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The Reading Comprehension Skill of d/Deaf and Hard-of-hearing Poles and Its Importance for Media Accessibility: A Pilot Study

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Abstract

The study investigates the reading comprehension skill of d/Deaf and hard-of-hearing (DHH) Poles in the context of media accessibility. Deriving from the assumption that spoken Polish typically acts as a second language for the DHH, the study employed state certificate exams designed for foreigners learning Polish as a second language. A reading comprehension test was composed on the basis of these exams, containing tasks at B1, B2 and C1 proficiency levels. It was administered to 126 participants: 87 d/Deaf and hard-of-hearing (DHH) and 39 hearing persons acting as the cont Correlation between rol group. It was also accompanied by a demographic questionnaire to determine the relationship between the reading skill and such aspects as age, education, degree of hearing loss, onset of hearing loss, preferred means of communication (sign language, spoken Polish, both), declared proficiency in Polish and preferred media accessibility method (sign language interpretation, subtitling, either of the two).

Key words: media accessibility, subtitles for the deaf and hard-of-hearing, SDH, reading comprehension, deaf, hard-of-hearing, literacy.

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1. Introduction

To make a given material truly accessible, media accessibility professionals should know their audience, which involves not only understanding the perceptual limitations of the recipients or identifying their preferences but also recognizing their cognitive and linguistic abilities. This is especially important when working with d/Deaf and hard-of-hearing (DHH) viewers. Only through investigating their linguistic competences and literacy skills can media accessibility professionals choose the appropriate accessibility method – verbatim subtitling, edited subtitling, sign language interpretation – that will cater best to the needs and capabilities of the audience.

There are a number of studies into the reading comprehension skill of DHH children and students. They were conducted in various countries and for different languages – English (Holt, 1994), Dutch (Wauters, Van Bon, & Tellings, 2006), Persian (Rezaei, Rashedi, & Morasae, 2016), Japanese (Takahashi Isaka, Yamamoto, & Nakamura , 2017), and more. All of such studies point to DHH children having a considerably lower reading comprehension skill than their hearing peers. For instance, Kyle and Harris (2006) report that deaf children typically experience a delay of at least five years in their reading skill when leaving school, while Holt (1994) claims that the reading skill stops developing in the 4th or 5th grade. Only one study exists in which Polish DHH students had their skills tested in terms of the national spoken language. It was conducted by Kowal (2011a) for her unpublished doctoral dissertation. She tested the Polish language skills of 50 DHH students from the final high school grade, showing that they average the A2 proficiency level.

Research into the reading skills of adults is not that voluminous, most likely due to the difficulties in contacting and motivating large samples of participants, but it produces similar findings. For instance, having tested 24 deaf American adults, Parault and Williams (2010) demonstrated that the reading skills of the participants were below the sixth-grade level. No such research has been conducted on the Polish DHH people. Although it is possible to extrapolate the results attained in other countries and draw some conclusions for Poland, they would have to be fairly general, as the literacy level of a deaf population is influenced by the educational system, access to rehabilitation, and the structure of the language itself – all of which usually differ from country to country.

The present paper describes the preliminary results of a study that investigates the reading comprehension skill of DHH Poles. It involves testing the skill using reading comprehension test exercises (levels B1, B2 and C1) taken from state certificate exams designed for foreigners learning Polish as a second language. So far, it has been conducted on 126 participants – 87 DHH and 39 hearing persons acting as the control group. The DHH participants include not only secondary school students (aged 16 to 19) – like in the study by Kowal (2011a) – but also working adults (aged 20 to 60) and seniors (aged 60+) to achieve a broader perspective on the DHH population of Poles. The test is also accompanied by a demographic questionnaire to determine the relationship between the reading skill and such aspects as education, degree of hearing loss, onset of hearing loss, means of

communication (sign language, spoken Polish, both), declared proficiency in Polish and preferred media accessibility method (sign language interpretation, subtitles, either of the two).

2. Subtitling for the DHH

In the community of subtitlers and among researches in the field of media accessibility, there is an ongoing debate on how to handle the spoken content in subtitles – whether it should be verbatim or edited. The dispute pertains mostly to intralingual subtitling since editing and text condensation in interlingual subtitling raise no objections either among scholars or the DHH themselves (Szarkowska, 2010). Szarkowska, Krejtz, Klyszejko, & Wieczorek (2011, p. 363–364) list three approaches related to handling the content transcript in intralingual subtitling: "verbatim," "edited" (sometimes also called "adapted"), and "standard."

As the name suggests, "verbatim" subtitles are a full, word-for-word transcript of the given speech. Their main advantage lies in presenting the exact same content as in the original. According to a report by the British Office of Communication (Ofcom, 2005), the hard-of-hearing tend to opt for verbatim subtitles since such a transcript enables them to complement their residual hearing. The d/Deaf communities also advocate verbatim, arguing for equal access to information and content, and even treating any intervention in the original text as a form of censorship. Editing subtitles was also severely criticized by the Polish DHH (Szarkowska, Pietrulewicz, & Jankowska, 2015). Another advantage of a verbatim transcript lies in the fact that it requires less time to prepare and is thus the least expensive (Ofcom, 2005, p. 6).

However, verbatim subtitles suffer from two significant drawbacks. The first issue is high presentation speed. Since we speak faster than we read, a verbatim transcript of speech can be too fast to be read – especially for the viewers with lower literacy skill – and research into the matter proves that it indeed very often is (Sancho-Aldridge, 1996; de Linde & Kay, 1999; Neves, 2008; Romero-Fresco, 2009; Cambra, Silvestre, & Leal, 2009). The other issue is linguistic complexity. Given the fact that, on average, the reading comprehension skill among the DHH is inferior, a word-for-word transcript of speech might be too difficult for some viewers to comprehend. These two drawbacks can lead to a paradox: the concept of having a full and equal access to information via verbatim subtitles de facto is likely to deprive many users of such access.

"Adapted"/"edited" subtitles provide a transcript of the content with considerable simplification in terms of lexis and syntax, which should be suited to the inferior linguistic skills of the audience. Additionally, the subtitle presentation speed is lower than in the case of regular subtitles in order to accommodate slower readers. The main advantage of this approach is that it should foster comprehension to a much greater extent than the other types of subtitles. This is evidenced by the empirical research conducted by Baker (1985), Jelinek Lewis and Jackson (2001) and Burnham et al. (2008), but a more recent study carried out by Szarkowska et al. (2016) on Polish DHH found no

difference in favour of edited subtitles. In fact, the DHH tested in the experiment tended to have slightly better comprehension scores for verbatim subtitles, although it should be noted that their presentation speed was 180 words per minute – so within the limits of readability – while the rate of speech on TV or DVDs can be significantly higher (Romero-Fresco, 2009).

A great disadvantage of edited subtitles, as stated above, lies in the fact that they breed strong resentment in the target audience. Ofcom (2005) reports that the initial reaction of DHH viewers to any mention of editing is universally negative. They view editing as information deficit, discrimination, over-protectiveness or patronizing, and similar reservations are held by a majority of Polish DHH (Szarkowska et al., 2015). Yet, having considered the practical aspects of editing and the diversity of the d/Deaf community, many recipients do acknowledge the fact that sign language users and seniors might struggle with non-edited subtitles due to difficult lexis, complex sentences and high presentation speed. The DHH who remain adamant include the viewers who are ideologically-minded, retain some hearing, can lip-read or live with hearing family members (Ofcom, 2005, p. 17). Another disadvantage of edited subtitles lies in their high cost, relatively long preparation time and specialized skills of the subtitler. Faced with such financial and organizational requirements, as well as with the dissatisfaction of DHH communities, broadcasters and distributors prefer to avoid any editing (Romero-Fresco, 2009).

“Standard” intralingual subtitles comprise a transcript of the content which is limited by the time and space constraints typical for regular interlingual subtitling: the number of lines, number of characters per line, and comfortable reading speed. In order to adhere to these constraints, the content which is unnecessary for the overall understanding of the material – like repetitions, false starts, hesitations, etc. – is eliminated. The content is also condensed wherever possible, without entailing a loss of information.

Standard subtitles constitute a middle ground between verbatim and edited. They ensure sufficient presentation time with little interference in the lexis and syntax of the original text. However, they are not free of drawbacks either. Firstly, the issue of sufficient speed is problematic. Given the disproportion in the literacy skill of the DHH, and the resulting discrepancies in the reading speed, it is difficult to assess what presentation pace would accommodate the audience best. For hearing viewers, the subtitle reading speed oscillates between 145–200 words per minute (Diaz-Cintas & Remael, 2007; Szarkowska & Gerber-Morón, 2018). Having tested 262 hearing, 110 hard of hearing, and 205 deaf people with different captioning speeds, Jensema (1998) established the optimum speed for most viewers to be 145 words per minute. Keeping the subtitle presentation pace within this limit would enable the DHH who are slower readers to absorb the content to a greater extent, but at the same time it would most likely force the subtitler to include less of what is said in the original. As stated above, this can cause an outcry of the DHH who can spot the difference, and also – paradoxically – have a negative influence on comprehension, especially if vital information is omitted or the cohesion of the text is disrupted, as evidenced by Szarkowska et al. (2016). Secondly, even retaining the presentation speed at the level of 180 words per minute can

entail considerable editing, as the spoken content can reach the pace of up to 250 words per minute (Romero-Fresco, 2009). Lastly, unedited lexis and syntax can possibly obstruct comprehension among the DHH with low literacy skill, as evidenced by Baker (1985), Jelinek Lewis and Jackson (2001), and Burnham et al. (2008).

3. Rationale and hypothesis

The difficulty in choosing the most suitable approach out of the three presented above resides in the fact that the DHH are a very heterogeneous audience. The heterogeneity is visible in the umbrella term itself – d/Deaf and Hard-of-Hearing – which includes two distinct groups of viewers, each with different abilities and conflicting expectations. For instance, the hard-of-hearing (HoH) with a good command of the spoken language and some residual hearing to rely on would benefit most from verbatim subtitles but dislike the adapted ones for their content loss and discrepancy between the spoken text. On the other hand, the d/Deaf who do not lip-read and have low literacy skills would profit from adapted subtitles, but might find verbatim too fast and complex. It thus seems that adapting the subtitles to one type of viewers might result in the exclusion of the others.

The best solution to this problem is to provide different types of subtitles simultaneously to cater for the distinct needs and expectations, but unfortunately most broadcasters and distributors employ a one-size-fits-all policy, with only one subtitle stream or file available. In this case, the conundrum of choosing the proper approach cannot be resolved without testing the reading comprehension skill of the total DHH audience, including both the d/Deaf and the hard-of-hearing. Knowing the general level of the skill in this population, as well as the number of proficient and poor readers, will enable media accessibility professionals to select the method which would ensure the greatest comprehension with maximum possible satisfaction among the widest range of viewers with various degrees of hearing impairment. Obviously, the results of the research can be applied outside media accessibility as well – to any form of written communication directed towards the DHH: brochures, application forms, official letters, contracts, etc. If their reading skill is lower, all such materials can be simplified accordingly.

To achieve significant and comprehensive results, such a test should be administered to participants who represent the entire spectrum of the population, and are thus diversified according to age, education, degree of hearing loss, onset of hearing loss, means of communication (sign language, spoken Polish, both), declared proficiency in Polish and preferred media accessibility method (sign language interpretation or subtitling). This will also enable the discovery of any relations between these aspects and the reading comprehension skill. Once these relations are established, it is possible to make judgments about the entire population of Polish DHH, using statistical data from other sources, like the Central Statistics Office of Poland or the Polish Association of the Deaf.

When searching for an appropriate reading comprehension test, one can refer to Polish researchers (Januszewicz, Jura, & Kowal, 2016; Kowal, 2011b) who claim that, in general, spoken Polish acts like a second language for deaf Poles, and invoke a number of arguments to corroborate this opinion. Firstly, it is not acquired in the process of natural acquisition through listening and speaking, as the d/Deaf have little or no perceptual abilities to do so. Instead, it is learned in artificial conditions on limited sources and unnaturally limited language input (Januszewicz et al., 2016, p. 362). Secondly, in most cases it never becomes native or even native-like, despite many years of learning. Thirdly, the d/Deaf do not use it as a preferred means of communication due to its audio-verbal modality. Fourthly, the language errors committed by deaf Poles resemble the errors committed by hearing foreigners learning Polish as a second language (Januszewicz et al., 2016, p. 366–368; Jura 2011, p. 44–50; Kowal, 2011b, p. 23). Lastly, many deaf Poles tend to highlight their cultural and linguistic distinction from their hearing co-citizens by capitalizing the adjective describing their condition – "Głuchy" [Deaf] – much like nationalities are capitalized in Polish orthography. All of the above inclined the researchers to call deaf Poles "silent foreigners" (Januszewicz et al., 2016, p. 362; Kowal, 2011b, p. 21).

It is needless to say, though, that the above argumentation is not devoid of flaws. Deafness is not a binary issue, it is gradable and complex. Depending on the degree of hearing loss and the time of its onset, the hearing aids, rehabilitation and education, deaf children can achieve different proficiency levels in terms of the spoken language, and can even use it as a preferred means of communication or alongside a sign language. This means that the "foreignness" of the DHH is also gradable, with the d/Deaf tending to be more and the hard-of-hearing less "foreign."

The metaphor of foreignness, however, can be creatively exploited. If the DHH Poles are "foreigners" to various extents, and their command of spoken Polish varies, sometimes being their second language, then it is possible to check its proficiency using tests designed for foreigners learning Polish as a second language. Such tests are prepared by the State Certification Commission to be used during the Certificate Examinations in Polish as a Foreign Language, and are available for various proficiency levels.

4. Method

4.1. Participants

A group of 126 volunteers participated in the experiment, including 87 DHH and 39 hearing persons acting as a control group. The DHH were recruited in a DHH boarding school, the Polish Association of the Deaf and through other associations in Lublin, Poland. During the recruitment of the DHH, the main focus was placed on diversification of age and education, but in the demographic questionnaire accompanying the reading comprehension test, the DHH were also to give information

about their degree of hearing loss, onset of hearing loss, means of communication, proficiency in Polish and preferred media accessibility method.

The DHH participants fall into three age groups. The first one almost exclusively comprises students aged 16 to 19 (*n* = 32), who attended a special-education vocational boarding school at the moment when the test was administered. Such special-education schools are specifically suited to the needs of DHH students, and a major portion of Polish DHH are schooled in such facilities. Unlike in the investigation conducted by Kowal (2011a), which included only final grade students, the participants spanned all the three grades of secondary vocational school. The other two groups include working adults aged 20–60 (*n* = 33) and seniors over 60 years old (*n* = 22), who were absent in the previous study.

In terms of education, the DHH participants fall into five categories, depending on the highest educational stage they completed: *primary* (*n* = 4), *junior high* (*n* = 33), *vocational (n* = 31), *secondary* (*n* = 9), *post-secondary or higher* (*n* = 10).

The DHH participants were asked whether they consider themselves d/Deaf (*n* = 43) or hard-of-hearing (*n* = 44). They were also to indicate the degree of their hearing loss. The categories they could choose from were a simplified classification by Clark (1981) and included the following division: mild – 25–40 dB (*n* = 6), moderate – 41–70 dB (*n* = 19), severe – 71–90 dB (*n* = 14), profound – over 90 dB (*n* = 34). Fourteen participants did not know their level of hearing loss.

As the onset of hearing loss has a profound impact on the acquisition of the national spoken language, a related question was included in the questionnaire. Because the process of acquiring and mastering a language is gradual, the proposed age intervals when hearing loss occurred correlate with the stages of linguistic development and include the following categories suggested by Krakowiak (2006):

- born deaf (*n* = 46) – if the hearing loss is profound, the child is unlikely to develop any auditory function for the given language;
- hearing lost before the age of 3 (*n* = 18), that is, usually after the development of basic auditory functions and the ability to communicate using holophrases (i.e. one-word sentences) but before acquiring the ability to understand and formulate full sentences, which constitutes the basics of a language system;
- before the age of seven (*n* = 10), which is after learning to understand and formulate full sentences, but before the phonological development is complete;
- at the age 7–12 (*n* = 0), when the auditory and linguistic functions are still developing, syntactic rules are acquired, and the lexicon is rapidly expanding;
- as a teenager (*n* = 3), when speech and language development are complete;
- a separate answer was provided for the participants who did not know when they lost their hearing (*n* = 10)

The participants were also asked what means of communication they use: whether it is sign language (*n* = 28), Polish (*n* = 7), or whether they use both sign language and Polish (*n* = 52). They also estimated their general proficiency in the Polish language on a scale from 0 to 5, where 0 meant *no knowledge of Polish*, and 5 meant a *very good command of the language*. None of the participants marked 0, five marked 1, six marked 2, twenty-three marked 3, eighteen marked 4, and fourteen marked the highest value. Unfortunately, because this question had a slightly different graphic form than the previous questions, twenty-one participants skipped it and gave no answer.

Finally, the participants were asked about their preferred accessibility method: sign language interpretation (*n* = 26), subtitling (*n* = 40), either sign language or subtitling (*n* = 21).

4.2. Test

The study used sample tests from the Certificate Examinations in Polish as a Foreign Language, prepared by the State Certification Commission. At the moment when the study was being conducted, the sample tests were available for three proficiency levels: B1, B2 and C1. All the three levels were downloaded from the webpage of the State Certification Commission (http://certyfikatpolski.pl/dla-zdajacych/przykladowe-testy-zbiory-zadan/). Two reading comprehension exercises were chosen from each level and compiled in an ascending order into the test used in this research. For each level, the exercises were of the same type, i.e. A/B/C multiple choice and matching headings to text, so that the results for each level would not be distorted by the changing format of the exercise. In the Certificate Examinations, both the A/B/C questions and the headings pertain to very short snippets of text, 1 to 4 sentences long, with one question/heading per snippet. The test used in this research involved 42 questions altogether: the B1 level included five A/B/C multiple choice questions and seven headings to match; the B2 level, five A/B/C questions and ten headings; and the C1 level, seven A/B/C questions and eight headings.

High school and university students, as well as recent high school and university graduates, should be familiar with these two formats. The A/B/C reading comprehension format is widespread in the Polish educational system: similar exercises are present on the lower secondary school exam in Polish and English, and on the "new" Matura exam, i.e. the basic exam in Polish, the basic and advanced exams in English and other foreign languages. The heading format is not that ubiquitous as it is typical rather for foreign language tests. Yet, it is present on both basic and advanced exams in English and other foreign languages of the new Matura.

The participants who graduated before the educational reform introducing the new formula of Matura, that is, prior to 2005, might be unfamiliar with the two formats. In these cases explanation was provided.

4.3. Procedure

The participants were informed that they would take part in a test checking their reading comprehension skill in terms of the Polish language. Before the test, they were asked to fill in the demographic questionnaire. Whenever necessary, sign language interpretation was provided to make sure the questionnaire's content was properly understood. Sign language interpreters also explained the procedure and the format of the exercises if the participants were unfamiliar with it. No interpretation was provided for the content of the texts or the questions. If a group of participants were taking the test at once, they were separated and forbidden to communicate to make sure their work was independent. In the original Certificate Examinations candidates are allowed 60 minutes for five reading exercises. The participants in the experiment were given 120 minutes for six exercises, but the longest session lasted about 90 minutes.

5. Results

Reading comprehension results were processed using ANOVA, with the demographic information from the questionnaire – age, education, degree of hearing loss, onset of hearing loss, preferred means of communication, preferred media accessibility method, and declared proficiency in Polish – acting as independent variables. Whenever the independent variables were numerical – or could be assigned a numerical value – the Pearson correlation coefficient was also calculated to determine if there is a relationship between a given variable and the reading comprehension skill. In the cases of multiple comparisons, the post-hoc Bonferroni correction was applied to pinpoint the location of the most significant differences. The descriptive statistics are given in tables below, and include the mean result for each proficiency level and the total mean result – together with their corresponding standard deviations (*SD*) – as well as the maximum and minimum result, and the median.

5.1. General Results

The general results correlate with the findings discussed above, which point to the DHH having a significantly lower reading comprehension skill than their hearing peers, with F (1, 124) = 245.71, $p < .00001$. On average, the DHH participants scored 37% in the B1 test, 30.9% in B2 and 28.7% in C1, with the total result at 31.9%. By contrast, the hearing control group scored 92.9% in B1, 92.8% in B2 and 88.8% in C1, with the total result at 88.8%. As the pass mark is 50% for B1 and 60% for B2 and C1, the DHH would generally settle below B1, which corroborates the earlier findings by Kowal (2011a). What is also interesting is the relative flatness of the DHH results for each proficiency level, with the difference between B1 and C1 being a mere 8.3%. This means that most participants performed either equally well or equally poorly at each test level.

Table 1.

Test Results of All the DHH and Hearing Participants

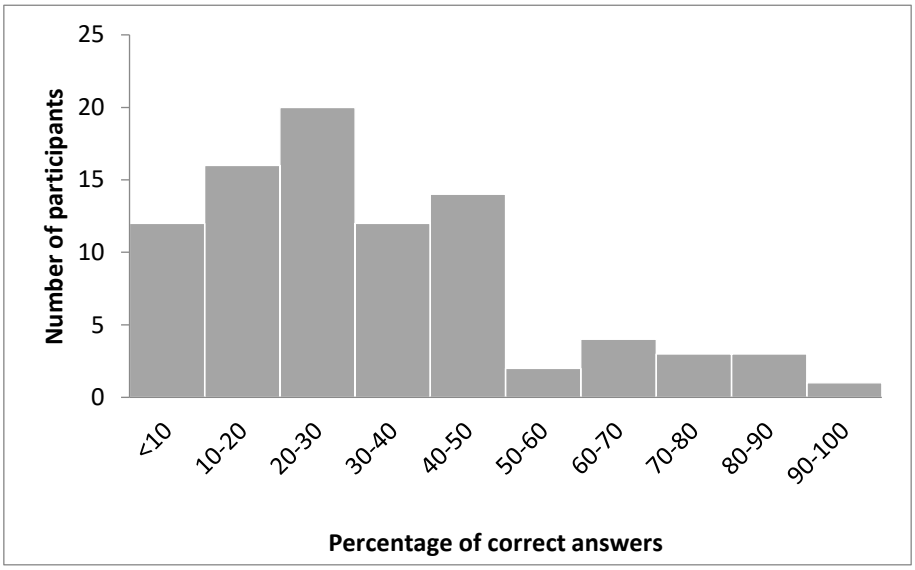
	Mean % B1 (*SD*)	**Mean % B2 (*SD*)**	**Mean % C1 (*SD*)**	**Mean % total (*SD*)**	**Minimum value %**	**Maximum value %**	**Median %**
DHH	37 (28.9)	30.9 (26.5)	28.7 (18.8)	31.9 (21.5)	0	95.2	26.2
Control group	92.9 (10.0)	92.8 (11.3)	81.4 (18.9)	88.8 (10.6)	47.6	100	92.9

What should also be stated at this point is that four participants found even the B1 test far too demanding, and submitted it without any answers marked, which was included in the results as zero. Moreover, many participants had problems comprehending the accompanying questionnaire and required sign language interpretation to fill it in properly. For some, however, the test was fairly easy. Hence the glaring disproportion between the lowest (0%) and highest (95.2%) scores, as well as relatively high standard deviation values, which means that the Polish DHH population comprises both excellent users of the national language as well as illiterates.

For media accessibility professionals, it is crucial to know the proportions of both capable and incapable users among the target recipients. Although the mean and median values in the table above suggest some answer to this question, the following histogram serves as a more convenient representation of the distribution of linguistic competences within the DHH audience. For each ten-percent interval, it presents the number of participants whose mean total score settles within that interval.

Figure 1.

Distribution of the Reading Comprehension Competences (Mean Total Result) Among the DHH Participants



The largest number of participants is situated within the 20–30% interval. 74 out of 87 participants, which is 85% of the tested population, scored fewer than 50% of points on the test, and a curious, steep fall can be observed at the 50% threshold. This means that 85% of the participants are at the B1/B2 level or below. To get a more accurate percentage of participants at each proficiency level, the official pass marks for B1 (50%), B2 and C1 (60%) can be employed, in which case 6 participants (6.8%) pass C1, 12 (13.7%) pass B2, 28 (32.2%) pass B1, and 59 participants (67.8%) do not pass even the B1 level.

5.2. Age

Age is a factor influencing the reading comprehension results between the three age groups of DHH participants – *younger than 20*, *aged 20–60*, *older than 60* – with high statistical significance: F (2, 84) = 17.62, $p < .00001$. The post-hoc Bonferroni correction points to significant differences between the elderly and each of the other two groups ($p < .0001$), but the difference between the youngest and the middle-aged group does not reach statistical significance. When the age of the participants and their results are analysed outside the age groups, as raw data, the Pearson correlation coefficient also points to a moderate negative relationship, with $r = -0.56$. Conversely, the correlation is positive – but weak, $r = 0.34$ – for the control group, meaning that the literacy skill slightly rises with age. The ANOVA results between the three control age groups do not point to statistical significance, though, with F (2, 36) = 4.53, $p = .0176$. This can be explained by the fact that older hearing participants also had the highest education.

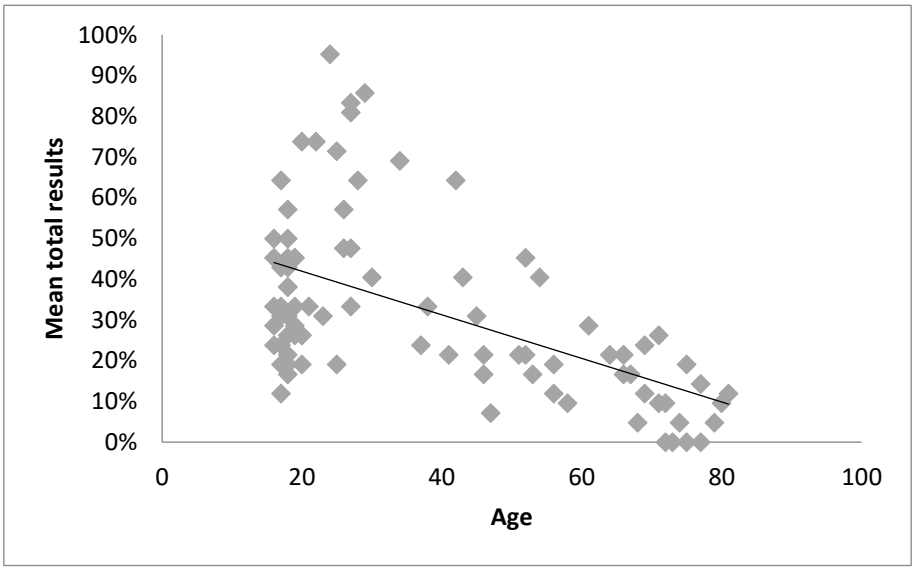
Table 2.

Test Results per Age Group

	Mean % B1 (*SD*)	Mean % B2 (*SD*)	Mean % C1 (*SD*)	Mean % total (*SD*)	Minimum value %	Maximum value %	Median %
<20	45.6 (23.6)	29.4 (21.5)	31.9 (10.7)	34.9 (14.3)	11.9	73.8	32.1
20–60	47.0 (30.2)	44.2 (30.9)	35.2 (23.2)	41.8 (24.9)	7.1	95.2	33.3
60+	9.5 (11.6)	13.0 (11.5)	14.5 (13.0)	12.6 (9.1)	0.0	28.6	11.9

Figure 2.

Moderate Negative Correlation between Age and the Mean Total Results of the DHH Participants



It comes as no surprise that working adults scored higher than the other DHH groups, as they arelikely to have everyday contact with the Polish language for professional reasons. This group also includes the DHH with higher education, who have a very good command of the language and achieved the best scores, thus increasing the mean result. On the other hand, it includes the widest disparity in reading proficiency, with a difference of 88% between the highest and the lowest result, and a difference of 62% between the highest and the median result. The vocational school students were second best, which can be considered relatively high or low, depending on the reference point. Their case will be discussed at length in the next section. Seniors achieved a very low total score of 12.6%, with the highest result reaching a mere 28.6%, which itself is below the average for all DHH

age groups taken together. The four participants who were incapable of answering a single question also belong to this age group. This means that the reading proficiency level within this group is definitely below B1.

5.3. Education

The DHH participants were divided into the following five groups according to their education: primary (*n* = 4), lower secondary (*n* = 33), vocational (*n* = 31), upper secondary (*n* = 9), post-secondary or higher (*n* = 10). At this point, the specificity of the Polish educational system should be delineated. The system has recently been reformed, but at the time of the study students obligatorily progressed from primary to lower secondary school. Then, they could choose either the upper secondary stage, which provides general education and ends with the Matura exam, or the vocational stage, which provides both general and vocational education, and can offer the possibility to take the Matura exam as well. Passing the Matura is necessary for pursuing higher education.

It can be assumed that the results should improve along with the educational background of the participants, because from one educational stage to the next, the language input becomes more complex and diverse. To be able to progress, a student should absorb the curriculum material and the related lexis, and then be able to re-express it in Polish during state exams conducted at the end of each stage. Having a poor command of the language makes the exams increasingly difficult, with the Matura exam being an overwhelming challenge for many DHH students.

Table 3.

Test Results in Each Educational Background

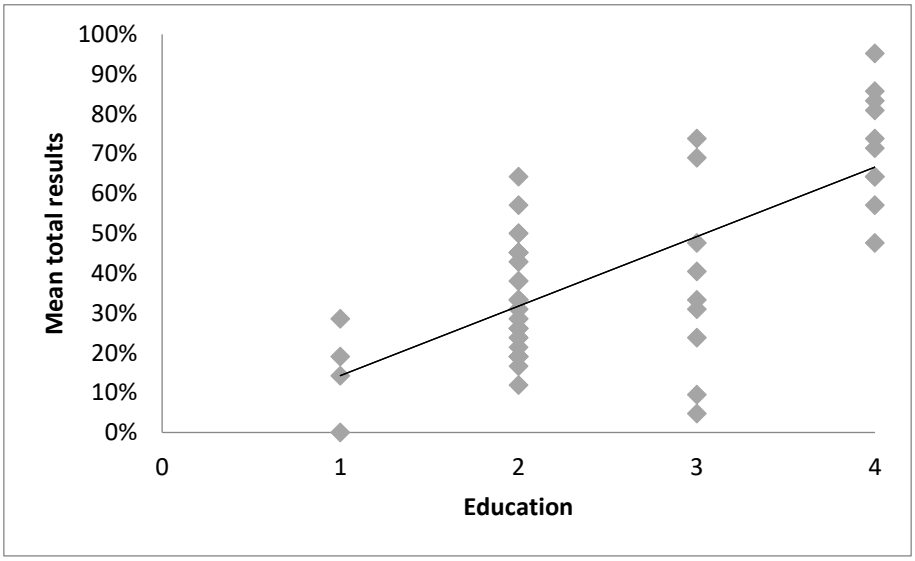
	Mean % B1 (*SD*)	**Mean % B2 (*SD*)**	**Mean % C1 (*SD*)**	**Mean % total (*SD*)**	**Minimum value %**	**Maximum value %**	**Median %**
Primary	16.7 (13.6)	15.0 (10.0)	15.0 (14.8)	15.5 (11.9)	0.0	28.6	16.7
Lower secondary	43.9 (22.3)	27.3 (19.0)	30.5 (10.1)	33.2 (12.5)	11.9	64.3	31.0
Vocational	17.5 (19.0)	17.8 (14.5)	18.5 (12.1)	18.0 (11.7)	0.0	45.2	16.7
Upper secondary	41.7 (28.9)	40.7 (29.9)	29.6 (16.0)	37.0 (23.8)	4.8	73.8	33.3
Higher	78.3 (24.3)	80.7 (17.9)	59.3 (26.7)	72.4 (14.4)	47.6	95.2	72.6

As predicted above, education has a statistically significant influence on the reading comprehension skill, with F (4, 82) = 30.55, p < .00001. Post-hoc comparisons with the Bonferroni correction

showed that statistically significant differences lie between higher education and every other stage, as well as between vocational and lower secondary, and vocational and upper secondary ($p < .002$ in each of the comparisons). The results can also be analysed using the Pearson correlation coefficient if the respective educational stages – excluding the vocational path – are assigned consecutive numbers from 1 (*primary*) to 4 (*higher*), according to the ascending order of the primary-to-higher educational path. The outcome almost reaches a moderate positive correlation, with $r = 0.48$, meaning that reading proficiency indeed rises together with education. The correlation is also moderate positive for the control group, with $r = 0.51$, and the ANOVA results for the hearing participants point to slight statistical significance, with $F(2, 36) = 7.27$, $p = .0022$.

Figure 3.

Positive Correlation between Respective Educational Stages and Mean Total Results of the DHH Participants



The DHH participants with post-secondary or higher education scored the highest in all categories, with relatively low disproportions between individual results, which would situate them at the C1 proficiency level. The DHH with upper secondary education were second best, albeit with a considerable difference of 69% between the highest and the lowest result, and 40% disparity between the highest and the median. Their results would place them at B1/B2 level. Those with primary education scored the lowest, even with the top result located below the total mean of all the results, and the overall reading proficiency level below B1.

The DHH participants with lower secondary education constitute the only exception in the trend, but this can be accounted for. 32 out of 33 participants in this group are vocational secondary school students. They are in constant contact with Polish through their school duties, and they are used to solving tests, which is also likely to have had its impact on their performance in this study. Hence their high results in relation to the adjacent educational stages. One more conclusion can be drawn here:

since the DHH vocational school students have a higher proficiency in Polish than the DHH who already finished vocational education in the past, then the proficiency is likely to decrease with time if education is not continued.

The results attained by the DHH vocational school students are high in relation to adjacent educational stages, but low in relation to their control group, which includes 14 hearing vocational school students. There is a slight difference in age – and thus in linguistic competence – between the two test groups here, as the DHH include grades 1–3 and ages 16–19 (with one student aged 21), while the hearing control group comprises only third-graders aged 18–19. Yet, the disproportion between the results of both groups is too wide to be explained by this minor inconsistency. The DHH settle at the A2/B1 reading proficiency level, whereas the hearing students easily reach C1. The difference between the results of DHH vocational students and the results of their hearing counterparts is statistically significant, with F (1, 43) = 134.8, p < .00001.

Table 4.

Test Results of Hearing And DHH Vocational Schools Students

	Mean % B1 (*SD*)	**Mean % B2 (*SD*)**	**Mean % C1 (*SD*)**	**Mean % total (*SD*)**	**Minimum value %**	**Maximum value %**	**Median %**
Hearing students	89.3 (10.6)	85.7 (15.2)	71.9 (22.5)	81.8 (13.4)	47.6	100.0	81.0
DHH students	43.9 (22.3)	27.3 (19.0)	30.5 (10.1)	33.2 (12.5)	11.9	64.3	31.0

5.4. Deaf or Hard-of-Hearing

The participants were asked whether they consider themselves d/Deaf (n = 43) or hard-of-hearing (n = 44). Intuitively, the latter should score higher than the former as they can possess some residual hearing, which gives them better and wider access to Polish via the aural channel, especially with a proper hearing aid. This prediction is confirmed by the results of the test, in which the hard-of-hearing (HoH) performed almost twice as well as the d/Deaf. The results are statistically significant, with F (1, 85) = 19.41, p = .00003. However, this is undermined by the results for each hearing loss category, described in the next section.

Table 5.

Test Results of the Participants Who Consider Themselves D/Deaf or Hard-Of-Hearing

	Mean % B1 (*SD*)	Mean % B2 (*SD*)	Mean % C1 (*SD*)	Mean % total (*SD*)	Minimum value %	Maximum value %	Median %
Deaf	24.6 (25.3)	21.7 (21.4)	21.7 (13.3)	22.5 (16.3)	0.0	73.8	21.4
Hard-of-hearing	49.1 (27.2)	39.8 (28.2)	35.6 (20.9)	41.0 (22.2)	0.0	95.2	39.3

5.5. Degree of Hearing Loss

Intuitively, the more residual hearing a participant has, the better and wider access to spoken Polish via the aural channel and thus the higher the result. Thus, HoH with mild hearing loss should score the highest – maybe even close to the results of the control group – as they can have the greatest possible contact with the spoken language, especially with proper hearing aid. Moderately deaf should perform better than severely deaf, who would achieve a higher result than those with profound deafness. However, this is not reflected by the results. The mean total scores are flat and oscillate around 33%, and there seems to be no relationship between the degree of hearing loss and reading comprehension, with F (4, 82) = 0.48, p = 0.75. This is also corroborated by the Pearson correlation coefficient being close to 0 (r = 0.0002).

The best users of Polish fell into the category of severe (95.2%) and profound (85.7%) deafness, while the best HoH with mild deafness scored a low 45.2%. Moreover, of all the groups, the mildly HoH performed the best on the B1 test but the worst on B2 and C1, scoring less than half as many points, while the results were relatively similar for each proficiency level in the other deafness categories. These scores are difficult to explain, and most likely the low small sample size of the mildly deaf (n = 6) is to blame.

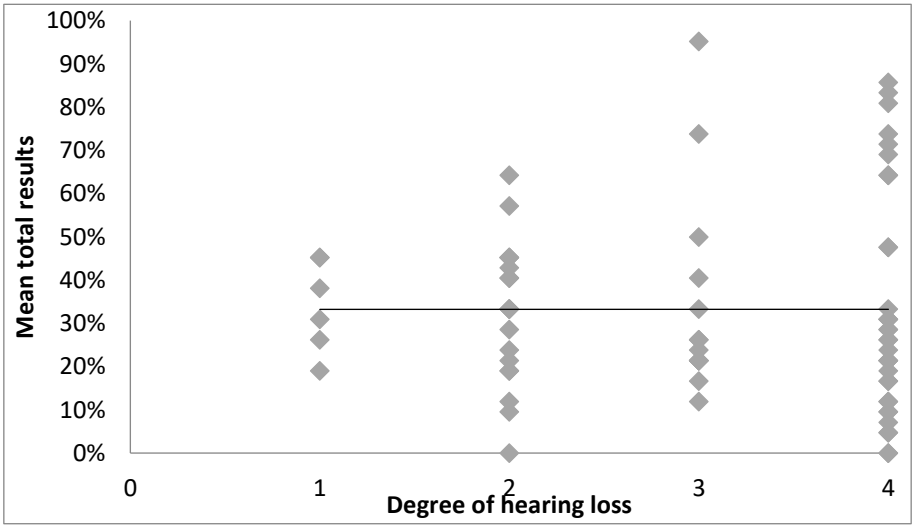
Table 6.

Test Results in Each Hearing Loss Category

	Mean % B1 (*SD*)	Mean % B2 (*SD*)	Mean % C1 (*SD*)	Mean % total (*SD*)	Minimum value %	Maximum value %	Median %
Mild	58.3 (25.3)	24.4 (10.0)	24.4 (13.1)	34.1 (10.6)	19.0	45.2	34.5
Moderate	37.7 (20.3)	32.3 (24.2)	28.1 (13.8)	32.3 (16.5)	0.0	64.3	33.3
Severe	39.9 (31.0)	31.4 (27.1)	33.3 (20.6)	34.5 (23.7)	11.9	95.2	25.0
Profound	36.0 (32.3)	34.1 (32.1)	29.6 (22.6)	33.1 (26.0)	0.0	85.7	26.2
Don't know	26.2 (27.1)	23.3 (18.8)	24.8 (15.3)	24.7 (17.1)	0.0	57.1	19.0

Figure 4.

Zero Correlation between Respective Degrees of Hearing Loss and Mean Total Results of the DHH Participants



5.6. Onset of Hearing Loss

Intuitively, the reading comprehension skill should increase together with the age when the hearing loss occurred, and the time of aural exposure to the spoken language should be proportional to the proficiency in this language. As stated by Krakowiak (2006, p. 269), even a short exposure to linguistic sounds leaves traces in the central nervous system that can be used in rehabilitation. However, in extreme cases, a lack of proper hearing loss treatment can result in the degradation of linguistic skills, even among those children who lost hearing postlingually.

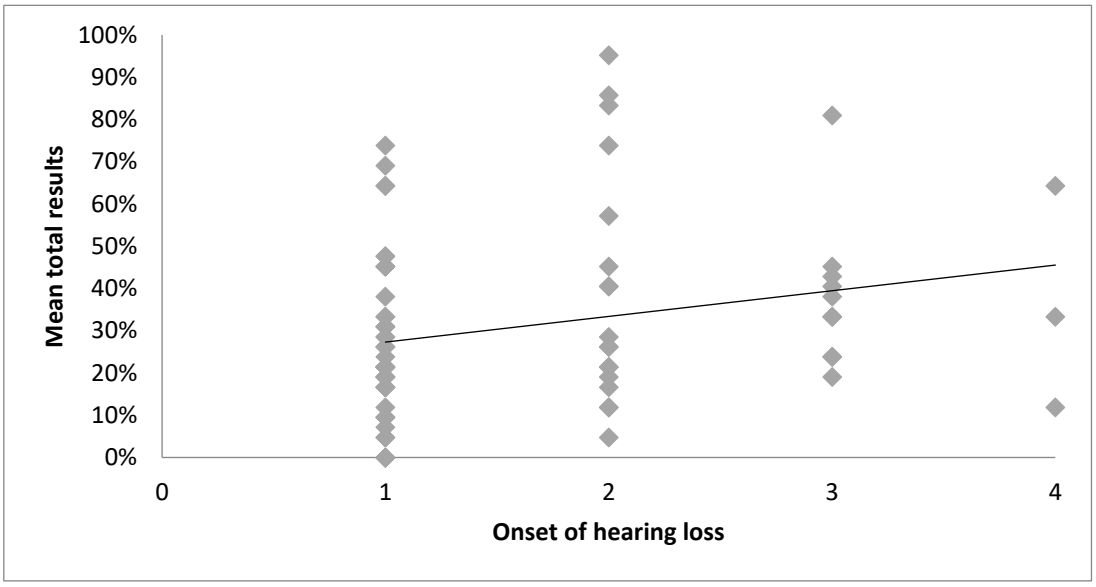
Table 7.

Test results in each age category when hearing loss occurred

	Mean % B1 (*SD*)	Mean % B2 (*SD*)	Mean % C1 (*SD*)	Mean % total (*SD*)	Minimum value %	Maximum value %	Median %
Born deaf	30.3 (27.9)	23.6 (23.8)	24.5 (15.1)	25.8 (18.3)	0.0	73.8	21.4
Before the age of 3	45.4 (33.2)	39.6 (33.2)	34.4 (24.7)	39.4 (28.2)	4.8	95.2	27.4
Before the age of 7	47.5 (21.2)	37.3 (22.5)	31.3 (18.1)	38.1 (17.4)	19.0	81.0	35.7
As a teenager	30.6 (26.8)	42.2 (40.7)	35.6 (15.4)	36.5 (26.3)	11.9	64.3	33.3
Don't know	44.2 (28.3)	38.7 (19.3)	33.3 (22.2)	38.3 (29.6)	9.5	71.4	38.1

Figure 5.

Weak Positive Correlation between Respective Onsets of Hearing Loss and Mean Total Results of the DHH Participants



Note: 1 for born deaf, 2 for deaf before the age of three, 3 for deaf before the age of seven, 4 for deaf as teenager.

Surprisingly enough, the assumption formulated above is largely invalidated, and there seems to be little relationship between the two measured phenomena according to ANOVA results, with F (4, 82) = 2.03, p = 0.1, and the Pearson correlation coefficient of r = 0.24, pointing merely to a weak correlation. Although the participants who were born deaf did score considerably lower than the others, the result reaches a plateau of 36–39% for the remaining ages of hearing loss. What is especially unanticipated is the result of the participants who lost hearing as teenagers – theoretically, they should have scored the highest since their exposure to spoken language via the aural channel was sufficient to develop excellent linguistic skills, but in fact they achieved the penultimate score. Most likely the small sample size (n = 3) is again to blame here.

5.7. Means of Communication

The participants were asked what means of communication they use: whether it is sign language (n = 28), Polish (n = 7), or whether they use both sign language and Polish (n = 52). Unsurprisingly, those who communicate in Polish scored the highest (though it is still 20 percent point lower than the result of the hearing users of Polish) and showed the C1 level in reading proficiency, while sign language users achieved very low results, considerably below the B1 level. What comes unexpectedly is the relatively modest result attained by the participants who declared communicating both in sign language and Polish. Some of them show a language proficiency below the B1 level. Perhaps the reason for this lies in their perception of communication: if they can

mutually exchange information using several simple phrases, they consider it effective communication. Nevertheless, the results are statistically significant, with F (2, 84) = 17.94, $p < .00001$. Post-hoc Bonferroni comparisons also indicate that the differences lie between each of the three groups ($p < .02$).

Table 8.

Test Results for Each Means of Communication

	Mean % B1 (*SD*)	**Mean % B2 (*SD*)**	**Mean % C1 (*SD*)**	**Mean % total (*SD*)**	**Minimum value %**	**Maximum value %**	**Median %**
Sign language	21.4 (19.7)	19.3 (19.7)	21.0 (14.4)	20.5 (15.6)	0.0	69.0	19.0
Polish	67.9 (27.8)	71.4 (24.6)	59.0 (25.9)	66.0 (23.2)	31.0	95.2	71.4
Both	41.2 (28.7)	31.7 (24.7)	28.8 (15.7)	33.4 (18.8)	0.0	83.3	28.6

5.8. Declared Proficiency in Polish

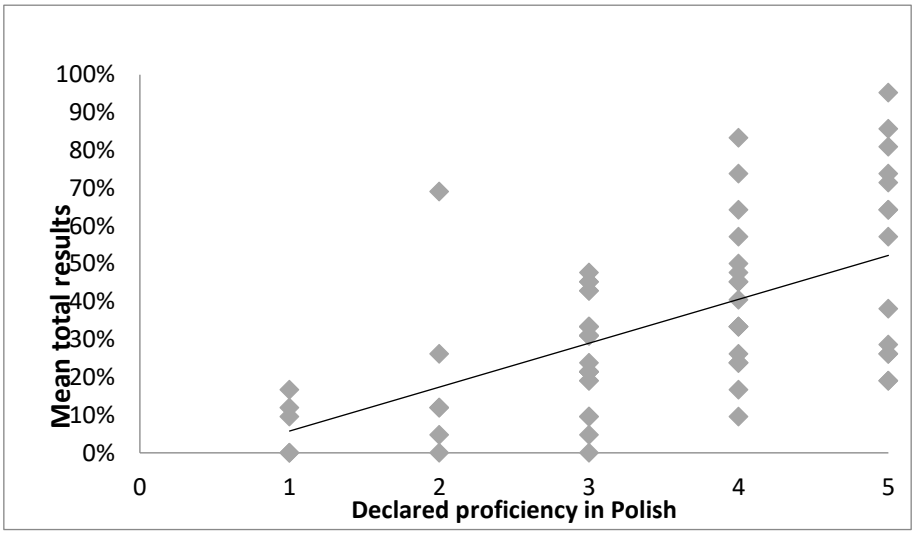
Table 9.

Test Results in Each Declared Proficiency Category

	Mean % B1 (*SD*)	Mean % B2 (*SD*)	Mean % C1 (*SD*)	Mean % total (*SD*)	Minimum value %	Maximum value %	Median %
0	–	–	–	–	–	–	–
1	5.0 (11.2)	9.3 (8.9)	8.0 (11.9)	7.6 (7.4)	0.0	16.7	9.5
2	19.4 (28.2)	22.2 (32.8)	20.0 (18.9)	20.6 (25.3)	0.0	69.0	11.9
3	33.3 (25.9)	25.2 (15.4)	23.5 (12.4)	26.9 (13.3)	0.0	47.6	31.0
4	50.9 (28.7)	41.5 (28.0)	31.5 (13.3)	40.6 (19.8)	9.5	83.3	36.9
5	55.4 (30.2)	55.2 (34.6)	50.5 (25.6)	53.6 (26.7)	19.0	95.2	60.7
No answer	29.4 (22.1)	19.4 (14.3)	25.1 (11.9)	24.3 (12.3)	4.8	50.0	21.4

Figure 6.

Moderate Positive Correlation between Declared Proficiency in Polish and the Mean Total Results of the DHH Participants



Note: From 0 (no knowledge of Polish) to 5 (very good command of Polish).

Unsurprisingly, the results improve along with the declared proficiency, so there is a relationship between the declared and actual proficiencies according to ANOVA, with $F(5, 81) = 8.29$, $p < .00001$. Post-hoc Bonferroni comparisons point to statistically significant differences ($p < .005$) lying between the proficiency levels which are not adjacent to each other, i.e. 1 and 3, 2 and 4, 1 and 4, etc. The Pearson correlation coefficient of $r = 0.58$, indicates a moderate positive relationship. The results also show that the DHH tend to overestimate their proficiency in Polish, which is visible especially in the minimum values as well as total mean and median results for each proficiency level.

5.9. Media Accessibility Preferences

Table 10.

Test Results for Each Preferred Media Accessibility Method

	Mean % B1 (*SD*)	Mean % B2 (*SD*)	Mean % C1 (*SD*)	Mean % total (*SD*)	Minimum value %	Maximum value %	Median %
Sign language	20.5 (21.4)	14.6 (12.8)	17.7 (11.9)	17.4 (12.4)	0.0	45.2	19.0
Subtitles	40.2 (30.1)	35.8 (28.3)	32.5 (21.0)	35.9 (22.3)	4.8	95.2	29.8
Either	51.2 (25.6)	41.6 (27.4)	35.2 (15.7)	42.1 (20.2)	9.5	83.3	40.5

Unsurprisingly, the viewers who rely more on sign language interpretation achieved a very poor result, almost two times lower than the total mean. This corroborates the predictions formulated by Ofcom (2005) interviewees that sign language users might find comprehending verbatim subtitles a challenge. However, somewhat unexpectedly, those who prefer subtitles scored relatively low, with the median result slightly below 30%, and the overall reading proficiency at A2/B1 level. It seems that even though they do prefer subtitles, many of them might have serious difficulties understanding their content. The participants who feel comfortable with both accessibility methods achieved the highest scores on each proficiency test. The results are statistically significant, with $F(2,84) = 11.05$, $p = .0001$. Post-hoc Bonferroni comparisons, however, point to significant differences between the participants who prefer sign language only and the other two groups ($p < .0004$). The difference between those who prefer subtitles and those who can do with either captions or sign language interpretation does not reach statistical significance.

6. Research limitations

Although the above results provide new insights into the reading comprehension skill of the DHH, they are also beset with two significant drawbacks. Firstly, the study used plain texts as test material, and not actual subtitles, which are accompanied by image. The image can provide further context and extra-textual information, which – in the process of viewing – merges with the captions into one stream of content. It is evident that DHH viewers can infer meaning from the image and thus compensate for certain issues with understanding the subtitles. It can be suggested that

the comprehension results would have been higher if the study had involved testing captions. The suggestion is indisputably valid, but the lack of image can be counterbalanced by the advantages of reading a printed text. Unlike in the case of subtitles, which are displayed at a certain rate and then disappear, the participants could choose their own reading speed, re-read any passage as many times as necessary and focus longer on the key parts. Obviously, this can also be interpreted as a disadvantage of the study, as it can be suggested that the results could have been lower had the text been transient like actual captions.

The other drawback lies in the sample size. Although 87 DHH participants is a rather high sample in itself, especially in relation to some others studies of a similar nature, the number of participants within each category under examination is too low to produce statistically significant results. This might be the reason for the counterintuitively low results of the mildly HoH (n = 6) and the d/Deaf who lost hearing in their teenage years (n = 3). A higher sample would also further corroborate and extend – or disprove – the findings for other variables.

6. Discussion

Given the fact that the results achieved by the DHH in the reading comprehension test were generally low, with 85% of the participants scoring less than 50% of points, it can be concluded that non-edited subtitles can be difficult to read and comprehend for a significant majority of the audience. In fact, sign language users, seniors and the DHH with poor education – the groups whose reading proficiency seems to be below the B1 level – might even find edited subtitles too demanding, and would require sign language interpretation to fully access the content of given audiovisual material. Yet, as stated in the section on research limitations, further study on actual subtitles is necessary to corroborate this conclusion.

The results also point to interesting correlations between reading comprehension and the tested variables. Surprisingly enough, there is a zero relationship between reading comprehension and the consecutive degrees of deafness, and only a weak positive relationship between reading comprehension and onset of hearing loss, but further research on larger samples is needed to corroborate or disprove them. However, moderate relationships were discovered between reading comprehension and age, and reading comprehension and education. The latter can be employed to estimate the percentage of proficient and incapable readers within the DHH community. Since there are no national statistics on the topic, one has to resort to research conducted on smaller samples. Kowal and Stadnicki (2012) report a relevant study on 1315 members of the Polish Association of the Deaf in Wrocław. The educational background of the participants was the following: *no education* – 2%, *primary* – 15%, *vocational* – 59%, *secondary* – 20%, *higher* – 4%. This would mean that merely 4% of the Polish DHH read at the C1 level, which allows unhampered comprehension of non-edited subtitles, 20% read at the B1/B2 level, at which complex syntax and sophisticated lexis could significantly impede comprehension, whereas 71% read below the B1

level and require either extensive subtitle editing or a sign language interpretation to access the content of given audiovisual material. However, the results of the present study should be further validated on a larger sample for the above percentage to be truly accurate.

Finally, the Certificate Examinations in Polish as a Foreign Language, prepared by the State Certification Commission, turn out to be a useful tool for checking the reading comprehension of the Polish DHH. As expected from native speakers, the hearing control group achieved very high results, which means that the test exercises are definitely feasible. Moreover, the results of the control group were not strongly influenced by such factors as age or education, although it must be admitted that the control group was not as diversified as the DHH. The results were not immaculate, though, which points to some slight imperfections of the test. In the case of the DHH, the results also seem quite plausible, as they correlate with the educational background and declared proficiency in Polish. On the other hand, lack of correlation between the degree and onset of hearing loss can raise some suspicion. To prove the usefulness of the test beyond doubt, further research is needed on samples that are larger and more diversified.

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