The Abilities and Deficits in Reading and Writing of Low Literate Adults

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Abstract

Low literacy skills in adulthood have been associated mainly with a difficulty in reading comprehension. The question arises whether the difficulty of low literate adults is restricted to the complex task of reading comprehension or whether deficits can be traced back to the more basic reading and writing skills. This question will be examined in the present article based on previously published empirical studies of that population. The available data indicate deficits of these adults not only in reading comprehension, but also in the very basic components of reading and writing such as decoding, orthographic knowledge, word recognition and spelling, in addition to deficits in reading fluency. Alongside these broad deficits, the results also indicate large variance within adults participating in basic education and literacy classes, as a considerable proportion of those adults do not exhibit extreme deficits across the different reading and writing components.

Keywords: Reading, writing, functional illiteracy, adult education

1 Introduction

Despite having spent at least some years in the compulsory educational system, the occurrence of low literacy skills among adults is a frequent phenomenon worldwide. In the recent survey of adult skills "Programme for the International Assessment of Adult Competencites (PIAAC)", an average of 18.5 % of the population between the ages of 16 to 65 in the countries participating in the survey were found to have poor reading skills, which were defined as at or below level 1 in literacy proficiency (OECD 2016a). Participants at level 1 could complete only very basic reading comprehension tasks i.e. locating a single piece of information in a very short text. The information was identical/synonymous with the information given in the question, while little competing information was inserted (OECD 2016a). Notably, a high prevalence of poor literacy skills was even found in the European welfare states, e.g. 10.6 % in Finland, 11.7 % in the Netherlands, and 18 % in Germany. A recent large-scale study carried out in Germany further indicated that 20.5 % of the adults in this country present deficient spelling skills, even in the writing of simple and frequent words (Grotlüschen et al. 2019).

While the PIAAC survey covers a wide range of ages, the distance from formal education may play a role in the difficulty to retain functional reading and writing skills. Nonetheless, the recent "Programme for International Student Assessment (PISA)" survey indicates high proportions of low literacy skills in 15-year-old adolescents as well (OECD 2016b) i.e. adolescents who have almost completed compulsory education. Notably, about 20 % of the students in this survey (averaged for the participating countries) did not attain the baseline level of proficiency in reading, which should enable them to participate effectively and productively in life. As was the case in the PIAAC survey of adults (OECD 2016a), a high prevalence of 15 years old adolescents with low literacy skills was also found in the western welfare countries, e.g. 16.2 % in Germany, 15 % in Denmark, and 21.5 % in France.

Low literacy skills naturally limit one's ability to use printed information in daily life in various contexts – at home, at work and in the society. Consequently, low literate adults are often referred to as functional illiterates (e.g. Egloff et al. 2011). Considering the necessity of reading and writing skills in literate societies for almost every aspect of life, it may come as no surprise that functional illiteracy has been associated with different negative conditions. For instance, the "Canadian Youth in Transition Survey" from 2009, which followed students who were assessed by PISA for several years, showed that students scoring below the basic level in reading were at a higher risk of not attending post-secondary education and experiencing poorer employment outcomes (OECD 2010). Low self-esteem, frustration, sadness and social avoidance have also been considered as conditions related to low literacy in adulthood (Gottesman et al.1996; Eme 2011).

The quest to improve literacy skills in adults is, however, a road lined with hurdles. Some of the major challenges include: limited participation of low literate adults in adult education programs (Grotlüschen, Reder & Sabatini 2016); high attrition rates from literacy classes (Greenberg et al. 2013); limited knowledge of evidenced-based practices in adult literacy courses and on specific abilities and difficulties of low literate adults. In trying to address the final challenge, the question at the center of the present article is what are the skills and deficits of low literate adults in the different components of reading and writing.

The need to examine this question results from the fact that the suggested definition of functional illiteracy puts an emphasis on deficient reading comprehension (Egloff et al. 2011; Vágvölgyi et al. 2016). Accordingly, the level of literacy skills is often defined in large-scale studies based on performance in reading comprehension tasks (e.g. OECD 2016a, 2016b). While this focus on reading comprehension is justified, as it is the essence of reading, it is important to recognise that reading comprehension is a highly complex procedure (Perfetti, Landi & Oakhill 2005), and difficulties in this skill may stem from various sources. However, the analysis of more basic reading and writing skills in large-scale studies are rare (Baer, Kutner & Sabatini 2009). Such basic skills include fluency in reading, word reading and spelling, as well as the ability to decode single graphemes and to rely on orthographic knowledge for word recognition and spelling. As the mastery of these foundations of literacy is expected to

free up cognitive resources for the complex task of reading comprehension (as well as text composition), the understanding of low literate adults' performance in these skills should contribute to the design of appropriate instructional programs (National Research Council 2012). Therefore, in this article, we review the reported performance of low literate adults in tasks addressing the basic components of reading and writing from previously published studies.

We first refer to the results of the PIAAC survey (OECD 2016a), as it is a recent large-scale study, in which an effort was made to disentangle to some extent the complex task of reading comprehension, while comprehension at different text levels was considered – of passages, sentences and isolated words. We further review studies published in international peer-reviewed scientific journals, in which groups of low literate adults were examined. These articles were sourced from the "Education Resources Information Center (ERIC)". The following search terms were taken into account: 1. Reading OR writing AND 2. Skills OR abilities AND 3. Low literate adults OR functional illiterates OR functional illiteracy OR literacy class OR basic education. The search resulted in 263 articles. Some additional articles, which appeared to be relevant, were obtained from the references of these resulting articles. Manual selection of the articles followed thereafter. Studies were considered once they presented empirical and standardized results on the different reading and writing components. We did not consider articles in which only raw data of performance were presented, as these did not allow for estimating the level of reading and writing skills according to age norms. However, two exceptions to this rule were made; we included studies presenting raw data, if they presented error analysis in reading or spelling, and if standardized measures were reported at least for some of the reading and writing components. Studies also had to relate to adults who have some knowledge of reading and writing, thereby excluding cases of illiteracy. Articles relating only to second language learners were excluded from analysis, and so were articles in which adults enrolled in secondary and in basic education programs analysed as one group. Based on this screening process, we refer to 17 studies.

2 Performance of low literate adults in the different components of reading and writing

The review on the literacy skills of low literate adults is presented from the higher order skill of reading comprehension to the more basic skills of fluency in text reading, word reading and spelling. We also refer to some underlying processes of word reading and spelling i.e. decoding and the application of orthographic knowledge.

2.1 Comprehension of sentences and passages

The recent PIAAC survey differentiated for the first time between levels of reading comprehension, while including the testing of sentence and passage comprehension, in addition to the comprehension of single printed words (OECD 2016a). How-

ever, the latter skill is separately discussed under the Word Reading section under paragraph 2.3. The sentence-reading task in the PIAAC survey required participants to identify whether a sentence made logical sense in the real world. The passage-comprehension task comprised a prose text, while at certain points in the text, participants were given a choice of two words and were required to select the word that made sense in the context of the passage. Although the passage-comprehension task took longer to complete, in the majority of countries participating in the survey, the sentence comprehension task was more difficult for the low literate adults (at or below level 1) than the passage comprehension task. The average accuracy rate on the sentence comprehension task of these adults was approximately between 76 % and 93 % -depending on the specific participating country, while the accuracy rate of reading of a passage was between ca. 83 % and 94 % (OECD 2016a). At face value, these may not appear to be low comprehension rates; nevertheless, they were considerably below the achievements of adults at higher reading levels, who reached an average accuracy rate of approximately 94 % in sentence reading and 95 % in passage reading (when taking into account all countries participating in the survey). The low literate adults required also around 1.75 times longer on average to complete both the sentence and passage comprehension tasks (Grotlüschen et al. 2016). It should be further considered that although participants at both below level 1 and at level 1 in the PIAAC study are considered as candidates for basic literacy programs, considerable differences in accuracy in reading comprehension between participants of the two levels were observed. Grotlüschen et al. (2016) reported a gap of 12 % in accuracy rates in the sentence reading task and of 16 % in the passage reading task (when the gap was averaged for all countries).

Other studies, applying standardized reading comprehension tests allow for a better evaluation of the results in relation to the level expected by different age groups. Nanda, Greenberg, and Morris (2010) administered in their study, a standardized sentence reading comprehension task ("WJ-III Reading Fluency Subtest", Woodcock et al., 2001) of the same type applied in the PIAAC survey (OECD 2016), i.e. participants had to read as many statements as they could in three minutes and decide whether each statement was true or false. The participants were 371 low literate adults who were native or non-native speakers of English. Results indicated deficient performance in this task in relation to the expected performance level based on age, while some advantage was found for the adults who were native speakers of English over the non-native English speakers. Additional data comes from another study of low literate adults, who are speakers and readers of the German language (Grosche & Grünke 2011). These researchers examined 54 adults involved in literacy classes and who had attended school in Germany. They applied a German version of the same sentence-reading task described above ("Salzburger Lesescreening (SLS)", Mayringer & Wimmer 2005). In order to be included in the sample, participants had to present a reading level in this test, which matches the one expected by 1st to 4th graders. Finally, Eme, Lambert and Alamargot (2014) tested 52 native speakers of French, who were involved in an adult literacy program. These participants ex-

pressed a reading comprehension level between the 1st and 3rd grade, as observed in a standardized reading comprehension test of the cloze type, which required the comprehension of sentences.

The testing of passage comprehension using standardized tasks further confirms the deficient level of reading comprehension of low literate adults. Mellard, Fall and Woods (2010) examined 174 English speaking adults, who participated in adult basic education programs (while excluding participants receiving instruction in English as a second language). These researchers applied a passage comprehension test from the standardized test ("Woodcock Reading Mastery Test (WRMT-R)", Woodcock 1998), in which participants were required to read short passages of two to three sentences and complete a cloze task. The reading comprehension of these participants was at the level expected by 5th graders (also see Fracasso, Bangs & Binder, 2016). Nanda et al. (2010) also reported a deficit of low literate adults in passage comprehension, when tested with another cloze procedure ("WJ-III Passage Comprehension Subtest", Woodcock et al. 2001). Their study also indicated better performance of native compared to non-native speakers of English. While the testing of reading comprehension using a cloze procedure may also involve writing, Nanda et al. (2010) found significant deficits in an additional reading comprehension task administered in their study, in which participants were required to answer multiple-choice comprehension questions following the reading of passages ("Gray Oral Reading Test (GORT-4)", Weiderholt & Bryant 2001). The native speakers of English in their study showed a standard score of 3.80 and the non-native speakers of English presented a standard score of 3.10, when compared to norms of young adults (18 years of age). Taken together, these results confirm significant gaps in reading comprehension of low literate adults in relation to the expected level by age – even in the handling of very short texts, and when different comprehension tasks are applied.

2.2 Fluency in reading of connected texts

Fluency in reading has been conceptualized as a complex procedure and is defined as the ability to read at "a level of accuracy and rate where decoding is relatively effortless; where oral reading is smooth and accurate with correct prosody; and where attention can be allocated to comprehension" (Wolf & Katzir-Cohen 2001, p. 218). In practice, however, fluency in reading is often tested in oral reading of texts, while measures of reading accuracy and time are taken into account. Fluency in reading has been suggested to be a central component of reading comprehension –amongst others, because slow reading is thought to hamper efficient processing of information in the working memory (Breznitz 2006).

Nanda and her colleagues (2010) applied a reading fluency task, from the GORT-4 (Weiderholt & Bryant, 2001), in which participants (N=371) read stories aloud, while measures of accuracy and reading time were recorded. The low literate adults in their study presented very poor performance when compared to norms of young adults at the age of 18 (with a standard score of 1.28 and 1.09 in native and non-native speakers of English, respectively). Mellard et al. (2010) further revealed

considerable variance in the fluency of text reading within adults having below basic to basic literacy skills. In their study, the Qualitative Reading Inventory task (Leslie & Caldwell 2001) was applied. Participants were asked to read two passages designed for sixth-grade level, while a measure of the number of words read correctly in one minute was calculated. Participants were grouped into six reading-level categories, as defined by the U. S. Department of Education. The average fluency measures suggested considerable variance between the groups such that participants at level 1 read 26 words per minute (SD = 34), participants at level 2 read 71 words (SD = 34), participants at level 3–94 words (SD = 37), level 4–112 words (SD = 28), level 5–125 words (SD = 34), and participant at level 6 read 160 words (SD = 30) per minute in a connected text.

2.3 Word reading

The ability to recognize printed words accurately and quickly is considered as the building block of skilled reading (Ehri 2017; Lervåg, Melby- Lervåg & Hulme 2018). In the recent PIAAC survey, participants were also tested for the more basic level of comprehension i.e. comprehension of single printed words (OECD 2016a). The task applied required participants to select the word corresponding to a picture out of four alternative words. Of the participants at or below level 1 in literacy proficiency, accuracy in word reading was rather high, with a mean accuracy rate of above 93 % in the countries taking part in this survey. In contrast to the case of comprehension of sentences and texts, the gap between participants below level 1 and participants at level 1 for accuracy in word comprehension was modest (an average of 5 % for all countries). These results suggest that adults with low comprehension of sentences and texts are still able to accurately recognize highly familiar words (concrete nouns, e.g. bird, circle, chair, see Grotlüschen e al. 2016). However, it is worth mentioning that in the USA, adults categorised as having below level 1 reading skills presented much lower accuracy rates (77 %). The irregularity of the English spelling, which has been shown to impose significant difficulties in the acquisition of reading skills (Share 2008), may not – or at least not exclusively, explain these results, as adults below level 1 in other English speaking countries reached an accuracy rate in word reading of approximately 90 % (e.g. 88 % in UK and 89 % in Australia). This rate was similar to the one found in the same group of adults from countries in which more transparent orthographies are read (e.g. 93 % in Germany, 91 % in Spain). Nonetheless, the deficit of low literate adults in word reading may become more apparent when a measure of time is taken into account, as adults with below level 1 reading skills took about 1.97 times longer (averaged for all countries) to complete the printed word reading task than adults with level 3 literacy. Similarly, adults at level 1 required 1.45 times longer for completing the word reading task than adults at level 3 (Grotlüschen et al. 2016).

Other studies applying standardized tests, which as previously stated allow a closer examination of performance in relation to the expected level by age, further stress the deficits of low literate adults in the reading of single words. Grosche and

Grünke (2011) applied a standardized word reading test ("Würzburger Leise-Leseprobe (WLLP)", Küspert & Schneider 1998) in their study of German speaking low literate adults (N=54, all having attended a school in Germany), which was similar to the one applied in the PIAAC survey (OECD 2016a) i.e. a word had to be matched to a picture. The scores represented the words correctly identified in a given time. The low literate adults involved in their study presented a word reading level, which was equivalent to the one expected by 1st to 4th graders (also see Bolzmann et al. 2017).

While the matching between a picture and its corresponding word addresses the silent mode of reading, additional studies applied oral word reading tasks. For example, in the study by Mellard et al. (2010) who examined 174 English speaking adults with below basic to basic literacy skills, participants presented a word reading ability equivalent to the level expected by 5th graders. Nanda et al. (2010) also reported an average word reading level between the 3rd and 5th grades in low literate adults who were both native and non-native speakers of English. Additional evidence for deficits in reading aloud of words by readers of English can be found in a series of other studies (e.g. Barnes et al. 2017; Gottesman et al. 1996; Greenberg, Ehri & Perin 1997; Mellard & Fall 2012; Miller et al. 2017; Sabatini et al. 2011).

Notably, the difficulty in oral word reading does not appear to be restricted to the reading of the opaque English orthography, which may impose considerable challenges when reading single words without a supporting context. Namely, similar deficits in oral word reading were also reported in low literate adults who read the more transparent German orthography (Vágvölgyi, 2018). It may also be mentioned that in the study by Eme et al. (2014) of French speakers, the oral word reading level of 52 low literate adults participating in a literacy program was equivalent to the level of a matched group of children between the 1st and 3rd grades.

Finally, in line with the differences in silent word recognition time between participants below level 1 and at level 1 in the PIAAC study (OECD 2016a), studies applying oral word reading tasks also indicate a considerable variance within the group of low literate adults. Mellard et al. (2010) reported such differences from adults having below basic to basic literacy skills, whereby participants with very low literacy skills read approximately half the number of words in a given time compared to participants with somewhat higher literacy skills, while the gap in word reading rate further dramatically increased as literacy level increased (also see Mellard, Woods & Fall 2011). Similarly, in the study by Gottesman et al. (2010) of adults involved in a literacy program, participants could be divided into three groups according to their word reading level: 72 participants reached the highest quartile on the Word Identification subtest of the "Woodcock-Johnson Psycho-Educational Battery Revised (WJ-R)" (Woodcock & Johnson 1989) with a mean standard score of 100 (SD = 15); 134 participants showed a mean standard score of 69 (SD = 12); and 64 participants performed at the lowest quartile, with a mean standardized score of 36 (SD = 8).

2.4 Spelling

Similarly to the relations between efficient printed word recognition and reading comprehension, the ability to produce efficiently words in writing is expected to free up cognitive resources for the complex task of text composition (Kent & Wanzek 2016). Words included in standardized spelling tests usually address the ability to transform each sound into its appropriate grapheme, in addition to the ability to access word-specific orthographic knowledge and acquaintance with the conventions of the orthography written. Gottesman and her colleagues (1996), who analysed performance of 280 English speaking adults enrolled in an adult literacy program, showed extreme deficits of these adults in a standardized spelling test ("Wide Range Achievement Test-Revised (WRAT-R)", Jastak & Wilkinson 1984), which were over two standard deviations below the norm group mean. In line with these results, Greenberg et al. (1997) reported a disadvantage of the low literate adults in her sample (n = 72) compared to younger reading-levels controls (n = 72) in a measure of spelling (including orthographically complex words at different levels of difficulty). However, such a disadvantage in word spelling of low literate adults compared to reading-level matched younger controls was absent in the study by Eme et al. (2014) with French speakers. Nevertheless, performance of the adults in their sample did not exceed the performance of the younger controls (children in the 1st to 3rd grades).

Results by Gottesman and her colleagues (1996) further demonstrated significant variance in spelling within low literate adults who participate in literacy classes. When the participants in their study were divided according to their relative word reading skills, participants with the most severe word reading deficits and participants with intermediate word reading skills differed significantly in spelling from adults defined with the highest word recognition skills.

2.5 Processes of reading and spelling: decoding and orthographic knowledge

Two main pathways for word recognition have been suggested: the one relies on decoding of graphemes into their corresponding sounds and the other relies on the direct identification of larger orthographic units (such as whole words or morphemes, Coltheart 2005; Harm & Seidenberg 2004). The first is expected to be dominant in novice readers or in the reading of unfamiliar words. However, with reading experience and print exposure, readers are expected to acquire orthographic knowledge and sensitivity to the orthographic conventions of their script, and as a result, the direct recognition of orthographic units larger than graphemes takes a larger role in reading (also see Ehri 2017; Share 1995). These two pathways should also be relevant in spelling. Spelling is expected to begin with a process of "spelling by hearing" while children transform each sound into its appropriate grapheme. It is then expected to progress to the application of orthographic knowledge, which is critical for efficient spelling and for the writing of irregular words. Relatively few studies have addressed the availability and application of these pathways in low literate adults. These are discussed below, separately for reading and spelling.

Decoding and orthographic knowledge in reading

While familiar words can be read either by relying on orthographic knowledge or by decoding each grapheme into its corresponding sound, pseudowords are read mainly using the latter process (except for pseudowords comprising familiar orthographic clusters, such as morphemes). For this reason, decoding skills are typically tested in a pseudoword reading task. Mellard at al. (2010) reported very low decoding skills in their sample (N=174) of English speaking adults that had below basic to basic literacy skills, with them being at the level expected by 3rd and 4th graders. Deficits in decoding by low literate adults participating in adult basic education courses were further confirmed by Fracasso et al. (2016), Mellard & Fall (2012) and Nanda et al. (2010). Notably, Nanda et al. (2010) reported larger deficits of low literate adults who were native speakers of English compared to adults who are not native speakers of English. Greenberg et al. (1997) further found significantly poorer decoding skills of 72 adult literacy students in a standardized test when compared to 72 reading-level, matched typically developing children in the 3rd to 5th grades (speakers of English). Restricted application of processes of decoding can also be inferred from the analysis by Greenberg et al. (2002) of reading errors of these adults, as their reading mistakes were more often real words whereas children's reading errors were decoding mistakes.

While decoding difficulties may be affected in particular by orthographic transparency, there are very few reports on decoding deficits from low literate adult readers of orthographies with more transparent spelling-sound relations than the English one. However, significant decoding deficits have been reported in one study on low literate adult readers of the German orthography (Vágvölgyi 2018). Additional data can be found in the study of French speakers by Eme et al. (2014), who reported lower performance of 52 low literate adults (participating in a literacy program) in a pseudoword reading task, compared to reading comprehension-level matched children between the 1st and 3rd grades.

As in the case of word reading, data by Mellard et al. (2010) indicate considerable gaps between adults with below basic to basic literacy skills. Participants at the lowest literacy level in their study read less than half the pseudowords in a given time compared to participants in the next literacy level, and participants in this level read approximately half of the items read by participants in the following level (also see Mellard, Woods & Fall 2011). Considerable gaps were also obtained between these participants and participants at higher literacy levels (also see Binder & Lee 2012).

As far as the application of orthographic knowledge in reading is concerned, Greenberg et al. (1997) provide a somewhat complex picture on the availability of these skills in low literate adults. As previously stated, they observed a disadvantage of the low literate adults in their sample over reading-level matched children in reading of pseudowords but an advantage of the adults in reading of real words. Although these results may suggest some advantage of the adults in applying orthographic knowledge in reading, other tasks applied in their study do not support this possibility. Namely, the adults presented lower performance compared to the younger controls

in reading rhyme words, which were spelled differently (e.g. fuel/mule). Decoding alone of these pairs would not suffice in order to succeed in this task, and hence the application of orthographic knowledge was required. The adults and younger controls further showed similar performance in two other tasks addressing orthographic skills. The first was a word likeness task, in which sensitivity to frequent and infrequent orthographic sequences in words was tested by presenting participants with pairs of invented words, and asking them to circle the item which looks more like a real word (e.g. vism/visn). The second was a letter position task, in which participants were required to determine which is the most frequent position of a letter in a word (e.g. whether c appears most often in the beginning, middle or end of a word). These results suggest then some advantage in the application of orthographic knowledge compared to decoding in reading by low literate adults, though both processes are below the level that would be expected in adulthood.

Decoding and orthographic knowledge in spelling

One way of gaining a closer look on processes and knowledge available to participants in spelling is through the analysis of spelling mistakes. Greenberg et al. (2002) analysed the spelling mistakes of 72 low literate adults (speakers of English), and found more phonological mistakes in spelling than in a group of reading-level matched children. Results by Eme et al. (2014) of French speaking low literate adults also suggest poor application of decoding in spelling. In this study, the adults showed lower performance in spelling of pseudowords compared to reading-level matched younger children (between the 1st and 3rd grades). This was in contrast to the results of a real word dictation task, in which the adults showed equivalent performance to the level of the children (as already reported here under the spelling section). The error analysis of the word spelling task further indicated fewer phonologically acceptable errors, which resulted in a transcription that did not phonologically correspond to the target word (or in a nonresponse). The two groups did not differ, however, in the extent of spelling errors categorized as lexical or grammatical ones. These results may then suggest some advantage of applying orthographic knowledge in spelling over decoding processes.

A more detailed characterisation of the spelling errors, which sheds some light on the availability of phonological and orthographic processes in spelling, can be found in the study by Worthy and Viise (1996), who compared the spelling of 41 adults enrolled in a workplace literacy program with 92 achievement-level-matched children. The test applied was an informal spelling test corresponding to levels expected by first to fourth graders (Schlagal 1982). The words in the lists accounted for the most frequent errors made by typically developing children on these four levels. A qualitative analysis of spelling errors indicated that the two groups made no (adults) or almost no (children, with 1%) errors in the category of letter reversals (such as b for d), and very few mistakes in the category of letter sequences (e.g. vocie for voice, with 2% and 1% mistakes in adults and children, respectively). Participants did not differ in categories of spelling of short vowels (e.g. chein instead of chin, with 9%

and 6 % mistakes in adults and children, respectively), and in the category of consonant units (e.g. bave instead of brave, with 13 % and 10 % mistakes in adults and children, respectively). However, significant differences were found in categories of long vowels (e.g. plane instead of plain) and double consonants (bated instead of batted), with an advantage to the adults compared to the children (adults made 13 % of errors, while children made 22 % of errors in the category of long vowels; adults made 26 % of errors, while children made 36 % of errors in the category of double consonants). This pattern reversed however, in two other categories relating to the word's ending: adults made more errors (10 %) in the spelling of inflectional or derivational morphemes (e.g. omissions, e.g. bat for batted; substitutions, e.g. batting for batted; and erroneous additions, e.g. wrinkly for wrinkle) compared to children (1 %), as well as in phonological misrepresentations (these included different, recognizable words, e.g. success for such, and nonwords, e.g. brode for brave, with 8 % of errors in adults and 1 % in children). These results suggest the mastery of very basic and limited features of the English spelling. Nevertheless, the adults appeared to have shown some relatively more advanced use of orthographic knowledge. However, the adults made more spelling errors that were rarely made by the children, including omissions, substitutions, and additions of derivational and inflectional morphemes, and omission of word endings in general.

3 Discussion

While the difficulty in understanding printed texts is often used as the main criterion to define poor literacy skills in adulthood, the purpose of this review was to examine whether low literate adults show deficits also in the more basic reading and writing skills, which may explain –at least to some extent, their deficit in reading comprehension. In the following discussion, we first refer to the main conclusions derived from the present review. Afterwards, practical aspects of the results and further research directions are considered.

3.1 Broad deficits alongside broad variance

Two main conclusions are apparent from the current review. The first conclusion is that low literate adults present, on average, deficits not only in the higher order skill of reading comprehension, but also in the more basic skills of fluency in reading, word reading, spelling and in the ability to apply decoding and orthographic processes. Despite having spent at least some years in the compulsory educational system, these adults lack on average the mastery of the foundations of literacy, while performing in basic reading and writing tasks at a level equivalent to the level of elementary school children. Even though not many studies explored these deficits, the results appear to be rather strong, as these were replicated in different samples, while different diagnostic test were used.

The clear deficits in decoding, which is the key skill enabling the deciphering of the orthographic code should in particular draw our attention. It is a skill systematically taught during the course of the first grade, and is expected to be mastered early on in the first years of schooling, and as early as the end of first grade in readers of transparent orthographies (see Seymour, Aro & Erskine 2003). Insufficient decoding ability was suggested to elicit a chain of negative effects on the course of the development of literacy skills (Stanovich 1986). Namely, imprecise decoding has been found to hamper the acquisition of orthographic skills (Share & Shalev 2004). Consequently, the development of the ability to recognize words accurately and fast "by sight", or to spell words correctly is also impaired (Ehri 2017; Share 1995). The process of reading then remains inefficient, and minimal cognitive resources are left over for comprehension. Furthermore, the gap in reading experience between good and poor decoders is already large by the first grade of school, and this gap constantly increases, with its further negative impact on the development of cognitive reading-related skills (Stanovich 1986). It bears mentioning, however, that dyslexic readers have also been shown to have a core and persistent deficit in decoding ability, while concurrently being able to reach higher education (Bar-Kochva & Amiel 2016; Bruck 1990). Obviously, inefficient decoding should not necessarily lead to functional illiteracy in adulthood, while models relating to interactions with other factors – environmental and emotional ones as causes of functional illiteracy have been suggested (review in Eme 2011).

The second conclusion of this review is that low literate adults, who attend literacy classes or basic adult education programs, present a large variance in reading and writing skills (see Binder & Lee, 2012 for a similar conclusion). This was found in reading comprehension, fluency in reading, word reading, decoding and spelling. The results of Gottesman et al. (1996) in particular demonstrate this variance, as of the adults involved in a literacy program in their study (N=270), 72 adults actually presented efficient word-reading skills. Studies of low literate adults often involve the entire group of adults participating in a literacy class (with very few exceptions of studies applying clear exclusion criteria, see Grosche & Grünke, 2011). Consequently, samples of low literate adults include participants varying in factors such as first language, age and educational experience. The findings by Nanda et al., (2010) further suggest differences of performance in various reading tasks by low literate adults who are native and non-native speakers of English (advantage of the native speakers in most tasks, but a disadvantage in decoding). However, the question to which extent other possible factors mediate literacy skills and progress in these classes requires further examination.

3.2 Practical considerations

The addressing of the broad range of reading and writing deficits of low literate adults and their variance in literacy programs faces considerable challenges. There is a wide spectrum of forms and means of provision of literacy interventions for adults, usually referred to as "Adult Basic Education (ABE)" or "Adult Literacy (AL)", while

diversity is evident within, as well as, between countries (Hamilton & Merrifield 1999; European Commission 2015). Adult basic education is a broad umbrella term that covers both formal and non-formal education forms designed to improve adults' necessary basic competencies such as language literacy (reading and writing skills), mathematical and ICT (technological) literacy (European Parliament and the Council of Europe, 2006). It also covers both general and vocational education in different contexts (Mccaffery, Mace & O'Hagan 2009). These frameworks often set different goals; so while some aim at a school-leaving certificate, other courses aim for the more general goal of improving literacy skills. Workplace literacy approaches further combine literacy training with specific work-related contents (e.g. work-related terminology and ICT skills, see Schroeder, 2016). Family literacy programs may also be considered as a means of improving literacy skills not only of children but also of the adult caretakers (Nickel, 2014, 2016). Other alternative approaches such as web-based platforms, educational software or self-organized learning circles exist worldwide. While some efforts have been made to phrase curriculums for literacy instruction for adults (the German project "Framework curriculum and course concept for graduate-oriented basic education", Deutscher Volkshochschul-Verband 2014a, 2014b 2017) and to offer training for course instructors (e.g. by the German Adult Education Association (Deutscher Volkshochschulverband e. V., see https://www.grundbildung.de/qualifizieren) the diversity of offers still suffers from lack of clear standards regarding contents and teaching quality and methods (Löffler & Weis 2016). Accordingly, and to the best of our knowledge, systematic diagnosis of reading and writing skills which addresses the different components of reading and writing is not carried out in these contexts. It may be reasonable to assume that the understanding of the abilities and difficulties of each participant should contribute to the appropriate design of the relevant instructional program. Two findings coming from studies on literacy instruction for adults are the restricted progress found following literacy courses (e.g. von Rosenbladt & Lehmann 2013) and the high attrition rates (Greenberg et al. 2013). While there may be various sources for these difficulties, the relevance of instruction to the reading and writing proficiency of each individual should be considered in trying to improve instructional results. Nevertheless, the scientific background justifying the implementation of such a systematic diagnosis in literacy classes appears to be lacking, as research exploring the actual potential of such diagnoses on the adjustment of instruction in adult literacy programs and on progress in reading and writing skills is still required. If found effective, additional directions for examination should relate to the implementation of diagnostic procedures in literacy classes (e.g. who should carry out the diagnosis, how results should be communicated and how interventions should be accordingly designed).

An additional challenge in providing appropriate interventions for adults with low literacy skills is that the effects of the programs offered on progress in the different components of reading and writing is seldom evaluated (or is evaluated but with questionable methodologies, see reviews in Greenberg et al. 2011; Nickel 2014). This is in sharp contrast to the study of intervention methods in children who struggle

with reading and writing acquisition. Efforts to provide general recommendations for interventions in adults have been made, however, based largely on research of children (e.g. Kruidenier, MacArthur & Wrigley 2010). While this line of research should give a good direction, it may not cover the specific needs of low literate adults. As suggested by Greenberg et al. (2011), adults may have difficulties that are entrenched and harder to remediate compared to children. It may then be suggested that factors such as training time and the direct training of automaticity in decoding and in word processing may play a larger role in adults than in children. However, these suggestions require experimental confirmation. The very few studies examining the effects of interventions addressing the basic, as well as higher order components of reading in literacy classes for adults, support the need to further explore the special requirements of this population. Greenberg et al. (2011) for example, compared the effectiveness of five instructional approaches in English speaking low literate adults. The approaches covered low (e.g. letter identification, word reading) and higher order literacy skills (e.g. comprehension of passages) next to a control/comparison approach, which was based on a local community-based literacy program. Four approaches, which trained decoding, reading comprehension, fluent reading, and extensive reading components (including reading and discussing literature of own choice) alone or in combination with each other were included. Although three approaches (decoding & fluency, decoding & comprehension & fluency, and decoding & comprehension & extensive reading & fluency) particularly aimed at skills in which low literate adults show difficulties, the significant improvements were rather small (effect sizes: .03 to .18), and smaller than previously reported in the case of children. The ability of adults to generally improve basic reading and writing skills was confirmed in a training study by Rüsseler et al. (2012). However, in their study, the basic reading and writing skills were addressed in training as part of a comprehensive intervention, which involved many other factors (also including perceptual training and social activities). Therefore, the role of the training of the basic reading and writing skills could not be disentangled. Further research is clearly needed in order to evaluate the effectiveness of diagnostic procedures and of intervention programs addressing the different components of reading and writing in adult literacy programs. An additional question for future examination is to which extent the training of the basic components of reading and writing actually leads to better reading comprehension, text composition, and to improved reading habits in everyday settings.

4 Summary and conclusions

In summary, the studies reviewed in this article indicate that the deficits of low literate adults on average extend well beyond the complex task of reading comprehension, and comprise the more basic reading and writing components. This may suggest that these basic skills need to be addressed in literacy classes. However, the

different factors affecting the efficiency of such instruction still require further research. Moreover, the results do not point to the need to automatically address all components of reading in adult literacy classes, as low literate adults may not present difficulties in the entire spectrum of reading and writing components. The variance in the literacy skills of adults participating in basic education and literacy courses suggests that diagnosis should precede intervention in class in order to plan the most relevant instruction program for each individual. Nonetheless, the advantage of such a systematic diagnosis on actual reading and writing outcomes still has to be scientifically proven.

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