

The HODA Project

Assistive Listening and Communication Devices at School



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The report “Hörteknik och dess användning i skolan – HODA” in English

*Lotta Coniavitis Gellerstedt, november 2015
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The report Hörteknik och dess användning i skolan – HODA in English

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Appendix 1

Definitions and concepts in the HODA Study

Appendix 1.1

Sound and light

Appendix 2

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Glossary to Appendix 2

Preface

This paper is a translation of the report *Hörteknik och dess användning i skolan* (the HODA Study), which we call *Assistive Listening and Communication Devices at School*¹ in English. The study was carried out in Stockholm County in 2013 by Sweden's *National Agency for Special Needs Education and Schools* in close cooperation with the *Hearing Habilitation Children and Youth* unit at Karolinska University Hospital, Stockholm. Eighty-five pupils with hearing loss in inclusive education, their teachers, mentors, and municipal special needs teachers (specialized in hearing loss issues) took part in the study.

The HODA Study deals with issues that have an impact on the auditory environment in schools, i.e. on the preconditions for communication in the classroom. Significant components of the auditory environment are the acoustic characteristics of the classroom, the teaching methods used in class, and the technological and pedagogical qualities of assistive listening and communication devices. Although our overall understanding of these components has been vague up to this point, the HODA Study has provided a multifaceted description and has highlighted a major need for concrete measures as well as for more knowledge in this field.

Translating this report into English was viewed as important, given both that the HODA Study contributes to a better understanding of how microphone systems function and are used in the classroom, and that we consider the results and discussions included in the report to be of

wide-ranging interest. Moreover, the HODA literature study on previous research reveals that few studies and reports on the actual use of microphone systems in schools are available in English, adding weight to the decision to disseminate our results to a wider audience.

It is clear from our study that a teacher's knowledge about how to teach and how to use a microphone system in the classroom is crucial for a pupil with hearing loss to be able to participate effectively in education and classroom activities. Thus, we hope that the HODA Study will contribute to support for teachers and for the development of teaching practice and knowledge in this area. We also look forward to further development and research in areas related to the acoustic properties of school environments, the technical condition of microphone systems, and the adjustment of assistive listening and communication devices for use in educational settings.

Many people have taken part in and contributed to the HODA Study, and we are most grateful to all the pupils, teachers, and municipal special needs teachers who have answered our questions, and to the parents and school principals who made data collection possible.

The working group that carried out the HODA Study jointly designed the study and the various forms and protocols used for data collection. Several individuals in the group were also directly involved in the data collection. Discussions within the group about data and results have been crucial in providing useful knowledge and comments that enrich the report's presentation and analysis. A big thank you to the working group!

Håkan Bergkvist
Head of HODA Project

Coordinator Auditory Environment, National
Agency for Special Needs Education and Schools

¹ *Assistive listening and communication device* refers to technology (microphone systems) used together with hearing aids in a complementary way. *Hearing aid* is here used as an umbrella term covering behind-the-ear hearing aids, in-the-ear hearing aids, bone-anchored hearing aids, CROS hearing aids, and cochlear implants.

Introduction

This publication presents the report *Hörteknik och dess användning i skolan – HODA*² in English. The translated version differs from the Swedish version in a few ways, the most significant of these being:

- A brief introduction to the relevant Swedish context has been added (see Section 2)
- Only one of the six appendices to the Swedish report has been translated in its entirety (Appendices 1 and 1.1 to this report, corresponding to the Swedish report's appendices (*bilagor*) 3 and 3.1)³
- Appendix 2 to this report corresponds to the Swedish appendix *Bilaga 6*, which contains all the tables referred to in Section 8. However, only the titles of the tables have been translated and added as a list of content and, likewise, a glossary has been added to facilitate reading the tables. As such, the tables are reproduced here in the Swedish language. Note that decimal points are given as commas (,) in Swedish.
- References are generally the same here as in the Swedish report. However, when references are given in footnotes, those written in Swedish are marked "(in Swedish)".

The results of the HODA Study are presented in sections 8.1–8.5 of the report and each such section ends with a summary and comments on the results. In various places in the report, especially in Section 8, quotes from pupils and teachers as well as excerpts from notes taken by the classroom observers are interspersed in the text, as are case-descriptions of the classroom situations of four pupils.

Percentages are calculated and plentifully presented. At times, the denominator is very small and percentages are uncertain. We systematically present the denominator (called "basis"), i.e. the number corresponding to 100 percent, as a reminder of its size and also to avoid problems in understanding how the percentages have been calculated.

2 http://www.butiken.spsm.se/produkt/katalog_filer/00564.pdf. "HODA" is the Swedish acronym for the project name and is used frequently in this report.

3 All six appendices can be found here in Swedish: http://www.butiken.spsm.se/produkt/katalog_filer/00564b.pdf. The untranslated appendices are Background and aim of the HODA Project (*Bilaga 1*, included in Section 2 of the English text), Forms and protocols used in data collection (*Bilaga 2*, omitted completely here), Information letters (*Bilaga 4*, omitted completely here), Response rates in phase 2 (*Bilaga 5*, omitted completely here but, as in the Swedish version, the conclusions are presented in Section 7 of the English text).

1 Summary

The Communication devices⁴ at school (HODA) project was carried out jointly by the *National Agency for Special Needs Education and Schools* and the *Hearing Habilitation Children and Youth* unit at Stockholm's Karolinska University Hospital. The HODA Study addresses a number of issues with a decisive impact on pupils with hearing loss' access to education, and on their participation in educational situations. These issues can be summarized in the concepts of acoustic environment, communication devices⁵, and pedagogics.

The study was carried out in 2013 and, initially, a deal of medical data about all individuals aged 10–16 years and registered at the hearing habilitation unit in Stockholm were collected. Besides demographic information, data concerning hearing and communication devices prescribed to these young people were registered and processed. Extensive, supplementary data collection was carried out with the participation of 85 pupils attending grades 4–9 in inclusive education in Stockholm County. All these pupils had been prescribed hearing aids⁶ as well as some kind of communication device to supplement the use of hearing aids at school.

Thus, pupils have been interviewed as part of the HODA Study and, in addition, observations have been carried out in classrooms. Moreover, the pupils' classrooms have been examined from

an acoustic point of view and microphone systems have been checked. The pupils' teachers, mentors, and municipal special needs teachers have also completed questionnaires.

The results of the study reveal a number of shortcomings in the acoustic environment in schools and flaws in the technical devices. Such deficiencies greatly restrict a pupil's opportunity to participate in education and schoolwork.

One basic precondition for pupils with hearing loss to be able to participate in class is a good acoustic environment in the classroom. Our examination of acoustic quality shows that only one in five classrooms meets the minimum requirements established by authorities. The result is deeply concerning, not only for pupils with hearing loss, but also for many other pupils and for their teachers.

The starting point when prescribing microphone systems for use at school is that a pupil should receive a device that functions both technically and pedagogically. That is to say, the system should transmit good sound and should be functional in the pedagogical situations where it is intended to be used. Our study shows that there are plenty of shortcomings in the systems' technical function. Our observers listened to the devices used in the classroom for an entire lesson. A mere 41 percent of devices worked throughout the lesson and in the remaining cases, from minor to major faults in the systems were noted. Indeed, the pupils themselves report poor sound quality in the systems and desire improvements. One important finding was that pupils use the devices extensively in spite of malfunctions, and we understand this to be an indication of the great importance of the microphone systems to the pupils.

Concerning the functionality of the devices, our study shows that the technology needs to be further developed in order to make the devices

4 The term *Assistive Listening Device* is frequently used in English. However, we avoid this term in favor of the term *Communication Device*, to indicate that communication rather than listening alone is the issue.

5 Communication devices: Technology that supplements the use of hearing aids, e.g. wireless microphones and induction loop systems. "Communication devices" and "microphone systems" are used synonymously in this report.

6 Hearing aids: Behind-the-ear hearing aids, in-the-ear hearing aids, bone-anchored hearing aids, cochlear implants, etc.

(especially microphones for the classmates (or peer mics)) easier to use. Thus, we see that there is plenty of room to improve the microphone systems. If pupils are to be given the proper opportunities for participation, it is crucial that routines and clear responsibilities for informing school staff concerned about the consequences of hearing loss for a pupil and how to use communication devices are in place at schools. Time and again, we found that such routines and responsibilities were lacking.

The results of the study underline the importance of support for teachers and pupils. In spite of this, many municipalities in Sweden lack a special needs teacher specializing in issues concerning hearing loss. Of the 85 pupils taking part in the HODA Study, just 17 received support from such a municipal special needs teacher. We view the lack of local special needs teachers with this specialization as a major problem.

Moreover, support staff such as special needs teachers from municipalities, hearing habilita-

tion units, and state support agencies as well as technical audiologists, are sorely needed for information and training purposes. Furthermore, a general plan is needed to improve the acoustic properties of schoolrooms to achieve the quality required for inclusive education when young people with hearing loss are pupils. Better sound quality and easier handling in class by teachers and classmates are important aims in the necessary further development of the communication devices used. The technical condition of microphone systems also needs to be checked regularly.

Besides the HODA Study, the HODA Project also includes a literature study⁷. The literature examined shows that few studies have looked into the use of microphone systems in educational settings. This is true generally, and when it comes to pupils in inclusive education, systematic studies and evaluations are even harder to find. Few studies adopt an overall approach that takes into account technological, pedagogical, social, and physical environment-related perspectives.

7 Bjarnason 2014 (in Swedish).

2 National context and background of the HODA Project

In Sweden in 2013, approximately 4,600 children and adolescents aged 0–20 years used hearing aids⁸, and about 2,600 of these also had communication devices for use at school⁹. Once they are of age, one major undertaking for these young people is to attend school and participate in education and schoolwork. This is an obligation as well as a right for all children throughout the nine-year compulsory school system in Sweden. From day one, these young girls and boys must manage the consequences of their hearing loss in a setting where communication is inevitably important¹⁰. At the same time, school has been characterized as one of the most important protective and supportive spheres for children and young people in general, and for vulnerable children and young people in particular.

The Swedish context

In the following section we present a short general outline of the Swedish school system¹¹ and some information about where in the system we find young people with hearing loss or deafness.

The Swedish school system

Attending school is compulsory from the age of seven and most children attend a *grundskola* (nine-year compulsory school), which is divided into three levels: lower level (grades 1–3), intermediate level (grades 4–6), and upper level (grades 7–9). Pupils with learning disabilities can attend a *särskola* (compulsory school for pupils with learning disabilities). Pupils with hearing loss or deafness and/or other impairments that impede communication can attend a *specialskola* (special school). There are also a few other options, such as the Sami School, international schools, and boarding schools. Typically, pupils continue on to *gymnasium* (upper secondary school comprising 3–4 years of study) after compulsory school.

Schools are financed by the state, but are managed by either the municipalities or organizers of independent schools (*friskolor*). In 2013, about 86 percent of pupils attending Swedish compulsory schools went to schools run by municipalities, and 14 percent attended schools run by organizers of independent schools¹².

Facts

Municipalities

The lowest level among *local government* districts and one of Sweden's principal administrative divisions. There are 290 municipalities in Sweden, each governed by a municipal assembly that is elected by the municipal electorate every four years in conjunction with the *general national elections*. Municipalities are responsible for local services, including schools, welfare provision, and physical planning.

8 "Hearing aids" is used here to signify behind-the-ear hearing aids, in-the-ear hearing aids, CROS (Contralateral Routing of Signals) hearing aids, bone-anchored hearing aids, and cochlear implants.

9 Svensk Teknisk Audiologisk Förening/The Swedish Technical Audiological Society, 2010. Hörselskadades Riksförbund/The Swedish Association for Hard of Hearing People, 2014. Calculations performed by Coniavitis Gellerstedt in the HODA Report in Swedish, 2015.

10 See also Åkerström, Studie III.

11 See also <https://www.european-agency.org/country-information/sweden/national-overview/special-needs-education-within-the-education-system>, September 2015.

12 Statistics Sweden: *Yearbook of Educational Statistics 2015*, Table 4.2.

Hence, central and local authorities are jointly responsible for Swedish schools. The government and central authorities lay out general objectives and conditions in Sweden's Education Act and curricula and ensure compliance. Municipalities and independent schools are tasked with distributing resources and organizing education in accordance with central regulations, so that pupils are able to achieve national goals.

Facts

Some specific issues relevant to the HODA Study

Teaching methods: Over time, traditional teacher-led lectures have been supplemented with teamwork, group tasks, pupils' individual projects and the like. Thus, discussions and presentations in small groups as well as in whole-class settings have become common in Swedish classrooms. Computers and computer-related equipment are used in a range of educational tasks.

Team of teachers, training team: Teachers in a specific school may be organized into teams, e.g. teachers associated with a certain level or grade, or teachers who work together on themes involving several subjects.

Action program, action plan: For pupils in need of special support, an action program or action plan to provide this support must be prepared by their teachers in consultation with the pupils themselves, their parents, and specialist support teachers¹³. This plan, which identifies needs and the means to meet them, is evaluated continuously and may be revised.

Classroom: Typically, the pupils in a school class at the levels relevant to the HODA Study use one room as their regular classroom ("home classroom") and a varying number of lessons (e.g., physical education, natural science subjects, and music) take place in other venues at the school, often with special equipment.

A number of children with hearing loss or deafness and their parents choose *specialskola* (special schools) where both Swedish sign language and spoken Swedish are used as teaching languages. Others choose to attend a *hörselklass*, which is a school class at a mainstream school that provides an environment designed to

accommodate an entire school class of pupils with hearing loss. However, most pupils with hearing loss in Sweden choose to go to school together with hearing peers in what is referred to as "inclusive education" at either municipal-run or independent schools. Naturally, pupils are free to change the type of school they attend. In this report we discuss pupils who were attending inclusive education in 2013, exclusively.

How are the needs of these pupils in inclusive education met by the community? Is the education provided accessible, allowing pupils to participate in training and schoolwork? The most important policy documents are quite clear and explicit on these issues. The Swedish Education Act (2010:800) stipulates that the diverse needs of pupils must be considered. Education must be supportive and stimulating in order for pupils to develop optimally. The ambition must be to compensate for differences in order to have all pupils benefit from education. All children and young people must have equal access to education, irrespective of the type of school, their geographical place of residence and social or economic situation. Moreover, the Swedish Discrimination Law (2008:567) legislates on actions against discrimination.

Facts

County councils

County councils are self-governing local authorities and one of Sweden's principal administrative divisions, besides municipalities. Sweden has 20 county councils (some of which are called "regions"). County councils are governed by a county council assembly that is elected by the county electorate every four years in conjunction with the general national elections. The most important responsibilities of county councils are the public health care system and public transportation.

The public health care system is regulated by national laws, but is chiefly run by local authorities. When referred to in this report, the *county council* signifies the public health care system as managed by the county council, unless otherwise stated.

13 In 2014 the legislation on action programs was changed, allowing schools a more flexible approach to supporting pupils. It is important to remember that data collection for the HODA Project was carried out in 2013.

As indicated above, county councils, municipalities, organizers of independent schools, and individual schools have the authority and the power to influence a pupil's situation at school. Consequently, pupils with hearing loss are not given the same type and amount of support all over the country. For example, differences can be seen concerning the following:

- County council regulations and routines concerning prescriptions of communication devices
- Local municipality decisions to spend, or not to spend, resources on a special needs teacher with appropriate training to fulfill their overall responsibility to support pupils with hearing loss in the municipal area
- Local school principals' decisions to spend, or not spend, resources on improving classroom acoustics.

This report focuses on pupils in schools run by municipalities or organizers of independent schools in the Stockholm County Council area¹⁴.

Despite the regional and local variations in support as referred to above, communication devices for use at school are indeed prescribed to pupils with hearing loss all over Sweden, and such devices are one of a number of crucial means by which these pupils can participate in education. Consequently, technical devices, in combination with teaching methods and acoustics, help make up the specific auditory environment in which the approximately 2,600 pupils in Sweden with communication devices spent their schooldays in 2013.

14 The rationale for choosing the Stockholm area was the comparatively large number of children and young people registered with the habilitation unit and the wide array of devices prescribed by this unit.

Support for pupils with hearing loss in Sweden

Responsibilities and resources are in place at various levels of Swedish society to ensure that pupils with hearing loss have access to education and schoolwork, as mentioned above. We will now examine this situation more closely in relation to pupils in inclusive education.

To put it simply, people, premises, and technology are important in an individual pupil's everyday life at school. The fundamental responsibility for ensuring that the teachers involved are sufficient in number and have the relevant general competence and specialized competence needed to teach pupils with hearing loss (with and without hearing and communication devices) lies with the municipality and the school, in particular¹⁵. When a pupil with hearing loss is due to begin in a new school class, several measures must be taken by the school to ensure the pupil's rights¹⁶. Planning, time-table preparation, ensuring teachers' competence, and providing information are important measures in ensuring that the people surrounding the pupil in the school environment meet the requirements¹⁷.

According to the Swedish Education Act (2010:800), each municipality must have a Pupil Health Unit staffed with (among others) people competent in issues related to pupils with special needs. A municipality may also choose to employ personnel with an overall responsibility to support pupils with hearing loss within the municipality. Moreover, a municipality may also ask for additional support, free of charge, from the *National Agency for Special Needs Educa-*

15 A report by the Swedish Schools Inspectorate, however, states that municipalities lack an overall policy concerning pupils with disabilities in connection with their task to organize education. Explicit, documented strategies were also lacking at the school level, with the exception of a few schools run by independent organizers. See Skolinspektionen/Swedish School Inspectorate, 2009 (in Swedish), p. 12.

16 Sweden's *National Agency for Special Needs Education and Schools* provides advisory publications on these issues.

17 It is also possible for anyone interested to consult www.horsel-boken.se (site in Swedish) about issues related to pupils with hearing loss.

tion and Schools, such as further training for a team of teachers at a school in issues related to teaching pupils with hearing loss.

Facts

Special needs teachers with expertise in hearing-related issues, examples from the Swedish context

1. Special needs teachers working in a municipality who have an overall responsibility within the municipality to support pupils with hearing loss, their teachers, classmates, and schools.
2. Special needs teachers working at a county council hearing habilitation unit for children and adolescents.
3. Special needs teachers working at the *National Agency for Special Needs Education and Schools* as advisors on issues related to hearing loss and deafness.

The municipality and the school are also responsible for ensuring that school premises are suitable and adapted to the needs of pupils with hearing loss, among others. Long-term planning is needed so that the necessary adjustments can be made when a pupil starts attending a particular school¹⁸. Comprehensive legislation regulates the physical school environment in Sweden, with the major laws in force being the Education Act, the Environmental Code, construction laws, the Work Environment Act, and the Discrimination Law¹⁹.

Clearly, the acoustic environment is of great importance in general, and for pupils and teachers with hearing loss, in particular. According to the Swedish *National Board of Housing, Building and Planning*, general requirements are met when sound class C (as specified in Swedish Standard SS 25268:2007) is achieved. However, requirements are stricter when people with hearing loss remain in a certain place for an extended period.

18 See Skolinspektionen/Swedish Schools Inspectorate, 2009, p. 13 (in Swedish).

19 See also Sveriges Kommuner och Landsting/The Swedish Association of Local Authorities and Regions, 2011 (in Swedish).

Facts

Swedish Standard SS 25268:2007 *Acoustics—Sound classification of spaces in buildings—Institutional premises, rooms for education, preschools and leisure-time centers, rooms for office work and hotels* (Section 5.3.3): Premises that fulfill the requirements of sound class C or better are accessible but not optimized for persons with varying degrees of hearing loss. To optimize /.../ the sound level from installations and traffic, in particular the maximum level, has to meet the requirements of sound class B or better and reverberation-time, in particular at 125 Hz, should be as short as practically possible. See also Appendix 1.1.

County councils are responsible for ensuring that pupils and students with disabilities are provided with assistive devices at school. Consequently, county council habilitation units prescribe microphone systems as well as hearing aids to pupils with hearing loss. Various forms of information and support are given to the pupil, their parents, and their teachers in connection with prescription. When the hearing aids are cochlear implants²⁰, the procedure is somewhat different, however.

The HODA Study has been carried out in the Stockholm County Council area and, accordingly, the HODA pupils have been the intended recipients of the specific forms of information and support provided by the habilitation unit *Hearing Habilitation Children and Youth* at Karolinska University Hospital in Stockholm²¹. Advice, support, training, and a variety of other measures are offered by personnel with medical, psychological, acoustic, and other specialties, such as technical audiologists, speech therapists, welfare officers, and special needs teachers. In addition to the above, children with cochlear implants are provided with specific support by a CI-team at the Ear, Nose, and Throat *Clinic* at Karolinska University Hospital.

20 Cochlear implants are considered when the child suffers from deafness or severe hearing loss and requires a surgical operation.

21 In addition to the child diagnosed with hearing loss or deafness, their parents, siblings and relatives, and staff at preschool and school make up the target groups for information and support provided by the habilitation unit. All measures are taken in cooperation with the child's parents.

.....

In summary, we can conclude that the school, municipality, county council, and state all have important roles to play in the process of making education accessible to young people who suffer from hearing loss.

3 The HODA Project

The understanding of communication devices in school settings that framed and guided the HODA Project was generated via experiences and observations made by professionals (such as technical audiologists, counselors, and special needs teachers) directly involved in supporting pupils with hearing loss in schools. At local schools, these professionals encountered deficiencies in knowledge and competence concerning hearing loss and the importance of teaching methods, acoustics, and technical devices in accommodating pupils with hearing loss. Indeed, only a few municipalities have a special needs teacher with training appropriate for managing an overall responsibility to support pupils with hearing loss and their teachers in the municipal area. Moreover, a switch from stationary to portable communication devices had been observed in prescription practices, and the completely unknown consequences of this change in relation to the situation of pupils in schools had been pointed out by professionals working locally. Furthermore, attention was given to the fact that independent assessments and evaluations of communication devices for use at school were no longer carried out²², meaning that the manufacturers' assessments were not challenged. In addition, it was noted that financial restrictions in recent years had made county councils focus on their core tasks within the public health system, which suggests that audiological staff, in the long run, may lose their former competence and knowledge of different types of communication devices. Moreover, it was well known that teaching methods in contemporary Swedish schools require that pupils listen to fellow students as well as to the teacher during discussions and presentations in class.

22 Formerly, such assessments were carried out and governed by the county councils as part of their procurements.

In other words, both the adult teacher and the young classmates would need to use microphones in a smooth and practical way. More than that, knowledge about the usefulness of communication devices at school was indeed limited, in spite of the large sum of money spent on them²³.

The HODA Project was carried out by the *Swedish National Agency for Special Needs Education and Schools* (SPSM (Swedish acronym, as used in this report)) in close cooperation with Karolinska University Hospital, Stockholm, and its unit *Hearing Habilitation Children and Youth*. A steering committee was set up and the HODA Project was implemented by a working team of educationalists and technical audiologists employed by the two authorities and with extensive experience and work practice related to the everyday situation at school for pupils with hearing loss, in cooperation with a sociologist.

HODA forms part of a larger undertaking by SPSM called *Auditory Environment* that aims to generate further knowledge within this field. Its purpose has been to guarantee the quality of activities carried out by SPSM by developing and disseminating knowledge both inside and outside the authority. The coordinator of this undertaking and leader of the HODA Project has been Håkan Bergkvist, technical audiologist at SPSM.

The purposes and aims of the HODA Project are further described in Section 5 of this report. In the next section, Section 4, a summary of the findings of a literature study²⁴ concerning communication devices at school is presented.

23 Svensk Teknisk Audiologisk Förening/The Swedish Technical Audiological Society 2010, Bergkvist 2009, 2013, Bergkvist & Norman 2014, Gustafsson 2009. (All in Swedish.)

24 The author of the HODA literature study is Sif Bjarnason, Örebro University. The study is presented in a separate report, available in Swedish at http://www.butiken.spsm.se/produkt/katalog_filer/00566.pdf.

4 Literature study, previous research

For pupils with hearing loss to participate in school activities a number of preconditions must be met. Such requirements are described in numerous publications. Some basic requirements frequently mentioned are the use of communication devices, decent acoustics in classrooms and other premises where education takes place, and teaching methods adapted to suit students with hearing loss. The publications referred to here primarily focus on *instructions and explanations* concerning how to achieve such an environment at schools, though without reference to investigations into the actual use of communication devices in the learning process.

Research studies show that communication devices frequently suffer technical problems associated with practical difficulties in everyday use (Antonson 1998; Rekkedal 2012) and defects such as audio glitches and disturbing external noise. Communication devices can, of course, also function well and fulfill their purpose, but, in addition to the adequate technical performance of devices, the attitude of the pupil with hearing loss as well as the attitudes of teachers and other professionals at the school, peers and parents, are crucial in achieving a satisfactory situation in class. Closely related to personal attitudes is knowledge about the devices, for instance, knowledge about how to check that a device is working, knowledge about troubleshooting and, of course, knowledge about how to handle a device. Many interviewees in various studies state that they lack knowledge and need further training (see, for example, Nelson, Poole, and Munoz 2013). Rekkedal (2013) and Coniavitis Gellerstedt (2007) conclude that, among other factors, a teacher's knowledge and attitude towards communication devices determines whether they will be used in the classroom or not. Presumably, regular use is the only way to quickly discover and fix technical problems,

which, in turn, depends upon the availability of technical audiologists and special needs teachers.

Communication devices have a tendency to guide or steer conversation, which could be regarded as a technical problem. Wennergren (2007) and Holmström (2013) have conducted research on this, though from completely different points of departure. By observing what happened in classrooms, Wennergren concluded that there was a need for technical development. Device design had to take into account the fact that teaching methods had expanded and now included not only *monologs*, but also *dialogs* and *teamwork*. Communication devices designed to be useful in ordinary, running conversations in real-life classroom situations where all the pupils suffered from hearing loss were explored in the Wennergren study.

Pupils who choose not to use communication devices have been the focus of a number of studies. (See, for instance, Jonassen 2009 and Regel Poulsen 2009.) For example, when starting at a higher level in the school system, pupils might experience the strongly negative consequences of a stigmatization process as a result of their devices and, therefore, they considered their devices undesirable. Thus, the device did not support the pupil, but rather reinforced their disability. In the study by Regel Poulsen, sound quality seemed to be the most decisive factor in discontinuing the use of communication devices and just listening with a hearing aid in the M-position instead. For a relatively large number of the pupils covered by this research, the sound inside the communication device was so utterly disturbing that using it resulted in worse sound quality than pure amplification of the sound from the speaker. It seems that the experience of sound and sound quality in communication devices used by children and pupils is a very important area for further research.

.....

The HODA literature study shows that there are few studies dealing with the use of communication devices in educational settings. This is the case in general, and when it comes to pupils in inclusive education, the lack of systematic studies and evaluations is significant. Few studies adopt a comprehensive approach, including technical, educational, social, and environmental perspectives. Given that this area is open to interdisciplinary research (see Antonson and Danermark 1994), the shortage of empirical studies and systematic evaluations is primarily seen as a consequence of practical and methodological difficulties.

5 Purpose and aim of the HODA Study

The overall purpose of the HODA Study is to enhance participation in inclusive education for pupils with hearing loss.

As mentioned in Section 3 above, our study was motivated by problems and a lack of information as identified by professionals specializing in hearing-related issues and working directly with pupils with hearing loss in schools. A lack of data within the field of communication devices in schools prompted the HODA Study and shaped its design. Moreover, the literature study revealed that knowledge is indeed limited both nationally and internationally. We must conclude that this field of knowledge does not inspire research, while also pointing out that the little research actually performed in this area has primarily been carried out in the Nordic countries. Accordingly, the wide-ranging investigation conducted in the HODA Study will hopefully provide a welcome contribution to this field of knowledge. Additionally, this report will also highlight some further questions that could be of interest for researchers and professionals to explore further.

Thus, the aim of the HODA Study is to provide basic knowledge about communication devices in schools. For example: What communication device packages are prescribed for use in class? Do the devices work satisfactorily from an educational and technical point of view? Are the devices actually used during class?

The main purpose of the study is to improve bases for decision-making for professionals when providing support to pupils with hearing loss. More specifically, the results of the study will be used to improve the quality of:

- The process for selecting and prescribing communication devices for children and youths to use at school
- The counsel and advice given by state and county council authorities to personnel at local schools.

More specifically, the purpose and aim of the HODA Study have been condensed into six questions to be answered by the study:

1. What specific communication device packages have been prescribed for the pupils in the study?
2. To what extent are the devices used by pupils and teachers?
3. Do the devices function well technically?
4. To what extent do the devices prescribed meet the requirements of different pedagogical situations?
5. What are the pupils' feelings about the devices?
6. What is the situation at schools in terms of how teaching and the use of devices are organized? For example, "home classroom"²⁵ and routines related to the use and management of the communication devices.

Section 7 describes the empirical and practical parts of the study and at the end of Section 8, we return to the questions above and our answers to them. In the next section, we will give an account of our understanding of the field of knowledge that we are entering.

²⁵ The regular classroom used by pupils in a school class. A varying number of lessons are taught elsewhere, such as lessons in physical education, music, and natural science subjects.

6 Frame of reference for communication devices at school

Laws, policy documents, regulations, and other documents state that public authorities are responsible for providing a coherent educational system and ensuring that all individuals have access to an inclusive education. In this context, the ability to adapt the educational, physical, and social settings at schools is viewed as critical by the three school authorities in Sweden²⁶. A recent law²⁷ that stipulates that a lack of accessibility in any type of school is to be regarded as discrimination heightens the requirements imposed on schools. UN conventions on the rights of persons with disabilities and on the rights of the child contain important basic principles concerning equality and non-discrimination, the best interests of the child as a primary consideration, and assuring that the child has the right to express their views freely in all matters affecting the child²⁸.

The HODA Study's focus is the everyday life of pupils with hearing loss in schools. In each lesson, each pupil finds themselves in a specific auditory setting determined by the acoustics and lighting of the room as well as by the teaching methods used during class. The auditory environment in any given classroom changes when the class transitions from listening to a lecture to a joint discussion of questions generated by the lecture. For a pupil with hearing loss and a communication device, technology is added to the elements that make up the auditory environment (see Figure 1).

The auditory environment has an impact on a pupil's ability to listen to, hear, understand, and remember what has been said, as is the case for all

pupils. If hearing and interpreting sounds consumes a lot of energy, the risk is that the listener will not have sufficient energy left to remember and process the message. In such cases, the teaching has not functioned as intended and is not accessible, as it is disrupted by unwanted sound or noise²⁹.

What will happen at the upper secondary school level, where the teachers are many? How much energy will she need during class? I feel our school has not handled the question of communication devices in an adequate way. How come she manages so well in spite of all this?

Teacher of a pupil with a communication device in the 6th grade

Figure 1 below presents a number of factors related to the auditory environment (comprised of teaching, physical environment, and technology, as mentioned above) that influence the preconditions for communication. Is it possible to manipulate these factors for the better? What is it possible for an individual school, a municipality, or a school organizer to do in order to improve the situation? One simple measure of importance to all people in a school is probably to improve the acoustics and lighting. In their initial phase, such improvements are both cheap and efficient³⁰. However, improving the auditory environment requires systematic work within all the areas indicated in Figure 1.

26 Skolverket, Skolinspektionen, Specialpedagogiska skolmyndigheten/ The Swedish National Agency for Education, the Swedish Schools Inspectorate, the National Agency for Special Needs Education and Schools, 2014 (in Swedish)

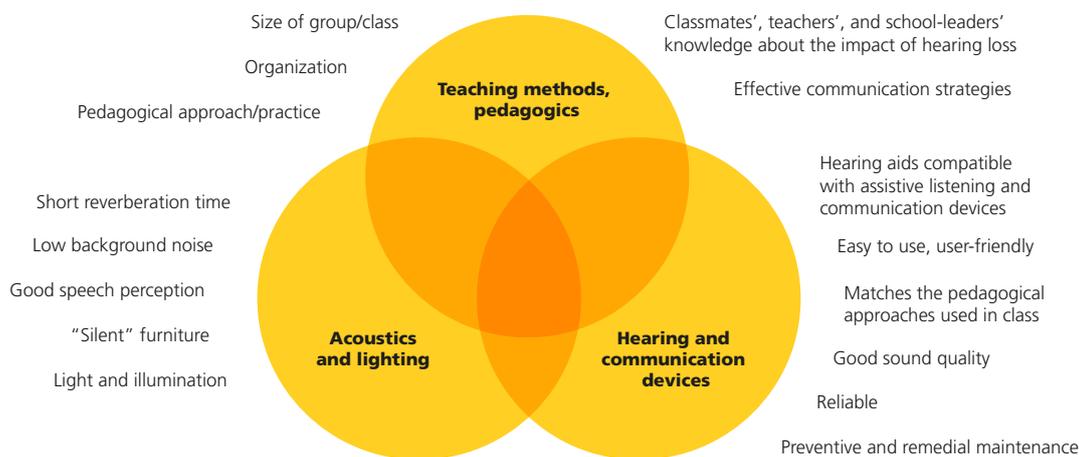
27 In effect from January 2015

28 For a discussion of the UN Convention on the Rights of the Child and its implementation, see Åkerström 2015, pp. 15ff.

29 See, for example, Ljung 2010, Boman and Enmarker 2004. See also Arlinger 1999 (in Swedish), Hygge 1999 (in Swedish), Kjellberg 1999 (in Swedish), Lehto and Östh 2008 (in Swedish).

30 See Gustafsson 2009, Chapter 2 (in Swedish), Holmberg 2014 (in Swedish), and Sveriges Kommuner och Landsting/Swedish Association of Local Authorities and Regions 2011 (in Swedish).

Figure 1
Auditory environment



Auditory environment, Bergkvist 2014.

As such, pedagogics, acoustics, and lighting, plus communication devices—the auditory environment—are seen here as both important and partially interrelated tools in the learning process. That said, a schoolroom is also a social setting. Classrooms might be perceived³¹ as local holding points for:

- Reproduced relationships, e.g. relationships between teacher and pupils, or between pupils themselves
- Social positions, e.g. the position as a teacher, the position as a pupil, and the position as a classmate
- Practices and routines, e.g. how lessons are initiated and concluded.

Obviously, social relations, positions, and practices are infused with power in classrooms also. Power is not explicitly addressed in the design of the HODA Study, but we will return to questions related to power later in this section and in our comments on the empirical results.

In the inclusive classroom, the vertical relationship between teacher and pupil as well as the horizontal relationships between the pupils themselves form arenas for learning³². For example, qualities such as social competence, speech, and self-esteem develop through horizontal relationships between peers³³. In other words, it is important to ensure each and every pupil access to both arenas. For pupils with hearing loss, there is an obvious obstacle that needs to be removed. Communication devices are a means to achieve this, and we see microphones for use by classmates as important in giving the pupil with hearing loss opportunities to participate in tasks involving the entire class and to participate in class activities.

Multi-microphone systems were introduced in Swedish schools in 2005 to satisfy new requirements after “unilateral teaching from the teacher’s desk” had gradually been replaced by increasing elements of dialog, discussion, and teamwork during class. In Norway, it is common for pupils with hearing loss in inclusive education

31 Cf. “Social settings” in Layder 1997.

32 See also Åkerström 2014, Study III.

33 See Ahlström 2014 (in Swedish).

to be provided with microphones for their classmates. As far as we know, practices³⁴ vary in the county council-run habilitation units that prescribe communication devices in Sweden. Multi-microphone systems require discipline from the teacher and classmates in regards to taking turns, which may be hard to live up to. This is an issue that we will return to several times in this report.

Well-established routines and patterns of action are seen as potential resources in the social setting for those taking part in interaction in class. Moreover, we assume that each person in a classroom seeks to uphold the image of themselves as a competent participant in the interaction during the lesson. Routines and known patterns of action could lead to more equal opportunities for participants in grasping the ongoing interaction and communication in class. Established practices and routines create a predictable structure of work and conserve people's energy, while at the same time completely or partly neutralizing power advantages³⁵.

Facts

Hearing and communication devices

See also Appendix 1

Hearing aids

Hearing aids is used here to signify behind-the-ear hearing aids, in-the-ear hearing aids, CROS hearing aids, bone-anchored hearing aids, and cochlear implants.

Most hearing aids have two or more listening programs or positions to choose between depending on listening environments and needs. All hearing aids have an "M-position", or microphone position. When using the M-position, all sounds in the environment are amplified. In the "T-position", or alternatively, "FM-position", sound is picked up electronically by the tele coil of the hearing aid via induction loop systems or radio waves and all other sounds are shut out. A combined "MT-position", or alternatively, "MFM-position", might also be available.

34 See also Gustafsson 2009: 116–118 (in Swedish).

35 See Widén 2014 (in Swedish) about the importance of routines related to taking turns in classes with multi-microphone systems and Nilholm and Alm 2010 on strategies used in a class that was characterized as inclusive.

Communication devices, microphone systems, Assistive Listening Devices

Technical devices (such as induction loop amplifiers, wireless microphones, and receivers) that supplement listening via hearing aids. *Stationary installations* with induction loop systems and wireless microphones (with or without microphones for classmates) or *personal-worn, portable receivers* with listening via a neck loop or mini FM receiver (with or without microphones for classmates) are the technologies used in Swedish school contexts.

Loudspeakers

The purpose of loudspeaker systems is to distribute speech acoustically in the classroom from the teacher's and, if available, classmates' microphones.

So far, we have discussed communication devices generally. The purpose of communication devices is for the desired sound from a sender (e.g., speech) to reach the receiver (the person with hearing loss) with as little interference as possible. Thus, the task is to amplify the desired sound without simultaneously amplifying other, undesirable sound, interference between transmitter and receiver. What is known as the "signal-to-noise ratio" should be optimized.

With the above in mind, it is easy to understand how deeply interrelated the elements of the auditory environment are. If the *pedagogical* situation is one where many pupils are supposed to talk, for instance during a discussion, the point is that everyone in the room should be able to hear everything said by others. If there is no multi-microphone *technology*, the pupil with hearing loss risks missing the things said by their classmates in such cases. If the room has poor *acoustics*, the unwanted sound will interfere with the desired sound on its way from sender to receiver. If the *lighting* is poor, visual support in communication is hampered. Consequently, teaching risks becoming inaccessible to pupils with hearing loss.

Various technical solutions for achieving acceptable signal-to-noise ratios have been launched and new ones added. Few communication devices have been specifically designed for use in a school setting. The design of communication devices is frequently the result of com-

promises between signal-to-noise ratios on the one hand, and adjustments for users and practical handling, or the reliability of the devices, on the other. Communication devices consist of three transmission parts³⁶:

- A *transmitter*, usually consisting of one or more wireless microphones
- A *receiver* used by listeners. The receiver may be stationary or portable
- A *connection* between the receiver and the hearing aid.

Sound is transmitted via radio waves from microphone to receiver. The shorter the distance between the mouth of the speaker and the microphone, the better the system's signal-to-noise ratio will be. This is of great importance, especially when it comes to various models of multi-microphone systems³⁷. Loudspeakers may be added to communication devices.

Surveying development within the field of communication devices, Bergkvist points out that the area is characterized by:

- Rapid product innovation and development
- An increased complexity in products, which increases the requirements imposed on the user
- Producer-specific designs, leading to incompatibility
- Varying quality in terms of sound, reliability, and functionality in school settings.

Stationary induction loop systems and microphone systems using wideband radio technology are the types of communication devices traditionally used in Swedish schools³⁸. In time, however, personal-worn (or as we call them, "portable") devices have become more common. Such devices can be moved around and taken to different classrooms and are supposed to be more

common when pupils start upper secondary school, where teaching frequently takes place in a number of different classrooms. Stationary devices, however, are said to provide better sound quality and to be more reliable. In addition, in order for a pupil with hearing loss to be able to hear what their classmates say, peer microphones are now more commonly prescribed³⁹.

Inevitably, using a communication device at school entails extra work. All hearing technology needs a certain amount of practical management on a daily basis: Microphones need to be charged and should be in the right place at the right time. Portable devices must be moved between different classrooms. Devices with technical problems must be reported and checked again after repair. Moreover, the teacher, the classmates, and the pupil with hearing loss need to know how to handle the devices. For instance, teachers need to know how to check that the device is functioning from a technical standpoint. Everyone in the classroom needs to know how and when to turn the microphones on and off and when discipline in turn-taking is necessary. If peer mics are not within reach of everyone in the class, measures must be taken and routines established to solve such problems. In summary, communication devices inescapably generate user requirements. The requirements related to the use of this technology in schools are associated with knowledge and routines. There is also a need for a positive attitude towards the required modifications to the way conversations and dialogs are conducted in the classroom. Obviously, teachers play an important role as implementers and role models in achieving this.

In the HODA Study, our point of departure has been that the pupil with hearing loss should not be the person who bears primary responsibility for the extra work and requirements described above. However, such an approach is not self-evident. For example, in a case study from

36 Gustafsson 2009 (in Swedish).

37 Bergkvist and Norman 2014, figures 8 and 9 (in Swedish).

38 Bergkvist and Norman 2014, Figure 10 (in Swedish).

39 Svensk Teknisk Audiologisk Förening/The Swedish Technical Audiological Society 2009 (in Swedish), Bergkvist and Gustafsson 2009 (in Swedish), Coniavitis Gellerstedt 2007 (in Swedish).

the US, pupils with hearing loss were encouraged to take responsibility and were, indeed, fully responsible for all practical tasks related to the communication devices⁴⁰. In the HODA literature study⁴¹, we see that Holmström⁴² raises the question of who controls the communication device in the classroom. Through their way of dealing with the use of microphones in the classroom, teachers or resource persons might indeed determine what the pupil with hearing loss has access to. In the HODA Study, we have viewed communication in the classroom as the joint responsibility of all in the room. Such an approach might be merely theoretical if it is not translated into actual routines, clear and established responsibilities, and an order of communication that provides everybody with social space: A challenge for teachers.

How do you go about getting the pupil to take responsibility for their technical devices and training? How do you tackle these issues with the pupils?

Teacher of a pupil with a communication device in the 7th grade

Case study

Alice

Alice attends the upper level of a nine-year compulsory school. There are more than 30 pupils in her class. The classroom is crowded, with pupils sitting in pairs. Alice has been placed at the front of the room. The lighting is good, but the acoustics are poor. Tables and chairs generate noise and unwanted sound also enters through windows and doors. Alice is disturbed by noise from the corridor when she attends class in the room where lessons in social science subjects are held.

Alice suffers from a moderate hearing loss and has a stationary induction loop system as well as a portable device for use at school. The portable device was in her locker outside the classroom when we visited the school, and was used during lessons in two subjects, only, outside of the standard classroom. This device was not charged when we checked it. The stationary

device was installed in Alice's standard classroom and was in working order. There were 12 microphones for her classmates in addition to the teacher's microphone. The teacher had reported a damaged teacher's microphone and a number of damaged classmates' microphones weeks ago without any response. There were two loudspeakers in the classroom and they were in working order.

Alice's teacher—who suffers from hearing loss and uses hearing aids herself—has not attended any course or further training in how to work with pupils with hearing loss and does not have any previous experience of teaching pupils with hearing loss. Alice received some support from a municipal special needs teacher during 2013.

The classmates' microphones had been laid out by the teacher when the social science subject lesson started, and were also packed away by the teacher at the end of the lesson. The teacher checked that the loudspeakers worked and checked with Alice that she could hear via the communication device. Dialogs between teacher and pupils as well as shorter group tasks or teamwork activities were carried out in class. During teamwork activities, Alice (who was without any communication devices) and her team sat in a narrow corridor with a completely unacceptable acoustic environment.

The technical devices were used properly during the observed lesson. However, a number of the classmates' microphones did not work satisfactorily due to inaccurate trimming or inadequate handling by pupils. Order in the class was good, and the teacher showed an awareness of Alice's needs and adjusted her teaching by, for example, talking in a distinct way, repeating answers, writing on the board, and asking follow-up-questions. Alice herself appeared to be well aware of her needs and seemed to have a positive self-image. She and her peers seemed to be well motivated in the learning process.

The responsibility for charging the portable device and for bringing it to other classrooms is explicitly Alice's.

Conclusion

Alice has both stationary and portable devices, a number of microphones for her classmates, a loudspeaker, and an educator who works attentively using stable routines and an approach that is appropriate for a pupil with hearing loss.

However, we also found several deficiencies, poor acoustics being one of them. Moreover, Alice cannot visually interpret or lip-read her peers when they speak, and there are no rooms for teamwork. A number of the microphones in the multi-microphone system did not work due to interference from a transmitter in the vicinity of the school. There were no written instructions for teachers and substitute teachers on how to handle the devices.

Despite deficiencies, we assess Alice's situation in class as being one of the best of the 63 classroom situations we observed.

40 Cawthon 2001, pp. 220–221.

41 Bjarnason 2014 (in Swedish).

42 See, for example, Holmström 2013, p. 78.

Some research on pupils with hearing loss and technology has dealt with communicative and technology-related strategies used by the pupils in class. Some communicative strategies used by pupils with cochlear implants in a study by Holmström⁴³ were, for example, to ask for speech to be repeated, to adjust the device, to look at the speaker, to observe, to seek eye contact with a resource person, and to ask for clarifications. Technology-related strategies used by the pupils concern how they use the different listening programs in their hearing aids in different situations⁴⁴. In the HODA Study, only teachers' strategies are discussed.

In conclusion, everyday life at school is the HODA Study's focus and, accordingly, auditory and social settings in the classroom have been critical in its design.

43 Holmström 2013, p. 102.

44 Odelius 2010.

7 Data collection in the HODA Study

In this section we provide information about the population and data collection used in the HODA Study.

Gross population, target population, and considerations

Gross population

The group of children and youths of interest in the HODA Study was made up of all those registered at the Hearing Habilitation Children and Youth unit at Stockholm's Karolinska University Hospital and attending inclusive education⁴⁵. Besides being registered at the habilitation unit in the spring of 2013, the pupils had to meet two additional criteria. They were required to:

1. Live in the Stockholm County area and have been born between 1997 and 2003
2. Have been prescribed hearing aids bilaterally or monaurally, if deafness in one ear, or (in the case of conductive hearing impairment) if differences in hearing loss between the left and right ear did not make a bilateral bone conduit useful.

Data from medical records were collected for the gross population. See also Phase 1 below.

⁴⁵ As such, pupils attending *hörselklass* or *specialskola* were excluded (these forms of education are explained in Section 2 of this report). Pupils with diagnosed auditory neuropathy were also excluded.

Target population

A third criterion had to be met for the pupils to be included in the collection of specific HODA data: They should:

3. Have been prescribed microphone systems for use at school.

General overview of data collection

Initially, information from medical records concerning all pupils in the gross population was registered. This group of children and adolescents consists of pupils with hearing loss and hearing aids who, in the spring of 2013, according to their medical records, either:

- Currently had communication devices prescribed by the habilitation unit for use at school, or
- Had previously had communication devices (later returned) prescribed for use at school, or
- Had never been prescribed communication devices for use at school.

Based on data from medical records, we describe these three subgroups of pupils in the gross population in terms of demography, degree of hearing loss, type of communication device prescribed, etc. Data from Phase 1 was intended to answer HODA question number 1: What specific communication device packages have been prescribed for the pupils?

In a second phase, a variety of methods for collecting data concerning the target population were used:

1. *Examination and measurement of acoustic parameters* in the classroom where the pupil was taught social science subjects or (if this was not possible) the classroom where Swedish was taught. See also Point 4 below.

2. *Examination of technical devices* used by HODA pupils in the classroom where social science subjects were taught or (if this was not possible) in the classroom where Swedish was taught. The examination was carried out once an entire lesson had been observed by our observers.
3. With the consent of the pupil and their guardian:
 - *Interviews* were carried out with pupils in the target population
 - Teachers in social science subjects/Swedish were asked to fill in a questionnaire
 - Mentors were asked to fill in a questionnaire
 - Municipal special needs teachers specializing in issues related to hearing loss were asked to fill in a questionnaire if they were in contact with the HODA pupil or the pupil's school.
4. With the consent of those HODA pupils currently possessing communication devices for use at school, their guardians, and the school principals concerned, we *observed one entire lesson* in social science subjects or (if this was not possible) in Swedish. The motivation for choosing social science subjects (and thereby the classroom where the examination of the acoustics and technical devices was to be carried out) was that we judged that this particular school subject would offer lessons with a variety of pedagogical situations.

The examinations and interviews, questionnaires, and observations were designed to answer the remaining HODA questions. The concepts and definitions used in the HODA Study are presented in Appendix 1⁴⁶ to this report.

46 The forms used for interviews, the questionnaires, and the template for the observations are included in Swedish in Appendix/ *Bilaga 2* of the HODA report in Swedish. http://www.butiken.spsm.se/produkt/katalog_filer/00564b.pdf.

Test study prior to the second phase

The HODA working group prepared the various protocols, templates, and forms to be used in data collection. The experience of the professionals in the working group strongly influenced the design of these documents and elements from other studies were also considered, such as studies carried out by Rekkedal. The forms were tested in six cases: Pupils meeting criteria 1–3 above, with the exception that they did not live in the Stockholm area. The test study gave valuable input and gave rise to changes in protocols, templates, and forms to be used in the main study. Some further improvements were also made during data collection in the main study.

Data collection

Altogether, 229 children and adolescents met criteria 1 and 2 above and, accordingly, made up the gross population. An identification number was assigned to each of these 229 persons and this number was then used throughout the HODA Study. The connection between this identification number and the pupil's name, address, school, etc. was known only to those persons working directly with data collection in the study and these persons were bound by a confidentiality agreement.

Phase 1: The medical records of the 229 children and adolescents were examined and the information needed for the HODA Study was registered in Excel and later exported to IBM SPSS Statistics, which was used to process the statistical tables in the study. See also the section on quality below.

Altogether, 150 children and adolescents met criteria 1, 2, and 3 above and, accordingly, made up the target population. Thus, these youngsters currently had (103 pupils, corresponding to 69 percent), or had previously had (47 pupils, corresponding to 31 percent) communication devices prescribed for use at school.

Phase 2: During the spring of 2013 the guard-

Table 7.1
Response rates in the HODA Study

Participation in the HODA Study	Number	Participating in the study (%)	Percentage of target population with HODA data
Target population: All pupils	150	100%	100%
Of which: Participated in the HODA Study Interview with the pupil* and examination of acoustics were carried out and, if the pupil had communication devices, classroom observation and examination of technical devices were also conducted.	85	57%	57%
Teachers concerned	85	100%	–
Of which: Participated in the HODA Study Filled in a questionnaire	81	95%	54%
Mentors concerned	85	100%	–
Of which: Participated in the HODA Study Filled in a questionnaire	74	87%	49%
Target population: Pupils with devices	103	100%	100%
Of which: Participated in the HODA Study Interview with the pupil, examination of acoustics, classroom observation, and examination of technical devices were carried out	63	61%	61%
Teachers concerned	63	100%	–
Of which: Participated in the HODA Study Filled in a questionnaire	61	97%	59%
Mentors concerned	63	100%	–
Of which: Participated in the HODA Study Filled in a questionnaire	56	89%	54%
Target population: Pupils currently without devices	47	100%	100%
Of which: Participated in the HODA study Interview with the pupil and examination of acoustics were carried out	22	47%	47%
Teachers concerned	22	100%	–
Of which: Participated in the HODA Study Filled in a questionnaire	20	91%	43%
Mentors concerned	22	100%	–
Of which: Participated in the HODA Study Filled in a questionnaire	18	82%	38%

* In four cases, no interview with the pupil could be conducted. Notwithstanding, all the remaining data was collected.

ians of pupils in the target population born in 1997, 1998, or 1999 were contacted, and we contacted the guardians of the remaining children during the fall. Initially, we sent a letter⁴⁷ with information about the study to guardians and asked them to give their consent to their child taking part in the study. Included was

also a letter to the pupil. The guardians were asked to fill in a written permission and also to inform us about what school the child attended, for example. Two cinema tickets for the pupil and the correction of any problems found in their microphone systems were offered to those participating. If the written permission was not returned, we contacted the guardians by telephone to give more information about the study and about the implications of an agreement to participate. A number of guardians and pupils expressed an interest in taking part in the study

47 All the documents sent to guardians, pupils, and school principals are included in Appendix/Bilaga 4 of the HODA report in Swedish. http://www.butiken.spsm.se/produkt/katalog_filer/00564b.pdf.

and many of them returned the written permission. We also got permission to visit the school from the principal of each school. Municipal special needs teachers specializing in issues related to hearing loss were contacted by telephone and subsequently received a questionnaire to answer.

Altogether, 85 pupils agreed to participate in the study, corresponding to 57 percent of the target population. In most cases, their teachers and mentors also answered their questionnaires. More details on response rates in the HODA Study are provided in Table 7.1.

Of the 85 pupils participating in the HODA Study, 17 had contact with a municipal special needs teacher specializing in issues related to hearing loss and 16 of these special needs teachers answered our questionnaires.

We have examined and compared the 85 children and adolescents who participated in the study (we have chosen to call them “HODA pupils”) and the 65 who chose not to participate in terms of known characteristics, such as age, gender, degree of hearing loss, and whether they currently use communication devices or not⁴⁸. In conclusion, for the group of pupils that is the focus of this report—i.e. pupils with current access to microphone systems for use at school—we consider that the size and composition of our group of informants is acceptable. The situation for the group of *pupils who have previously had microphone systems for use at school* is more worrisome, even though we have data for almost half of the target population. We are obliged to note here that girls are heavily underrepresented, and that pupils with multiple medical diagnoses are overrepresented in this subgroup of HODA pupils. Indeed, we present very few data regarding pupils who earlier had (but no longer have) microphone systems for use at school. In addition, we estimate that children and adolescents with foreign backgrounds, as well as children and adolescents in schools for pupils with

learning disabilities, may be underrepresented in the HODA Study generally. See also the section on quality below.

Data collection in Phase 2 was carried out during the spring term for older pupils and during the fall term of 2013 for the younger pupils. Data collection was carried out by technical audiologist Sören Holmberg and special needs teacher and coordinator for deaf/hearing-loss issues Carin Norman and, during the fall, also by special needs teacher and adviser on hearing-loss issues Anna Kjellander. Typically, a school was visited on one occasion by the technical audiologist and one special needs teacher and the examination and measurement of acoustic parameters and the interview with the HODA pupil were carried out on this occasion. In cases where the pupil had a microphone system, the examination of technical devices and the observation of a lesson in the classroom were performed. Questionnaires were given to the teachers and mentors concerned and a number of these were also filled in during our visit. Otherwise, we left a return envelope for the teacher or mentor to send the questionnaire in later. See also the section on quality below.

In addition to the data collected according to the procedure described above, the interviewers/observers in the HODA Study, Carin Norman and Sören Holmberg, also made extensive notes on their impressions of the general situation around the HODA pupil when visiting the schools. The case studies of four pupils contained in this report are based on these notes.

During their visits to the various schools in the HODA Study, the special needs teachers and the technical audiologist gained significant insight into the educational, social, physical, and technical environments in which the individual HODA pupil spent their school days. In the 63 cases where an entire lesson in the classroom was observed, this resulted in a vivid experience of everyday life at school. Classroom observations were carried out in order to obtain knowledge about the use of technology in various pedagogical situations. The teachers concerned were forthcoming and, as far as we can judge, behaved

48 An extensive presentation of this data is given in Swedish in Appendix/Bilagga 5 of the Swedish HODA report. http://www.butiken.spsm.se/produkt/katalog_filer/00564b.pdf.

as they usually do in class. Unfortunately, there was rarely an opportunity for the special needs teacher and acoustic engineer to give immediate and complete feedback to the teachers and mentors concerned.

As mentioned earlier, measurements of acoustic parameters and examinations of technical devices were carried out during our school visits. Feedback was given to the school principal concerned by means of a letter containing the registered acoustic parameters as compared to current norms. The municipality's pupil health unit also received a copy of this letter. If problems were found when examining technical devices and these faults could not immediately be cleared by the technical audiologist, feedback was provided to the *Hearing Habilitation Children and Youth* unit at Karolinska University Hospital concerning actions to be taken by this unit.

Processing and presentation

Data were registered in Statistical Package for Social Sciences (SPSS) and further processing of the data was carried out in this program. Even small numbers are presented in the tables, since we assess the risk of being able to identify individuals to be non-existent.

Quality

As is obvious from the foregoing, we have collected data from a variety of sources: Medical records, measurements, expert assessments, observations of school lessons, interviews with young people, and questionnaires filled in by adults. All these types of data might be unreliable; burdened by errors generated in some stage of collection or registration. Extensive efforts were made to minimize the risk of error. After registering data from the various data sources in separate SPSS files, frequencies and cross tables were used to check plausibility and correspond-

ence between information from these different sources. If data from the diverse data sources did not seem reasonably coherent, we checked the primary data sources and tried to remedy the problem and correct our data files. However, we cannot rule out that other types of errors may have been generated between data source and final registration in SPSS. Such errors are often generated in a random way and, for good reason, one usually hopes that such errors will cancel each other out. It is more worrying if data are burdened by systematic errors, distorting the results. Are there such systematic errors in the HODA data? We will discuss this risk in the following section.

Medical records

The information contained in the medical records at the *Hearing Habilitation Children and Youth* unit at Karolinska University Hospital in Stockholm was collected and registered for purposes other than those pertaining to HODA. The three groups of pupils that:

- Currently had communication devices prescribed for use at school;
- had previously had communication devices (later returned) prescribed for use at school; and
- had never been prescribed communication devices for use at school

make up our gross population and the two first groups make up our target population. The classification of a pupil as belonging to one of these groups was primarily decided on the basis of information registered in the *Take Care* medical records system, which is more up-to-date than the register of assistive devices. For a number of reasons, however, we cannot rule out a certain degree of uncertainty related to this classification. For instance, the information in the medical records refers to the time period that a child in the Stockholm County Council area has been registered with the *Hearing Habilitation Children and Youth* unit. Thus, no measures taken or assistive

devices prescribed in other parts of Sweden or abroad are included. Apart from this, our general assessment is that nothing indicates any over-reporting or under-reporting of information relevant to the HODA Study in the medical records. A few individual cases of missing information have been noted. We consider the medical record-based description of the 229 young persons in our gross population and the 150 youngsters in our target population in Section 8.1 to be very reliable. Some of these reliable medical record data are also used in other sections of this report, such as data on the degree of hearing loss.

Examinations: measurements, assessments, and tests

The procedures for *measuring* noise, reverberation, light, magnetic background interference, and magnetic fields, i.e. for *assessing* the acoustic environment in the classroom and the condition of microphone systems, and for *testing* the devices are explained in detail in Appendix 1.

Measurements are made using a simplified procedure and should be viewed as *indicative measurements*. There is nothing to indicate that any systematic errors may have occurred in measuring and assessing the acoustic classroom environment. Tests and assessments of the technical devices were carried out by experts and under strict criteria (see Appendix 1). All in all, we believe that the measurements, assessments, and tests carried out in the HODA Study are of a high quality, providing us with a very good overview of the physical environment of 85 classrooms and of the condition of 63 pupils' microphone systems on one particular school day in 2013. Neither do we have reason to believe that these specific classrooms or these specific devices differ in a systematic way from any others. One might think that the acoustic environment in the HODA classrooms might possibly be better than in classrooms without a pupil with hearing loss, or that someone at the school had checked the microphone system before we visited the school. However, the HODA results presented later in this report do not support such suspicions.

Response rates

Of the 150 pupils in our target population, 85 pupils, corresponding to 57 percent, chose to participate in the HODA Study. The core of the HODA Study is made up of information relating to these 85 pupils, their classrooms, their teachers and mentors, and their municipal special needs teachers specializing in issues of hearing loss. A response rate of 57 percent among young people in a data collection effort not administered by the school itself may be considered relatively high⁴⁹. HODA was carried out through close cooperation between the *Hearing Habilitation Children and Youth* unit in Stockholm and the *National Agency for Special Needs Education and Schools*, and we believe that this fact, in combination with the two cinema tickets given to the participants, was decisive in obtaining this response rate.

We cannot rule out that the pupils who chose not to participate in the HODA Study differ from those who participated. These pupils might feel that the ramifications of their hearing loss are very significant and troublesome, and something they would rather not talk about. However, it is also possible that the pupils who chose not to participate do not experience any problems related to their hearing loss, and therefore do not feel they are affected by the HODA Study. Thus, we are not in a position to state with any certainty whether the results of the HODA Study in Phase 2 are valid for the entire target population (nor, indeed, for all pupils in Sweden belonging to the corresponding national target population). As mentioned above, we have examined and compared the 85 children and adolescents who participated in the study (HODA pupils) and the 65 who chose not to participate in terms of known characteristics, such as age, gender, degree of hearing loss, and

⁴⁹ See, for instance, *Children's Environmental Health Survey 2011*. A 46-percent response rate among youngsters aged 12 years old was given as the expected rate. Institutet för Miljömedicin/The Institute of Environmental Medicine 2013 p. 39. This report is written in Swedish, but includes an extensive summary in English. http://ki.se/sites/default/files/mhr2013_1.pdf.

whether they currently have communication devices or not. We have previously commented on the results of this analysis.

In conclusion, we believe that we can provide an extensive overview of the situation at school for the pupils participating in HODA, and in particular for HODA pupils who currently have communication devices. We also believe that many of the results and the discussions of them as presented in this report are highly valid.

Observation of a lesson

All HODA pupils currently using microphone systems at school as well as their principals accepted that we were present and observed what happened during one lesson, typically a lesson in a social science subject. As mentioned earlier, the rationale for choosing social science subjects (and thereby also the classroom where acoustics and technical devices were examined) was that this kind of lesson would involve many different types of pedagogical situations. Each lesson was attended by two observers who filled in reports about their observations on a number of issues. Although one observer focused on technical factors and the other focused on pedagogical matters, both tried to cover technical as well as pedagogical elements. Afterwards, the two observers reviewed their notes together and discussed differences in their records before agreeing on one final version of their report. There is nothing in this procedure that makes us believe that any systematic error may have been generated.

Interviews and questionnaires

Forms for data collection were designed and tested in a pilot study and were further improved during the course of data collection. Nonetheless, the questions are many and some of them are difficult. Notwithstanding, the interviewers were able to explain and clarify questions that pupils did not immediately understand. In spite of this assistance, some

answers are missing⁵⁰ from the interviews and, in four cases, no interview could be carried out at all. These relate to three pupils in schools for pupils with learning disabilities and one recently-arrived pupil who had not learned Swedish yet. All other data concerning these four pupils was collected, however.

The interviewers were the same two persons who observed a lesson in the HODA pupil's classroom. They noted that pupils frequently gave a positive and favorable report on their situation in class and on the way their teachers and classmates used the microphones. However, these reports did not always match supplementary information obtained through other questions, through the observations made in class, or through examining the actual condition of the microphone systems. Consequently, we cannot rule out that our young informants in a systematic way gave favorable descriptions and assessments of various issues. The reasons for this could be many, including loyalty or a desire to please or, indeed, that the pupils have never found themselves in an optimal situation with a technical device and, therefore, have difficulty in imagining such a situation and comparing it to their own current situation. When relevant, we will comment on this in the presentation given in this report.

Some missing answers were also discovered in the questionnaires filled in by teachers and mentors. Among other things, teachers were asked to make assessments about their pupils' hearing loss, about the physical environment at school, and about the microphone system in different pedagogical situations. Such assessments might have been difficult for them to make, particularly if they lacked frames of reference or an opinion as to what would be optimal. When relevant, we will comment on this in the presentation given in this report.

⁵⁰ Missing answers are presented either in, or directly under, each table in Appendix 2 to this report.

Summary

We consider that the risk of systematic errors in the HODA data is insignificant, with the exception of a few cases. We believe that pupils may underreport problems occurring in their everyday situation at school. We also believe that pupils with foreign backgrounds are underrepresented among the pupils participating in the HODA Study. Finally, we have missing interview data (the remaining data is acceptable) concerning pupils in schools for pupils with learning disabilities.

Summary and comments

A variety of data sources were used in the HODA Study to collect data on pupils with hearing loss and their experiences of using microphone systems at school. Some of our data files have missing answers and there is a certain degree of underrepresentation. However, we believe that the results presented in Section 8 of this report give ample material for answering the HODA questions presented in Section 5, and for a discussion about the situation at school for this group of pupils.

8 Results of the HODA Study

8.1 Children and youth with hearing loss registered at the habilitation unit *Hearing Habilitation Children and Youth* at Karolinska University Hospital, Stockholm

Introduction

The presentation in this section is based entirely on data taken from medical records collected and registered in the first phase of the HODA Study.

Gross population

All those registered at the *Hearing Habilitation Children and Youth* unit at Karolinska University Hospital in Stockholm, and attending inclusive education, made up the group of children and youth analyzed in the HODA Study. Consequently, pupils in *hörsekllass*⁵¹ or *specialskola*⁵² were excluded, as were pupils with diagnosed auditory neuropathy. Besides being registered at the habilitation unit in the spring of 2013, the pupils had to meet two additional criteria. They should:

1. Live in the Stockholm County area and have been born between 1997 and 2003
2. Have been prescribed hearing aids bilaterally or monaurally, if deafness in one ear, or (in the case of conductive hearing impairment) if differences in hearing loss between the left

and right ear did not make a bilateral bone conduit useful.

These children and youths with hearing loss totaled 229 individuals aged 10–16 years. In this section we give a brief presentation of this group, hereinafter referred to as the gross population.

Facts

Degree of hearing loss

Classification used by Karolinska University Hospital

The audiometric values below are averages of values at 500, 1,000, 2,000, and 4,000 Hz.

HL: Hearing Level

Normal = < 20 dB HL

Slight = 20-40 dB HL

Moderate = 41-60 dB HL

Severe = 61-90 dB HL

Deaf = ≥ 91 dB HL

Facts

Hearing and communication devices

See also Appendix 1

Hearing aids

Hearing aids is used here to signify behind-the-ear hearing aids, in-the-ear hearing aids, CROS hearing aids, bone-anchored hearing aids, and cochlear implants.

Most hearing aids have two or more listening programs or positions to choose between, depending on listening environments and needs. All hearing aids have an “M-position”, or microphone position. When using the M-position, all sounds in the

51 *Hörsekllass* is a school class at a mainstream school that provides an environment designed to accommodate a class consisting entirely of pupils with hearing loss.

52 *Specialskola* is a school for pupils with hearing loss or deafness and/or other impairments that impede communication. Swedish sign language as well as spoken Swedish are used in teaching.

environment are amplified. In the "T-position", or alternatively the "FM-position", sound is picked up electronically by the tele coil of the hearing aid via induction loop systems or radio waves and all other sounds are shut out. A combined "MT-position", or alternatively an "MFM-position", may also be available.

Communication devices, microphone systems, Assistive Listening Devices

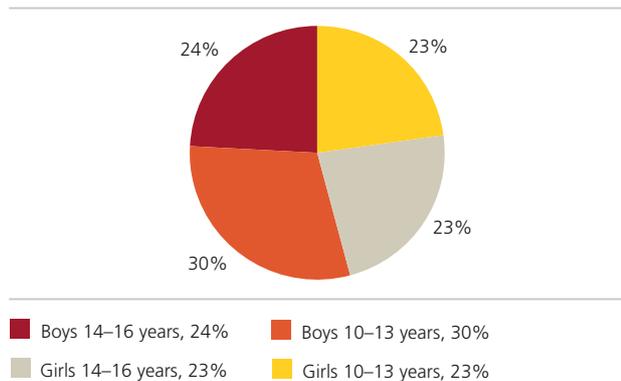
Technical devices (such as induction loop amplifiers, wireless microphones and receivers) that supplement listening via hearing aids. *Stationary installations* with induction loop systems and wireless microphones (with or without microphones for classmates) or *personal-worn, portable, receivers* with listening via neck loop or mini FM receiver (with or without microphones for classmates) are the technologies used in Swedish school contexts.

Loudspeakers

The purpose of loudspeaker systems is to distribute speech acoustically in the classroom from the teacher's and, if available, classmates' microphones.

As is evident from the diagram below, there were more boys than girls registered at the habilitation unit, especially among the younger patients.

Chart 8.1.1
Gross population by gender and age

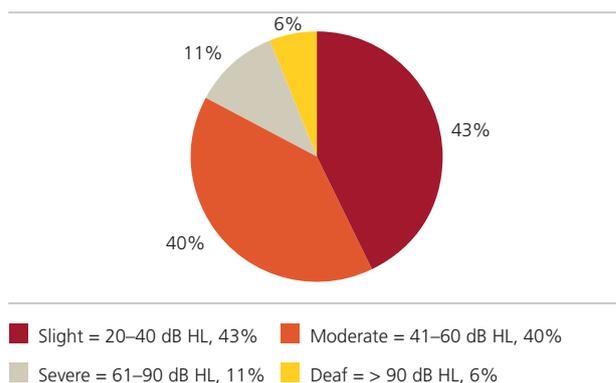


Gross population, 229 individuals, by gender and age. See also Table 8.1.1.

The graph below shows the degree of hearing loss without hearing aids. We observe that slight and moderate hearing losses dominate. All indi-

viduals suffering from deafness have cochlear implants, usually in both ears. See also Table 8.1.6.

Chart 8.1.2
Degree of hearing loss

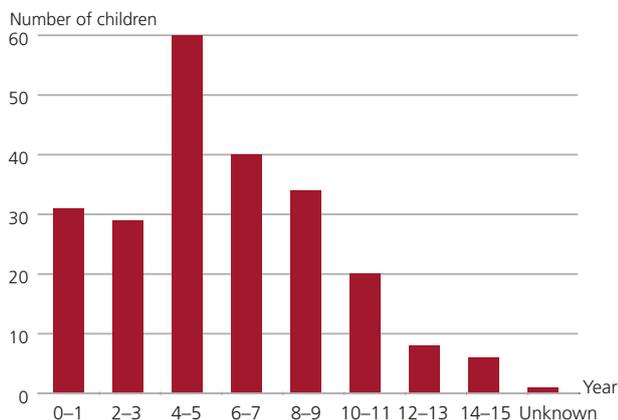


Gross population, 229 individuals aged 10–16 years by degree of hearing loss. Degree of hearing loss without hearing aids according to the classification used by Karolinska University Hospital. See further information about this in the running text. See also Table 8.1.2.

Most of the children and young people in our gross population received their diagnosis when they were 4–5 years old⁵³, as can be seen in Chart 8.1.3, with more profound hearing loss often being diagnosed early on in the child's life, as is shown in Chart 8.1.4.

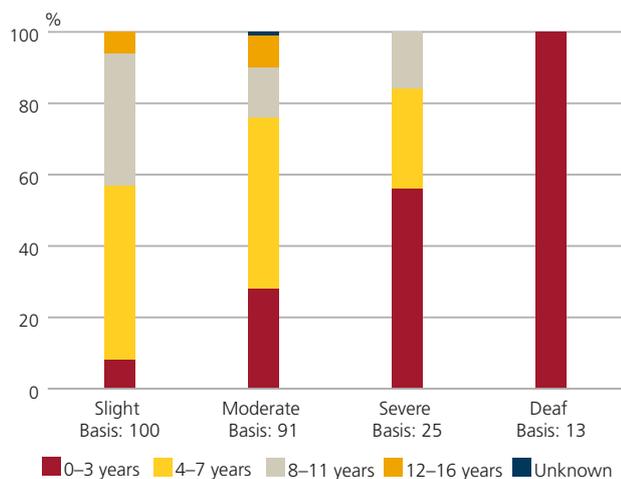
53 Screening for hearing loss in newborns in Sweden through otoacoustic emissions was introduced in stages and has been offered for all newborns since 2005. Accordingly, the children in the HODA gross population (born 1997–2003) have been offered such screening to varying degrees. There are two major reasons why hearing loss might not be detected through screening: One is that the child was born with a very slight hearing loss that was not detected at the time, but has since intensified, or when the onset of hearing loss occurs later. In both these cases, the hearing loss is usually detected when the child undergoes the 4-year-old checkup at child health centers. The other reason is that children with recurring otitis may eventually develop hearing loss.

Chart 8.1.3
Age at diagnosis of hearing loss



Child's age when the diagnosis of hearing loss was established. Columns total 229 children and youths aged 10–16 years. See also Table 8.1.3.

Chart 8.1.4
Degree of hearing loss and age when the diagnosis was established



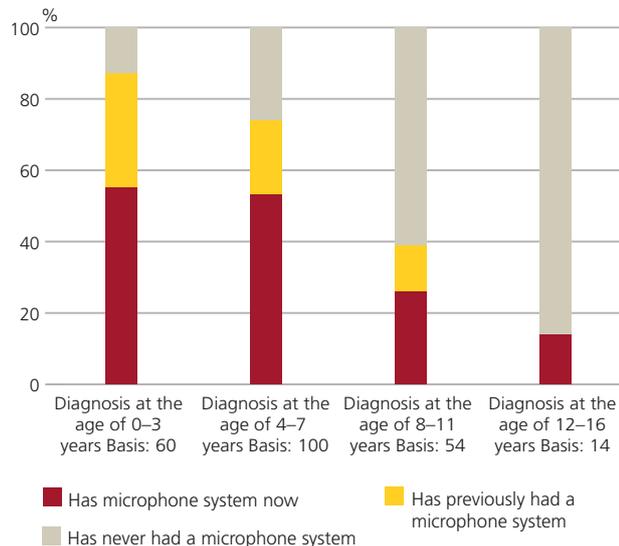
Degree of hearing loss and the child's age when the diagnosis was established, 229 children and adolescents aged 10–16 years. Basis = Denominator when calculating percentages in each column. Note that age is presented in intervals, including *four cohorts*, with the exception of the last age category, which includes *five cohorts*. See also Table 8.1.4.

Eight percent of the 229 children and youths in our gross population have cochlear implants in both ears and 88 percent have behind-the-ear hearing aids or in-the-ear hearing aids in both ears. The remaining four percent have combinations of different types of hearing aids. See Tables 8.1.5 and 8.1.6. From Table 8.1.7, we can conclude that most children got their first hearing aid in the same year as their diagnosis was established. Using hearing aids early on has been found to be important for speech development in children with hearing loss⁵⁴. In the HODA gross population, approximately one in four children got their first hearing aid before the age of four, and one in two children got their first hearing aid before the age of seven. See Tables 8.1.7 and 8.1.8. Among the 18 boys and girls now with cochlear implants in both ears, 13 children (72 percent) received their diagnosis before the age of two, and their first hearing aids before the age of three.

Not surprisingly, an early diagnosis seems to imply that pupils have tested and, in many cases, also returned communication devices for use at school, as can be seen in Chart 8.1.5. Obviously, children who have their diagnosis established early on have had more time to adapt to their hearing loss, to their hearing aids, and to other assistive devices. The same goes for their families, peers, and other people in their social vicinity. Children and young people who have their diagnosis established after having started school encounter quite a different situation, even if their hearing loss is often milder from a comparative standpoint. Among the 68 individuals in the HODA gross population who had their diagnosis established after the age of seven, 63 percent were diagnosed with slight hearing loss, 31 percent with moderate hearing loss, and six percent with severe hearing loss. See also Table 8.1.4.

54 See Gustafsson 1984 (in Swedish).

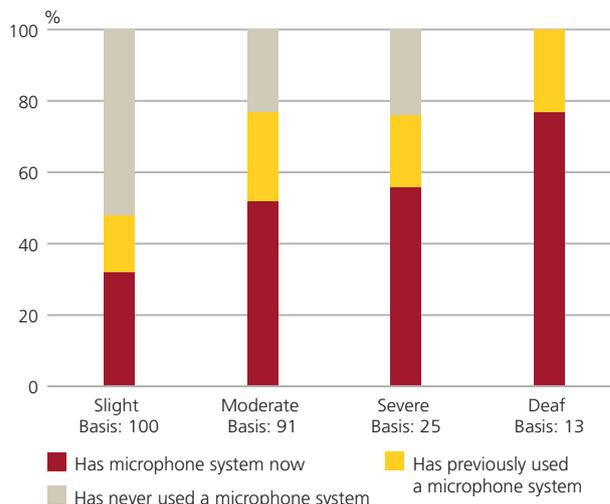
Chart 8.1.5
Age when diagnosis of hearing loss was established and communication device for use at school



Age when diagnosis of hearing loss was established in combination with communication devices at school, 229 children and adolescents aged 10–16 years. Basis = Denominator when calculating percentages in each column, that is, the total number of children in each age interval. Note that age is presented in intervals consisting of *four cohorts*, with the exception of the last age category, which includes *five cohorts*. See also Table 8.1.9.

Over three-quarters of pupils with current or former access to communication devices for use at preschool or school got their first hearing aids before the age of eight. The corresponding proportion among pupils who have never been prescribed communication devices is less than one-quarter. See Table 8.1.10. As seen in Chart 8.1.6, the greater the degree of hearing loss, the more often communication devices for use at school are prescribed. Even though the number of children with severe hearing loss is small—25 persons—one might still wonder why such a large proportion has not been prescribed, or tested, communication devices for use at school. We also noted that over half of the pupils with slight hearing loss have never used communication devices at preschool or school. See Table 8.1.11. Chart 8.1.6 shows the degree of hearing loss in combination with communication devices at school.

Chart 8.1.6
Degree of hearing loss and communication devices for use at school



Degree of hearing loss and communication devices at school, 229 children and adolescents aged 10–16 years. All those classified as deaf have cochlear implants, usually in both ears. Basis = Denominator when calculating percentages in each column, that is, the total number of children in each category of the degree of hearing loss. See also Table 8.1.11.

In subsequent sections of this report the pupils who presently have, or have previously had, communication devices at school are the focus (i.e., the 150 individuals who correspond to the red and yellow sections of charts 8.1.5 and 8.1.6), and in particular the 103 girls and boys now using communication devices at school, shown in red in the graphs. However, before we leave our gross population, we will look into whether or not and how pupils with hearing loss and their teachers receive different types of support. See also Section 2 above about the support given to pupils with hearing loss.

In the Stockholm County Council area in 2013, just a few of the 26 municipalities had a municipal special needs teacher with an overall responsibility to support pupils with hearing loss, their teachers, classmates, and schools. More than 40 percent of the 229 pupils in the gross population did not have access to such a local special needs teacher in their municipality. See Table 8.1.12. We also noted that pupils who earlier had a communication device at school, but later returned it, more often lacked access to a special needs teacher in their municipal-

ities, as compared to pupils presently using communication devices. Has a lack of support for the pupil from, for instance, a municipal special needs teacher been a significant factor in the pupil's decision to stop using a communication device at school? The HODA Study does not provide an answer to this question. Moreover, mere access to a municipal special needs teacher does not automatically mean that support is also provided to a pupil and their teacher; a point we will return to later.

Besides any support received from a municipal special needs teacher, pupils also receive support from the habilitation unit *Hearing Habilitation Children and Youth* through hearing consultations or visits at school from a special needs teacher. Hearing consultations are always carried out by the habilitation unit on behalf of parents or the pupil and can be described as gatherings of relevant people, such as the pupil's teachers or training team, for the purpose of informing them about the pupil's hearing loss, and to ensure the optimal use of communication devices. The purpose of a visit to a school by a special needs teacher from the habilitation unit could, for example, be to follow up on a hearing consultation or to take part in a pupil social welfare meeting or talks with teachers about teaching methods and pedagogics. In our gross population of 229 pupils with hearing loss, hearing consultations and visits from the habilitation unit special needs teachers during the last two years have concerned pupils presently or previously using communication devices in nine out of ten cases. We will return to this point when we address our target population below.

Target population

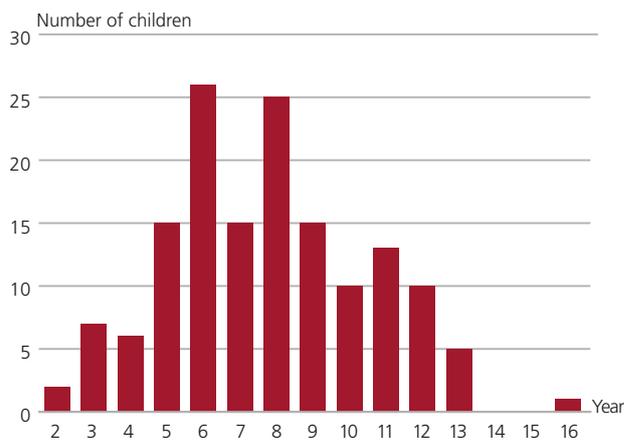
We call the pupils who now have, or have previously had, communication devices for use at school our target population. This population totals 150 boys and girls aged 10–16 years who have been prescribed communication devices for use at school. The devices are different types of stationary or portable devices, the purpose of which is to give these pupils with hearing loss opportunities to be involved in what goes on in the classroom. Thus, for pupils with hearing loss, access to communication devices is a factor in the accessibility of their schools. However, access to communication devices is often a

necessary, though not a wholly sufficient, precondition for pupils with hearing loss to be able to truly participate in education and school activities.

Chart 8.1.6 and Table 8.1.11 reveal that, as a group, our target population has been diagnosed with higher degrees of hearing loss compared to the young people who have never been prescribed communication devices. In addition, it is obvious that pupils who have been prescribed communication devices also to a larger extent received their diagnoses and their hearing aids at an early age. See tables 8.1.9 and 8.1.10.

Chart 8.1.8 shows at what age children in our target population were prescribed communication devices for use at school (including preschool) for the first time⁵⁵. We observe that the years around the time when children begin attending school (typically at the age of seven in Sweden) figure prominently when it comes to starting to use communication devices.

Chart 8.1.8
The child's age when prescribed a hearing device for use at school or preschool for the first time



Age when prescribed a communication device for use at school or preschool for the first time. Columns total 150 children and adolescents aged 10–16 years who have been prescribed communication devices. See also Table 8.1.14.

⁵⁵ "For the first time" refers to the first time since the child was registered at the *Hearing Habilitation Children and Youth* unit. Children who have moved into the Stockholm County Council area from other parts of the country or from abroad may have an earlier medical history that is not registered in the medical records used to collect data for the HODA Study.

Approximately one in ten pupils in the target population was prescribed communication devices in the same year as they were diagnosed with hearing loss. See Table 8.1.15. As is shown in Chart 8.1.9, the first hearing device is most commonly prescribed some years after the diagnosis is established.

Of the 150 pupils who have had communication devices prescribed for use at school or preschool, a majority, or 57 percent, have had such devices prescribed on several—at the most three—occasions by the *Hearing Habilitation Children and Youth* unit. Among those who have kept their devices, 67 percent had devices prescribed more than once, while the corresponding proportion among those who have returned and do not presently use any devices is 36 percent. See tables 8.1.16 and 8.1.17. It is safe to say, however, that pupils who have returned their communication devices may be prescribed such devices again later in their school years. Indeed, the question about communication devices might also re-emerge during further studies or when at work.

About three-quarters of the pupils in our target population were initially prescribed a stationary communication device for use at school or preschool. On examining the devices prescribed for the second and third time, we find that stationary systems are rarer. See Table 8.1.18. In other words, it is not unusual for a pupil to be prescribed a stationary microphone system and later to turn to using—or supplementing this with—a portable system. Chart 8.1.10 reveals that portable microphone systems are increasingly commonly prescribed on the second and third occasions. The reasons for this may be that the child has grown older and is assessed as needing a portable system, or that the prescription of portable microphone systems, in general, has become more popular lately.

Chart 8.1.11 illustrates that the greater the pupil's degree of hearing loss, the more prescriptions they have. However, this pattern is somewhat muddled by pupils suffering from deafness and those with cochlear implants.

Among the 103 boys and girls who presently use communication devices, more than one-third,

or 37 percent, have been prescribed one or more stationary systems only, and thus do not seem to have had the experience of using a portable system. Almost as many pupils, 34 percent, were initially prescribed one or two stationary devices and thereafter a portable device. Less than one in five pupils has been prescribed one or more portable systems, only, and, accordingly, seems to have no experience of using a stationary system. See also Table 8.1.20.

On examining the type of microphone system prescribed on the most recent prescription occasion to the 103 pupils presently using communication devices, we see from the lower part of Table 8.1.21 that somewhat more pupils were prescribed portable systems on the most recent occasion. The patterns differ between younger and older pupils in a slightly unexpected way, with portable devices being more common among the younger pupils, and stationary systems among the older pupils. We also noted that neck loops⁵⁶ dominate the portable systems, even among the younger pupils who usually have a home classroom⁵⁷.

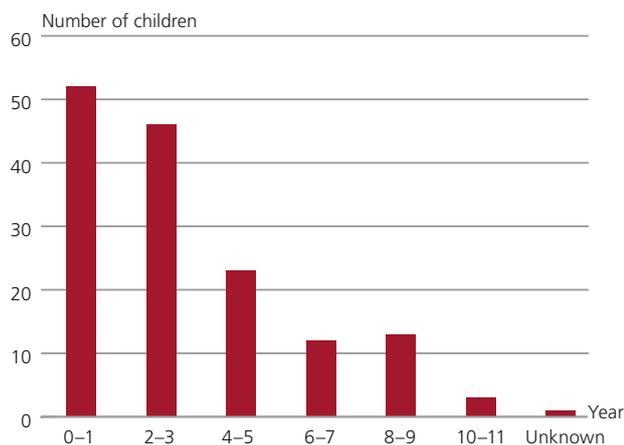
Chart 8.1.12 suggests that older boys more often have a stationary microphone system prescribed as compared both to younger boys and to girls in both age groups. However, the basis used to calculate the percentages shown in the graph is very small, and each child might represent a high percentage—as much as seven percent among older girls—which certainly does not allow us to view the pattern as stable based on these data alone. Still, we do feel that this is an issue worth looking into further.

It is not always registered in the medical records that a certain pupil's microphone system has been returned, even though they do not use the device at school anymore. One reason for this might be that the device is used by another pupil. Most of the 47 pupils who previously used a microphone system at school returned it to the *Hearing Habilitation Children and Youth* unit

56 See Appendix 1.

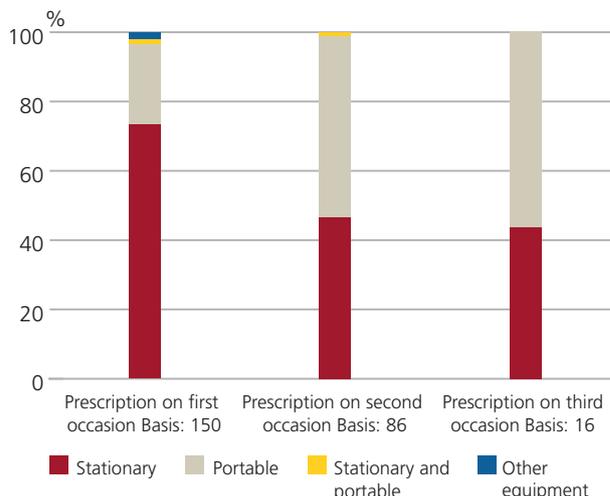
57 I.e. most lessons are held in one and the same classroom.

Chart 8.1.9
Number of years between diagnosis and first communication device



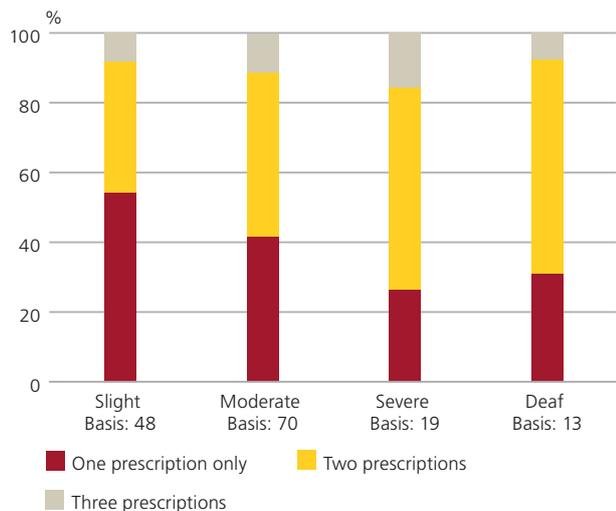
Number of years that passed between establishing diagnosis and the first communication device for use at school or preschool. The columns total 150 children and adolescents aged 10–16 years who have been prescribed communication devices. See also Table 8.1.15.

Chart 8.1.10
Type of communication device prescribed on each occasion



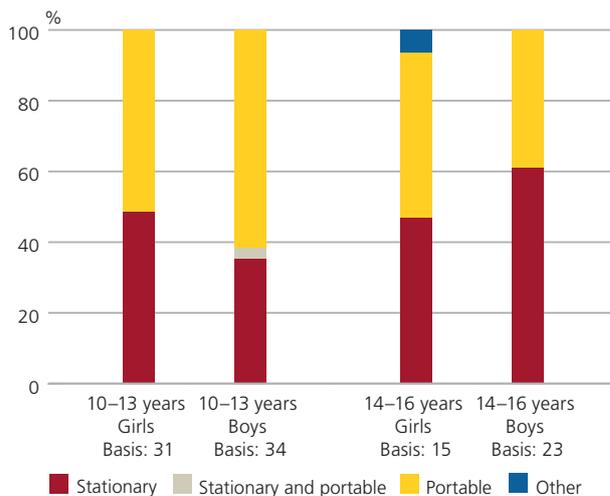
Type of communication device system prescribed at the first, second, and third prescription. Basis = Denominator when calculating percentages in each column. Other equipment: Equipment to be used without hearing aids. See also Table 8.1.18.

Chart 8.1.11
Degree of hearing loss and number of prescriptions



Degree of hearing loss and number of prescriptions, 150 pupils who have been prescribed communications devices. Basis = Denominator when calculating percentages in each column. See also Table 8.1.19.

Chart 8.1.12
Pupils currently using communication devices at school and the type of device prescribed on the last prescription occasion

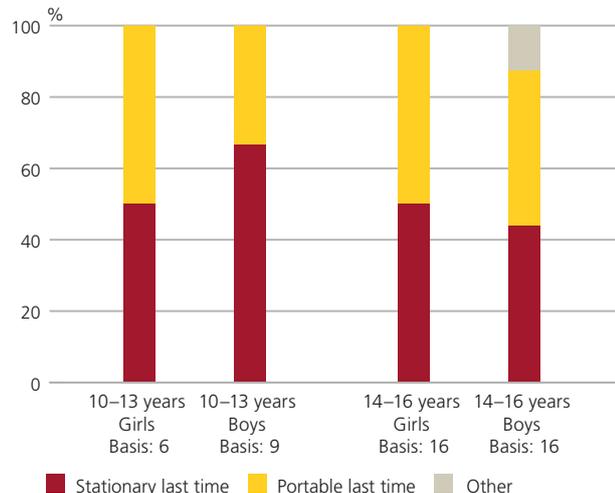


Type of microphone system prescribed on the last prescription occasion to 103 pupils presently using communication devices at school. Age: Pupil's age, 2013. Other: Equipment to be used without hearing aids. See also Table 8.1.21.

when they were 10–13 years of age. Could it be that this is a sensitive age when microphone systems should not be visible? See also Table 8.1.22.

The basis for calculating percentages among pupils who no longer have communication devices at school (see Chart 8.1.13) is even smaller than when we performed the same calculation for pupils who presently use devices at school. The chart suggests that stationary and portable systems were equally common among the girls in both age groups, while stationary systems were more common than portable systems among younger boys.

Chart 8.1.13
Pupils who no longer use communication devices at school and the type of device prescribed on the last prescription occasion

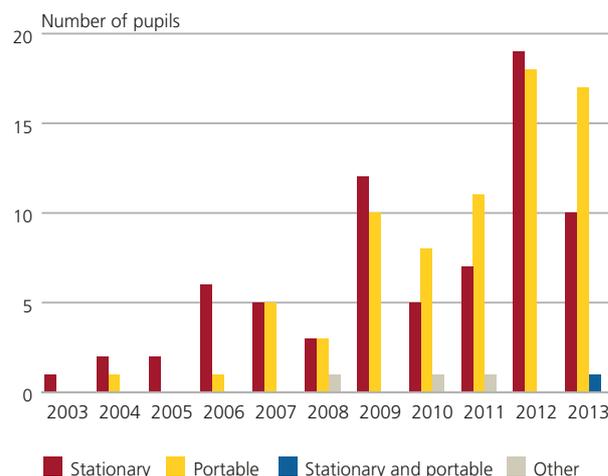


Type of microphone system prescribed on the last prescription occasion to 47 pupils who have returned their communication devices. Age: Pupil’s age, 2013. Other: Equipment to be used without hearing aids. See also Table 8.1.23.

In the target population as a whole, portable microphone systems have been prescribed slightly more often on the most recent prescription occasion. See tables 8.1.24 and 8.1.25. Portable devices seem to have become more popular lately, as can be seen in Chart 8.1.14. This may be a consequence of the shift in technology, as mentioned in Section 3 of this report. The data for 2013,

however, refer only to prescriptions issued during the spring.

Chart 8.1.14
Latest communication device. Year of prescription and type of device



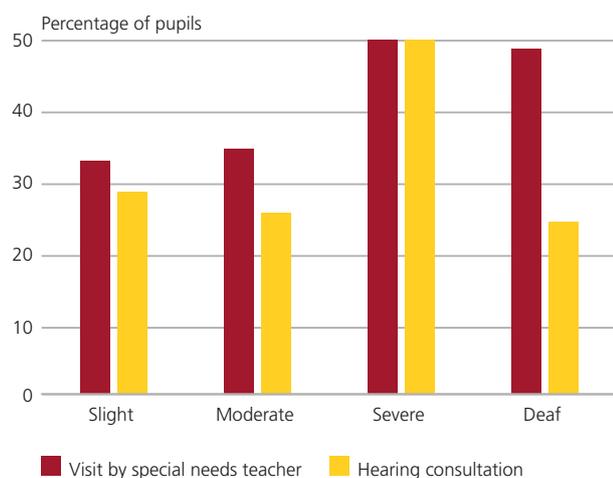
Type of microphone system prescribed on the last prescription occasion to the 150 pupils in the target population. Note that 47 pupils have returned their devices and, moreover, that prescriptions in 2013 refers to prescriptions issued during the spring, only. See also Table 8.1.24.

It has long been the case that an extra teacher’s microphone has been used by the pupil’s classmates in class. Prescriptions of microphones explicitly for use by classmates of the 150 pupils in our target population in the Stockholm area occurred for the first time in 2006, when one pupil was prescribed five peer mics. Since then, 70 separate prescriptions of microphones for classmates have been issued. The number of microphones prescribed on a single occasion and intended for use by classmates in a multi-microphone system range from one peer mic to 16 peer mics. We were unable to analyze the number of peer mics prescribed and the size of the class. Either six, nine, or ten peer mics were most commonly prescribed, the average being 7.4 microphones per occasion. See also Table 8.1.26. It is consistently more common for girls to have peer mics prescribed. See also Table 8.1.27. Data on the prescription of microphones for classmates in relation to the pupil’s

degree of hearing loss, type of hearing aid, gender, and whether or not the pupils have communication devices at present or have returned them, are shown in tables 8.1.28-31.

As mentioned above, support from the *Hearing Habilitation Children and Youth* unit is provided either through visits to schools by a special needs teacher or a hearing consultation. Chart 8.1.15 lets us review the extent of the support given to pupils in the target population, presently with or without communication devices, in relation to their degree of hearing loss. We recall that all children who are classified as suffering from deafness also have cochlear implants and that these children receive support (in addition to the support given by *Hearing Habilitation Children and Youth*) from the CI-team at Karolinska University Hospital, and that this support is not included in the data presented here.

Chart 8.1.15
Support during the last two years from
***Hearing Habilitation Children and Youth*:**
Visit at school from special needs teacher
and hearing consultation, respectively



Pupils aged 10–16 years who now have, or have previously had, communication devices for use at school, 150 individuals: Percentage of pupils who have received support from the *Hearing Habilitation Children and Youth* unit during the last two years via a visit at school by a special needs teacher and hearing consultation, respectively, in combination with their degree of hearing loss. See also Table 8.1.32.

Summary and comments

The information in Section 8.1 could be regarded as a statistical account of activities at the hearing habilitation unit based on medical records covering all children and youths with hearing loss aged 10–16 years in the Stockholm County Council area.

We noted that somewhat more boys than girls were registered at the *Hearing Habilitation Children and Youth* unit and that the most common degree of hearing loss was slight or moderate hearing loss. In addition, more severe hearing losses were diagnosed comparatively early on in the child's life, and an early diagnosis frequently implies that a child has experience in the use of microphone systems. For most children, the question of communication devices seems to come up around the time they begin school, and pupils often had devices prescribed on more than one occasion. In examining the type of microphone systems prescribed for use at school or preschool, portable systems were slightly more common among pupils who have kept their device at school. Somewhat unexpectedly, we found that portable devices were more common among the younger pupils, while stationary systems dominated among older male pupils.

The account given in this section generated some questions that needed to be addressed. One such question was how and among whom views are exchanged about whether or not a pupil should have a communication device at school. For instance, how is it possible that around one-quarter of pupils with severe hearing loss have never even tried using a communication device? One explanation might be that the child does not have the cognitive capability to use such a device. However, of the relevant pupils, just one has a diagnosis other than hearing loss registered in their medical record. Hence, it seems often to be the case that one or more persons—the pupil, parents, staff at school or at the habilitation unit—have come to the decision that communication devices are not needed or will not be trialed. The HODA Study does not answer questions concerning how decisions on these issues are reached. Microphone systems used in schools

to help pupils with hearing loss participate and reach educational goals do require specific measures to be taken, though this is certainly also the case when no technology is used.

Another question raised was whether the assessments of the individual need for microphone systems at school have resulted in a gendered pattern. More research is needed on these issues⁵⁸.

The large number of portable systems, often with a neck loop receiver, prescribed to younger pupils also raises questions. Younger pupils usually spend most lessons in the same classroom. Is the portable device a complement to a stationary device, or is it the only equipment that the pupil uses? We have been unable to provide an answer to this question.

To conclude, the questions about a gendered pattern and an unexpectedly high rate of use of portable systems by young pupils might motivate collective reflection on the part of habilitation staff as to how assessments of individual needs are carried out by personnel prescribing devices at the hearing habilitation unit. Regularly discussing and reflecting upon systematic statistics concerning prescription activities, disaggregated by gender and age, might be a way to achieve a conscious and transparent practice for prescribing technical devices.

We observed that pupils often had their first communication devices prescribed by the time they began school. This is a reminder of the need for schools to be prepared for the eventuality that a new pupil with a hearing loss (for example) may show up when the term starts. Long-term planning is important for both the pupil and the relevant teachers if starting school is going to be a successful and smooth transition for children with hearing loss.

8.2 Pupils, teachers, and municipal special needs teachers in the HODA Study

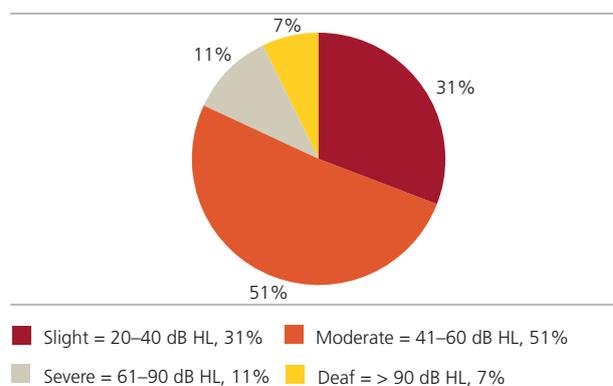
This section discusses the pupils participating in the extensive HODA Study and their teachers as well as municipal special needs teachers.

Pupils

The HODA pupils comprise 85 children and youths born between 1997 and 2003 and, accordingly, were 10–16 years of age when the HODA Study was carried out in 2013. The boys totaled 48 pupils, making up 56 percent of the group, and the girls were 37 pupils, corresponding to 44 percent. Over one-third of the pupils had their diagnosis established before the age of four. See also Table 8.2.1. A large majority of the HODA pupils, over 85 percent, had in-the-ear or behind-the-ear hearing aids, while a few had cochlear implants and even fewer had other types of hearing aids. See Table 8.2.2. In Chart 8.2.1 we see the HODA pupils' diagnosed degrees of hearing loss.

All the 85 HODA pupils had used communication devices at school. They either had such devices in 2013, or they had used such devices earlier but had returned them. They attended

Chart 8.2.1
Degree of hearing loss



HODA pupils (85 pupils) who have been prescribed communication devices for use at school: Degree of hearing loss. Degree of hearing loss according to the classification used at Karolinska University Hospital. See also Table 8.2.3 and Appendix 1.

58 Åkerström discusses the different experiences of participation at school by girls and boys and suggests a number of hypotheses for further investigation. See Åkerström 2014, p. 106.

the intermediate⁵⁹ or upper levels of nine-year compulsory school. More than 60 percent of the 82 pupils answering the question about their use of hearing aids “always” or “mostly” used their hearing aids at school during class, during breaks, and in the school canteen⁶⁰. This is about the same rate observed in a study from 2006⁶¹. According to the HODA Study, boys used their hearing aids more than girls. About 30 percent of the HODA pupils used their hearing aids more selectively during specific lessons or activities. For example, one in four pupils rarely or never used hearing aids during physical education. A few stated that they never use their hearing aids at school. Obviously, none of these pupils had microphone systems at school any more. See also Table 8.2.4.

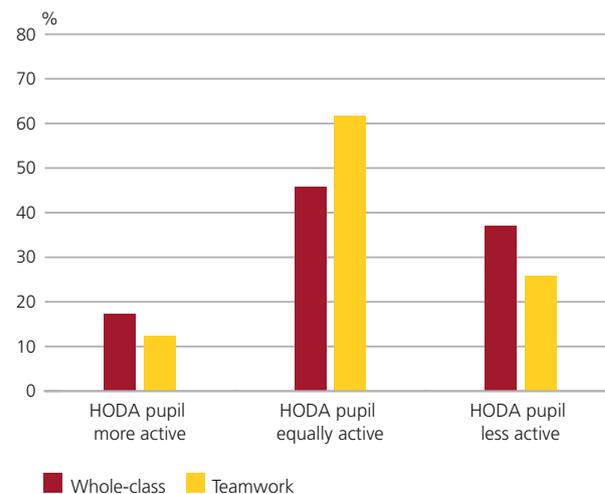
As we understand from the above, three pupils did not answer the question about their use of hearing aids at school. In the case of four pupils, as indicated above, no interview was conducted, and there were a few additional pupils who answered only a small number of the interview questions. One of these pupils just recently arrived in Sweden and the other pupils attend schools for pupils with learning disabilities. In some of these cases, however, some questions, such as the one about the use of hearing aids, were answered by the teacher.

Information about whether the size of the class or group of pupils was reduced to accommodate the needs of the pupil with hearing loss is available for 67 pupils. In eight of these 67 cases, corresponding to about 12 percent, such a reduction had been made. Seven of these pupils followed the curriculum for compulsory schools, and one followed the curriculum for schools for children

with learning disabilities. In Section 8.5 below, we will see that about half of the 63 classes with communication devices consisted of fewer than, and half consisted of more than, 20 pupils. About one-quarter of the classes had fewer than 15 pupils.

We asked the social science subject teacher⁶² to evaluate the activity of the HODA pupil during class (as compared to their classmates) when the lesson is performed with the entire class together and when the pupils work in teams, respectively. Activity is here defined as answering questions, asking questions, or taking part in discussions, for example. In Chart 8.2.2, we see that teachers usually thought that their pupil with hearing loss was active in class to the same extent as their fellow pupils. However, in more than one-quarter of cases, the teacher considered the pupil with hearing loss to be less active in class than their peers.

Chart 8.2.2
HODA pupils as compared to their classmates in terms of activity in class—assessment made by the teacher



Activity of pupils with hearing loss in whole-class settings and during teamwork, respectively, according to an assessment by their teachers. The red and yellow columns combined total 100 percent of 81 pupils who now have, or who previously had, microphone systems at school. See also tables 8.2.5 and 8.2.6.

59 Two pupils were in the third grade at the lower level of nine-year compulsory school when the data were collected. They are classified here as attending the intermediate level.

60 All HODA pupils with cochlear implants in one or both ears “always” used them at school.

61 Coniavitis Gellerstedt 2006 (in Swedish). This study concerned pupils aged 13–19 years in all types of schools. Pupils in compulsory schools used their hearing aids to a larger extent than pupils at upper secondary schools and female pupils used hearing aids more often than male pupils.

62 In some cases, the Swedish teacher answered the questionnaire instead. However, for four of the 85 pupils, no data were received from a teacher. Consequently, the percentages have been calculated based on the answers given by 81 teachers.

There could be many reasons why HODA pupils are more or less active in class than their classmates. When teachers assessed pupils with hearing loss to be less active in class than their classmates, they judged that this lower degree of activity was related to the microphone system or the hearing loss in several cases. See tables 8.2.5 and 8.2.6. In addition, we see in the tables that teachers more often perceived male HODA pupils to be active in class, as compared to their corresponding evaluation of the activity of female HODA pupils. Boys have been found to be more outgoing in class than girls in other studies⁶³, also.

We should also mention that during three of the 63 observed lessons, our observers noted that the HODA pupil was not participating or involved at all. The observers also found that further adaptations in teaching methods and physical settings to meet the needs of these three pupils could indeed be made, although they could not help wondering at the choice of inclusive education in the cases of these pupils. All three pupils suffered from deafness or severe hearing loss and followed the curriculum for the nine-year compulsory school.

Of the 85 pupils participating in the HODA Study, 20 percent lived in municipalities with a municipal special needs teacher with an overall responsibility to support pupils with hearing loss, their teachers, classmates, and schools, and these pupils also received support from this special needs teacher. Almost all these pupils had microphone systems at school. Another 40 percent of the pupils also lived in municipalities that had a special needs teacher, but we have no record of any support being given. The remaining 40 percent of the HODA pupils lived in municipalities where there was no special needs teacher. See Table 8.2.7. We will comment on these issues in the summary.

The pupils were asked in the interview if there was a special needs teacher or someone else providing support at school in issues related to

hearing loss. A little more than one-quarter of the pupils answered affirmatively. The teachers answered a similar question and more than 40 percent of them stated that their pupil was in contact with a special needs teacher, although 57 percent of the teachers did not know. See also tables 8.2.8 and 8.2.9. We mentioned in Section 2 of this report that there are many people involved with the pupil with hearing loss and many of these actors are pedagogues of one sort or another with various titles. Neither pupils nor teachers can be expected to know exactly what kind of pedagogue is providing support in any given case.

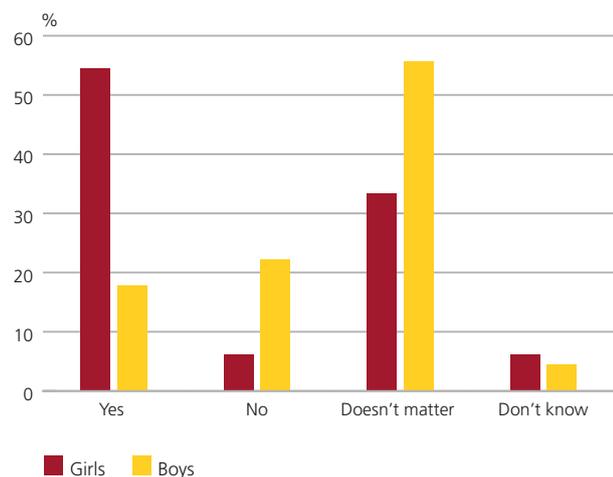
According to the teachers, 14 percent of the HODA pupils had a student assistant and, in about a quarter of the cases, there was a class assistant, teacher's assistant, or other kind of resource person in the classroom. See Table 8.2.10.

Frequently, a pupil with hearing loss is the only one in their class with their condition. Hence, habilitation units, the Swedish Association of Hard of Hearing People, and other organizations outside of schools arrange activities for children and youths with hearing loss so they can meet others in the same situation. About one-third of the 78 HODA pupils who answered a question about this had taken part in such activities during the last two years. This was more usual among boys than girls, and more usual among younger than older HODA pupils. See Table 8.2.11.

HODA pupils were asked if they would appreciate having classmates with hearing loss in their classes. In Chart 8.2.3 we can see that it was more important to girls than to boys to have a peer in the same situation in their class.

63 See Thurfjell & Viklund 2006 (in Swedish).

Chart 8.2.3
“Would it be nice if there was another pupil with hearing loss in your class?”



Percentage of girls and boys, respectively, concerning having a classmate with hearing loss. The red columns total 100 percent of answers from 33 girls, and the yellow columns total 100 percent of answers from 45 boys. Missing answers: Seven. See also Table 8.2.12.

Of the 85 HODA pupils, 63 had communication devices for use at school and 22 had previously had such devices. Table 8.2.13 shows what type of microphone systems the pupils had been prescribed on the most recent prescription occasion. Stationary and portable devices are equally common. We can see that stationary systems were somewhat more common among the older pupils, and portable systems among the younger ones. Subsequent discussions will focus on the 63 pupils who presently use communication devices at school. However, the experiences with microphone systems of pupils who have returned their devices will also be commented on.

Teachers

The *teachers* in HODA are those teaching social science subjects or, in some cases, Swedish. Data were obtained from 81 of the 85 teachers in question. In 60 percent of cases, the teacher was the pupil's mentor. In other words, *mentors* were often teachers of social science subjects, although many mentors also taught other subjects. Data

were obtained for 74 of the 85 relevant mentors.

Of the mentors, over 60 percent had assisted the HODA pupil for several school years. The corresponding rate among the teachers was somewhat lower, 53 percent. Moreover, there were a few teachers who had replaced the regular teacher and were teaching the HODA pupil temporarily on the day we visited the school. In conclusion, in about 40 percent of cases, the first encounter between the teacher or mentor and the pupil with hearing loss had occurred during the current school year. See Table 8.2.14.

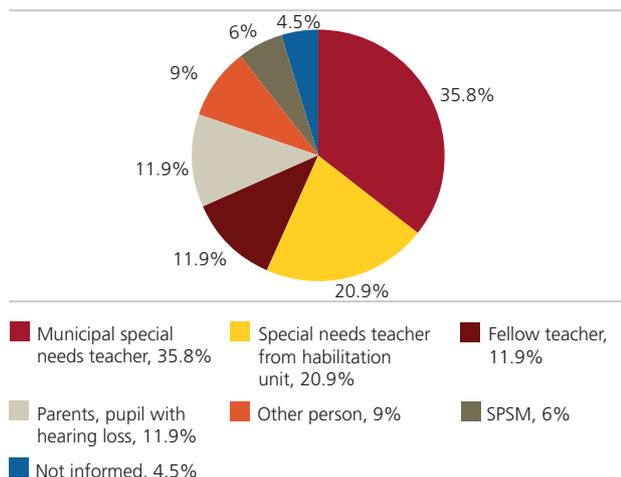
Barely half of the mentors, or 45 percent of the 67 who answered the relevant question, stated that they had taken some measure to facilitate the pupil with hearing loss' participation in class. This might have taken the form of support, an extra resource person, or fewer pupils in the class, for example. See also Section 8.3 below.

When asked about whether there are routines concerning who is responsible for informing the staff at school about the consequences of the pupil's hearing loss and about how to use the microphone system, 36 percent of the 66 mentors who answered this question stated that there were no such routines or that they did not know. Thus, in about two-thirds of the HODA schools there seem to be clear and established routines pertaining to these matters.

Most commonly, the information that the pupil has a hearing loss had been given to mentors by someone at the school—a headmaster, previous teacher or mentor to the pupil, or the Pupil Health Unit. However, in about 20 percent of cases, the pupil's parents were the first to inform the teacher. See Table 8.2.15.

We also asked the mentors about who had given them the most useful information on how to support a pupil with hearing loss in class, for example through teaching strategies. In Chart 8.2.4, we can see that, in particular, special needs teachers were very important in disseminating knowledge about how to modify teaching. Fellow teachers, the pupil, and their parents were also important sources of information.

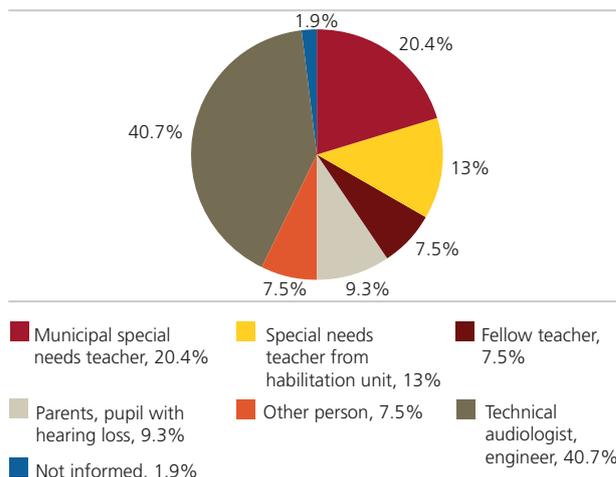
Chart 8.2.4
 “Who has given you *the most useful* information on how to support a pupil with hearing loss in class through teaching strategies, etc.?”



HODA pupils’ mentors, 67 individuals: Persons or authorities providing the most useful information.
 SPSM: National Agency for Special Needs Education and Schools.
 See also Table 8.2.16.

Mentors of pupils who presently use communication devices at school were also asked who had given them the most useful information on how the device works and how to handle it for optimal results. From Chart 8.2.5, we can conclude that, besides or together with special needs teachers, technical audiologists and other technicians play an important role. We also noted that, in about every tenth case, the pupil with hearing loss and their parents were the most important sources of information on appropriate support during lessons, as we saw above, as well as of information concerning the communication device.

Chart 8.2.5
 “Who gave you the most useful information on how the microphone system works and should be handled for optimal function?”



Professionals or authorities that have provided the most useful information about microphone systems according to mentors of pupils with communication devices. See also Table 8.2.17.

Of the 18 mentors assisting pupils with hearing loss who had previous experience of microphone systems at school, 70 percent knew that their pupil had used a communication device. Over half of these mentors thought that such a device for use in school would be useful to this pupil now.

We asked the teachers to state what degree of hearing loss⁶⁴ they thought their HODA pupil had without hearing aids. Such an evaluation is difficult to make. The assessment is not medical, as in the case of the medical records, but rather functional. However, more than a third of the teachers, about 37 percent, knew or assessed the hearing loss of their pupil in terms equal to those registered in the medical records. The majority, about 59 percent, thought that their pupil suffered from a hearing loss more severe than what was registered in their medical record, and a few assessed their pupils as suffering from a less severe hearing loss than what was registered. See Table 8.2.18.

64 Either slight, moderate, or severe hearing loss, or deafness.

Just under half of the teachers, about 47 percent, had no prior experience teaching pupils with hearing loss, while about 37 percent had taught one or more other pupils with hearing loss for more than one school year. See Table 8.2.19. More than half of the teachers, about 53 percent, stated that either they themselves or someone in the training team had undertaken a course or further education in how to teach pupils with hearing loss. However, almost one in five teachers, 18 percent, did not know if such further teacher training had taken place or not. See Table 8.2.20. About half of the teachers, 51 percent, said that they themselves or the training team were in contact with a municipal special needs teacher, while about 30 percent did not have such contacts. Again, about one in five teachers did not know. See Table 8.2.21.

About one-third of the teachers, 31 percent, thought that they had enough knowledge about the impact on teaching when a pupil in the class suffers from hearing loss, while others were more uncertain. Teachers with prior experience of teaching pupils with hearing loss appeared to be more hesitant about whether their own knowledge was sufficient or not. See Table 8.2.22. The vast majority of teachers, about 84 percent, thought that they had either some need, or a major need, for further vocational training in issues related to teaching and supporting pupils with hearing loss. See Table 8.2.23.

What didn't you hear?

Follow-up on the part of the teacher when the pupil said he had not heard

Municipal special needs teachers

We saw earlier that about 60 percent of the 150 pupils in the target population lived in municipalities with a special needs teacher during all or part of 2013. See Table 8.1.12. However, having a local special needs teacher in your municipality does not automatically mean that you get access to such a teacher if you are a pupil with hearing

loss. In the HODA Study, 16 pupils received support from a municipal special needs teacher in 2013. Of these, 15 had microphone systems at school and one pupil had used such equipment previously. See also Table 8.2.7. Accordingly, the description given below is based on very few observations.

The task of supporting the specific HODA pupil was assigned to the special needs teacher by either the school principal or the municipal support unit, or both, in five of the 16 cases. Two special needs teachers reported that they were engaged by a teacher, and another two that this was part of their job. In one case, a previous special needs teacher had passed on the task and, in another case, a special needs teacher at the school had taken the initiative to engage the municipal special needs teacher specializing in issues related to hearing loss.

Support given by municipal special needs teachers can be provided in different ways. Table 8.2.24 provides more information on this. We noted that support targeting teams of teachers was the most common type of support provided, frequently in combination with support for the specific pupil or their entire class. If they met with the pupil, it seems that the special needs teacher usually met them once per school term. As a rule, the support was recorded and most special needs teachers thought that the support given was sufficient and, moreover, that they were free to determine the extent and nature of their support. Support specifically related to hearing and communication devices appeared to be fairly extensive.

Usually, the municipal special needs teacher (perhaps together with the mentor or a technical audiologist) was responsible for informing relevant staff at the school about the impact of the specific pupil's hearing loss and about the working of the microphone system. However, sometimes there were no such routines concerning information. See Table 8.2.25. We can also see from this table that the municipal special needs teachers frequently thought that they themselves and the relevant teachers needed further education and training related to teaching pupils with hearing loss.

It was quite common for municipal special needs teachers involved in the HODA Study to assess the HODA pupil's activity during class as being less than that of their classmates, and more than half of them considered that issues related to hearing loss hindered the pupil's activity. See Table 8.2.26.

Summary and comments

Most HODA pupils used their hearing aids to a large extent in school. Most of them were also as active during class as their classmates, according to an assessment made by their teachers, although there were also pupils who were less active, in some cases due to hearing loss or microphone systems. Few pupils received support from a municipal special needs teacher and few pupils had other classmates with hearing loss. Many HODA pupils, in particular female pupils, would like to have a classmate with hearing loss.

Several HODA teachers had no experience teaching pupils with hearing loss and many of them had met the pupil taking part in the HODA Study for the first time during the current school year. Most often, though far from always, there were routines in place at schools related to information about a pupil's hearing loss and its pedagogical consequences and to how to handle the microphone systems. The importance of technical audiologists and special needs teachers in providing teachers with useful knowledge and information appeared to be very significant. Frequently, education and further training for teachers educating pupils with hearing loss was needed.

We will now comment on a few of the results presented above. There may be many reasons why a pupil is more or less active than their classmates during class. However, we observed that in some cases the teacher judged that reduced activity on the part of the pupil with hearing loss was related to the hearing loss or the communication device. Also, the municipal special needs teachers relatively often considered the pupils they support to be less active in class than their classmates. Such a situation contravenes the Edu-

cation Act and other regulatory documents on the rights of pupils to participate and be involved in education.

We noticed that girls were judged to be less active than their classmates more often than boys were. Such results are supported by other studies (without a focus on hearing loss), but we cannot rule out that hearing loss is seen as a bigger problem by girls than by boys, leading to girls keeping a lower profile in class than boys. We will return to these issues later.

As stated earlier, pupils with hearing loss can choose to attend a *specialskola*⁶⁵, a *hörselklass*⁶⁶, or a mainstream class with hearing classmates. Parents and pupils choose the type of school the pupil will attend, frequently after having discussed the decision with hearing loss professionals. However, the HODA observers wondered about the choice of school in the case of three of the 63 observations of full lessons in classes with a pupil with hearing loss. These three pupils suffered from severe hearing loss or deafness and were not at all participatory or involved during class. We must here conclude that the schools had failed utterly in removing obstacles to the pupils' access to education in these cases.

While routines related to informing all personnel concerned about a pupil's hearing loss and how to use any communication devices were frequently in place, many of the mentors stated that there were no such routines or that they did not know about them. According to a report from the Swedish Schools Inspectorate about the situation of pupils with disabilities in compulsory schools, information of this kind is given when a pupil starts school and sometimes when a new school term begins. Routines and responsibilities related to new school personnel and new pupils coming to the school in the middle of a school term were frequently lacking at the schools

65 A special school primarily for pupils with impaired hearing and/or with severe speech and language disabilities. Both Swedish sign language and spoken Swedish are used at these schools.

66 A school class at a mainstream school providing an environment designed to accommodate an entire class of pupils with hearing loss.

visited by the Inspectorate⁶⁷. In summary, we can conclude that each and every municipality and each and every school should have a clear, documented, and established strategy concerning the various measures that need to be taken when pupils with hearing loss, or any other impairment, come to school.

About half of the teachers had not met a municipal special needs teacher and we know that many municipalities do not have a professional of this kind. We also know from our HODA results that this professional, in particular, is a very important person when it comes to providing relevant knowledge about hearing loss and microphone systems in educational settings to teachers and training teams. In other words, the lack of municipal special needs teachers is a major problem.

We saw that a majority of the teachers, about 59 percent, assessed their pupil's hearing loss to be more severe than was established in their medical diagnosis. While we do not wish to exaggerate the impact of this, the question arises as to whether teachers tend to see the way a specific pupil acts in class and in eye-to-eye conversations (with or without microphone systems) as a sign of problems related to hearing that the teachers find difficult to tackle. What might this entail in terms of expectations and requirements? These are questions that the HODA Study cannot answer.

Those teachers who had previously taught pupils with hearing loss were more hesitant to say that they had sufficient competence for this task as compared to teachers without such prior experience. We have concluded that actual experience leads to a more realistic understanding of what is required when teaching pupils with hearing loss. This is of importance to schools when planning to receive a new pupil with hearing loss. Schools should either try to use the competence that may already exist among its teachers, or plan for the requisite further education and training of its teachers.

67 Skolinspektionen/Swedish Schools Inspectorate 2009 (in Swedish).

8.3 The schools and the school environment

In Sweden, the school environment is the subject of public debate, ongoing national inspections⁶⁸, supervision projects⁶⁹, and analysis⁷⁰. The HODA Study focuses specifically on the acoustic environment in schools. For a microphone system to work in an acceptable way, the physical and social settings in the classroom must support—not impede—its use.

The 85 HODA pupils attend different schools all over the Stockholm County area. In this section, we will take a closer look at the physical and social environments in these schools. The physical environment has been examined in one particular classroom; the classroom where the HODA pupil in question undertakes their lessons in either social science subjects or Swedish. In other words, the school as a whole has not been studied.

Physical environment

We have examined aspects of the physical environment in the classroom where the HODA pupil and their peers are taught either social science subjects or Swedish. We did so by *measuring* noise, reverberation, and lighting, and by

68 During 2013–2016, the Swedish Work Environment Authority is carrying out a program in which 30 percent of all schools will be inspected. <https://www.av.se/arbetstilljoarbete-och-inspektioner/inspektioner-utredningar-och-kontroller/inspektion/aktuella-inspektioner/skoltillsynen-2013-2016/>, September 2015 (in Swedish).

Equal treatment plans in place in 150 schools have been examined by the Equality Ombudsman.

The Swedish Schools Inspectorate has examined the situation in schools for pupils with disabilities. See Skolinspektionen/Swedish Schools Inspectorate 2009 (in Swedish).

69 In 2014 and 2015, Sweden's Public Health Agency examined the indoor environment in schools. The focus was on ventilation and cleaning. <http://www.folkhalsomyndigheten.se/amnesomraden/tillsyn-och-regelverk/tillsyn-miljobalken/inomhusmiljon-i-skolan/> September 2015 (in Swedish).

70 Statistics Sweden on, for instance, *Children's experiences from school* http://www.scb.se/statistik/_publikationer/LE0106_2011A01_BI_LE125BR1201.pdf (in Swedish with a brief summary and list of tables in English).

assessing noise in the room generated by furniture, doors, and windows, and by neighboring indoor and outdoor environments. Simplified measuring procedures were used and, accordingly, the results are viewed as “indicative measurements”. More details on how the measurements and assessments were carried out and the meaning of the classifications *good*, *acceptable*, and *poor* can be found in Appendix 1. We have also asked pupils and teachers about their assessments of the physical environment in the classroom. Hence, our examination has a bearing on an important part of the auditory environment. See Section 6 above.

More information on the requirements that apply when pupils with hearing loss remain in a venue is provided in Appendix 1.1, which presents standards and benchmarks for sound and lighting.

The examination of the acoustic and lighting properties of the 85 HODA classrooms was conducted because pupils with hearing loss and microphone systems were central to our interest here. For these pupils, good acoustic and lighting conditions are particularly important in fully benefiting from education and schoolwork. For a person with hearing loss, a good acoustic environment is necessary for communication devices to deliver acceptable results. A good lighting environment makes it easier to see what is written on the board, to interpret facial expressions, and to lip-read. In other words, acoustics and lighting at school are factors in the accessibility of education for children and young people suffering from hearing loss. Moreover, good acoustics and lighting in the classroom facilitate learning for many other pupils, such as for children and young people with difficulties concentrating, or when teaching is performed in a language that is not the pupil’s mother tongue⁷¹. Naturally, a good classroom environment is also important for teachers.

Acoustic environment

Swedish Standard SS 25268.2007⁷² defines five sound functions of importance when assessing the acoustic quality of a premises. These functions are reverberation, background noise, impact sound insulation, airborne sound insulation, and sound level from external sources. Through measurements and further calculations regarding these five parameters, a room can be defined as belonging to one of four sound classes: A, B, C, or D. Sound class C denotes the minimum required level established by Sweden’s *National Board of Housing, Building and Planning*, while sound class D is to be applied only when sound class C, for technical, antiquarian, or economic reasons, cannot be achieved. Sound classes A and B correspond to very good and good acoustic environments, respectively. In addition, when premises are used by persons with hearing loss, the Standard SS 25268.2007 recommends at least sound class B.

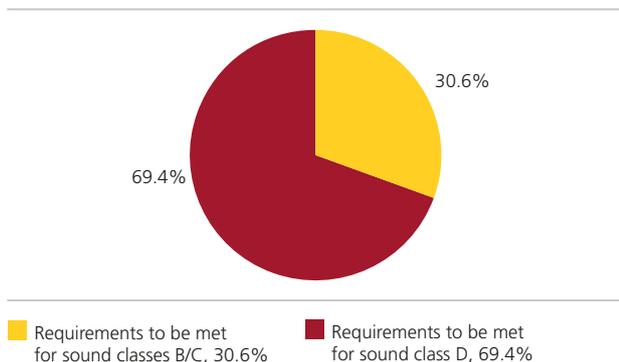
“Indicative measurements” of two of the five sound functions mentioned above were taken as part of HODA: reverberation and background noise. In Appendix 1.1A, we explain how we interpret Swedish Standard SS 25268.2007 and we judge that, on the whole, we have probably given a more lenient assessment compared with an evaluation based on all five sound functions and a strict application of the requirements related to each sound class.

Swedish Standard SS 25268.2007 specifies the requirements concerning levels of background noise and reverberation, respectively, for a room to be classified as belonging to one of the four sound classes—A, B, C, or D. Charts 8.3.1 and 8.3.2 show background noise and reverberation levels in the classrooms.

71 See, for instance, Arlinger 1999, p. 40 (in Swedish).

72 Acoustics – Sound classification of spaces in buildings – Institutional premises, rooms for education, preschools and leisure-time centres, rooms for office work and hotels <http://www.sis.se/en/construction-materials-and-building/protection-of-and-in-buildings/acoustics-in-building-sound-insulation/ss-252682007> (in Swedish).

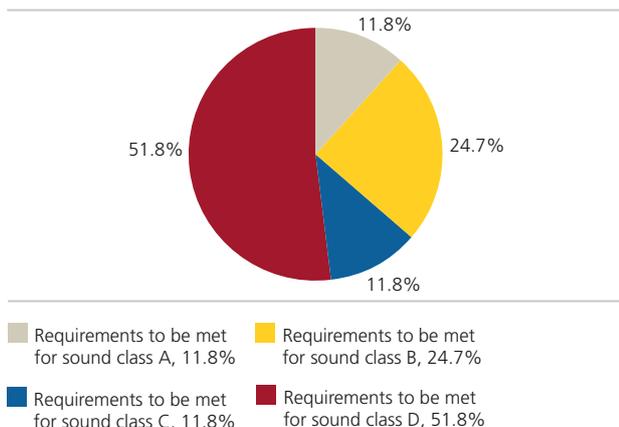
Chart 8.3.1
Background noise, joint estimation



Joint estimation of A-weighted and C-weighted noise measurements in 85 classrooms. It is clear from the chart that no classroom met the requirements for sound class A. See also Table 8.3.1 and Appendix 1.1.A.

We note that the noise level was quite unacceptable in most of the classrooms. Unfortunately, our results are not unusual. In 2003, half of the classrooms examined in a study did not meet the *National Board of Housing, Building and Planning's* minimum requirements, and in 2007, the corresponding figure was over 80 percent of the classrooms examined⁷³. Our results concerning

Chart 8.3.2
Reverberation, joint estimation



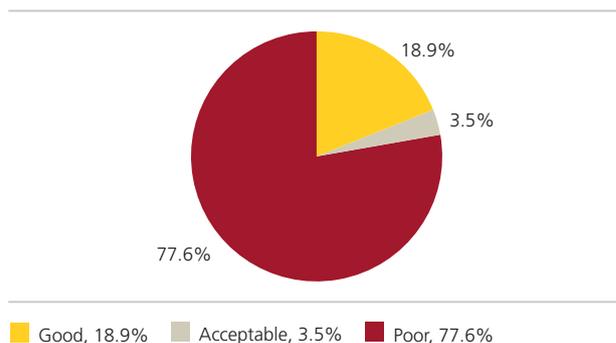
Joint estimation of reverberation (125 and 250-4,000 Hz) in 85 classrooms. See also Table 8.3.2 and Appendix 1.1.A.

73 Arbetsmiljöverket/Swedish Work Environment Authority 2003 (in Swedish) and Sjöström 2007 (in Swedish).

reverberation, or echo, were not much better, as we can see in Chart 8.3.2.

By combining our data on background noise and reverberation we obtain a dual assessment of the acoustic environment. See appendices 1 and 1.1A for the method used. We see from Chart 8.3.3 that approximately one in five classrooms was classified as having “acceptable” or “good” acoustic qualities, and thereby as meeting the *National Board of Housing, Building and Planning's* requirements. Most of these classrooms met the more rigorous criteria concerning people with hearing loss. Still, the dual assessment of the acoustic environment is alarming, not least of all given that previous estimates, mentioned earlier, also revealed a quite unacceptable situation⁷⁴.

Chart 8.3.3
Acoustic environment, joint estimation



Acoustic environment: Joint estimation of noise and reverberation measured in 85 classrooms. See also Table 8.3.3 and appendices 1 and 1.1.A .

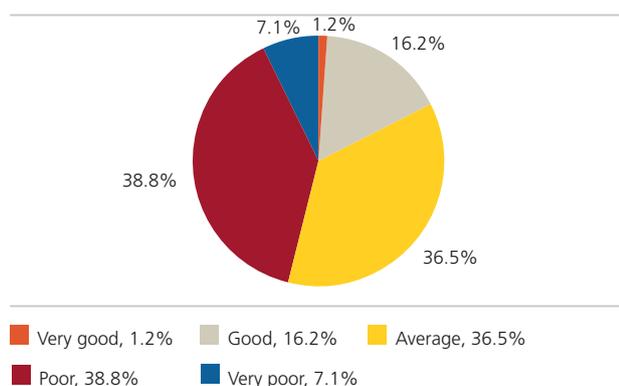
Moreover, our assessment of noise in the 85 classrooms generated by furniture, doors, and windows, and by nearby indoor or outdoor environments also yielded disappointing results. The easiest problem for a school to fix is probably the furniture, for instance by buying acoustic

74 During a number of years in the early 2000s, acoustics were measured in classrooms in the southern part of Sweden, Skåne County. The results were alarmingly poor and even though schools were informed, few improvements had been made at a later check-up. See Sjöström 2007, Larsson & Rikardson 2008 (in Swedish).

desks and attaching felt pads to chairs and tables. In 34 of the 85 classrooms, or 40 percent, no such measures had been taken. See Table 8.3.4. Doors either did not have a tight seal or made noise in 86 percent of the classrooms, and in 44 percent of the rooms, the windows were noisy. Disturbing noise outside the windows was registered in 39 percent of the rooms and disturbing noise from outside the room, e.g. from corridors or adjacent classrooms, was registered in almost half (46 percent) of the 85 classrooms. See Table 8.3.5.

We have tried to combine noise-related issues in the classroom into a simple measurement⁷⁵, taking into account our assessments of furniture, doors, windows, and the nearby environment. The result of this combination is shown in Chart 8.3.4. Here we see that, when measured this way, almost half (46 percent) of our 85 HODA pupils with hearing loss, as well as all their classmates and teachers, spent their time in venues that were equipped and situated in an unacceptable way from an acoustic standpoint.

Chart 8.3.4
Assessment of noise-related issues inside and outside the classroom



Composite measure of noise-related issues inside and outside 85 classrooms. See also Table 8.3.6 and Appendix 1.

⁷⁵ See Appendix 1 for the method used.

In summary, we cannot help but conclude that the acoustic environment in schools is disturbingly poor. But how do teachers and pupils feel about acoustics in schools?

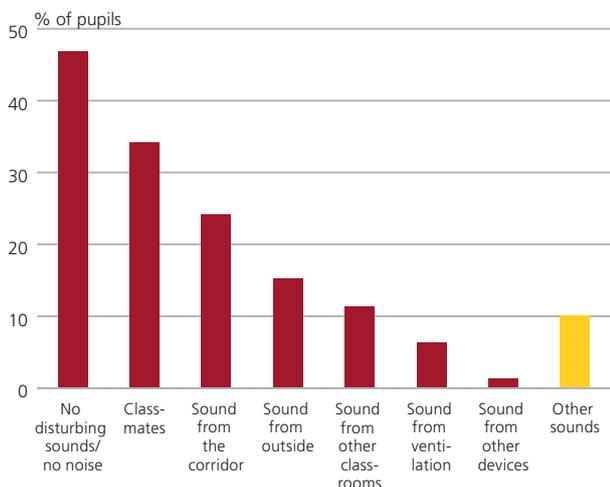
Of the 78 teachers who answered a question about this, just six percent thought that acoustics in the classroom were poor. The remaining teachers thought that the acoustics were either good (about 85 percent) or excellent (about 9 percent). See Table 8.3.7. We also asked the pupils' mentors to assess the adjustments made by the school to meet the needs of pupils with hearing loss. One in four mentors, about 26 percent, thought that insufficient measures had been taken to improve the sound environment, and about 14 percent of mentors thought that adjustments made regarding furniture were insufficient. Thus, the great majority of mentors thought that their school had made reasonable adjustments to meet the needs of pupils with hearing loss. As we remarked earlier in this report, the ability to make assessments of this kind is most likely related to a person's frames of reference. See also Table 8.3.8.

In a report by Statistics Sweden⁷⁶, 60 percent of pupils aged 10–18 years reported that the classroom is usually calm during lessons. This indicates that the remaining 40 percent of pupils were disturbed in one way or another during class. In the HODA Study, pupils were asked a more direct question about disturbing noise in the classroom⁷⁷, which 79 pupils answered. More than half (53 percent) of these HODA pupils were disturbed by various sounds during lessons. The pupils were asked to state what type or types of sounds they were disturbed by. In Chart 8.2.5, we can see the percentage of the 79 pupils who were disturbed by different types of sounds in class. See also Table 8.3.9.

⁷⁶ Statistics Sweden *Children's experiences from school* http://www.scb.se/statistik/_publikationer/LE0106_2011A01_BI_LE125BR1201.pdf (in Swedish with a short summary and list of tables in English).

⁷⁷ "Thinking about the classroom where social science subjects are taught, are there sounds in this room that disturb you during the lesson?"

Chart 8.3.5
Disturbing sound

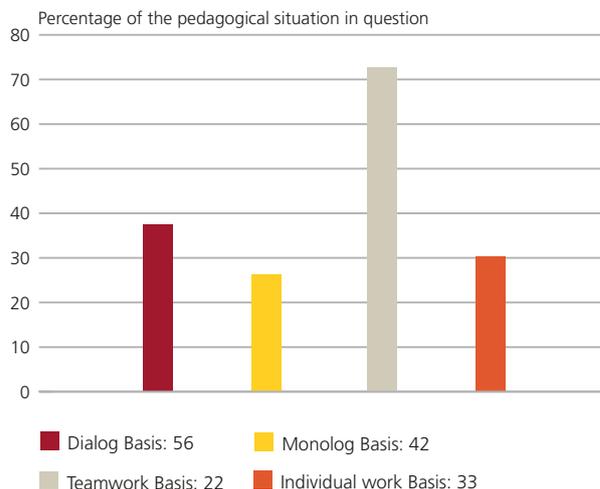


Sound disturbing the pupils during lessons in the social science subject classroom. Percentage of 79 pupils. Each respondent could state several sources of disturbing sound, and the columns thus total more than 100 percent. Missing answers: Six. See also Table 8.3.9.

We noted that about one in three pupils was disturbed by their classmates. Such results were also observed in other studies. Moreover, in a study by Boman and Enmarker⁷⁸, it was sound generated by classmates, in particular, that was assessed to be the most disturbing of all. In Chart 8.3.5, we also see that sound entering the classroom from outside or from adjacent premises disturbed many pupils.

Any disturbing sound caused by pupils in class during different types of pedagogical situations was registered by our classroom observers. We distinguish between four pedagogical situations: *dialog*, *monolog*, *teamwork*, and *individual tasks*. The significance of each situation is further explained in Section 8.5. In Chart 8.3.6, we see that disturbing sound produced by classmates occurred during at least one-quarter of these situations and, in particular, when the class was engaged in *teamwork*.

Chart 8.3.6
Occurrence of disturbing sound caused by pupils



Occurrence of disturbing sound caused by pupils during the four different pedagogical situations. Basis: Number of this kind of pedagogical situations. See also Table 8.3.10.

Our observers also noted other types of disturbing sounds, such as noise from open doors and windows, pupils and teachers coming and going, disturbing sounds from corridors or other classrooms or from the schoolyard, drilling somewhere in the building, and car traffic. See Table 8.3.10.

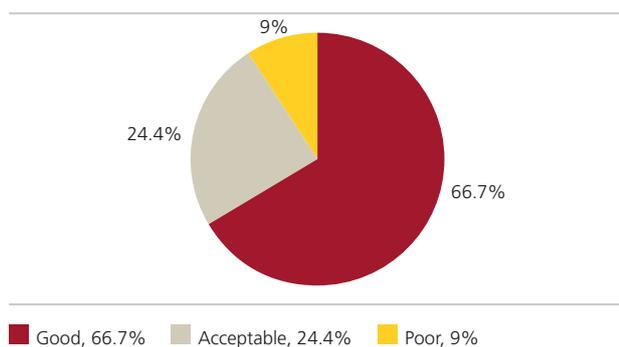
Lighting and luminosity

In terms of lighting and luminosity, the environment in the classrooms examined appears to be good⁷⁹. Lighting was either good or acceptable in nine out of ten classrooms, as can be seen in Chart 8.3.7.

78 Boman & Enmarker 2004.

79 It was possible to measure lighting in 78 of the 85 classrooms.

Chart 8.3.7
Light, measured



Light measured in 78 classrooms (rooms where social science lessons were held). See also Table 8.3.11 and appendices 1 and 1.1.B.

Notwithstanding, our observers noticed that there was seldom lighting focused directly on the board in the 63 classrooms where lessons were observed. Mentors were asked to assess whether adjustments to lighting and illumination were sufficient for pupils with hearing loss. About half of the mentors thought the adjustments sufficient, while 14 percent thought they were insufficient. See Table 8.3.8.

Magnetic background interference

Magnetic background interference was measured at the HODA pupils’ desks. When values for this parameter are too high, unwanted sound could be produced, disturbing the pupil via their hearing aids. Of the 63 schoolrooms examined, values were excessive in three cases. Values were acceptable in 24 rooms and good in 36 rooms.

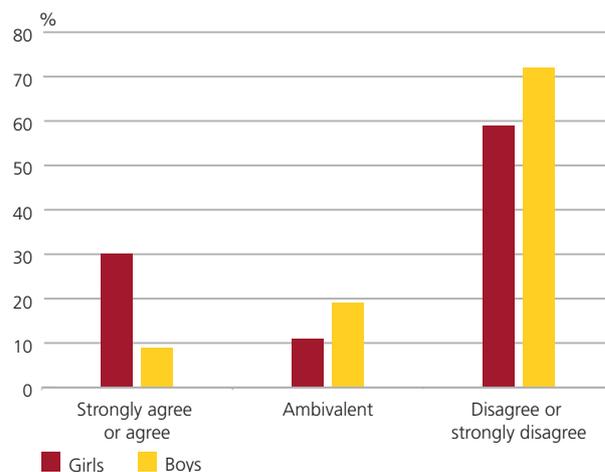
Social environment

Relationships between teachers and pupils and among pupils themselves form important parts of the social environment at school. We know that bullying, unfair treatment by teachers, and exclusion do indeed occur in schools⁸⁰, although

there were no general questions about such matters in the HODA Study. Rather, HODA focused on responsibilities and routines in relation to the use of communication devices. Before presenting our data on these, however, we will try to provide some clues about pupils’ feelings concerning their microphone system in the social environment of their classrooms.

Pupils presently using communication devices at school were asked to respond to the statement “It is embarrassing to have a microphone system,” and about one-fifth agreed. A large majority (67 percent), however, did not agree. In Chart 8.3.8, we note that there is a difference in the response patterns for girls and boys.

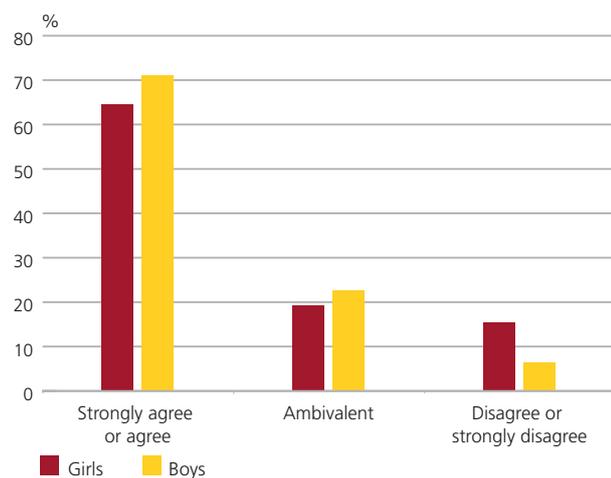
Chart 8.3.8
“It is embarrassing to have a microphone system”



Girls and boys responding to statement about microphone systems. The red and yellow columns total 100 percent of 27 girls and 31 boys, respectively. See also Table 8.3.12.

Another statement that we asked the pupils to respond to was “I feel comfortable with my microphone system.” In Chart 8.3.9, we can see how girls and boys responded. Here, too, we notice a difference between girls and boys.

80 See, for instance, Statistics Sweden 2012.

Chart 8.3.9**“I feel comfortable with my microphone system”**

Girls and boys responding to statement about microphone systems. The red and yellow columns total 100 percent of 26 girls and 31 boys, respectively. See also Table 8.3.13.

Thus, on the whole, there seems to be a fairly large minority among the pupils, and in particular among female pupils, who expressed negative feelings about communication devices in the social environment of the classroom. In addition, our interviewers also reported a similar impression.

Pupils who have previously used microphone systems at school were asked about the main reason for not using such devices at school anymore. “I heard equally well without it, I did not need it,” was by far the most common answer given by the 20 pupils who answered the question. Of course, this is a very reasonable answer. In Section 8.4 of this report we will see that there were some additional reasons given, such as teachers forgetting to use the microphone, the awkwardness of the system, or that the system was embarrassing.

Needless to say, for communication devices to work optimally, the whole system must be in good condition. All its parts must be in working order, and it must actually be used. We will return to issues concerning the condition and use of communication devices in sections 8.4 and 8.5. In the previous section of this report we examined other important preconditions for

well-functioning communication devices: acoustics and lighting. In this section, we will examine preconditions related to the social environment in the classroom.

Responsibility

When a pupil suffers from hearing loss and needs to have a microphone system at school, this inevitably generates a certain amount of extra work, as we mentioned in Section 6 above. Thus, communication devices inevitably require extra effort. Some of the requirements associated with the use and handling of the equipment at school are knowledge-related, and others concern responsibility and routines.

In order for the required extra work to be performed smoothly, it should be completely clear who is in charge of various practical issues and, in addition, the class should have good routines concerning the use of the microphone system. Our basic premise is that the pupil with hearing loss should not bear the primary responsibility for *gaining access* to what happens in the classroom. The teacher, classmates, and pupil with hearing loss need to know and apply routines, so that these become tools of interaction in the classroom and everyone’s mutual responsibility. If the pupil with hearing loss repeatedly needs to remind teachers and peers to use microphones in order for them to gain access to communication taking place in the class, the risk is high that the personality or identity exhibited by this pupil in class will become dominated by their hearing loss. As a consequence, feelings of embarrassment may be experienced, not least of all among adolescents undergoing puberty. One consequence of insufficient routines might be that the pupil with hearing loss keeps a low profile and is not privy to much of what is said and communicated in the classroom.

Responsibility for charging

Pupils who currently use communication devices at school were asked to answer the following question: “Has it been made clear, for instance in your action program, who has the responsibility for putting the microphones in the charger each

day?” This question was answered by 58 pupils and, of these, 71 percent responded affirmatively. Usually the teacher, though sometimes the pupil themselves, was responsible for this, according to the pupils. The question was answered in the negative by 17 percent of pupils, and 12 percent stated that they did not know. See Table 8.3.14.

Another question about charging revealed that it was indeed a teacher who usually put the microphones in the charger each day. In some cases this was done by a teacher in cooperation with the HODA pupil or a classmate. About one in five HODA pupils took care of microphone charging themselves. See Table 8.3.15.

Teachers answered similar questions and usually stated that the responsibility for charging lies with a teacher and, in some cases, that this responsibility was shared with others. About ten percent of teachers stated that the responsibility lies with the HODA pupil, sometimes in cooperation with a teacher. See also Table 8.3.16.

Responsibility for transporting portable devices

Portable microphone systems can be moved between the various locations where teaching takes place. Of the 63 HODA pupils who had microphone systems, 36 had a portable device. When asked, 69 percent stated that it had been made clear who was in charge of transporting the portable device. In about half of these cases, this person was a teacher, and in about one-third of the cases, the HODA pupil was responsible. However, one in five pupils with a portable device answered that this responsibility was not clarified or that they did not know. Moreover, in about every tenth case, the system was not used as a portable system; it was used in one classroom only. See Table 8.3.17.

Among the 25 HODA pupils who had a portable device and also used it in different classrooms, about 40 percent brought the microphones with them themselves to the classroom in question, and in 36 percent of cases, a teacher performed this task. See also Table 8.3.18.

Teachers answered a similar question and about 41 percent of those who had a pupil with a portable device stated that a teacher was responsible

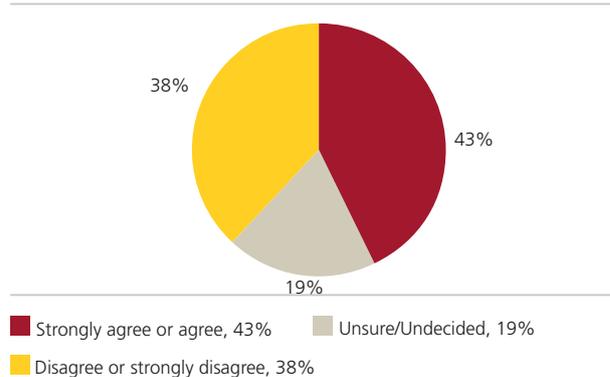
for its transport. Twenty-one percent stated that the HODA pupil was in charge of this. Quite a few of the teachers concerned, 15 percent, did not know or did not answer this question. See Table 8.3.19.

Responsibility for the functioning of the devices

The HODA pupils who had communication devices at school were now asked to give their views on a number of statements. One such statement was “It is my responsibility to ensure that the microphone system is functioning during the lesson.” The pupils were asked to make their views clear by rating their answers according to a 5-point scale, where one extreme was “strongly agree” and the other “strongly disagree”. See Table 8.3.20. We see in Chart 8.3.10 that close to half of the pupils agreed, and from Table 8.3.20, we can conclude that boys did not regard this as being their responsibility to the same extent as girls did.

Chart 8.3.10

“It is my responsibility to ensure that the microphone system is functioning during the lesson”



Pupils responding to the above statement about microphone systems. Percentages are calculated based on the 58 pupils presently using microphone systems and who answered the question. See also Table 8.3.20.

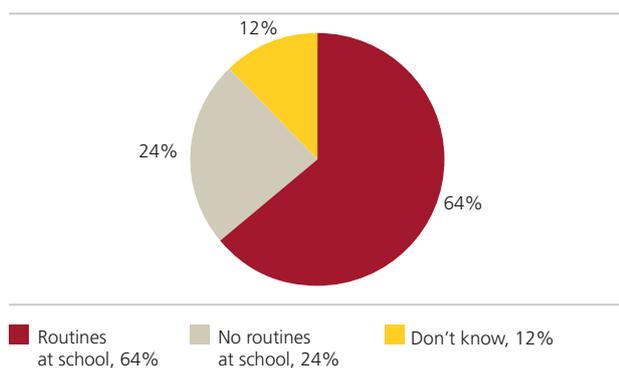
Routines

Routines regulating the situation of a pupil with hearing loss are required both at school and in the classroom. Routines contribute to a sense of security and conserve energy. Mentors of pupils using communication devices at school were

asked about the routines used for conveying information about a pupil's hearing loss, about the impact on teaching, and about how to handle the microphone system. Twenty-four percent answered that there were no such routines in place for when a new pupil arrives.

Chart 8.3.11

Routines at school concerning information about a pupil's hearing loss, its impact on teaching, and about how to handle the microphone system



Prevalence of routines at school to inform the staff concerned. Percentages are calculated based on the 50 mentors assisting a pupil with microphone systems who answered the question. See also Table 8.3.21.

Case study

Lucas

Lucas attends the upper level of a nine-year compulsory school. There are 16 pupils in his class and their desks are arranged in a U-shape in the classroom. Lucas is seated where he has a good view of all people in the room. The lighting in the room was good when we visited the school, but the light directed towards the board was not sufficient and the acoustics were poor. Absorbents on the walls had been painted over, which negatively impacted their noise-reducing function. Lucas is disturbed by a number of sounds within and outside this classroom during class.

Lucas suffers from a moderate hearing loss, and a stationary induction loop system as well as a portable device for use at school have been prescribed for him. There are two teachers' microphones, but no microphones for his classmates. Lucas uses his hearing aids, but neither the portable nor the stationary microphone system. When we checked his devices, the stationary system was not plugged into the socket and the portable system was stored, uncharged, in his locker.

The observed lesson started with a PowerPoint presentation

during which the curtains were drawn, and the schoolroom remained dark during the entire lesson. Lucas had difficulty visually reading, or lip-reading, his peers. His teacher has never taught a pupil with hearing loss before, and moreover, has not attended any course or training on how to work with pupils with hearing loss. She does not know whether Lucas uses his hearing aids or not and nothing in particular is done to meet his needs. The class was calm and well-motivated during the learning process.

Conclusion

Lucas has both a stationary and a portable communication device. He is well positioned in the classroom and uses his hearing aids continuously. However, no communication devices were used, nor were functioning. No written instructions for teachers and substitute teachers on how to handle the devices could be observed in the room. Lucas has a teacher who is completely unaware of his needs and no measures were taken to facilitate his participation in the learning process.

We assess Lucas' situation in class to be one of the worst of the 63 classroom situations that we observed.

Pupils and teachers also answered questions about routines related to the use of microphones in the classroom. A large majority of pupils, 88 percent, answered yes to the question "Do you think that teachers have good routines when they use the microphone?" The same applied for the question "Are the routines relating to when and how classmates should use microphones good?", although the yes percentage was lower (64 percent). A number of pupils answered no—eight and 29 percent, respectively. On the whole, pupils seemed to be quite satisfied with their teachers' routines. There are other questions and answers in the interviews, however, indicating that these results need to be put in perspective. We will see later that a number of pupils thought that an important improvement to the microphone system situation would be for teachers always to use the microphone. Concerning routines related to classmates' use of microphones, about one-third of the HODA pupils concerned were not content with these routines. See Table 8.3.22.

Among teachers of pupils who had microphone systems at school, 85 percent stated that they have routines in place concerning when and how they use their teacher's microphone. More-

over, as a rule, almost half of the teachers checked that their pupil could hear within the system. This check was performed either by asking the pupil or by listening to a loudspeaker. However, 49 percent of the teachers did not use such control routines.

Case study

Maja

Maja attends the intermediate level of a nine-year compulsory school. There are 28 pupils in her class and their desks are arranged in a U-shape in the classroom. Maja is seated in the front with her back to the light from the window, with a good view of all people in the room.

The lighting in the room was good when we visited the school, but the acoustics were poor. However, tennis balls on all chair legs and the pupils' outer garments hanging in the room reduced the noise. Moreover, a sign reading "We talk one at a time and into the microphone for everybody's benefit. We aim for a calm and quiet class," was also in place. Batons bearing the names of the pupils were used instead of showing hands or calling out. Pens of the same color were gathered in one place to reduce noise when a pupil was looking for a specific color. There were rooms for *teamwork* in close proximity to the classroom.

Maja has a moderate hearing loss and a stationary induction loop system as well as a portable device for use at school. Her stationary communication device was a multi-microphone system with one teacher's microphone and 12 microphones for classmates. The portable system was brand new and had not yet been used. The teachers were to learn the new system prior to its use in class. At present, Maja has no access to communication devices in the rooms for *teamwork* and the venues for music, handicrafts, art, and physical education.

Maja's teacher has taught other pupils with hearing loss previously, and has also attended a course on teaching pupils with hearing loss. Hence, the school had made use of the available competence when Maja started at this school. A municipal special needs teacher provides support to the school, the teacher, and Maja.

Peer microphones were placed in boxes with sound-reducing felt pads on all the tables when the lesson started. The teacher was a good and confident educator and well aware of Maja's needs. For instance, she took great care to maintain discipline in conversations and to give clear and explicit instructions. The working atmosphere in class was silent and calm. Classmates used their microphones in a conscious way and the entire communication device functioned well. Maja and her peers seemed to be well motivated during the learning process.

Conclusion

Maja has a stationary as well as a portable communication device, a number of peer microphones, and an educator who is well aware of her specific needs. Her school has taken advan-

tage of pre-existing teacher competence. The communication device worked well and was used without the need for reminders. Measures to reduce noise had been taken. A special needs teacher was available.

Nonetheless, there were no written instructions for teachers and substitute teachers on how to handle the devices. The ventilation was disturbingly loud and there was a lack of light directed towards the board. In addition, we also heard crackling in some of the microphones.

We assess Maja's situation in class to be one of the best of the 63 classroom situations that we observed.

Reminders

Pupils and teachers were asked about who reminds the teacher to use the microphone if he or she forgets. According to the pupils, it was the pupil themselves, perhaps in cooperation with a classmate, who reminded the teacher in four out of five cases (79 percent). According to teachers, the HODA pupil reminded them in somewhat more than half the cases, or 57 percent. When it comes to peer mics, usually several people remind classmates to use them, the teacher and the pupil with hearing loss among them. See also Table 8.3.23.

Case study

Elsa

Elsa attends the intermediate level of a nine-year compulsory school. There are 26 pupils in her class, but at times 52 pupils attend lessons in a "large class". Elsa is seated in the front of the classroom and pupils are organized into groups of 4-6 people. Elsa's location in the room is good and she can lip-read her peers. The lighting in the room was good when we visited the school, but the light directed towards the board was insufficient and the acoustics were poor. The class was loud and unruly and noise during *teamwork* was measured at 70 decibels (dB(A)). Elsa reports that she is disturbed by noise from classmates and from other classrooms.

Elsa has a moderate hearing loss and a stationary induction loop system as well as a portable device for use at school. The stationary communication device was a multi-microphone system with two teachers' microphones and seven microphones for her classmates. Written instructions for teachers and substitute teachers on how to handle the devices was posted in a visible

location inside the room. The portable device was not used.

The duration of the observed lesson was 85 minutes with no break. No peer microphones were distributed when the lesson began. The teacher used her microphone during the entire lesson, but did not know how it worked. The microphone was configured in such a way that it was on continuously, although the teacher pressed the button and thought that she turned it off when she talked to other pupils. As a result, Elsa listened to conversations that were not meant for her.

During *teamwork*, Elsa herself went to get microphones for her team peers. However, microphones were rarely used and there was no microphone discipline on the part of her fellow pupils. The teacher did not intervene and Elsa did not say anything to her classmates. In the interview, Elsa stated that she does not hear anything when a classmate does not use a microphone and that she needs the classroom to be silent and the speaker to speak clearly. The teacher had reported audio glitches, spillover between classrooms, and that the headset microphone was too large.

Conclusion

Elsa has both a stationary and a portable communication device. She is well positioned in the classroom and she can visually read, or lip-read, her peers. Elsa used her hearing aids continuously, the teacher's microphone was used all through the lesson, and information on how to use the devices was clearly visible.

However, we also noted many deficiencies. Classmates' microphones were not used. There was no break from listening for Elsa. She complained that the sound from the induction loop system is far too loud. The class was unruly and the classroom situation was very disorderly and lacked structure. The teacher and classmates alike lacked knowledge of how to handle the devices.

We assess Elsa's situation in class to be one of the worst of the 63 classroom situations that we observed.

Measures taken by teachers or mentors

We mentioned that almost half of the mentors had taken some measure to facilitate the HODA pupil's participation in class, such as having an extra resource person or fewer pupils in the class. See also Table 8.3.24.

There are also various other ways that teachers can assist pupils with hearing loss to participate during lessons. Such teaching strategies include repeating answers given by classmates, writing on the board, or giving visual demonstrations in other ways. Teachers can also

provide assistance by asking classmates to speak clearly and take their hands away from their mouths. These kinds of strategies can make the situation better for other pupils, too, and teachers did, in fact, use them very frequently. Almost four out of five mentors, 78 percent, stated that they did so either always or very frequently. See tables 8.3.25 and 8.3.26.

Summary and comments

Physical environment in the HODA schools

The acoustic setting in the classroom was alarmingly poor for most of the pupils and teachers. Lighting was good, as a rule, but there was rarely any direct light on the board.

The acoustics were poor and pupils were also disturbed by various sounds in the classroom. The ramifications of such a poor learning environment could be dire. The conclusion of one study⁸¹ was that a person's ability to assimilate and integrate knowledge is weakened if they are exposed to meaningful but irrelevant speech or to the sound of traffic. In another study⁸², the poor acoustic environment exposed by the report was described as startling given the avowed importance of knowledge, as frequently cited when talking about Sweden's potential in the face of global competition. The report also stressed that optimization of the acoustic environment should be seen as an investment in the future, since, in the long run, the status quo generates costs for the individual as well as for society.

Some years have passed since the studies mentioned above were carried out and now the HODA Study has again revealed that the acoustic environment in schools is unacceptable. At the same time, many politicians and others in Sweden are currently concerned about national

81 Boman and Enmarker 2004. This research did not focus specifically on pupils with hearing loss. See also Lehto and Östh 2008 (in Swedish).

82 Larsson and Rikardson 2008 and Sjöström 2007 (both in Swedish) focused on adaptations in schools for pupils with hearing loss. Acoustics in the classrooms were measured.

school results as revealed in international comparative studies. Thus, drafting and implementing an action plan to improve the acoustic environment in Swedish schools is absolutely necessary.

The social environment at school

Most HODA pupils who used a microphone system at school stated that they were not embarrassed or uncomfortable about having such a device at school. However, for a fairly large minority, especially among female pupils, the situation was more complex.

Frequently, there was no plan or routine in schools regarding providing information to the school staff concerned about the consequences of hearing loss and how to handle the communication devices. This result gives rise to concern about what happens when a pupil with hearing loss comes to a new school or a new class.

“Who is responsible? I had to look for information myself, but I didn’t know where to look. The pupil gave me information, but was very shy and downplayed her ‘problems.’ By mid-term, I was contacted by a special needs teacher specializing in pupils with hearing loss, asking if I needed additional information. She visited the school close to Christmas and, by that time, half the school year had passed! So, who is responsible for my getting the information I need to teach my pupil what they have the right to be taught?”

Teacher of a pupil using communication devices in the 9th grade

Half of the teachers routinely checked that their pupil could hear within the microphone system. Thus, in the remaining cases, teachers and classmates could be using microphones without the HODA pupil hearing anything, and the pupil might not have spoken up, choosing instead to keep a low profile.

Most commonly, teachers are assigned and, indeed, do take responsibility for charging the

microphones. Notwithstanding, one in five HODA pupils took care of charging. When there was a portable system to be moved from one classroom to another, the teacher and pupil were assigned and took responsibility for doing so equally often. Not infrequently, however, this responsibility was not clearly defined.

Hence, we can conclude that pupils with hearing loss who use microphone systems at school might regularly experience schooldays characterized by vagueness and uncertainty concerning the additional work required, such as charging and transporting microphones. There are also many pupils who are assigned and do take—or must take—responsibility for these tasks. We observed that pupils often stated that routines related to the use of microphones were good, at the same time as they often had to remind others to use the microphones when they forgot. Some of the pupils who no longer used microphone systems at school stated that one reason why they stopped using the devices was that teachers often forgot to use the microphone. In addition, we noticed that there are frequent problems related to the use of peer mics. We will return to this issue later in this report.

The answers to our quite specifically microphone-related questions reveal social environments in schools to be diverse and, indeed, situations do vary from pupil to pupil. One example of this diversity is Maja’s class, where routines created a workable speech-order. Another example is Lucas’ class, which had no routines at all, and where no adaptations had been made to suit his needs. We also noticed that girls seemed to have negative feelings towards their microphone systems more often than boys. We do not have many observations to support this inference, although we can point out that girls appear to be more vulnerable than boys in other studies, also⁸³.

83 See, for instance, Åkerstöm 2014, Study IV.

8.4 Microphone systems at school – prevalence and condition

All HODA pupils currently used, or had previously used, communication devices at school. In Section 7 of this report we pointed out that the classification of a pupil as belonging to one of these two categories is not always straightforward. The same was true of registering the type of microphone system a pupil used at school when we arrived. There are several reasons for this. For instance, all or part of a communication device could have been sent off for repairs, left at home, or undergoing charging in premises that were locked. There could also be other reasons for the device not being where it should be. As such, the situation regarding technology could, in some cases, appear to be quite disorganized. In addition, teachers were not always fully informed⁸⁴. Also, in some cases, a pupil might have borrowed a device that was prescribed for another pupil. Moreover, available devices were not always used. We will address this issue in the next section of this report.

In discussing microphone systems and their technical condition in this section, we are discussing the equipment in the specific classroom where the observed lesson took place on a school day in 2013.

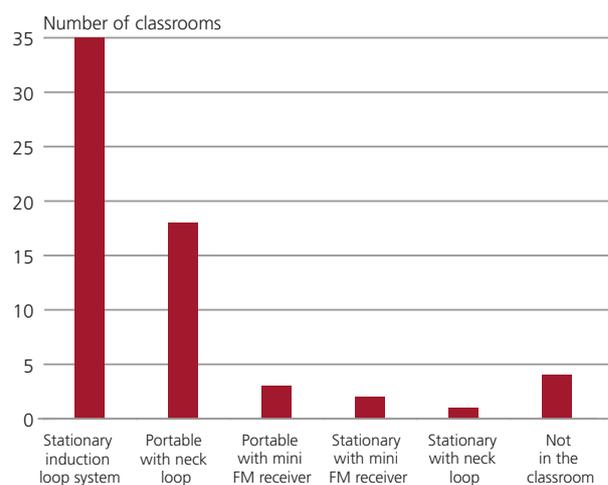
Prevalence of microphone systems

We recall that the lessons observed were 63 lessons in either social science subjects or Swedish. We noted that there were visible instructions on how to use the microphone system in just one of these 63 classrooms. In 49 of the classrooms (78 percent) there was one microphone system, and in 10 rooms, there were two different microphone systems.

We refer to the microphone system that was to be used during the observed lesson as micro-

phone system 1. This was a stationary system in 38 of the 63 lessons, and a portable system in 21 cases. No usable system was available in four of the classrooms. In two instances, this was due to either the pupil's hearing aid or the microphone system being elsewhere for repair. In the third instance, the device could not be found, and in the fourth, the microphones were being charged elsewhere. See Chart 8.4.1 and also Table 8.4.1. We see in the table that 25 of 33 boys (76 percent) and 14 of 30 girls (47 percent) had a stationary system for use in class.

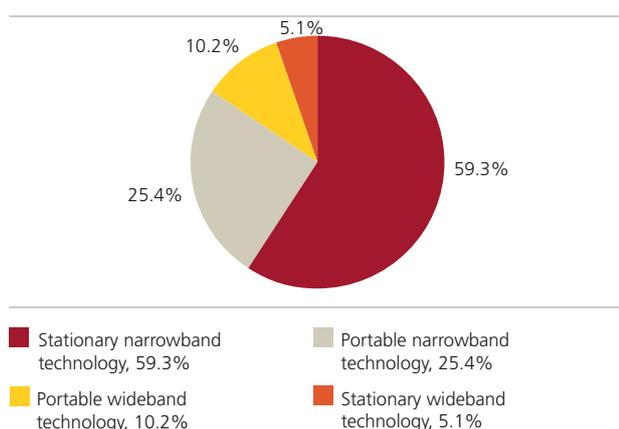
Chart 8.4.1
Type of microphone system to be used during the observed lesson



Type of microphone system to be used during the observed lesson. The columns total the number of devices used during 63 observed lessons. See also Table 8.4.1.

Another way to characterize the technology of communication devices is presented in Chart 8.4.2 and Table 8.4.2. In the table, we can also see the age of the devices and whether there were microphones for classmates or not.

⁸⁴ In one case, for example, there were a number of peer mics in a bag in the classroom. The teacher thought that these were extra microphones to be used if the teacher's microphone was out of order.

Chart 8.4.2**Category of microphone system**

Category of microphone system in the classroom to be used during the observed lesson. Red fields: Stationary systems. Gray and yellow fields: Portable systems. See also Table 8.4.2.

In the following discussion we focus primarily on the 59 microphone systems available for use during the observed lesson. There were most often two teachers' microphones, although in almost every third case (29 percent) there was only one. The most common types of teacher's microphone were microphones with a clip and headset microphones. See Table 8.4.3. Attenuation was good in four out of five teachers' microphones and for another eight percent attenuation was acceptable, while for 12 percent attenuation was poor. There are more details on attenuation in Appendix 1.

Chart 8.4.3 provides greater detail on the products⁸⁵ used as teachers' microphones in the communication devices.

In 36 of the 59 classrooms (61 percent) the microphone systems had microphones for classmates also. On average, there were 8-9 peer mics in these 36 classrooms, although the number varied significantly. See Chart 8.4.4 and Table 8.4.3. In the table we can also see that stationary

systems often have more peer mics than portable systems.

As we can see in Chart 8.4.5, there is a pattern of more microphones for classmates being used in larger school classes. Still, a number of large groups of pupils lacked peer mics altogether. There were no peer mics at all in 11 of 32 classes with 20 pupils or more, corresponding to over one-third of these large school classes. See Table 8.4.5.

Is there a sufficient number of microphones for classmates, and are the microphones placed so that they can be easily reached by all pupils in the class? Or is it necessary to hand the microphones around? Are microphones fetched when they are needed, or are they perhaps not used at all?⁸⁶ Chart 8.4.6 provides an overview of the situation when the lessons started.

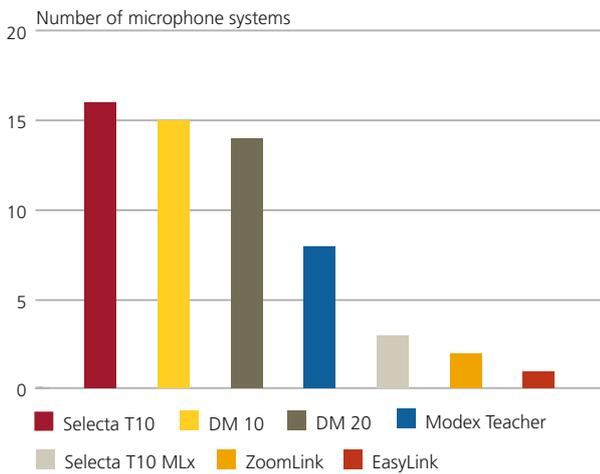
In about 40 percent of the classrooms with a microphone system, there were no peer mics at all. In these classes, a teachers' microphone was sometimes handed around and used by classmates. However, this meant that many HODA pupils lacked access to the arena of learning comprised of interaction between classmates in the class, as we mentioned in an earlier section of this report. Among the 103 pupils with microphone systems in our target population, almost 45 percent had never had peer mics prescribed. See Table 8.1.3.1.

We asked pupils and teachers if they thought that peer mics, or more peer mics than were presently available, were needed. Female pupils stated more often than male pupils that peer mics or more peer mics were needed: 36 percent among girls and 19 percent among boys. From Chart 8.4.7 we can conclude that experience using peer mics seems to generate a more positive attitude towards more microphones. In addition, we can see that teachers, more frequently than HODA pupils, thought that there was a need for more microphones for classmates. As we saw in an earlier section of this report, pupils often

85 The specific range of products shown here is the range that the Stockholm County Council has purchased through procurement procedures, and not products chosen freely by pupils or teachers.

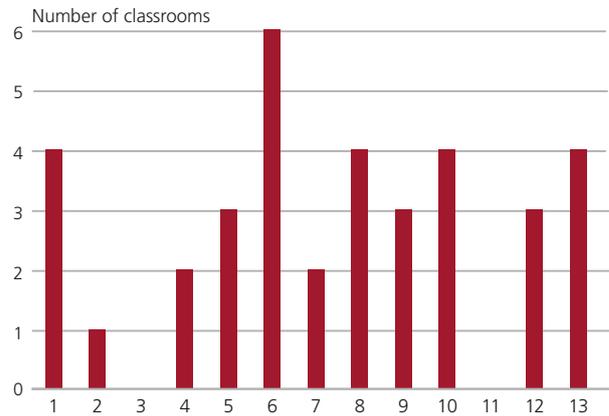
86 According to Rekkedal 2007, having a limited number of peer mics could mean that the procedure of handing them around to pupils in itself leads to less overall use.

Chart 8.4.3
Products—teachers’ microphones



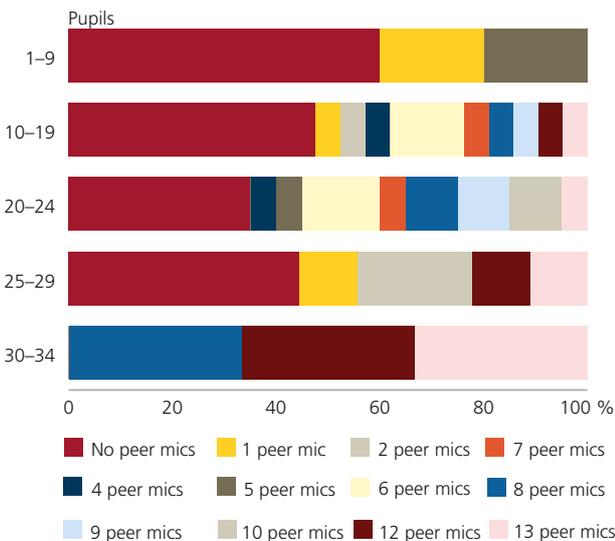
Number of microphone systems including teachers’ microphones of the models entered in the chart. Columns total 59 microphone systems. See also Table 8.4.4.

Chart 8.4.4
Number of peer mics



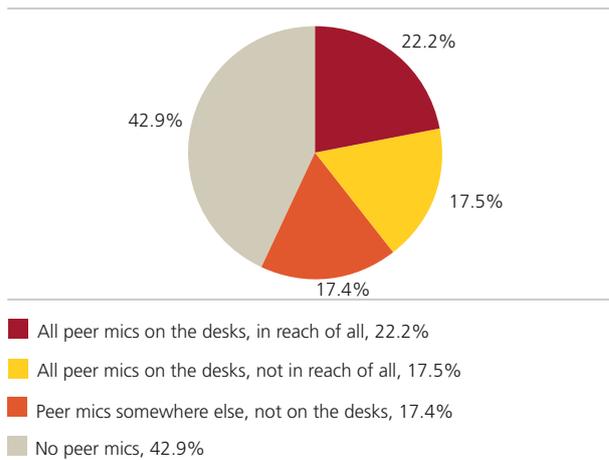
Number of microphones for classmates in the 36 classrooms with peer mics. See also Table 8.4.3.

Chart 8.4.5
Peer mics and number of pupils in the class



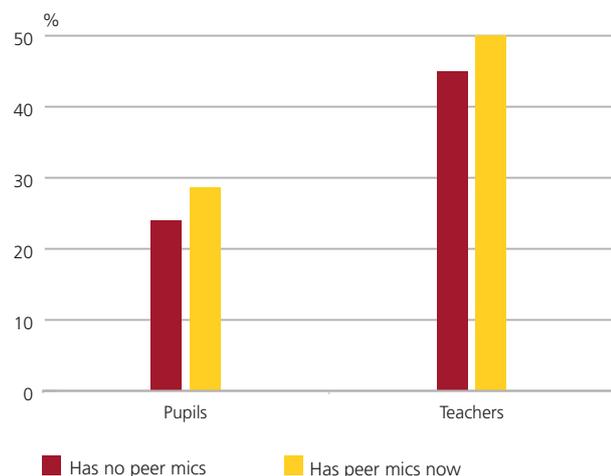
Number of pupils present in class during the observed lesson and number of microphones for classmates. See also Table 8.4.5.

Chart 8.4.6
Access to peer mics



Classmates’ access to microphones. Percentages based on 63 observed lessons. See also Table 8.4.6.

Chart 8.4.7
Need for peer mics or more peer mics



Opinion on the need for microphones for classmates. Red columns: Percentage of 25 pupils and 22 teachers, respectively, who presently have no microphones for classmates. Yellow columns: Percentage of 35 pupils and 32 teachers, respectively, who presently have microphones for classmates. See also Table 8.4.7.

thought that peer mic routines were poor, and this could, of course, influence their opinion here. On the whole, the issue of microphones for classmates might also be sensitive, since they remind everyone in the class of the pupil's hearing loss.

"It is not embarrassing that teachers use microphones. It is embarrassing that fellow pupils use microphones."

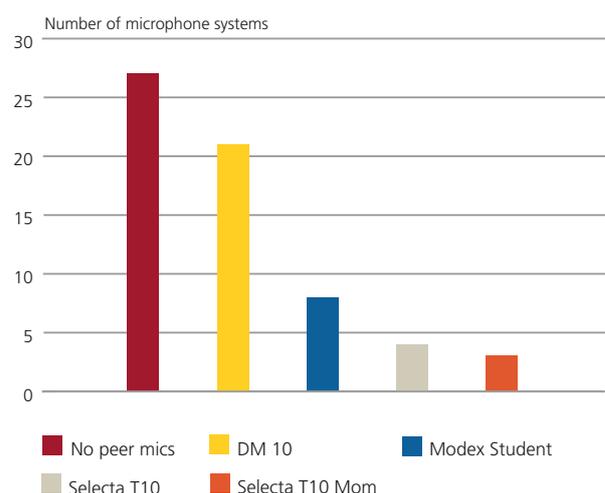
Pupil in the 6th grade

Chart 8.4.8 provides more detailed information about the products used as classmates' microphones in the communication devices.

More than half of the pupils, or 54 percent, had three receivers, ten percent had two receivers, and 36 percent had one receiver. In Chart 8.4.9 we can see in more detail the receiver products used in the communication devices.

Sixteen of the 63 classrooms had at least one, and commonly two, loudspeakers. In half of the 16 rooms with loudspeakers these functioned

Chart 8.4.8
Products—peer mics



Number of microphone systems, including classmates' microphones, of the models entered in the chart. The columns total 63 microphone systems. See also Table 8.4.4.

well, although in five cases the sound was poor, and in three cases the loudspeakers were turned off during the lessons observed. See Chart 8.4.10.

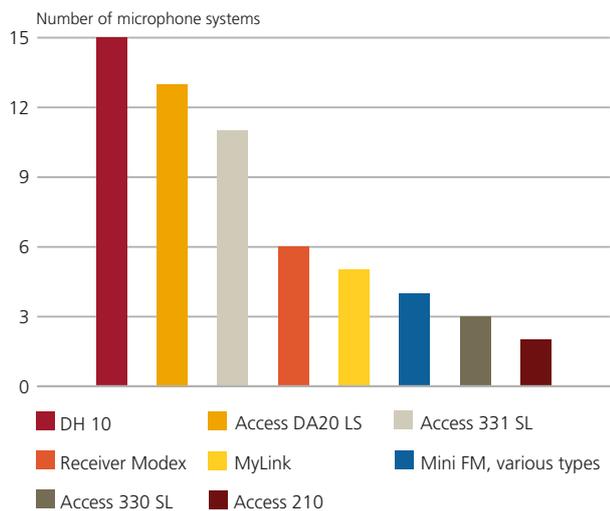
Audio teaching material—such as television, video, or DVD material—was rarely used during the lessons observed. Such audio material was used in just 11 of the 63 lessons, and in only five of these cases was the microphone system connected to it. See also Table 8.4.9.

Most of the classrooms had an interactive whiteboard connected to a computer, and this worked well in 26 of the 61 classrooms with such equipment. However, the computer was connected to the microphone system with good result in only seven cases. See also Table 8.4.10.

Participation

Have pupils and teachers been involved in decisions about the kind of communication device package to be used in school? Among the pupils, 22 percent said that they had been involved in such decisions. Almost all of these pupils were boys. Among the teachers, only about five percent had been involved in decisions concerning microphone

Chart 8.4.9
Products—receivers



Number of microphone systems with receivers of the models entered in the chart. The columns total 59 microphone systems. See also Table 8.4.4.

systems, although almost half of the teachers thought that it was important for them to be involved in such decisions. See also Table 8.4.11.

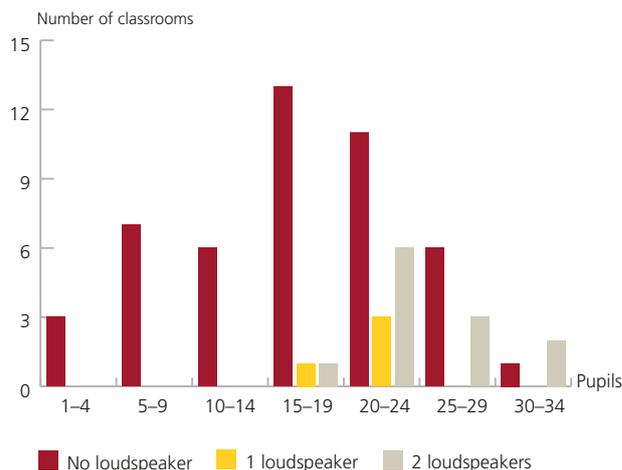
Condition of microphone systems

We listened to 59 devices for an entire lesson. The HODA observers⁸⁷ evaluated the function of these devices via the tele coil in hearing aids or mini-FM receivers that they wore during the lesson. If there were loudspeakers in the classroom, these were evaluated as well.

Of the 59 devices tested in this way during the observed lessons, 24 functioned well for the entire lesson, corresponding to 41 percent. Consequently, in more than half of the cases the devices did not meet reasonable criteria. Portable microphone systems worked more often than stationary systems (48 percent compared to 37 percent). See also Table 8.4.12 and Chart 8.4.11.

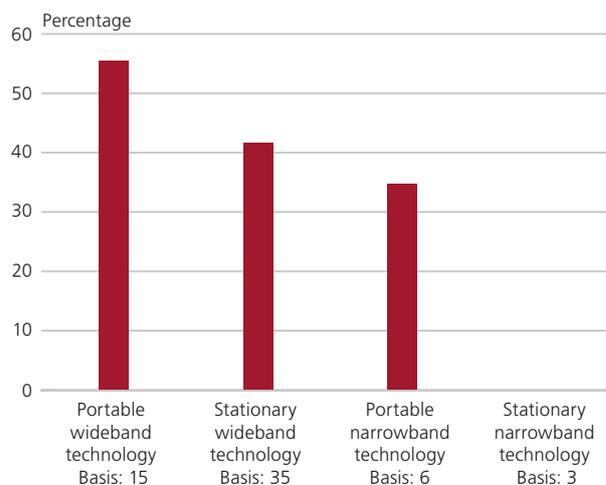
87 One technical audiologist specializing in communication devices for use at school and one special needs teacher specializing in issues related to teaching pupils with hearing loss and deafness.

Chart 8.4.10
Loudspeakers in the classroom



Number of loudspeakers in classrooms and pupils present during the observed lesson. See also Table 8.4.8.

Chart 8.4.11
Percentage of various categories of microphone systems that worked during the entire lesson



Fifty-nine microphone systems: Percentages of devices functioning during the entire observed lesson. Basis: Denominator in calculation of percentages = number of devices in each category. The chart shows that none of the three devices in the stationary narrowband technology category worked all through the lesson. Note that the bases, denominators, are small, in particular with regard to narrowband technology. See also Table 8.4.12.

“They should come here more often and check if it is working!”

Pupil in the 6th grade

In 2010, 25 stationary and 15 portable microphone systems in various schools in the Stockholm County area were tested and, at that time, problems were registered in 50 percent of the stationary devices and in 33 percent of the portable devices. During another control performed in 2006⁸⁸, about 60 percent of 95 stationary microphone systems had shortcomings. In other words, it is not unusual for the technology to function poorly. However, in regular and frequent technical controls conducted on stationary induction loop systems at the Åsbacka School⁸⁹, about 90 percent were found to be without problems⁹⁰.

However, there is no standardized way of evaluating microphone systems and, hence, no appropriate result to compare our findings with. In the HODA Study the criterion was that all technology should work faultlessly for the entire lesson. As can be seen from Table 8.4.2, the stationary microphone systems were older than the portable systems, which may explain their poorer condition. The number of peer mics may also affect the results, since we required that the entire system should function.

The following are some examples of faults and flaws found in the devices, arranged in order of frequency: Teachers’ microphone silent, peer mic silent, power cord not in socket, intermittent noise and sound glitches, spillover, receiver silent, lack of user adjustment, capacity of chargeable accumulators lost, weak sound in induction loop system, howling loudspeakers, and noise. Most commonly, there were a number of faults and flaws in each microphone system.

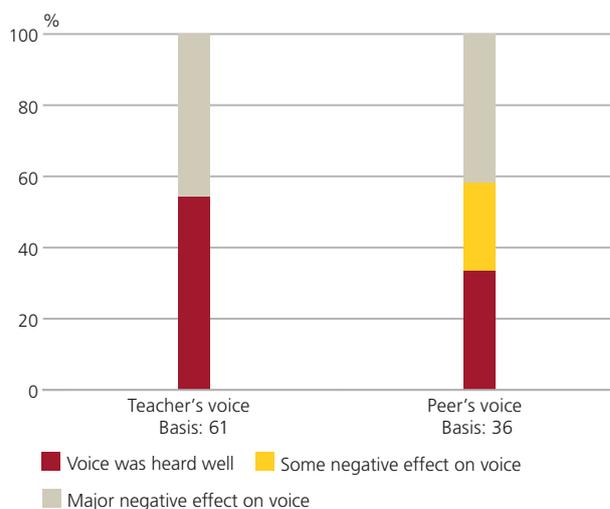
The technical function of all devices was checked after the lesson. Two of the four devices that were not in the classroom were also checked and both had faults. We were able to check the magnetic field of 36 induction loop systems and the results were good for 23 of these, acceptable for 11, and poor in two cases.

We made a detailed assessment of errors and flaws in the devices:

- Technical flaws were assessed in terms of the ability to hear the teacher via the microphone
- Technical flaws were assessed in terms of the ability to hear classmates via the microphones.

Thus, we were able to assess the teacher’s voice in 61 devices and classmates’ voices in all 36 devices with peer mics. Chart 8.4.12 shows that the teacher’s voice was heard with good quality sound in just over half of the devices (54 percent). Classmates’ voices were heard with good quality sound in only one-third of cases.

Chart 8.4.12
Quality—voice of teacher and voice of classmates



The teacher’s voice and classmates’ voices, respectively, were heard well, or technical errors affected the way the voice was heard. See also Table 8.4.13.

88 Holmberg presentation at Tema Hörsel (in Swedish).

89 A national special school for pupils suffering from deafness or hearing loss in combination with learning disabilities.

90 Holmberg 2013 (in Swedish). See also Linikko, Holmberg, and Lööf 2011 (in Swedish).

As can be seen in Table 8.4.14, in 23 microphone systems the voices of teachers as well as of classmates were heard with good quality sound. This corresponds to 38 percent of the 61 microphone systems that were checked. Table 8.4.15 shows the quality of the teacher's and classmates' voices in different categories of microphone systems.

In many cases—about 20 percent—the faults in the devices could be fixed immediately by the technical audiologist, although in almost half of the cases more comprehensive measures had to be taken. Frequently, the entire microphone system had to be reviewed and perhaps also supplemented, and sometimes information needed to be provided to teachers. No extra measures were needed for 32 percent of the microphone systems. See also Table 8.4.16.

Pupils and teachers on the condition of communication devices, technical difficulties, and improvements

Our conclusion from the foregoing results must be that communication devices are often in an unacceptable state. That said, how did pupils and teachers feel about this issue? When asked about the function of the microphone systems⁹¹, the majority—or 63 percent of pupils and 53 percent of teachers—stated that they always work. See Table 8.4.17.

Nonetheless, answers to other questions in the HODA Study urge us to view this result in a wider context. Indeed, questions can be formulated differently. In a Norwegian study, 30 percent of pupils stated that technical problems often occurred with teachers' microphones, and 20 percent said the same about classmates' microphones⁹². We asked pupils and teachers in the HODA Study how much time usually passes before the device is working again after malfunctioning.

Many, especially teachers, were uncertain about this, but the most common answer given by pupils and teachers was that 3–7 and 1–2 days, respectively, pass before the device is fixed. Moreover, pupils were asked if there were hissing, scrunching sounds, noise, sound glitches, or dropouts in their receivers and, if so, we called this *poor sound quality*.

Another question asked was whether the sound from the microphone was too loud or too weak and, if so, we called this *poor sound*. We see in Table 8.4.18 that about half of the pupils thought that their microphone systems were characterized by *poor sound quality*, and *poor sound* occurred in the system of every third pupil. In both cases, the stationary systems performed better than the portable systems in the pupils' estimation. Among the few pupils who use a stationary as well as a portable system, most thought that there was no difference between the devices in terms of listening, although more pupils thought that the stationary system was better suited to school than the portable system. We can conclude that there are a number of circumstances indicating that pupils are indeed experiencing problems with the devices.

The HODA observers noted “technically-related incidents” before and during the lesson observed. By incidents we mean such things as checking the device, adjustments to the device, and reminders. In Table 8.4.19 we see that such technically-related incidents occurred in more than one-third of the lessons.

Pupils and teachers alike were asked questions about what they thought would be the two most important improvements to their microphone systems. Their responses are shown in tables 8.4.20 and 8.4.21. Pupils who previously had microphone systems that have now been returned and municipal special needs teachers answered similar questions.

Concerning *improvements for the pupil with hearing loss*, the pupils themselves prioritized “better sound quality” in their devices and (in relation to stationary systems) “faster service” and that teachers and classmates should “always

91 Pupils were asked “When the microphones are charged, do they sometimes still fail to work?” and teachers were asked “Does the microphone system sometimes fail to function?”

92 Rekkedal 2012, p. 513.

use the microphone.”⁹³ Teachers thought that important improvements for their HODA pupil would be that teachers and classmates “always use the microphone” and “more peer mics.” The most common answers to a similar question as given by 12 municipal special needs teachers were “teachers always use the microphone” and “classmates always use the microphones.” Thus, teachers and special needs teachers reported similar priorities. Pupils who had previously used microphone systems at school answered “better sound quality” and “teachers always use the microphone.” In other words, HODA pupils with communication devices at school and HODA pupils without devices reported similar priorities.

In Section 8.5 we provide an account of how teachers responded to a number of statements about teachers’ microphones. The use of teachers’ microphones appeared to be quite unproblematic. However, three statements deviate from the general consensus. Two of these are related to the practical handling of the microphone: It is yet another thing for the teacher to remember, and it is difficult to turn on and off. A number of teachers also thought that the use of microphones stigmatized the pupil with hearing loss in the class.

“There should be a stationary induction loop system in each classroom used by the pupil. It is no fun to put on the portable device.”

*Mentor to a pupil with a device
in the 6th grade*

Expressing their opinions about important *improvements for teachers*, the most common suggestions among teachers themselves were that “it should be easier to see or hear whether peer mics are on or off” and “make charging the device obsolete.” These are improvements that would facilitate incorporating technology

into the teaching situation and practical tasks. Many teachers also stressed that microphones should be “sound and reliable”. Pupils with communication devices at school thought a major improvement for their teachers would be that their microphones were “easy to put on and take off” and that it should be easier for the teacher to “see or hear whether peer mics are on or off.” See Table 8.4.2.2. Municipal special needs teachers thought that microphones should be “easy to put on and take off”, and that it should be easier for the teacher to “see or hear whether peer mics are on or off.” Pupils who previously had microphone systems at school most often answered that they “do not know” what improvements would be good for teachers, although the answer that microphones should be “easy to put on and take off” was also common.

As we will see later, most teachers think that peer mics are easy to use, though only half of the pupils think that it is easy for their classmates to use the microphones. See Table 8.4.2.3. Regarding the most important *improvements for classmates*: Both pupils and teachers considered that “it should not be necessary to press a button when you talk” and “not necessary to talk into a microphone at all” (HODA pupils, in particular, considered this important for their classmates). “Access to peer mics” also featured (teachers, in particular, thought this was important). See Table 8.4.2.4.

The most common answers given by municipal special needs teachers to a similar question were “it should not be necessary to press a button when you talk” and better “access to peer mics.” Pupils who previously used microphone systems at school most often answered “it should not be necessary to press a button when you talk” and “not necessary to talk into a microphone at all.”

Pupils who previously used microphone systems at school were asked about the most important reason why they stopped using them. The answer “I heard equally well without them, they were not needed” was most common. And this is, of course, a very reasonable answer. As we see in Table 8.4.2.5, some other reasons were

93 We should add that five HODA pupils said that nothing needed improving; everything was fine.

that teachers forgot the microphone, and that the system was problematic and troublesome or embarrassing and stigmatizing.

Summary and comments

The microphone systems for use during the lessons we observed were more often portable than stationary systems. There were microphones for classmates in six of ten classrooms, and in four out of ten classrooms peer mics were placed on the pupils' desks, though they were reachable by all pupils in just two cases. There were loudspeakers—usually two of them—in some of the classes with many pupils.

Boys seem to have stationary systems more often than girls. This goes for HODA pupils as well as the entire target population, as we saw in Section 8.1. Since just one-fifth of pupils were involved in the decision about which microphone system they were to use at school, we can conclude that the type of device used is seldom the pupil's own choice. Stationary devices are more demanding on schools in terms of planning (i.e., in ensuring that the pupil in question has most lessons in a single classroom) if the device is to be used optimally for the pupil during the week. Do schools make more of these adjustments for boys than for girls?

A report from 2010⁹⁴ gives an account of how often microphone systems in schools are checked by professionals from the county council. It was concluded that an overall strategy of preventive action to ensure the function of microphone systems is lacking. In the HODA Study, 41 percent of the microphone systems met our criteria and worked all through the lesson. In other words, more or less serious deficiencies were found in almost 60 percent of the communication devices. Many questions arise from such a result. What percentage is reasonable? What are our ambitions? When do pupils lose confidence in the technology due to its poor performance?

The highest rates of well-functioning devices were found among portable and stationary wideband systems. We suggested in Section 6 of this report that stationary systems are considered to have better sound quality and be more reliable. Our results here instead indicate that stationary systems had better sound quality, according to pupils, but that portable systems were in better technical shape. Our observations are few however, and portable systems' superior technical status could be due to the fact that these, as a rule, have been prescribed more recently and, therefore, are not as old as the stationary systems. In addition, the number of peer mics involved makes a microphone system more sensitive to our criterion that all parts of the system should work all through the lesson. In conclusion, our results indicate that further studies, with more solid observational data, and evaluations of devices for use at school are urgently needed.

Technical flaws in the microphone systems often negatively affected the way teachers' and classmates' voices were heard. Thus, pupils listening to the teacher or peers in the system frequently experienced poor sound quality in their receivers. Indeed, when we asked the pupils themselves, they often thought that the sound quality was poor and wanted improvements to sound quality in their devices.

One relevant question is to what extent deficiencies in sound and sound quality have contributed to pupils' decisions to stop using such devices at school. When teachers, municipal special needs teachers, and pupils themselves judged what improvements in the devices were important for pupils with hearing loss, the use and handling of microphones was central. Using the device is, of course, a precondition for the microphone system to fulfill its function, and it is clear that routines and practical issues related to using the devices are important and need to be improved. As stated previously, the microphone systems were not always where they should be when we visited the classrooms and, in some cases, this was also an indication of insufficient routines in relation to the devices.

94 Svensk Teknisk Audiologisk Förening/The Swedish Technical Audiological Society 2010, pp. 10–11, 15–16 (in Swedish).

The suggested improvements to microphone systems that would help teachers were to a large extent related to facilitating the management of the microphones—especially peer mics—in the ongoing teaching situation and to the practical handling of the microphones. When peer mics are used, one problem that needs to be addressed is the fact that a button has to be pressed each time a classmate wants to say something. Another problem for pupils seems to be that classmates have to use a microphone at all when talking, while teachers want better access to peer mics. Microphones activated by voice or systems where all microphones can operate simultaneously are desired, although such technology presupposes control over background noise. We must conclude that further technical advancements are needed and that technical and education professionals and the pupils themselves must participate in this development.

8.5 Microphone systems at school—usage

In the two preceding sections of this report we focused mainly on premises and equipment. Hereinafter, we will involve the pupils and teachers in our analysis. We begin by providing a general account of the use of hearing and communication devices in schools based on our interview and questionnaire data. Next, we present an overview of the use and handling of communication devices based on our observations of full lessons.

Use of hearing and communication devices in general

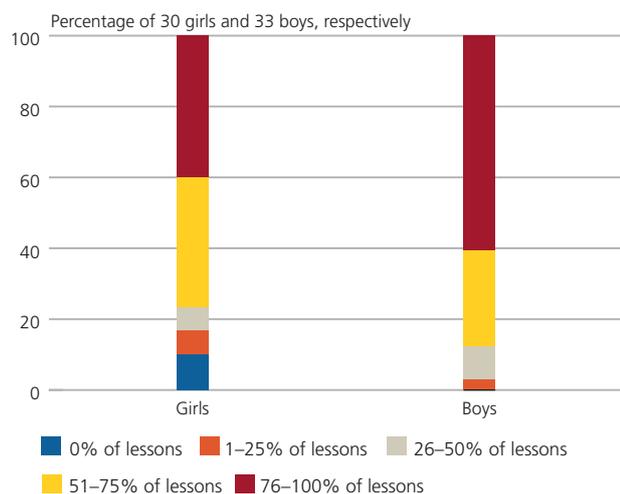
Pupils

To what listening program or position do pupils usually switch their hearing aids when a microphone system is used? As we can see in Table 8.5.1, HODA pupils typically used the same position on both their hearing aids. Our interviewers reported that pupils seemed unaware and uncertain of the terminology (for example, M-position and T-position) used for hearing aid programs and answered our questions in terms of “one beep”, “two beeps”. This indicates that advice and instructions given using current terminology will likely not be properly understood by young people.⁹⁵

The HODA pupil and the interviewer jointly examined the pupil’s school timetable and the classrooms with a microphone system in place were noted, as were the lessons during which a device was used. Hence, the pupil here provided us with an assessment of access to, and the use of, a microphone system, and also of the motivation for using such a system during a certain lesson. However, we cannot rule out the possibility that we received an overestimation of actual usage.

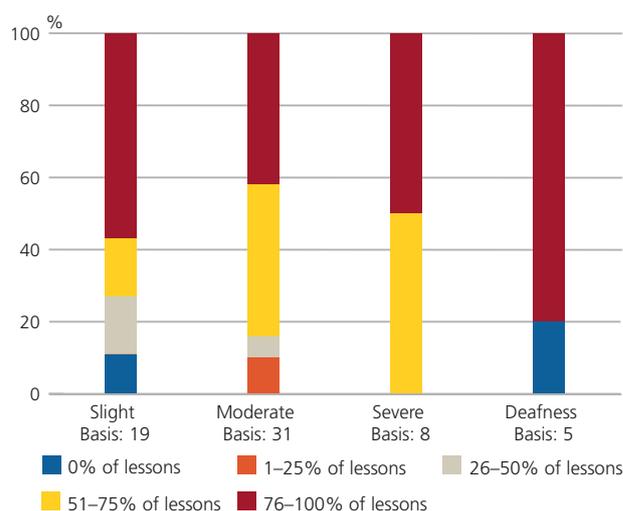
95 We did not ask any further questions about the listening positions used by the pupils in the HODA Study. In studies carried out by Odellius (2010), pupils appeared to be much more deliberate in their strategies. The pupils in this study attended *hörselklass*, that is, an entire school class of pupils with hearing loss at a mainstream school.

Chart 8.5.1
Use of microphone systems during the school week by gender



Use of microphone systems during school weeks. Percentage of the total number of lessons during one week when microphone systems are used according to 30 girls and 33 boys. See also Table 8.5.2.

Chart 8.5.2
Use of microphone systems during the school week by degree of hearing loss



Use of microphone systems during school weeks. Percentage of the total number of lessons during one week when microphone systems are used by pupils with hearing loss. Note: Small number of pupils with severe hearing loss and deafness. See also Table 8.5.3.

To begin with, we provide an account of the use of microphone systems (in terms of use during a lesson) as a percentage of a pupil’s total number of lessons⁹⁶ during the school week. In Table 8.5.2 we see that pupils most commonly stated that they use communication devices during more than 75 percent of their lessons. Boys reported using their microphone systems to a greater extent than girls. See Chart 8.5.1. We note that there were three pupils who stated that they did not use their microphone system at all. In two of these cases the devices did not function, and in all three cases, the HODA observers assessed that the schools in question were characterized by either a lack of knowledge or organizational deficiencies.

As can be seen in Chart 8.5.2, those who used their microphone systems most during the school week were pupils suffering from slight hearing

loss and deafness. We also find the three pupils not using their devices at all in these two groups. However, the bases for calculating the percentages are small.

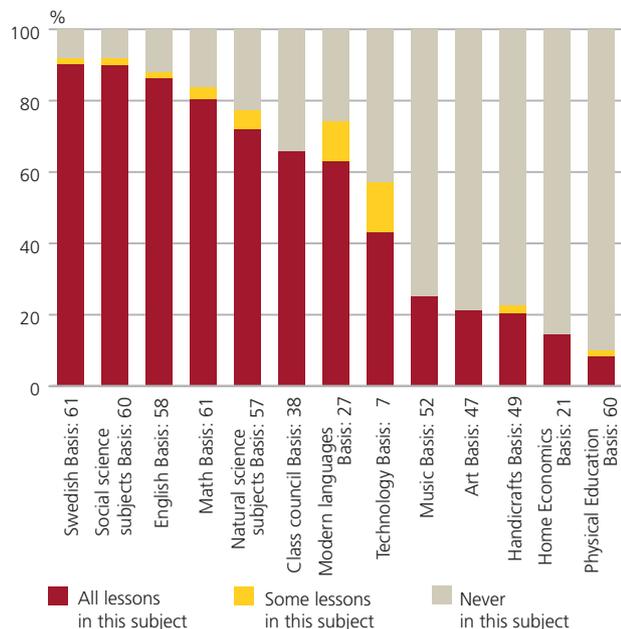
Next we will examine the use of microphone systems during lessons in the various school subjects. In Chart 8.5.3, school subjects are arranged in order of the frequency of device usage during *all lessons in that subject* according to the pupils themselves. We see that the use of communication devices is very high in Swedish, social science subjects⁹⁷, English, and mathematics: Four out of five pupils used microphone systems during all lessons in these subjects. We notice that the use of microphones in modern language classes⁹⁸ did not reach the same level as in English classes.

96 In referring to “lessons” here, we mean distinct educational sessions devoted to one school subject. Such sessions may vary in length.

97 Civics, History, Geography, and Religion.

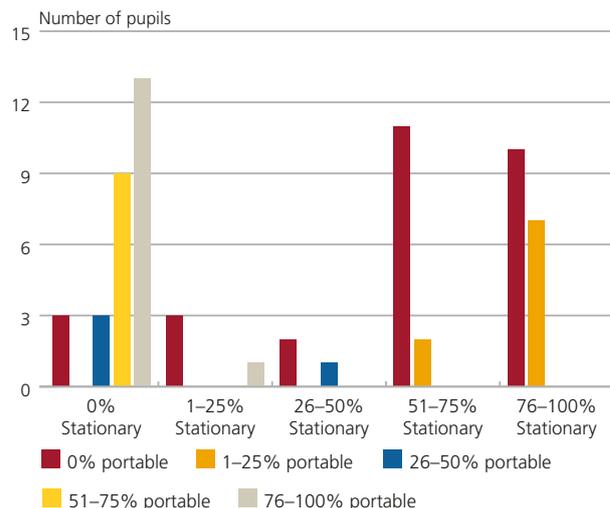
98 Spanish, French, and German.

Chart 8.5.3
Use of microphone systems during the school week by school subject



Percentage of pupils who use microphone systems for all, some, or zero lessons in a specific school subject. Each column totals 100 percent of the pupils taking this subject at school. Basis: Number of pupils taking the specific subject at school. Modern languages: German, Spanish, French. Missing answers: 1–3. See also Table 8.5.4.

Chart 8.5.4
Use of stationary and portable microphone systems during the school week



Use of stationary and portable microphone systems during the school week. Example: Of 11 + 2 pupils using a stationary system during 51–75 percent of their lessons, two pupils use a portable system during another 1–25 percent of their lessons. See also Table 8.5.6.

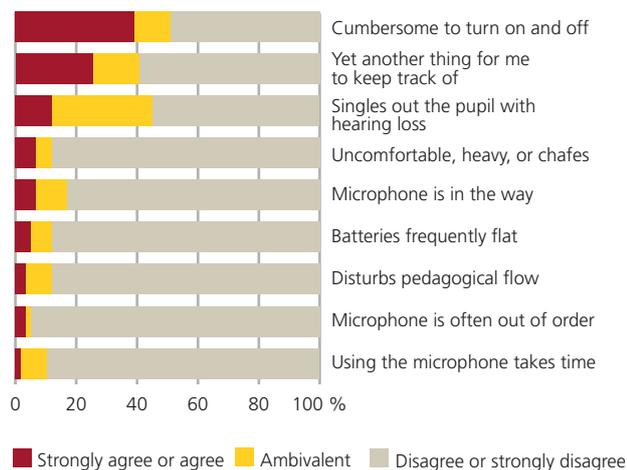
Table 8.5.5 shows the use of stationary and portable devices during the school week. Stationary systems were used somewhat more often than portable systems. We recall that boys more often had stationary systems and also used their devices more often than girls. In Chart 8.5.4, we see that a combined use of stationary and portable devices occurs.

Pupils as well as teachers were asked about teachers’ use of microphones during lessons. While the questions are not fully comparable, the answers nonetheless unambiguously indicate that teachers use microphones to a relatively large extent. Pupils were asked if teachers use microphones when the whole class is gathered and when pupils work in smaller groups. About 85 percent and 47 percent of the pupils stated that teachers always or mostly use microphones in whole-class settings and during *teamwork*,

respectively. Teachers stated that they always or mostly use the microphone—64 percent and 22 percent, respectively. Thus, 86 percent of teachers said that they usually use microphones during lessons. See Table 8.5.7.

The pupils were asked to choose two improvements that would make the microphone system better for them. We provide an extensive account of the answers to this question in the previous section of this report, and here we will simply note again that, for many pupils, one important improvement in relation to the device would be for their teacher always to use the microphone. We can conclude that these pupils’ teachers did not use the microphone to the extent preferred by their pupil with hearing loss.

Chart 8.5.5
Teachers’ opinions on the use of teachers’ microphones



Teachers’ opinions on a number of statements about the use of teachers’ microphones. See also Table 8.5.10.

The teacher’s microphone functions now and then. There are ten peer mics in the room, but they are not used. The teacher stands at the rear of the classroom and comments on the presentations given by the pupils without using a microphone.

Observation from a 5th grade class

The pupils stated that it is important that teachers use microphones, especially when the entire class is gathered. More than four out of five pupils, 83 percent, thought it important for teachers to use the microphone in whole-class settings. About half as many, 41 percent, thought this to be important when pupils work in smaller groups. See Table 8.5.8. As we can see in Table 8.5.9, teachers usually used microphones in classes where the HODA pupil thought this to be important. Alternatively, when the teacher usually uses a microphone, this becomes a reliable and important routine for the pupil.

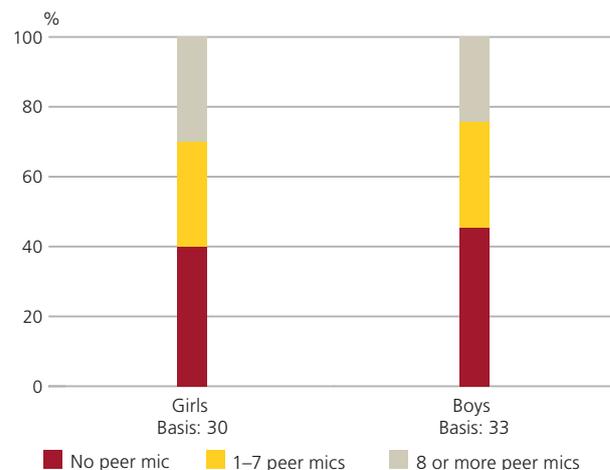
Teachers

Teachers were asked to give their opinion on a number of statements about using a teachers’ microphone when teaching. They were asked to give their opinion based on a scale of 1–5, from “strongly agree” to “strongly disagree”. As we can see in Chart 8.5.5, using a microphone in class seemed to be quite unproblematic for teachers. However, three statements deviate from this general trend. Two of these are related to the practical handling of the device: It is yet another thing for the teacher to remember, and it is awkward to put on and take off the microphone. Also, a number of teachers either thought that the use of a microphone singles out the pupil with hearing loss, or hesitated to give a definite opinion about this statement. See Chart 8.5.5.

Microphones for classmates

Not all microphone systems had microphones for classmates, as we noted earlier in this report. Of 63 communication devices, 36 devices, or 57 percent, had microphones for classmates. Chart 8.5.6 shows that devices used by girls more often had microphones for fellow classmates than those for boys.

Chart 8.5.6
Peer mics and gender



Percentages among girls and boys, with and without peer mics. Basis: Number of girls and boys, respectively. See also Table 8.5.11.

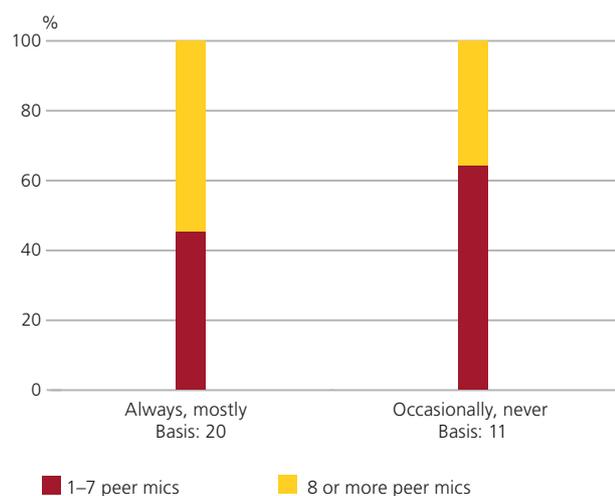
As we pointed out earlier, the number of peer mics used differs greatly. A teachers' microphone is sometimes used as a peer mic and, in these cases, we are referring to a single microphone that is handed round in the class. The following analysis concerns pupils who have been prescribed peer mics and who answered our questions. Four of the 63 pupils with communication devices in the HODA Study could not be interviewed. Of these, only one had peer mics.

Table 8.5.12 shows the answers given by 31 pupils to the question "How often are peer mics used in a way that is suitable for you?" Sixty-four percent answered "always" or "mostly". The frequencies among girls and boys were the same. Chart 8.5.7 is based on only a few observations, but still lends weight to the idea that more peer mics facilitate smooth usage in class.

(Diagram 8.5.7)

Chart 8.5.7

Appropriate use of peer mics



Peer mic usage is adequate, according to pupils using microphone systems with peer mics. Basis = number of pupils who feel that peer mics are used in an appropriate way always/mostly and occasionally/never, respectively. See Table 8.5.13.

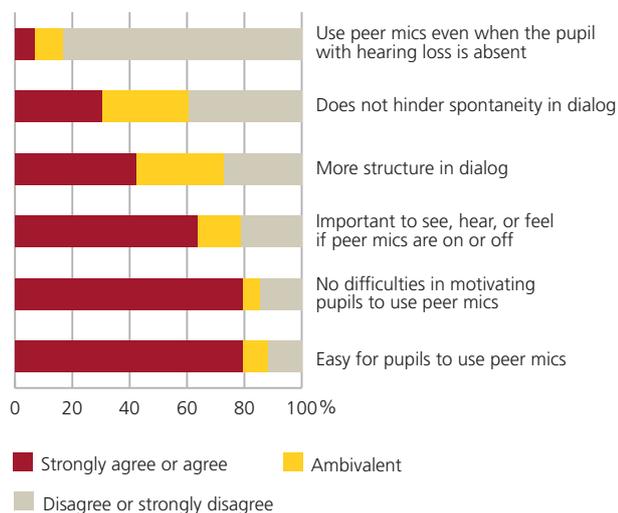
Someone should come here and tell my classmates how the microphones work. They need to shape up!

Pupil in the 6th grade

More than half of the 31 pupils (52 percent) thought that their classmates needed more information on how to use peer mics, although 32 percent did not think this was necessary. The remaining 16 percent said that they did not know. Almost all pupils (97 percent) thought it was important that peer mics be used in whole-class sessions, whereas considerably fewer, 41 percent, thought this to be important when working in groups. See Table 8.5.14.

Pupils and teachers with the relevant devices were asked about improvements in relation to peer mics that would create a better situation for classmates. We gave a detailed account of the answers to this question in the previous section of this report. We saw that many pupils and teachers would like to avoid the practical manipulation of the microphones in terms of pressing buttons when talking. In addition, the alternative "Easier to see, hear, or tactilely feel if the mic is on or off" was chosen by many teachers, as we will see below, and this could be seen as a way to tackle the same practical problem.

Teachers were asked to give their opinions by responding to statements about peer mics and, as we can see in Chart 8.5.8, the majority of teachers thought that microphones were easy for classmates to use and that they had no difficulty in motivating them to do so. However, we also noted above that teachers thought that an important improvement in relation to peer mics would be to remove the need to press buttons when talking. As we can see in Chart 8.5.8, it was important for more than 60 percent of the teachers to be able to easily identify whether peer mics were on or off. However, teachers seemed uncertain as to whether peer mics contribute to order and structure in classroom dialogs. Also, nearly 40 percent thought that the use of peer mics stifles spontaneity in classroom dialogs. It seems to be unusual to use peer mics when the pupil with hearing loss is absent. See Table 8.5.15.

Chart 8.5.8**Statements about the use of peer mics**

Teachers' opinions on a number of statements about peer mics. See also Table 8.5.15.

Use of microphone systems during the observed lessons

When we stepped inside the classrooms and observed what happened during an entire lesson in social science subjects or Swedish on one day in 2013, we were required to make sense of and describe many diverse impressions.

Pupils rush into the classroom in a disorderly way when the lesson is about to start. Everything is chaotic. The loudspeaker sound is set too high. The teacher has the microphone too close to their mouth. The high noise level causes a number of pupils to talk even louder, and some of them talk all the time. Peer mics are placed on the desks, but they are seldom used and neither the teacher nor the HODA pupil says anything about this.

Observation from a 5th grade class

The teacher lays out peer mics on each desk. There is a large carpet under the teacher's teaching position. The furniture is adequate and there are small tablecloths to dampen the noise from pens and microphones. Pupils enter and start reading quietly until all have arrived. A silent and calm class. Someone is drilling somewhere in the building, and the teacher goes to check up about this.

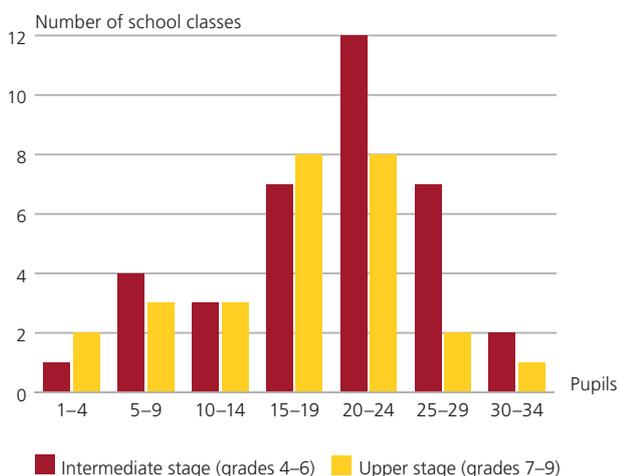
Observation from a 3rd grade class

As stated earlier, our observers encountered a number of disorderly situations in the classrooms. We have already discussed pupils who did not have a complete microphone system in the classroom and pupils who did not use their microphone systems. We also noted that, in one case, the teacher did not know that microphones in a bag on the classroom floor were intended for use by classmates. In a number of cases, the teacher's lack of knowledge about and ability to manipulate the devices smoothly resulted in situations where the teacher's microphone was not turned off when required. For instance, the HODA pupil (and the observers) could hear a teacher reprimanding a pupil taken out into the corridor, or they were able to hear a teacher's private conversation on a cell phone in the corridor.

About schools, classrooms, and the communication devices used

Of the 63 lessons observed, 53 were conducted in schools run by municipalities and ten were conducted in schools run by organizers of independent schools. Seven lessons were conducted in schools for pupils with learning disabilities and the remaining 56 lessons in mainstream compulsory schools. In about half of the lessons observed the class contained fewer than 20 pupils. See Table 8.5.16. The classes in schools for pupils with learning disabilities, however, were typically small; six classes had fewer than ten pupils and one had 10–14 pupils. Chart 8.5.9 shows the number of pupils present during the observed lessons.

Chart 8.5.9
Size of class and school stages

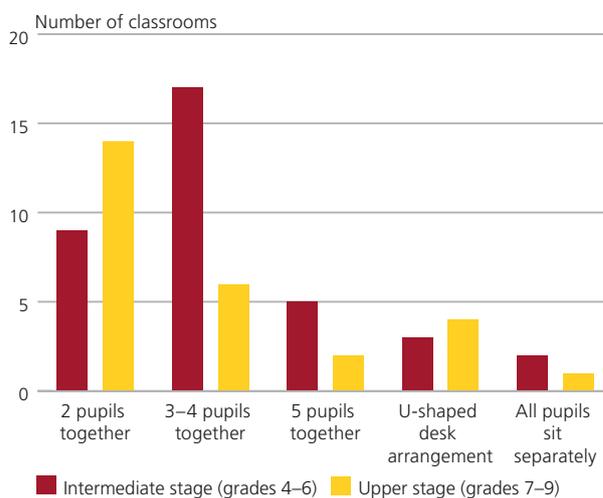


Number of pupils present during the lesson observed by school stage. Two pupils attended the lower stage, grade 3, but these classes are here included in the intermediate stage. The columns total 63 school classes. See also Table 8.5.16.

Six mentors stated that the size of the specific school class had been reduced because of the needs of the pupil with hearing loss, though none of these pupils followed the curriculum for pupils with learning disabilities. Two of the pupils attended classes with fewer than ten pupils, and in five of the six classes there was a student assistant or other resource person present.

The desks in the classrooms we visited were most commonly arranged for groups of up to four pupils. As we can see in Chart 8.5.10, groupings of two pupils were more common in the upper stage of compulsory schools (grades 7–9), and desks arranged for groups of 3–4 pupils were more common in the intermediate stage (grades 4–6).

Chart 8.5.10
Classroom: Grouping of pupils

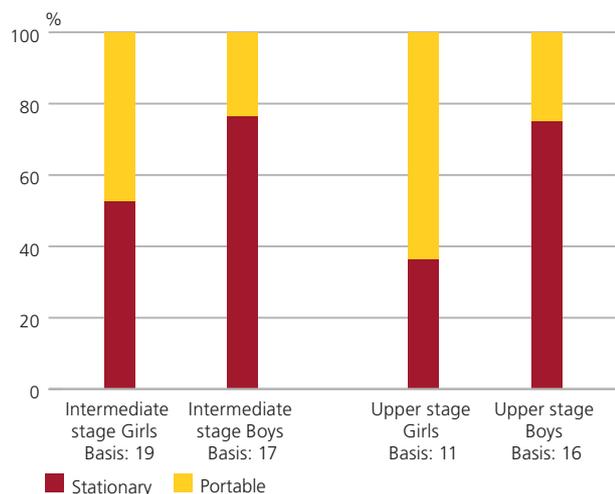


Classroom grouping and school stage. Two pupils attended the lower stage, grade 3, but these classes are here included in the intermediate stage. The columns total 63 school classes. See also Table 8.5.17.

About 70 percent of the HODA pupils had a seat in the classroom within three meters of the board, while the remaining 30 percent were seated farther away. About one in five pupils was seated facing the light, which can impede their ability to read the board and to lip-read. See Table 8.5.18.

As mentioned earlier, in 25 of the 63 classrooms the peer mics were placed on the pupils' desks when the lesson started. In 14 of these rooms, microphones were within arm's reach of all pupils. The peer mics were not laid out on the desks in 11 rooms, and in 27 classrooms the microphone systems had no peer mics at all. In the previous section of this report we provided a description of the types of microphone systems that were to be used during these lessons and we recall that, in four classrooms, there were no microphone systems that could be used. These four incomplete or broken devices are included in Chart 8.5.11, however. We see that the pattern of stationary systems being more common among boys than girls still holds true when we examine the type of microphone system used by school stage.

Chart 8.5.11
Type of microphone system, gender, and school stage



Stationary or portable microphone systems for use during 63 lessons by girls and boys attending intermediate and upper stages, respectively. Note that two girls attending the lower stage, grade 3, are here included in the intermediate stage. Four pupils who did not have a usable device at the time of the lesson (three girls attending the upper stage and one boy attending the intermediate stage) are included. See also Table 8.5.19.

When we talk about “lessons” in this report, we mean distinct educational sessions devoted to one school subject. Such sessions may vary in length. Most commonly, the observed lessons lasted about one hour, although there were also shorter and longer sessions. See Table 8.5.20. Many people with hearing loss state that they need to take a break from listening from time to time and to rest from sound.⁹⁹ Pupils at school can turn off their microphone systems for a time during a lesson and thus rest from listening, although the price of doing so might be that they miss something important. Various kinds of individual tasks undertaken during a lesson can also give a pupil with hearing loss the chance to rest from the strain of listening. We will now address the various elements of a lesson (what we call “pedagogical situations”), including individual tasks.

⁹⁹ See also Danermark & Coniavitis Gellerstedt 2003, p. 154 (in Swedish).

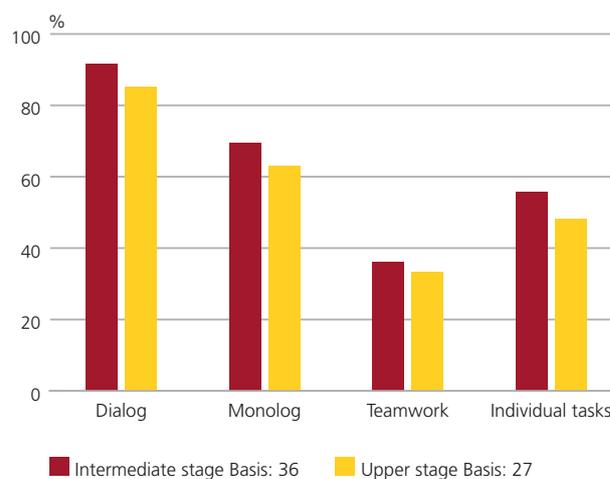
Pedagogical situations

We have distinguished between and estimated the duration of four educational situations or settings:

- *Dialog* between teacher and pupils or among pupils; discussions
- *Monolog*; such as a lecture, someone reading aloud, an instruction, a video
- *Teamwork*
- *Individual tasks*, such as pupils reading or writing on their own; exams.

The frequency of these four settings during the lessons observed is shown in Chart 8.5.12. We see that *dialogs* occurred in class in around nine out of ten lessons. *Dialogs* are very demanding situations for pupils with hearing loss. Lectures and other types of *monologs* were also very common, occurring in about 60–70 percent of the observed lessons, and individual tasks (at best representing a pause for the HODA pupil from the strain of listening) occurred in about half of the lessons.

Chart 8.5.12
Pedagogical situations



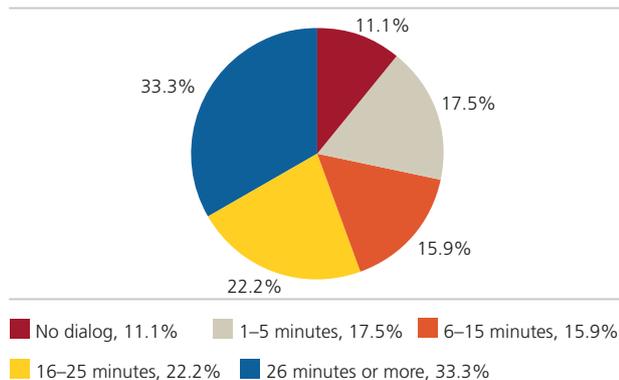
Frequency of different pedagogical situations during 36 lessons at the intermediate stage and 27 lessons at the upper stage, respectively. Two pupils attended the lower stage, grade 3, but are here included in the intermediate stage. See also Table 8.5.21.

The use of microphone systems during these four different pedagogical settings is shown below. We have also undertaken a kind of evaluation: Does the actual use of the technological devices meet the requirements of a specific pedagogical situation? The criteria applied in evaluating the microphone systems are presented in the overview tables. In general, though, for the evaluation to be truly useful, the use and technical condition of the devices must correspond completely to the requirements of the situation. It is not acceptable for pupils to listen through communication devices that only partially meet their needs in a specific pedagogical situation, day in and day out.

Use of microphone systems during dialogs

The length of the pedagogical situation *dialog* during the lesson was estimated by the HODA observers, and in Chart 8.5.13 we can see that, frequently, the total duration of *dialogs* in class was relatively long. In one in three lessons, *dialogs* took more than 26 minutes in total, and in over half of the lessons, the class was engaged in *dialog* for more than a quarter of an hour.

Chart 8.5.13
Dialog



Estimated duration of the pedagogical situation *dialog* in 63 observed lessons. See also Table 8.5.22.

We will now look more closely at the use of technology during *dialogs* in class. *Dialogs* occurred in 56 lessons and during 24 of these (43 percent)

both teachers' microphones and peer mics were used. In another 24 lessons only teachers' microphones were used, and in most of these cases (17 lessons), the microphone system did not include peer mics. In the remaining eight cases (14 percent), neither teachers' microphones nor peer mics were used. See also Table 8.5.23.

After the exam, there is a dialog in class. The teacher does not bring out the peer mics. The HODA pupil does not know which classmate is talking or what they are saying. The HODA pupil tries to make eye contact with the teacher, but the teacher is standing by one of the side walls and the HODA pupil has to turn around to see the teacher.

Observation from a 6th grade class

The teacher is talking in a loud voice, walking around in the classroom. The dialog is disorderly. Pupils read out questions without microphones. The teacher uses a microphone, but does not repeat any answers. The HODA pupil turns around and tries to see what their classmates are saying.

Observation from a 5th grade class

Evaluation: Are the requirements involved in a dialog situation met through the use of the technological devices?

Our assessments and the criteria used to evaluate the communication devices in what we refer to as *dialog* situations are presented in an overview table to follow.

We observed that the technology and the use of devices fully matched the demands generated by this kind of pedagogical situation for just eight of the 56 pupils exposed to *dialog* situations during the lesson observed, corresponding to 14 percent of the pupils concerned. Thus, the remaining 86 percent possibly failed to receive full access to the educational content in this frequently-occurring situation

Evaluation: Are the requirements met by the device?

Dialog

Assessment	Number of pupils concerned	Criteria for the assessment
The use and technical condition of the device fully matched the requirements of the pedagogical situation.	8 pupils	Teachers' and classmates' microphones were used in an appropriate way in this situation. The number of peer mics was sufficient. The system functioned from a technical standpoint.
The use and technical condition of the device partially matched the requirements of the pedagogical situation.	14 pupils	The number of peer mics was not sufficient, or peer mics were used occasionally. Most peer mics functioned from a technical standpoint. Some deficiencies were observed, such as audio glitches or scrunching sounds in the system, or loudspeakers did not function, or the teacher did not handle the system optimally.
The use and technical condition of the device did not match the requirements of the pedagogical situation at all.	25 pupils	No peer mics, or most peer mics did not work.
The device was not used.	5 pupils	In all these cases there were more or less temporary technical faults in the microphone system, such as drop-outs, or the receiver was silent.
The device did not work.	4 pupils	The four pupils who did not have their devices in the classroom.
No dialog occurred during the observed lesson.	7 pupils	–

Evaluation: Are the requirements met by the device?

Monolog

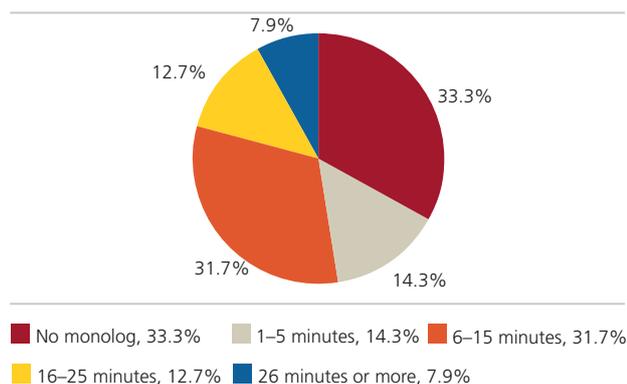
Assessment	Number of pupils concerned	Criteria for the assessment
The use and technical condition of the device fully matched the requirements of the pedagogical situation.	18 pupils	Teachers' microphones were used in an appropriate way in this situation. The systems functioned from a technical standpoint.
The use and technical condition of the device partly matched the requirements of the pedagogical situation.	13 pupils	Teachers' microphones were not used in an appropriate way in this situation, or were not used all the time, or some deficiencies were observed, such as audio glitches or scrunching sounds in the system, or the teacher was not aware of whether the microphone was on or off, or the loudspeakers did not work.
The use and technical condition of the device did not match the requirements of the pedagogical situation at all.	–	–
The device was not used.	7 pupils	In all these cases there were more or less temporary technical errors in the microphone system, e.g. the receiver was silent. Often there were several faults.
The device did not work.	4 pupils	Two of these pupils did not have their devices in the classroom and, in two cases, there were technical problems in the microphone system.
No monolog occurred during the observed lesson.	21 pupils	–

in the classroom. This was due largely to the supply, condition, and usage of peer mics. We also noted that a few pupils did not use their devices during this pedagogical situation, which could be due to technical shortcomings. See also Table 8.5.24.

Use of microphone systems during monologs

As we can see from Chart 8.5.14, lectures, reading aloud, and other situations where one person is speaking (what we call *monologs*) lasted for more than a quarter of an hour in about one in five lessons that we observed.

Chart 8.5.14
Monolog



Estimated duration of the pedagogical situation *monolog* in 63 observed lessons. See also Table 8.5.22.

The situations we call *monologs* occurred in 42 of the 63 lessons observed. A teachers' microphone was used during 34 such sessions (81 percent) and, in some cases, peer mics were also used. In the remaining cases, no microphones were used. See also Table 8.5.23.

Evaluation: Are the requirements involved in a monolog situation met through the use of the technological devices?

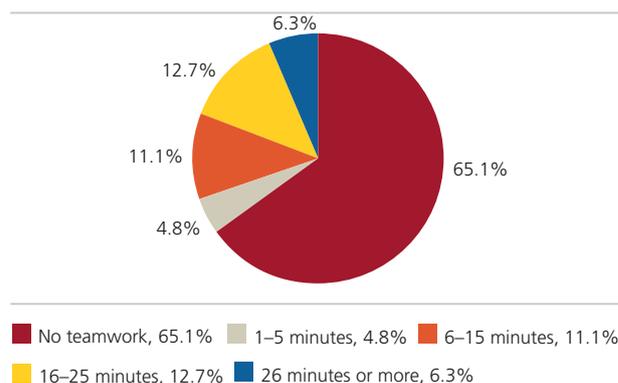
Our assessments and the criteria used to evaluate the communication devices in what we refer to as *monolog* situations are presented in an overview table to follow.

We note that for 18 of 42 pupils the use and technical condition of the microphone systems entirely matched the requirements involved in the *monolog* pedagogical situation, corresponding to 43 percent of the pupils concerned. For another 13 pupils, the use and technical condition of the microphone systems partially matched the requirements of the situation. We also note that there were pupils who chose not to use their devices during lectures and other *monologs* in class. See also Table 8.5.24.

Use of microphone systems during teamwork

As we can see from Chart 8.5.15, *teamwork* only occurred during approximately one-third of the lessons observed.

Chart 8.5.15
Teamwork



Estimated duration of the pedagogical situation *teamwork* in 63 observed lessons. See also Table 8.5.22.

The class was engaged in *teamwork* during 22 of the observed lessons. Both a teachers' microphone and peer mics were used during one of these sessions. In four cases only a teachers' microphone was used, and in another case, only peer mics were used. During 16 of the *teamwork* sessions, corresponding to 73 percent, no microphone was used at all. See also Table 8.5.23.

Evaluation: Are the requirements met by the device?

Teamwork

Assessment	Number of pupils concerned	Criteria for the assessment
The use and technical condition of the device fully matched the requirements of the pedagogical situation.	–	Microphones used in an appropriate way in this situation. The system functioned from a technical standpoint.
The use and technical condition of the device partly matched the requirements of the pedagogical situation.	1 pupil	Peer mics were used sporadically.
The use and technical condition of the device did not match the requirements of the pedagogical situation at all.	3 pupils	Only teachers' microphones were used.
The device was not used.	14 pupils	Five of the pupils had devices that functioned well, and the remaining nine pupils had more or less temporary technical faults in their microphone systems.
The device did not work.	4 pupils	Three of these pupils did not have their devices in the classroom and, in one case, there were technical problems in the microphone system.
No teamwork occurred during the observed lesson.	41 pupils	–

Evaluation: Are the requirements involved in a teamwork situation met through the use of the technological devices?

Our assessments and the criteria used to evaluate the communication devices in what we refer to as *teamwork* situations are presented in an overview table to follow.

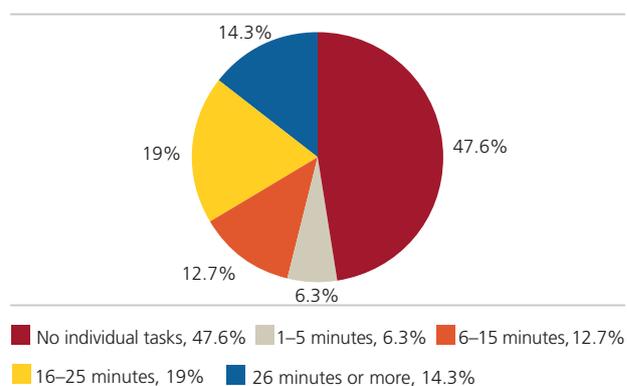
We note that the use and technical condition of the device never fully matched the requirements of a *teamwork* situation. We also note that most of the 22 pupils concerned did not use their devices during *teamwork* situations. See also Table 8.5.24.

Use of microphone systems during individual tasks

Working alone, reading quietly, exams, and other situations without explicit communication occurred during 33 of the 63 lessons observed. As we can see in Chart 8.5.16, in many cases this type of activity lasted for more than a quarter of an hour in total. Peer mics were never used, but

teachers' microphones were used—or were not turned off—during 17 of the sessions involving *individual tasks*, corresponding to 52 percent of these cases. See also Table 8.5.23.

Chart 8.5.16
Individual tasks



Estimated duration of the pedagogical situation *individual tasks* in 63 observed lessons. See also Table 8.5.22.

Evaluation: Are the requirements involved in a situation with individual tasks met through the use of the technological devices?

Our evaluation of the use of technological devices during *individual tasks* in class is presented in Table 8.5.24. Generally, we can state that it is the right of a pupil to be able to participate in everything that happens in class. The pupil can choose whether to listen or not if the teacher keeps the microphone on.

Technology-related shortcomings

Immediately after the lesson our observers assessed technology-related shortcomings in each HODA pupil's situation at school. Such shortcomings are related to organizational issues or a lack of knowledge at the specific school, and result in teachers not using the communication devices in an appropriate way. We found such shortcomings in 34 cases, corresponding to 54 percent of the 63 observed lessons.

Summary and comments

In this section of the report we have examined the use of communication devices at school in general and during an observed lesson, in particular. According to the pupils themselves, devices are used rather extensively during the school week. However, we noted that the use of devices during modern language lessons was as low as 63 percent. For the pupils, it is undoubtedly important that microphones are used and used appropriately, particularly in whole-class sessions. At the same time, we should point out that, apparently, practical problems in using the microphones as well as the teachers' ability to regulate the use of peer mics during the course of teaching are areas where there is room for improvement. Refinements that adapt devices to suit their users and handling in educational settings are overdue.

Problems related to the use of peer mics have been identified, such as when a pupil starts the upper level of nine-year compulsory school and possibly enters a situation with many and new

classmates. Classmates' attitudes towards using microphones are not always positive.¹⁰⁰ We also noted that a number of HODA pupils thought that a major improvement for classmates would be not to have to talk into a microphone at all. Thus, working to make everybody in the class sympathetic to microphone-use is an important task. In other words, the way a school plans and prepares when a pupil with hearing loss changes class or school level is very important.

In short, we can draw the conclusion that many of the school classes visited and observed by us are large, and that some lessons last for a long time. While both Maja's and Alice's classes were large, our observers still assessed their situation at school to be among the better situations observed. Perhaps more important than class size is the teacher's knowledge and ability to combine the pedagogical content of the lesson with the use of communication technology.¹⁰¹ However, in the absence of such abilities, class size may possibly play an important role. Further research is needed in these areas.

The most common pedagogical situation during the lessons¹⁰² was *dialog*, that is to say, discussions and conversations between teacher and pupils and among pupils in whole-class settings. The second most common situation was *monolog*, i.e. lectures and other sorts of one-way communication. *Individual tasks* also occurred during a number of lessons, and least common was *teamwork*, occurring during about one-third of the lessons. For a pupil with hearing loss, the *dialog* situation is judged to be the most demanding. The use and condition of the technical devices met the requirements involved in this type of situation in just 14 percent of the

100 Widén 2014, p. 11 (in Swedish).

101 In the same vein, a teacher's manner and way of teaching seemed to be very important to pupils with hearing loss in a study from 2006. Coniavitis Gellerstedt 2007, p. 9 (in Swedish).

102 When we refer to "lessons" in this report we mean distinct educational sessions devoted to one school subject. Such sessions may vary in length and consist of various activities or "pedagogical situations". The pedagogical situations identified in the HODA Study are *dialog*, *monolog*, *teamwork*, and *individual tasks*.

observed cases. A lack of peer mics was one of the reasons for this very low percentage. In *monolog* situations, 43 percent of pupils concerned had devices that were used appropriately and were in good technical condition. In the *team-work* situation, microphones were seldom used even when they were in good technical condition. Did the HODA pupil not need this technology in the smaller group, or is teacher-led training needed in order for the devices to be used? We are unable to answer this question.

Overall, the results of our investigation into the use and condition of communication devices in the school classes observed are discouraging. Many HODA pupils did not have full access to the education provided.

A report published by the Swedish Schools Inspectorate addresses those pupils with hearing loss who choose not to use technical devices, including hearing aids, at school. The report stresses, among many other issues, that schools need to improve their work to encourage pupils to use the assistive devices offered. In addition, the responsibility of the education provider and the school in these cases is emphasized. If a pupil chooses not to use the assistive devices offered, their school must increase other compensatory measures.¹⁰³ The results of the HODA Study and other studies help us understand that the motives behind a pupil's choice not to use assistive devices could be based on a number of different circumstances, such as technical faults or the inappropriate handling of devices in class and an unfavorable physical and social environment in the classroom.

8.6 The HODA questions

In this section we return to the questions that the HODA Study was intended to answer.

1. What specific communication device packages have been prescribed for the pupils in the study?

Results from the HODA Study that help answer this question are found in Sections 8.1, 8.2, and 8.4, and we will recapitulate these here:

- Stationary and portable microphone systems, respectively, had been prescribed in about equal numbers to the 150 pupils (aged 10-16 years) in the Stockholm County area who had, or had previously had, communication devices for use at school. Younger pupils, girls as well as boys, were prescribed portable devices on the most recent prescription occasion somewhat more often than older pupils. Among older pupils, boys were more often prescribed stationary systems on the most recent prescription occasion than girls.
- The prescription of microphones for the classmates of the 150 pupils in our target population in the Stockholm County area started modestly in 2006 when one pupil had five peer mics prescribed. Since then, a total of 70 prescriptions for peer mics have been issued to these pupils. The number of microphones prescribed on each occasion varies greatly between one and sixteen microphones, the average being 7.4 peer mics per prescription.
- The 85 pupils taking part in the HODA Study had also been prescribed stationary and portable devices in about equal numbers, stationary systems being somewhat more common among older pupils and portable systems more common among the younger pupils.
- Of the 63 pupils using communication devices, ten had two such devices. The device to be used in class when we observed the lesson was a stationary microphone system in 38 cases, and a portable microphone system in 21 cases. The devices also had microphones

103 Skolinspektionen /The Swedish Schools Inspectorate 2009, p. 17-18 (in Swedish).

for classmates in 36 cases. In four cases there was no usable device in the classroom when we observed the lesson. The 59 devices in the classrooms have been classified in terms of whether they use narrowband or wideband technology. We have also stated the products' brands.

Thus, the answer to this question is that stationary and portable microphone systems are now prescribed in about equal numbers, and that peer mics are currently prescribed more often.

2. To what extent are the devices used by pupils and teachers?

The results from the HODA Study that help answer this question are found in Section 8.5, and we will recapitulate these here:

- The pupils use their communication devices extensively during the school week.
- At least four out of five pupils use their communication device during all lessons in Swedish, social science subjects, English, and mathematics.
- Moreover, the HODA pupils report that it is important to them that microphones be used and used appropriately.
- More than four out of five teachers report that they usually use microphones during lessons.

Hence, the answer to this question is that communication devices are used extensively.

3. Do the devices function well technically?

The results of the HODA Study that help answer this question are found in Section 8.4, and we will recapitulate these here:

- About 40 percent of the microphone systems worked flawlessly.
- Those in the best technical shape were portable devices using wideband technology, and these systems were also the newest systems.

Thus, the answer to this question is that devices were more often out of order than in good technical condition.

4. To what extent do the devices prescribed meet the requirements of different pedagogical situations?

The results of the HODA Study that help answer this question are found in Section 8.5. This is the most difficult of the questions to answer and we recapitulate our findings below:

- The *dialog* situation in class is assessed to be the most difficult situation for pupils with hearing loss. The use and technical condition of the devices met the requirements in 14 percent of cases. A lack of peer mics is an important reason for this low percentage.
- In the lecture or *monolog* situation in class, the use and technical condition of the devices met the requirements in 43 percent of cases.
- Devices were seldom used during *teamwork* situations in class, even when they functioned well.

Thus, the answer to this question is that the use and technical condition of the microphone systems seldom satisfy the requirements.

5. What are the pupils' feelings about the devices?

The results of the HODA Study that help answer this question are found in several sections of this report. We recapitulate here as follows:

- When pupils assessed sound and sound quality, the stationary systems were judged to be better than the portable systems. In addition, stationary systems were assessed to be better suited for use at school.
- The most important improvements to their devices would be better sound quality, faster service, and teachers always using the microphone, according to many HODA pupils.

- The most important improvements to the microphone system for teachers, according to many HODA pupils, would be that the microphone were easy to put on and take off, and that the teacher could more easily see whether peer mics were on or off.
- The most important improvements for classmates concerning devices with peer mics, according to many HODA pupils, would be that they would not have to push buttons when speaking, or that they would not have to speak into a microphone at all.
- Positive, neutral, and negative feelings were identified concerning the HODA pupils' relationships with their microphone systems. Negative feelings were sometimes explicitly expressed in the answers to our questions, and in other cases we could interpret that negative feelings might have produced a certain answer.
- When teachers and mentors assessed acoustics and related adjustments made by their school, they often believed that the situation was either reasonably good or good.
- Established and well-functioning routines in relation to the communication devices were in place in schools and classrooms, but in many cases these were insufficient.
- Adjustments were made at schools to suit to pupils' needs, in combination with the provision of resource persons and extra support, and more of this is needed, according to pupils' mentors.
- Shortcomings related to the development of skills and competence, information-related responsibilities, and adjustments to teaching methods were observed. Often, knowledge about and access to the kind of support provided by a municipal special needs teacher specializing in issues related to hearing loss was lacking.

Hence, the answer to this question is that sound and sound quality in the devices is of utmost importance to the pupils with hearing loss. Pupils also want it to be much easier for both teachers and classmates to handle the microphone system in class from a practical standpoint.

Thus, the answer to this question is that shortcomings on the part of municipalities, organizers of independent schools, and individual schools constitute major obstacles for pupils with hearing loss and to their opportunities to participate in education and schoolwork.

6. What is the situation at schools in terms of how teaching and the use of devices are organized?

The results of the HODA Study that help answer this question are found in several sections of this report. It should be pointed out that it is the municipality or the organizer of an independent school that is responsible for ensuring good conditions at local schools.

- One basic precondition for good teaching is good acoustics. Good acoustics were rarely observed at the HODA schools.
- Another basic precondition for making education accessible to pupils using microphone systems is that the devices work. Well-working devices were all too rare in HODA school environments.

9 Concluding discussion

The HODA Study was initiated by professionals working within the field of communication devices at school. The study was carried out by the *National Agency for Special Needs Education and Schools* and the *Hearing Habilitation Children and Youth* unit at Karolinska University Hospital in Stockholm, Sweden. This report has provided an extensive and descriptive presentation of the results of the study. Our hope is that the professionals concerned, such as those in schools and hearing habilitation agencies, will gain a basis for making decisions on various measures to be implemented. We recall that about 2,600 pupils in Sweden had microphone systems at school in 2013. The results of the HODA Study concerning acoustics, the technical condition of communication devices, and the use of the devices in different pedagogical situations signal a major need for concrete measures as well as for more knowledge. In the final discussion below, we will highlight some of the issues of importance.

One basic precondition for good teaching is good acoustics. According to our measurements and current official requirements, good acoustics were rarely observed in HODA school settings. When teachers and mentors assessed acoustics and reported adjustments made by their school, they often assessed the situation to be either reasonably good or good. Our conclusion is that pressure to change and improve acoustics must come from elsewhere. Hence, a plan of action to systematically improve acoustics in Swedish schools is urgently needed.

Another basic precondition for making education accessible to pupils with microphone systems is that the devices work. We found that this is seldom the case. Our conclusion is that each prescription of microphone systems for use at school must always be followed by systematic and regular controls. A plan and an

allocation of responsibility for such measures should be prepared and implemented nationwide.

However, devices that function well from a technical standpoint are not sufficient—they must also suit their purpose and function in their setting at school. We have found that this is rarely the case. Our conclusion is that the microphone systems need to be improved in order to better meet the needs and requirements of their users (teachers, pupils with hearing loss, and classmates) and the requirements associated with teaching methods in contemporary schools. Research and development in this area should be carried out in close cooperation with pupils and educators in real classroom settings.

Moreover, we frequently found shortcomings regarding support, routines, and practices in relation to the use of microphones in the classroom. Consequently, a pupil with hearing loss might find themselves in a highly vulnerable position in the classroom. At the same time, the teacher's approach to the use of microphones could wholly determine the pupil's access to the goings-on in class. In this report we saw glimpses of examples of this in our observations as presented in Section 8.5: Teachers did not use microphones and, moreover, positioned themselves in the classroom in such a way that the pupil with hearing loss had great difficulty lip-reading. Clearly, the ability of the teacher to combine the pedagogical content of the lesson on the one hand, and the use of technology on the other in a way that is helpful for the pupil with hearing loss as well as their classmates is of major importance. Knowledge and support are needed for teachers to acquire and improve this ability. Various measures to support and raise teachers' awareness should be designed, such as tools to make them aware of the situation in the classroom for the pupil with hearing loss.

It is in schools that a foundation is laid for the solidarity required by people in a specific social setting in order for everyone in this setting to participate in what is going on. The pupils we are talking about here are pupils with hearing loss. Most of them use technical devices, others do not. In a few years' time they will enter the labor market and encounter a variety of physical and social work environments. Research on people with hearing loss at work quite clearly shows that acoustics and the social environment are crucial to their well-being.¹⁰⁴ If the education system and its schools take the lead through their pedagogical tasks and every-day practices, in combination with necessary improvements to their physical and social settings, the situation for people with hearing loss, among others, will generally improve.

Finally, we will revisit some of the thoughts discussed earlier in this report concerning further studies. One question raised was whether gender patterns exist in relation to pupils and microphone systems. This issue has arisen on various occasions without receiving an answer in this report. We wondered whether ideas about gender influence the prescription of devices and the adjustments made in schools. We wondered whether or not and, if so, how common images of girls and boys influence female and male pupils' ways of relating to their devices in schools. A number of studies highlight girls' vulnerable situations and further research into all these issues is certainly needed.

Acquiring more in-depth knowledge about technical devices, microphone use, and routines would require qualitative-type interviews, possibly in combination with the observation of lessons. Such interviews conducted with a strategic sample of pupils using communication devices at school and pupils with earlier experience of such devices, plus some of their classmates, could provide important information on which to base

further efforts to improve the situation at school for pupils with hearing loss. Such an approach might also generate theoretical developments in social science research into hearing loss.

The HODA Study investigated the quality of the communication devices in a number of classrooms in the Stockholm County area from a technical standpoint. As mentioned previously, the results justify the introduction of a national plan for systematic and regular controls. In addition, further evaluations of various categories of communication devices are also urgently needed and must be carried out in synch with the work to improve the microphone systems mentioned earlier. More advanced methods of analysis could certainly be used on data from the HODA Study, so as to supplement the descriptive presentation of the results provided in this report.

¹⁰⁴ See, for instance, (Swedish context) Gullacksen 1993 (in Swedish), Danermark & Coniavitis Gellerstedt 2003 (in Swedish), Bjarnason 2011 (in Swedish), Hua 2014.

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