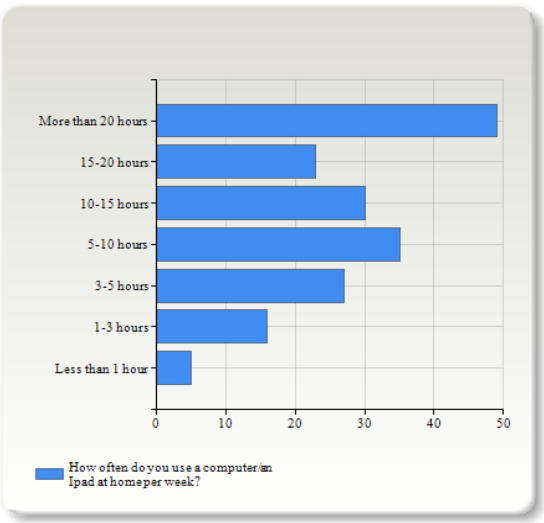
Table 2.

Question		Swedish students	German students S-H	German students M-V
Are you used to working with computers?	Yes	92.4% (171)	94.8% (147)	80.8% (21)
	No	7.6% (40)	5.2% (8)	19.2% (5)
Do you have a computer at home?	Yes	93% (172)	96.8% (150)	92.3% (24)
	No	7% (13)	3.2% (5)	7.7% (2)
Do you have an iPad at home?	Yes	69.2% (128)	60.6% (94)	65.4% (17)
	No	30.8% (57)	39.4% (61)	34.6% (9)

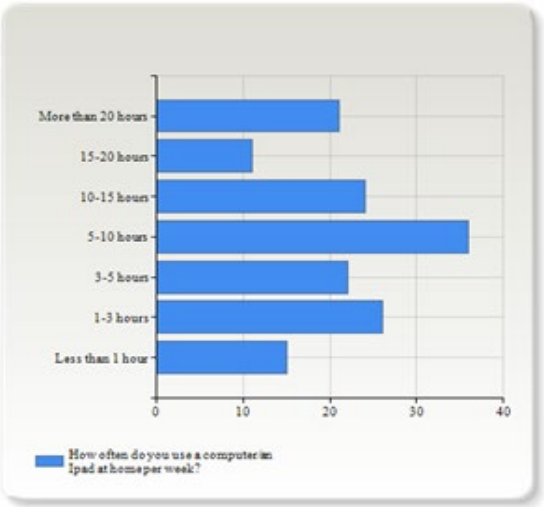
Contrary to what we had expected, we did not find any striking differences concerning the presence of computers or iPads among the students. Only in M-V, fewer students were used to working with computers.

b. Usage of computer/iPad at home per week

Swedish students



German students S-H



German students M-V

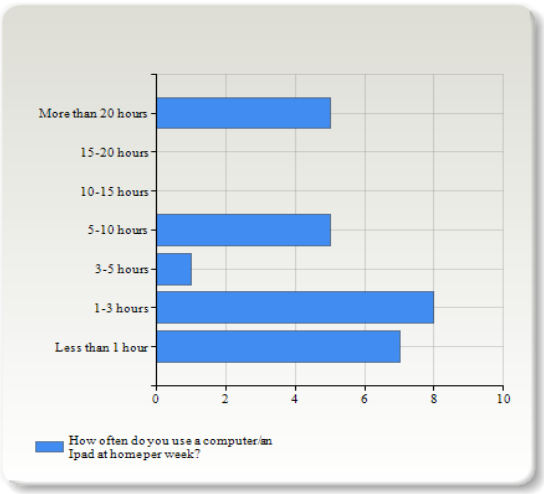
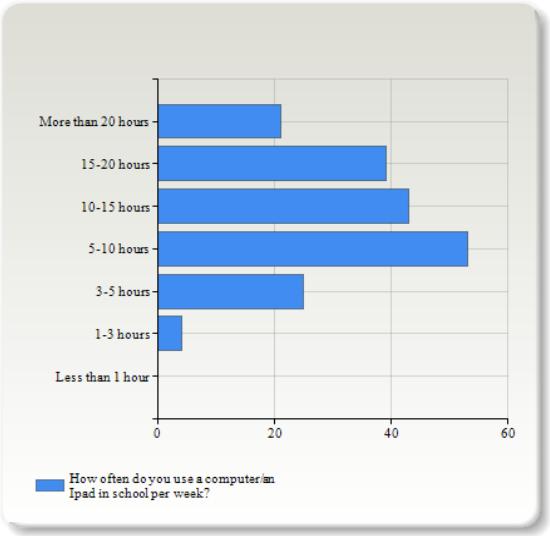


Figure 3: How often do you use a computer/an iPad at home per week?

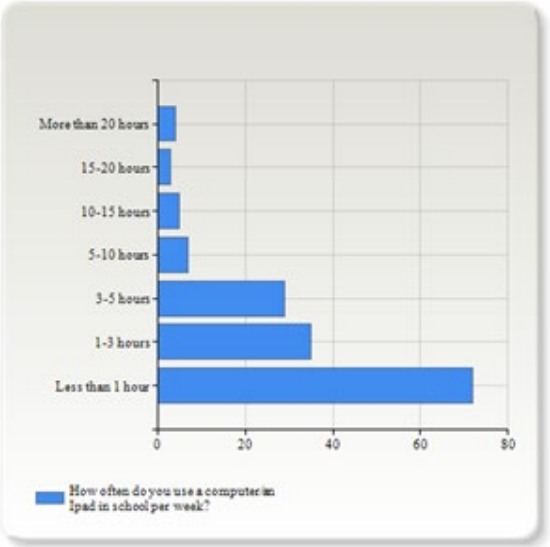
The bar charts show an evident difference in how much Swedish and German students use a computer/an iPad at home per week. 55% (102/185) of the Swedish students use this device for more than ten hours a week, 26.5% (49/185) more than twenty hours a week.
Of the German students in S-H, 36% (56/155) use a computer/an iPad at home more than 10 and only 13.5% more than twenty hours per week. In M-V, 80.8% (21/26) of the students use a computer/an iPad at home a maximum of 10 hours per week.

c. Usage of computer/iPad in school per week

Swedish students



German students S-H



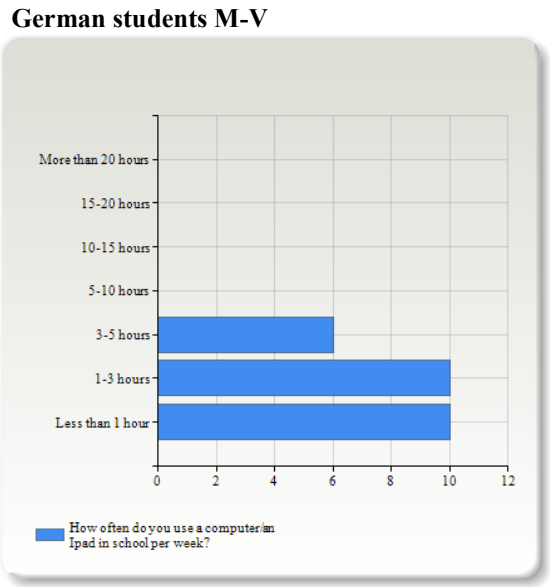


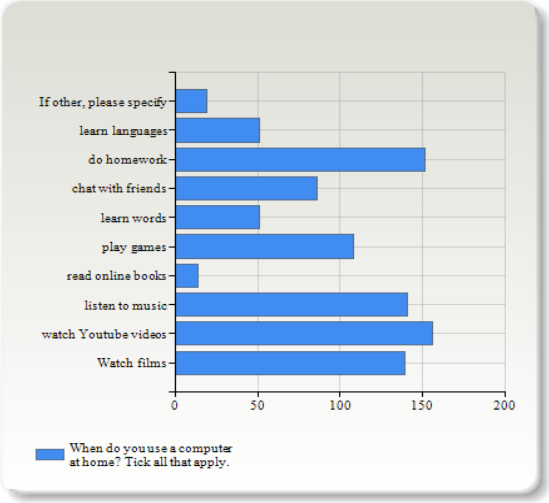
Figure 4: How often do you use a computer/an iPad in school per week?

Concerning the time spent using digital devices in school, the difference is even more striking. (cf. Internetstiftelsen 2018, Ministerium für Bildung, Wissenschaft und Kultur 2019). The use of computers in Swedish schools is much more frequent than in schools in Germany. Sweden started the so-called 1:1 computer system already ten to fifteen years ago and this has only just started in German schools (cf. Bmbf, 2019). The results from the questionnaire presented in the chart bar above clearly reflect this. 56% (103/185) of the Swedish students use a computer/an iPad more than ten hours a week, compared to only 8% (12/155) of the German S-H students, and none of the students in M-V.

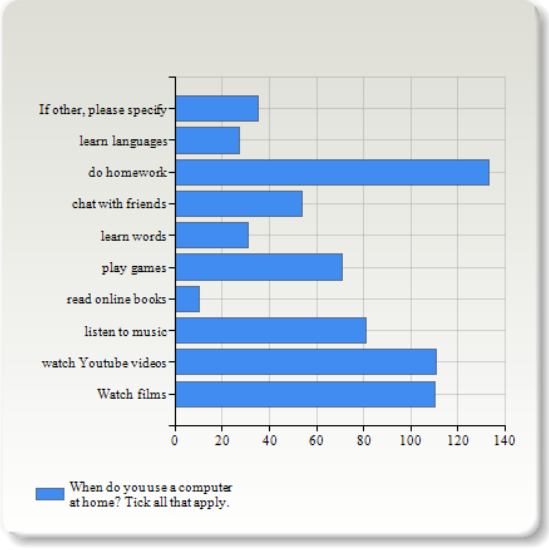
d. Purpose of using the computer at home

More Swedish than German students used their computers for watching videos, listening to music, and chatting with friends. 82% (151/185) of the Swedes and about 85% of the Germans students used a computer for doing their homework. While 28% (51/185) of the Swedes were seen to use a computer for learning languages, 17% of the S-H Germans and 38.5% in M-V (10/26) used a digital device for learning a language. The difference between the German groups is explained by the fact that the English teacher in M-V did her best to find free programs for her students (interview 5.12.2018). Among "other answers" the Swedish students chose "Skype, shopping, programming" while the German students opted for "research, presentations, emails, and language learning apps" (M-V).

Swedish students



German students S-H



German students M-V

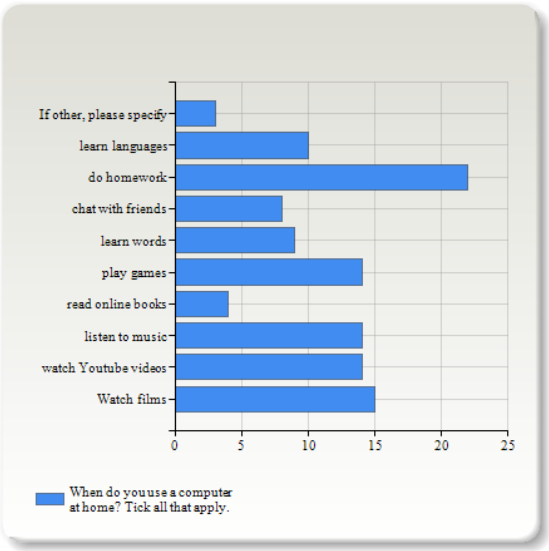


Figure 5: When do you use a computer at home?

e. Usage of computer/iPad for language learning

Table 3.

Question		**Swedish students**	**German students S-H**	**German students M-V**
Are you used to working with a computer for language learning?	Yes	82.2 % (152)	44.5 % (69)	61.5% (16)
	No	17.8 % (33)	55.5 % (86)	38.5% (10)

The results show a clear difference when you compare the use of digital tools among Swedish and German students. Twice as many of the Swedish students (82.2 %) are used to working with digital devices for learning a language compared to the German S-H students (44.5 %). This confirms the results in earlier studies concerning digitalization in school (cf. OECD, 2015; Ministerium für Bildung, Wissenschaft und Kultur, 2019; SCB, 2019). Once

again, the students in M-V are seen to use digital tools more than the S-H students.

f. Programs used for English language learning in school

This question was answered by 95% (175/185) of the Swedish, by 81% (125/155) of the German S-H students, and 96% (25/26) of the students in M-V. Once again, the answers strongly differ. The Swedish students gave 337, the German S-H students 50, and the M-V students 12 suggestions (total programs mentioned - *no program*).

Table 4: Answers from 175 Swedish students.

Programs used	**Frequency**
Read theory (reading and writing exercises)	84
Digilär	51
Clio	30
Glosboken (Vocabulary training)	35
Kim studies	28
School4you	14
Gleerups	12
iMovie (video editor)	11
Other answers	72
No program	1
Total	**338**

The Swedish students mentioned a variety of programs. Only some of the programs are freely accessible and each school has to pay a license for using the digital learning tools offered by “Read theory”, “Digilär”, “Clio”, “Glosboken” and “Gleerups”. “Kimstudies” is produced by an English teacher and can be used for free. “School4you” is a newly (2015/16) developed digital platform.

Table 5: Answers from 125 German S-H and 25 German M-V students.

Programs used	**Frequency S-H**	**Frequency M-V**
Dict.cc	10	0
Leo.org	8	0
www.english-hilfen.de	0	7
Pons	7	2
Youtube/video	7	1
Other answers	18	2
No program	*89*	*13*
Total	**139**	**25**

It is remarkable, that as many as altogether 102 German students said that they do not use any digital programs at all for learning English. The rest of the students only mentioned *dict.cc*, *leo.org,* and *pons*, which are all electronic dictionaries. Some also mentioned *Google translate* and three mentioned *Iserv* (S-H), which is a server in their school, from which they can download vocabulary lists. None of these "programs" mentioned are actual programs for learning English, except for the freely available programs on *www.english-hilfen.de*. These results show the lack of digital learning tools for learning English in these German schools.

Appeal factors

The purpose of investigating appeal factors was to know how and why students are motivated to use digital tools for learning English. The results are presented below.

> *a. In what situation would you learn more English, by using a book or by working with exercises on your computer?*

The answer to this question showed clear differences between the students' attitudes:

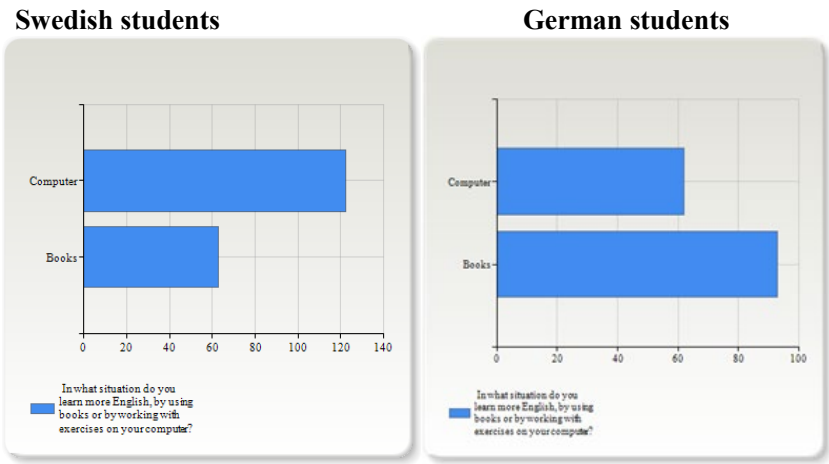


Figure 6: Learning English by books or computers

As seen in the results above 65.9% (122) of the Swedish students think they learn English better by using a computer and only 34.1% (63) by using a book. Among the German students, only 40% (42) think they learn better by using a computer and as many as 60% (93) by using a book. These results can be compared to the opinion poll among the German adult population, conducted by Wößmann et al. (2017). When asked if the federal government should equip each pupil in secondary schools with a laptop or computer, 67% said

yes, and 25% objected (ibid). In Sweden, every student in class seven to nine and high-school already has a computer or an iPad and so this question is non-existent. Digitalization in Sweden started years ago, not only in schools, and this reflects the differences in attitudes towards digitalization between the two countries. This falls in line with the results of Jensen (2017) who found that consumers of digital technology could engage in different tools for language learning depending on their motivation for engagement.

b. Would you like to use a computer more in language learning?

Table 6.

Question		**Swedish students**	**German students**
Would you like to use a computer more in language learning?	Yes	65.9% (122)	54.8% (85)
	No	34.1% (63)	45.2 % (70)

Once again, the actual usage of digital tools in schools seems to influence the choice as more Swedish (65.9 %) than German (54.8 %) students want to use digital tools. This is in line with Blomgren (2016). When asked to motivate their choices 91% (169/185) of the Swedish students and 87% (135/155) of the German students provided interesting insights as presented below. In the few cases, where some students answered in Swedish or German, the translations are provided in English.

Responses from Swedish students

69% (117) of the 169 Swedish students who answered were positive about using a computer /an iPad for language learning. Many students said that "I learn better, it is easier than books, I work better with a computer, it goes faster to learn than if you read in a text."

Other comments concerned quick access and efficiency. The majority of the students also talk about vocabulary learning and say that working on a computer/ an iPad is a good way to learn new words. "I find it much easier to use a computer to learn new languages as you aren't restricted to just one website while in a book you can only read what's in the book and you can also easily translate words you find."

When asked to motivate their choices, some students show a positive attitude and elaborate, "... right now, I'm learning a language on the internet and I think it's a fantastic tool and we should use it more often. It offers an alternate way of learning a language and it is often more interesting than the traditional learning tools that most schools use […]."

"Because I find it easier to learn and I think I learn more by doing words or sentences on an iPad or a computer than in a normal class with a teacher.

But I think that you going to need the basics from the 'physical' class to even get started on training different stuff on the iPad or computer. And maybe if we got a chance to maybe program a personal learning app we could maybe improve even more […]."

On the other hand, some students also exhibited a rather apprehensive attitude towards learning languages through digital tools. Out of the 169 Swedish students, 31% (52) were negative towards using the computer/iPad for learning English and they expressed more interest in the use of books and paper instead. Some of the interesting negative expressions that students provided regarding their attitude toward digital learning are presented below:

"... I think we should use iPads more when we learn a language. But I still think we should write on our own and not digital."; "Because I think that it sticks more if I write it down."; "When I read books, I get more concentrated."

A few comments were also related to technical problems, health problems, and digital distraction:

"There is usually a problem with the internet and it takes time away from the lesson, just to start working (our translation)."; "I have a hard time concentrating on the screen and the light disturbs my eyes."; "I think we learn more if we write as well and not only use computers or iPads and because auto-correct is a thing on digital tools."

Responses from German students

66% (89) of the 135 German respondents were positive about using a computer /iPad more in language learning. Many of the German students focus on the 'fun' associated with using a computer: "You are learning with fun and it gets boring to just listen to the teacher."; "I would like to use the computer more because you have more fun by learning."

Both German and Swedish students feel that they learn words and grammar better on a computer: "You can learn better and see how you use the words or grammar correctly. You don't need worksheets and everyone can work for her/his own."

German students particularly criticized their school system: Our School System Needs to Change! [...] some so many students are not motivated to learn any language. I think it would appear more attractive for students if Computers would be a constant way to teach and learn. "It cost not so much time like writing and I think it's time to get modern in school as well."

35% (47) of the 135 German respondents were negative towards using digital tools for learning English. Some negative answers were: "I am already learning a lot at home so I don't think I must work even more with computers"; "I don't want to use it more because it's not good for your eyes"; "It can lead to sleeping problems."; "I would not use it more, because it is better for my health and brain to learn with books."

c. *What do you like about different language learning tools? Please share at least three things with us.*

Responses from Swedish students
177 of the 185 Swedish students (95%) answered this question and most students have a positive attitude: "You can find different kinds of texts, if you don't like to talk in front of your classmates you have other ways of presenting your work, you can get more information from different pages instead of just one book."; "If we take the Tellagami program as an example, it makes it easier for the people who do not like to speak in front of a big crowd of people by allowing us to record our voices to speak for us during the presentation. School4you let us watch a video instead of us reading a big text and it also asks different questions […] it's simply just a great way of learning."

Responses from German students (Schleswig-Holstein)
152 of the 155 German students (98%) answered this question. 17 said that it is good to learn English by watching films, 12 talk about writing on your computer and 11 mentions vocabulary learning and 9 grammar: "We don't have much learning tools, just tools to write or to translate."; "Writing texts since I find it helpful in learning the correct spelling of a word."

As many as 55 (36%) said that they "don't know", "we don't use programs" or "We don't use any programs to learn languages!"

Responses from German students (Mecklenburg-Vorpommern)
All 26 students in M-V (100%) commented upon this question. 13 said "nothing" or "I don't use learning tools". Most of their comments concerned translation: "Translate words"; "Different kinds of translations"; "Faster translation". Some other comments were "the students can work faster" and "I get new experience".

Challenges and improvements

a. What kind of programs/digital tools would you like to work with on your computer to make your English better?

All 185 Swedish students (100%) answered this question.

Table 7: Answers from 185 Swedish students.

Programs you would like to use	**Frequency**
Watch films	72
Vocabulary learning	34
Grammar exercises	32
Read books	26
Listening exercises	19
I don't know	38

152 of the 155 German students in Schleswig-Holstein answered and 24 from Mecklenburg-Vorpommern.

Table 8: Answers from 152 German students S-H and 24 German students M-V.

Programs you would like to use	**Frequency S-H**	**Frequency M-V**
Watch films	61	11
Vocabulary learning	15	9
Grammar exercises	16	7
Read books	29	6
Listening exercises	20	3
I don't know	32	1

The most frequent answers given are very much the same in both groups. The conclusion that one might draw is, that there seem to be few programs for learning English used in the language classroom. Some answers were "I can´t tell. If I knew any, I would use them."; "I don't know any programs." A majority of the students in all groups talked about the advantages of watching films: "Watching films because you hear the language and so it is easier to understand people, who are talking that language." As all films in Germany are dubbed, you can never listen to spoken English.

b. Are there programs/digital tools that you don't like? Please specify.

Responses from Swedish students
There were 160 answers from the Swedish students. 69 (43%) of these answers were "no", that is they liked all programs they used. Some students said that they disliked certain programs for vocabulary training:
"I do not like glosor.eu very much because I believe it is a very monotonous program and I do not like that"; "I do not like digital tools that do not show if you answered correctly or not after you answered the question."; "I think that most of the learning digital tools are trash- because nothing can replace the learning of a book."

Responses from German students
There were 90 answers from the German students in S-H. 36 (40%) of these liked all programs they used. 19 students, compared to none among the Swedish ones, answered that they don't know any digital programs. There were no suggestions from the students in M-V, as they are not used to working with digital tools.

c. How can these programs be improved?

The Swedish students gave several suggestions for improvement and focused on user-friendliness. Some comments are: "Maybe by making it easier to find stuff so you don't have to click into several links to get where you want. Making it easier to search for the subject and not having the reader to write the words exactly right to find the link."; "Have better functionality, they can always improve for the people that have harder to learn, and the people that have harder to read, and just to make it simple"; "Make the programs more accessible, you always have to have a login or a paid membership"; "More bug fixes, more alternatives for learning exercises, some type of awarding system, or some sort of competition between you and your friends".

Many students also say that there should be a variety of learning levels, that is adaptable digital tools: "I would like a program that 'has it owns brain' so that it can ask some questions to see what level you are on so you can get tasks that will improve your 'skill'."; "Have a skip feature where you take a sort of test to determine your current level of English and adapt tasks according to your level."

The German students don't suggest any actual "digital learning tools", but rather give comments on films, YouTube, and dictionaries available on the internet.

Discussion and implications

Our study reveals obvious differences between school policies regarding ICT integration between Sweden and Germany. At least in Sweden, school policy seems to be more about the presence of ICT, i.e. having ICT as the goal, instead of looking upon ICT as the means of achieving the goal of higher student performance. Our results, as well as political decisions indicate this, especially since it is compulsory to use iPads for all children from the age of one in all pre-schools in Sweden since July 1, 2019 (Regeringen, 2017). In Sweden there is a lack of discussions concerning efficiency in teaching or learning. Education for in-service teachers and research on the use of digital tools needs to be further developed (cf. Gagnestam, 2010; Jelmini & Brandel, 2014; Fredholm, 2016). This is contrary to the attitudes and discussions going on in Germany (cf. Wößmann et al., 2017), where different polls and our results show that the Germans are more careful concerning the time spent using digital devices in school and at home. German politicians emphasize

that technology must follow pedagogy and not vice versa (Czimmer-Gauss, 2017).

This study discusses the attitudes among students in high schools towards digital tools for language learning. In an era of digital platforms where the intervention of technology is invasive in every aspect the study shows that there are still differences in how digital tools are integrated in school education in different countries. Although Sweden and Germany can be perceived as empirical contexts within a common European background, they have diverse viewpoints on how digital learning should be prioritized and facilitated for school level education. The Swedish system is more conversant with the use and integration of digital learning tools as compared to Germany. This is obvious also in how Swedish students are more comfortable with, and are able to present stronger suggestions for the improvement of digital tools as compared to their German counterparts. This correlates with the observations of Liaw (2002) and Na (2007). More Swedish students (66%) preferred a computer than German students (40%) for language learning. 31% of the Swedish and 35% of the German students were negative towards using digital tools for learning English. The answers from the study also correlate with Arthur et al. (2006), where young consumers of interactive technology valued immediacy. Students prefer smart digital tools that provide them with immediate feedback and adapt to their level of proficiency. They also desired higher functionality regarding user-friendliness and accessibility. Arthur, Sherman, Appel, and Moore emphasized this already in their study in 2006, yet much more needs to be accomplished in this area as seen from the responses in our study. Swedish students are more aware of different tools and can comment on their efficacy and performance and it can be assumed that they have a better understanding of these tools. They possess an analytical perspective in terms of how these tools can be improved and used better. This knowledge can be treated as an important source for "co-creation" where students and teachers can work collaboratively with entrepreneurs to produce value-intensive digital learning tools (Mckerlie et.al, 2018). In this way, more user-friendly language learning systems can be created and implemented at school level. Compare Yolageldili & Arikan (2011), who emphasize that language learning is a constant effort for young learners and that in the current digital era it is necessary to provide them with meaningful tools. There is need for more scientific studies on digitalization and the use of digital learning tools in schools. Although there is increased interest, there is still a lack of research in these areas. Schools and politicians do not seem to consider the findings from scientific studies on the use of ICT in education when making their decisions, which is also discussed by Haelermans (2017: 28):

> It seems that effectively using ICT in education while not being able to effectively transfer knowledge from scientific research to practice is a problem in many countries, including both Sweden and the Netherlands.

Further, the discussion between local politicians, responsible for the economy, users of the digital tools, and entrepreneurs in digital tools also seem to be non-existing. Cox and Marshall (2007: 68) identify in their research that

> National curricula need to embrace the fact that knowledge can be represented in new forms and this will have a fundamental impact on how a subject/topic is presented, taught, and assessed. This, in turn, requires professional development for all those in designing and creating national and local curricula and examinations.

Our study shows the lack of efficient digital learning tools in both Sweden and Germany. Adaptation is needed to create user-friendly tools and this can only be reached through cooperation between the users and the producers. Even though Sweden is far ahead concerning digitalization in schools, there is still a gap that needs to be bridged. An important aspect is the findings in the study conducted by Lärarnas Riksförbund (2016) (the Swedish National Union of Teachers), where 52% of the teachers answered that they produce their own digital learning tools because existing digital learning tools in their subject were either of low quality or not available. It is suggested that new research is needed to enable governments to identify the cost benefits of ICT in their education budgets and more securely plan and implement programs on ICT in education. Simply having access to ICT does not necessarily lead to its effective use (Haelermans 2017:17).

Conclusions and future directions

Our study presents the differences between two neighboring countries concerning digitalization in schools. The comparison between Sweden and Germany shows that both countries have very different approaches regarding digitalization. Although we do not claim that our results are generalizable, results show that students have different attitudes towards digital learning tools This can be assumed to be an impact of the country wise approach in digitalization.

Most countries in Europe currently ban the use of mobile phones in schools. As new tools need to be used, another direction of future studies could focus on the innovative but controlled use of mobile phones for school education. The overall impact of the need and speed for change is believed to have considerable influence on entrepreneurship in the business of digital learning tools. Co-creation between students, teachers, entrepreneurs and policy makers must be encouraged to support innovative, efficient and user-friendly digital tools in education. This has found new importance in the context of the pandemic due to Covid-19, which has placed increased emphasis on distance education through digital means. Our next stage in the research is to investigate the relationship between user attitudes and the entrepreneurial development in this sector. Our research will focus on how

co-creation-based models can be created between students and teachers as users and entrepreneurs as producers. New research projects need to account for the limitations in this paper so that outcomes are more generalizable and useful to many different countries and cultures.

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