

The home literacy environment of school-aged children with autism spectrum disorders

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Abstract

For typically developing (TD) children the home literacy environment (HLE) impacts reading competence, yet few studies have explored the HLE of children with Autism Spectrum Disorders (ASD). We collected information about the HLE of children aged 7-13 with ASD and their TD peers via a parental questionnaire and examined whether there were any differences in home literacy practices. Subtle group differences emerged. Children with ASD and concomitant language disorder (ALD) were engaged in shared reading and reading discussion more frequently than TD children and children with ASD and age-appropriate language skills (ALN). However, both ALN and ALD children engaged in shared reading for a shorter duration than their TD peers. Across groups, frequency and duration of independent reading was positively associated with reading ability and attitude. Thus, home literacy practices appear to reflect child characteristics and parents are well placed to facilitate their children's literacy development through encouragement and scaffolding.

Highlights

What is already known about this topic

- The home literacy environment (HLE) impacts the reading development of typically developing children
- Many children with ASD have reading difficulties, but little is known about the HLE of children with ASD

What this paper adds

- We examined the relationship between the HLE and reading for children with ASD
- Poorer readers with ASD were engaged in shared reading practices more frequently than proficient readers
- Children with ASD engaged in shared reading practices for a shorter duration than typically developing peers

Implications for theory, policy or practice

- Home literacy practices appear to reflect child characteristics
- Parents are well placed to facilitate their children's literacy development through encouragement and scaffolding

Introduction

Literacy skills are essential to access the educational curriculum and are associated with educational attainment (Pretorius, 2000). For typically developing (TD) children there is an intimate relationship between literacy and language competence (Adlof, Catts, & Lee, 2010; Carlson, Jenkins, Li, & Brownell, 2013; Cutting & Scarborough, 2006), but variation in reading skill can further be accounted for by the quality of the home literacy environment (HLE; cf. Bus, van IJzendoorn, & Pellegrini, 1995). Likewise, the literacy skills of children with Autism Spectrum Disorders (ASD) can be partially attributed to variation in oral language ability (Brown, Oram-Cardy, & Johnson, 2013; Ricketts, Jones, Happé, & Charman, 2013). However, little research has investigated the role of the HLE for children with ASD.

The reading accuracy and comprehension of children with ASD varies greatly, but many children encounter difficulties (Brown et al., 2013; Ricketts et al., 2013). Therefore the home environment may be especially important for these children, and may continue to be influential for a longer period of time. However, difficulties with social interaction and communication, plus a restricted repertoire of interests (American Psychological Association, APA, 2013) may influence reading behaviour and attitudes to reading, impacting upon the HLE. The current study examined how parents respond to the literacy needs of their school-aged children with ASD, taking into consideration language phenotype.

The term ‘home literacy environment’ (HLE) refers to a constellation of variables, including the extent to which children are exposed to literacy-related activities in interaction with family members, provision of printed materials, parental modelling of literacy behaviours, and parental attitudes to and beliefs about reading. Sénéchal, LeFevre, Thomas and Daley (1998) suggested that children can be exposed to both formal literacy instruction (i.e. direct teaching) and informal literacy experiences (e.g. shared reading) at home. The latter is of primary focus in the current study. Shared reading and story book exposure in early childhood (i.e. ages 2-7) not only promotes a positive attitude towards reading (Rowe, 1991), it also cultivates familiarity with written and oral language structures. It therefore facilitates both reading accuracy and comprehension (Bingham, 2007; Bus et al., 1995; Rowe, 1991; Scarborough, Dobrich, & Hager, 1991; Share, Jorm, Maclean, Matthews, & Waterman, 1983), especially if there is emphasis on the printed word, rather than pictures (Justic & Ezell, 2002). It also promotes expressive and receptive language development, predicting both concurrent and longitudinal language skill (Bracken & Fischel, 2008; Bus et al., 1995; Sénéchal & LeFevre, 2002), particularly when there is emphasis on active discussion and open-ended questioning (Bennett, Weigel, & Martin, 2002;

Bus et al., 1995; Richman & Colombo, 2007; Whitehurst & Lonigan, 1998). However, the extent to which parents engage their children in such practices may be driven by parental level of education and socio-economic status, both of which are positively associated with children's reading skill (Bracken & Fischel, 2008; Sénéchal et al., 1998).

There has been less research exploring the HLE of older children and adolescents, despite its potential benefits (cf. Klauda, 2009). The extant research indicates that provision of resources, encouragement to read and modelling of reading are positively associated with 9-11 year old children's attitude to reading and the amount of time spent reading for leisure (Hansen, 1969; Neuman, 1986; Shapiro & Whitney, 1997). In addition, these factors are positively associated with both reading accuracy and comprehension, as well as spelling competency (Conlon, Zimmer-Gembeck, Creed, & Tucker, 2006; Halle, Kurtz-Costes, & Mahoney, 1997; Hansen, 1969).

However, there is some evidence that the HLE does not directly contribute to the development of literacy skills of school-age children. For example, Bråten et al. (1999) found that three indicators of the HLE, namely positive family reading models, access to written language resources and shared reading practices, were indirectly related to orthographic processing skill for children aged 8-10 years via their impact on leisure reading. Likewise, Sénéchal and LeFevre (2002) found that the relationship between shared reading at home at age 5-6 and literacy skills at age 9 was not direct, but instead mediated by receptive language skill. Thus, the importance of child factors such as reading enjoyment and language should be taken into consideration when examining the HLE.

The nature of reading practices may also change over time, and in response to the child's needs. Typically developing older children should have sufficient skill to be able to read independently, and therefore may be less reliant on shared reading activities to attain exposure to text. Indeed, there is a bi-directional relationship between the amount of time spent reading independently for leisure and both reading accuracy and comprehension, as well as vocabulary knowledge (Anderson, Wilson, & Fielding, 1988; Cipelewski & Stanovich, 1992; Shapiro & Whitney, 1997). In addition, independent exposure to text predicts growth in reading accuracy, reading comprehension and vocabulary from age 8 to age 11 (Anderson et al., 1988; Cipelewski & Stanovich, 1992).

Home literacy environments of children with ASD

The HLE of children with ASD may differ to that of their TD peers. ASD is a neurodevelopmental disorder with a prevalence rate of 14.7 per 1,000 (Centers for Disease Control and Prevention, 2014). It is characterised by impairments in social interaction and social communication (APA, 2013), so children with ASD may be less motivated to engage in, and derive less enjoyment from shared reading than their TD peers. However, ASD is also characterised by a restricted repertoire of interests and behaviour (APA, 2013). Children with ASD may therefore have an intense preoccupation with reading, or read profusely to support a special interest, and this repeated exposure to text may enhance aspects of literacy development (Bryson, Landry, & Smith, 1994; Talero-Gutierrez, 2006).

The language skills of children with ASD may also interact with the HLE. Within ASD there are at least two distinct language phenotypes (Kjelgaard & Tager-Flusberg, 2001; Kwok, Brown, Smyth, & Oram Cardy, 2015) and whilst around 40-50% of children with ASD have concomitant language disorder (Autism Language Disorder; ALD), the remainder have age-appropriate structural language skills (Autism Language Normal; ALN; Kjelgaard & Tager-Flusberg, 2001; Loucas et al., 2008). For TD children, reading comprehension is underpinned by both decoding and language competence, as outlined in the Simple View of Reading (Gough & Tunmer, 1986). Concordantly, non-autistic children with Developmental Language Disorder (DLD) find reading more challenging than their TD peers, and children with ALD are also likely to be poor readers (Lindgren, Folstein, Tomblin, & Tager-Flusberg, 2009; Lucas & Norbury, 2015; Lucas & Norbury, 2014; Norbury & Nation, 2011). They may need more support to access texts than their peers with ALN and may find literature less rewarding. Thus, for school-aged children with developmental disorders, the HLE may reflect child characteristics, rather than literacy development being influenced by the HLE, as is the case for TD children (cf. Bus et al., 1995).

There is a paucity of research on the HLE of children with ASD. Preliminary investigation has indicated that young children with ASD (i.e. ages 4-8) are read to as frequently as TD children (Dydia, Lawton, Logan, & Justice, 2014; Lanter, Freeman, & Dove, 2012), however it is not known whether the duration of shared reading sessions is similar. For TD children, shared reading is especially beneficial if accompanied by discussion and questioning (cf. Bus et al., 1995). Many parents of young children with ASD do pose questions, including different types of questions, during shared reading (Lanter, Watson et al., 2012). However, the frequency of questioning is undetermined. Additionally, although the language skills of the

participants in the Lanter, Watson et al. study ranged from severely impaired to age-appropriate, the relationship between language phenotype and questioning style was not reported. It is plausible that both questioning frequency and style are associated with linguistic competence. In general, language phenotype within developmental ASD populations and shared reading practice remains largely unexplored either qualitatively or quantitatively. However, Dynia et al. (2014) ran regression analyses to explore predictors of shared reading frequency, and found that for the sample as whole neither linguistic competence (as indexed by the core language subtest from the CELF) nor ASD status (ASD vs TD) were significant predictors

Insight into the influence of language phenotype within ASD may be provided by examining the results of studies investigating the HLE of non-autistic children with Developmental Language Disorder (DLD). Some evidence suggests that non-autistic pre-school children with DLD are read to more frequently than their TD peers (Sawyer et al., 2014), whilst other research indicates that 4-5 year olds with DLD engage in literacy practices (e.g. telling stories) significantly less frequently than their TD peers (Skibbe, Justice, Zucker, & McGinty, 2008). Likewise, findings regarding the relationship between home literacy practices and attainment for children with DLD are inconsistent, with some researchers reporting a significant relationship between shared reading frequency and print knowledge (Sawyer et al., 2014), whilst others find no relationship (Skibbe et al., 2008). The disparity may be attributable to methodological differences in measures of literacy practices (McGinty & Justice, 2009).

Reading Enjoyment

Frequency and duration of shared reading practices may be associated with child enjoyment of reading. Lanter, Freeman et al. (2012) found that children with ASD enjoyed shared reading less than language-matched TD children, and also requested shared reading less frequently (twice rather than three times a week). These findings could be attributable to the difficulties children with ASD have with social interaction. However, the ASD group were older and had better procedural print-related skills (such as alphabetic, phonemic and word knowledge), so they were likely better equipped to access resources independently. Dynia et al. (2014) found that children aged 3-5 with ASD requested shared reading less often than their TD peers, on average three times per week rather than five times a week. However, independent reading frequency did not differ, with both groups of children reading on their own five times a week on average. These findings suggest that children with ASD are interested in reading, but enjoy shared reading less than their TD peers. However, again language competence needs to be considered, as for non-autistic children, attitude to literacy-related activities is positively

associated with language and literacy competence (Chall & Jacobs, 2003; Frijeters, Barron, & Brunello, 2000; Kaderavek & Sulzby, 1998; Sawyer et al., 2014).

Lanter, Watson et al. (2012) examined parental perception of child enjoyment during shared reading and found that children with ASD and age-appropriate vocabulary enjoyed and requested shared reading more than children with ASD and vocabulary impairments. Children with language difficulties may derive less enjoyment from shared reading than their non-language impaired peers due to difficulties with decoding (Lucas & Norbury, 2014) and impaired listening comprehension (Norbury & Bishop, 2002; Wagner, Sahlén, & Nettelblatt, 1999). However, listening to stories can facilitate vocabulary learning, especially if novel words are defined (Brett, Rothlein, & Hurley, 1996; Feitelson, Kita, & Goldstein, 1986; Stahl, Richek, & Vandevier, 1991). Thus, if parents are aware of their child's challenges, they may place more emphasis on home reading tuition in an attempt to bolster attainment.

Children with ASD may also differ from TD peers with regards to literature preferences. Understanding fictional narratives requires abstraction and draws on social cognitive skills, such as the ability to make inferences, identify causal attributes, understand character motivations and make predictions and conclusions. Consequently Randi, Newman and Grigorenko (2010) suggest that "children with ASDs typically prefer expository text, such as science texts. This may be because they find narrative text especially challenging because of its more abstract (and social) reasoning demands" (p. 895).

The Current Study

Despite the considerable impact the HLE can have on the development of literacy and language skills for TD children, little is known about the HLE of children with ASD. Attaining an overview of the HLE may increase our understanding of the variability in the reading skills of children with ASD. As many children with ASD have reading impairments (Brown et al., 2013; Ricketts et al., 2013), shared reading may continue to occur for longer than in typical development. Consequently, investigations of the HLE should not be restricted to the pre-school years, but also examine the practices of school-aged children with ASD. This may be an especially critical time in development as children begin to make the transition from shared to independent reading. As children with ASD find social interactions challenging, this transition may be more evident for children with ASD than their TD peers, but our understanding of independent reading by children with ASD is also limited.

The current study therefore sought to address these gaps in the literature by exploring the HLE of school-aged children with ASD. Notably the study took into account the role of reading and literacy competence, as these factors are related to the reading practices of TD children.

Two key topics were addressed:

1. Whether the frequency and duration of both shared and independent reading practices differed between TD and ASD peers, and across language phenotypes within ASD. It was predicted that the majority of children with ASD would engage in shared reading, but that the frequency and/or duration of such activities would be reduced relative to TD peers (Dydia, Lawton, Logan, & Justice, 2014; Lanter, Freeman, et al., 2012), potentially due to difficulties with social interaction. The ALD group was also expected to engage in less independent reading than both their ALN and TD peers (who were not expected to differ), as difficulties with decoding and comprehension would make independent reading challenging and reduce motivation. Therefore, the children with ALD would potentially have less exposure to text.
2. Whether attitude to reading (in terms of enjoyment and literature preferences) differed between children with ASD and their TD peers, and whether this varied by language phenotype. We hypothesised that children with ALD would enjoy reading less than their ALN and TD peers. We also anticipated that children with ASD would be more likely than their TD peers to enjoy factual books, and less likely to enjoy fiction books (cf. Randi et al., 2010).

Method

Participants

Parents whose children had participated in reading studies run by the XXX lab at XXX between September 2011 and September 2012 were contacted within a month and invited to complete the HLE questionnaire. They were sent a printed booklet and a freepost addressed envelope. Of the 85 TD and ASD families contacted, 64 returned the questionnaire (75.29% response rate), on average 6 months after the child complete the reading assessments. There were no differences in the socio-economic status of responders and non-responders ($t(75) = 1.37, p = .175$), in the age of their children ($t(83) = 1.35, p = .242$), or in the sex composition of their children ($\chi^2(1, n=85) = .27, p = .600$). There were also no differences in the non-verbal cognitive abilities, language skills or reading accuracy of the children (all $t < 1.40, p > .150$), as indexed by performance on the Matrix Reasoning sub-test of the Wechsler Abbreviated Scales of Intelligence (WASI; Weschler, 1999), the Expressive and Receptive One-Word Picture Vocabulary Tests (Gardner, 1990a, 1990b) and the Test of Word Reading Efficiency (Torgesen,

Wagner, & Rashotte, 1999). Ninety-two percent of the parental questionnaires were completed by the child's mother, the remainder were completed by the child's father ($n=1$) or an unspecified parent ($n=3$). The study was approved by the Research Ethics Committee at XXX and informed, written consent was obtained from all parents.

The child sample comprised 41 children aged 7-13 with ASD, including 21 with age-appropriate structural language skill (ALN) and 20 with concomitant language disorder (ALD). For comparison, 23 TD children who did not have any reported special educational needs, a history of ASD or language delay were recruited from local schools. Children with ASD held an existing diagnosis based on DSM-IV/ICD-10 criteria from a multi-disciplinary team external to the research group and were currently in receipt of a statement of special educational need for placement in a specialist school or unit serving children with ASD. They also met diagnostic criteria on the relevant module of the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000). Children with ALD were receiving educational support for language difficulties and obtained a scaled score below seven (10th percentile) on the Recalling Sentences subtest of the Clinical Evaluation of Language Fundamentals (CELF-4UK; Semel, Wiig, & Secord, 2003), a sensitive diagnostic marker of language impairment in both autistic and non-autistic populations (Botting & Conti-Ramsden, 2003; Conti-Ramsden, Botting, & Faragher, 2001; Riches, Loucas, Charman, Simonoff, & Baird, 2010). Assessments were administered by the manuscript authors and the sample includes a subset of the children reported in XXX.

Child details are reported in Table 1. All children had English as their first language and English was the primary language spoken at home. Characteristics of the three groups were compared through one-way independent ANOVAs with either Games-Howell or Bonferroni post-hoc comparisons as appropriate. Socio-economic status was indexed by The Income Deprivation Affecting Children Index (IDACI, Department of Education, 2010) rank scores, which are a measure of the proportion of children under 16 that live in low income households. The families included in this study were of fairly high SES, but subtle group differences emerged. Due to the known association between SES and the HLE for TD children, the three TD children with lowest IDCAI rank scores were excluded from all analyses in order to 'match' all groups in terms of socioeconomic status, as was one child with ALN.

The three participant groups were matched on chronological age. However, the TD group had a lower proportion of males ($n=12$) than the ASD group (ALN and ALD both 19 male), $\chi^2(1, n=60) = 9.38, p = .002$. To determine whether this had any bearing on HLE, TD males and females were compared through chi square analyses. There were no group differences

in parental reading enjoyment (yes vs. no), parental reading frequency (daily vs. not daily), frequency of encouraging their child to read (daily vs not daily) or number of children's books (>100 vs. ≤100), with all $\chi^2 < .1.60$ and $p > .200$.

The three participant groups were also compared for non-verbal cognitive ability and language ability. Non-verbal cognitive ability was indexed by the Matrix Reasoning subtest of the WASI, which has high internal consistency with an alpha of .92, and adequate test-retest stability with a coefficient of .77 (Weschler, 1999). The CELF recalling sentences subtest has excellent internal consistency and test-retest reliability, with coefficients .91 and .90 respectively (Semel et al., 2003). Similarly, the Expressive One-Word Picture Vocabulary Test has excellent internal consistency and test-retest reliability with coefficients of .96 and .90 respectively (Gardner, 1990a). The Receptive One-Word Picture Vocabulary Test also has excellent internal consistency with an alpha of .96, and good test-retest reliability with a coefficient of .84 (Gardner, 1990b).

The TD and ALN groups were matched on all these cognitive and language measures, whereas the ALD group had significantly lower scores on the language assessments. The ALD group did not differ from their TD and ALN peers on non-verbal IQ raw score, but there was a trend for the ALD group to have lower standard scores than their TD peers ($p = .084$) and they differed from their ALN peers ($p = .023$). This is in-line with previous research (e.g. Lindgren et al., 2009) and for the sample as a whole there was a significant correlation between WASI non-verbal and verbal IQ scores ($r = .27, p = .047$), which is also consistent with previous research (cf. Conti-Ramsden, St. Clair, Pickles, & Durkin, 2012; Dennis et al., 2009). It would be theoretically and statistically inappropriate to control for NVIQ in our analyses, so we did not do so. The ALN and ALD groups were matched on autistic symptomatology, as indexed by ADOS Total scores (Lord et al., 2000) and Social Communication Questionnaire scores (SCQ; Rutter et al., 2003), whilst the TD children had significantly lower SCQ scores (see Table 1). The SCQ has excellent internal consistency with coefficients ranging from .84 to .93 across age groups, as well as high sensitivity and specificity, with values ranging from 0.85 - .90 and .72 - .86 respectively (Berument, Rutter, Lord, Pickles, & Bailey, 1999; Chandler et al., 2007). The ADOS also has high sensitivity and specificity, with values ranging across modules from .90 - .97 and .87 - .94 respectively.

*****INSERT TABLE 1 HERE*****

Materials

Single word reading ability was assessed using the sight word efficiency (SWE) and phonemic decoding efficiency (PDE) subtests of the TOWRE (Torgesen et al., 1999), although two children with ALD refused to complete the TOWRE due to the timed element. The TOWRE has high test-retest reliability, with coefficients ranging from .83 - .97 across the subtests and age ranges. Passage reading accuracy and comprehension were measured via the Neale Analysis of Reading Ability (NARA-II; Neale, 1997). This measure also has good test-retest reliability, with a coefficient of .89 for reading accuracy and .82 for reading comprehension.

Information regarding the HLE was gathered through a parental questionnaire which included 11 reading related questions, as well as questions about the child's development, diagnosis, and education. The majority of the questions regarding provision of resources and child reading have previously been used by the Education Quality and Accountability Office to gain understanding of the HLE of children aged 8-13, for both assessment and research purposes. This includes The Progress in International Reading Literacy Study (PIRLS), which is a large international study exploring children's literacy (Education Quality and Accountability Office, 1999a, 1999b; Mullis, Martin, Kennedy, & Foy, 2007). For the question regarding literature types, the response options were a reduced list of those utilised for research purposes by The Literacy Trust (Clark & Foster, 2005); items related to extended/substantial reading were selected (e.g. fiction books), whilst more minimal reading formats (e.g. posters) were omitted.

Parental Reading

Parental reading enjoyment was ascertained through the question "Do you enjoy reading?", with response options of 'no', 'yes, a little' and 'yes, a lot'. Parents were also asked how frequently they read and could respond 'rarely or never', 'a few times a month', 'every week' or 'almost every day'.

Provision of Resources

Provision of literacy materials was quantified through specification of the number of children's books in the family home, with response options including '0-10', '11-25', '26-50', '51-100' or '101+'. The first three categories were combined to form a <50 category as only two families (both ALD) reported having less than 26 children's books.

Child Reading

To assess the frequency with which children were engaged in facilitative reading practices parents were asked “How often do you do the following things?” and the items listed were: ‘read to your child’, ‘read with your child’, ‘listen to your child read’, ‘ask your child questions whilst you/they are reading’, ‘talk to your child about what he/she has read’, and ‘encourage your child to read materials that are not part of work for school (i.e. books, magazines)’. Additionally, parents were asked how often their child reads alone at home (i.e. reads independently). Response options included ‘rarely or never’, ‘a few times a month’, ‘every week’ and ‘almost every day’. To assess reading duration, parents were asked ‘How long do you usually spend reading with your child?’ and “How long does your child usually read for?”. Responses were assigned to one of three times bins: <15minutes, 15-30 minutes and >30mins.

Parents indicated whether their child enjoyed reading by selecting the applicable response from three options, ‘no’, ‘yes, a little’ or ‘yes, a lot’. Parents were also asked “Does your child enjoy being read/reading any of the following?” and eight types of literature were listed (fiction, factual, religious, newspapers, manuals, magazines, comics and websites) with the response options of ‘yes’ or ‘no’. However, 24% of parents omitted responses for religious literature, and 16% omitted responses for manuals, so these were excluded from analysis. Responses for magazines and newspapers did not differ by group, so these were combined into a ‘periodicals’ category. The response option of ‘other’ was also included with the opportunity to specify the type of literature, however only two parents actually selected this option. Both of these stated that their child (one ALN, one ALD) liked reading ‘signs’, and as these typically comprise single words rather than connected text these responses were not included in the analysis.

Results

Parental Reading and Provision of Resources

The relationship between the HLE and ASD status and language ability should be considered in light of the children’s parents’ attitude towards reading (see Table 2). Ninety percent of TD parents reported that they enjoy reading, as did 85% of ALN and ALD parents, $\chi^2(4, n=59) = 6.24, p = .182$. Nearly 70% of parents in each group read almost every day and encouraged their child to read on a weekly basis. Parents also provided literacy rich environments for their children, with 86.43% of families having more than 50 children’s books in their home. This suggests that the majority of parents in the sample consider reading to be important.

INSERT TABLE 2 HERE

Children's Reading Skill

Understanding the relationship between the HLE and ASD status and language ability, can be enhanced by consideration of the reading skills of the children. For the children with ASD there was substantial overlap between language and literacy competence, see Table 1. Post-hoc analysis following one-way ANOVAs indicated that the children with ALN achieved similar single word and passage reading standard scores as their TD peers (all $p > .05$). In contrast, the children with ALD attained significantly lower scores on all reading measures (all $p < .05$). Sixty one percent ($n = 11$) of the children with ALD attained TOWRE Total standard scores less than 85, indicating single word reading impairments, compared to only 16.67% ($n = 3$) of children with ALN. Additionally, three children with ALD had insufficient skill to accurately read passages, and 57% of the children with ALD who could complete the NARA-II attained an accuracy standard score below 85, whereas none of the TD and ALN children did. Furthermore, 85% of the children with ALD attained a NARA comprehension standard score below 85, relative to 16.67% of the ALN group and none of the TD sample.

Reading and Reading Discussion Frequency

The frequency of reading related activities is detailed in Table 3. The majority of children read independently on a weekly basis, with no differences between the three groups, $\chi^2(2, n=59) = 2.55, p = .280$. However, group differences emerged in terms of daily independent reading, $\chi^2(2, n=59) = 7.26, p = .027, V = .35$. Only 25% of children with ALD read independently on a daily basis, which chi square analysis indicated is significantly lower than the 65% of TD children who do so, $\chi^2(1, n=40) = 4.95, p = .026, V = .40$, and marginally lower than the 55% of children with ALN who do, $\chi^2(1, n=39) = 3.10, p = .078, V = .33$. We hypothesised that children with poorer reading, mainly those with ALD, would engage in independent reading less due to difficulty with reading and to explore this we conducted independent samples t-tests (Table 4). Children with ASD (ALN and ALD) who read independently daily ($n = 14$) achieved significantly higher TOWRE Total scores than those who do not ($n=23$). Additionally, the daily readers ($n = 13$) achieved significantly higher NARA accuracy and comprehension standard scores than those who read less frequently ($n = 16$).

Eighty-five percent of the children with ALD engaged in shared reading on a weekly basis, which is significantly higher than the 47% of TD and ALN children who did so (both $p = .031$). This was contrary to our hypothesis that children with ASD would engage in shared

reading less than their peers due to difficulties with social interaction. To explore potentially influential factors, logistic regression (for the sample as a whole) was conducted, with frequency of shared reading (weekly vs not-weekly) as the outcome variable. When age was entered into the first step of the model, the overall model was significant, $\chi^2(1) = 11.54, p = .001$ and accounted for around 20% of the variance in shared reading frequency (Cox & Snell: 19.56%, Nagelkerke: 27.08%). Age contributed significant variance, $\beta = -.79, \text{Wald}(1) = 7.95, p = .005$, thus younger children were more likely to engage in shared reading more frequently¹. When CELF recalling sentences raw score (an index of language skill), TOWRE raw sum (mean of SWE and PDE subtests) and SCQ score (an index of autism symptomatology) were entered into the next block of the model, the model was again significant, $\chi^2(4) = 23.48, p < .001$, and around 20% of additional variance was accounted for (Cox & Snell: 34.57%, Nagelkerke: 47.85%). Age remained a significant predictor, $\beta = -1.10, \text{Wald}(1) = 9.39, p = .002$. CELF raw score was approaching significance, $\beta = -.18, \text{Wald}(1) = 2.94, p = .086$, suggesting that children with poorer language skills were more likely to participate in shared reading on a weekly basis. TOWRE score was not a significant predictor, $\beta < .01, \text{Wald}(1) < .01, p = .994$. In line with the ANOVA analyses, SCQ score was also a significant predictor, $\beta = .09, \text{Wald}(1) = 5.38, p = .020$, suggesting that children with higher SCQ scores were more likely to engage in shared reading on a weekly basis. The final model accurately predicted 85.72% of the children who participated in shared reading on a weekly basis, and 72.22% of those who did not.

The frequency with which parents engaged their children in reading discussion was also high, but associated with language and reading competence. Eighty-five percent of parents asked their ALD children questions during shared reading on a weekly basis, which is significantly higher than the 50% of parents with TD children, $\chi^2(1, n=40) = 4.10, p = .043, V = .37$, and 31.58% of parents of children with ALN who did, $\chi^2(1, n=39) = 9.39, p = .002, V = .54$. Additionally, 90% of parentstalk with their child with ALD about reading on a weekly basis, which does not differ from the 65% of TD families, $\chi^2(1, n=40) = 2.29, p = .130$, but is significantly higher than the 45% of ALN families who do, $\chi^2(1, n=40) = 7.29, p = .007, V = .48$ (see Table 3).

*****INSERT TABLE 3 HERE*****

*****INSERT TABLE 4 HERE*****

¹ When IDACI rank was also entered this first step of the model (as an index of socioeconomic status) it was not significant, $\beta = <.01, \text{Wald}(1) = .21, p = .644$. In consideration of the sample size, SES was omitted from the reported model.

Reading Duration

Data regarding independent reading duration was not provided for nine children (6 TD, 2 ALN, 1 ALD); only three of these were weekly readers, the others read less frequently. As illustrated by Figure 1, over 50% of TD children and 44.44% of the children with ALN read independently for more than 30 minutes, compared to just 10.53% of the children with ALD. We hypothesised that children with poorer reading, mainly those with ALD, would engage in independent reading less due to difficulty with reading and to explore this we conducted independent samples t-tests (see Table 4). Children with ASD (ALN and ALD) who read alone for ≥ 15 minutes ($n = 20$) achieved significantly higher TOWRE Total scores than those who do not ($n = 13$). Children with ASD who read alone for ≥ 15 minutes ($n = 16$) also achieved significantly higher NARA accuracy and comprehension standard scores than those who do not ($n = 10$).

Data for shared reading duration was not provided for 17 children (7 TD, 8 ALN, 2 ALD); only four of these engaged in shared reading on a weekly basis, the others did so less frequently. Responses indicated that 23.08% of TD children engaged in shared reading for more than 30 minutes, compared to only 3% of children with ASD. This finding may reflect the difficulties children with ASD have with social interaction, thus we explored whether shared reading duration was associated with ASD severity through an independent samples t-test. Children with ASD (ALN and ALD) who engaged in shared reading for ≥ 15 minutes ($n = 16$) received lower SCQ scores ($M = 20.55$, $SD = 7.27$) than those who engaged in shared reading for < 15 minutes ($n = 11$, $M = 24.00$, $SD = 7.80$), but the difference was not statistically significant, $t(31) = 1.62$, $p = .256$.

INSERT FIGURE 1 HERE

Reading Enjoyment

Sixty-three parents answered the question regarding child enjoyment of reading and indicated that 73.90% of TD children enjoy reading (43.48% a little and 30.44% a lot), as do and 80% of children with ALN (55% a little and 25% a lot). In contrast, the majority of children with ALD do not enjoy reading, with only 25% enjoying it a little and 20% enjoying it a lot. However, chi square analysis determined that the group differences were not statistically significant, $\chi^2(4, n = 59) = 5.57$, $p = .230$. Across all three groups, enjoyment of fiction books was similar, $\chi^2(2, n = 56) = 1.08$, $p = .583$, as was enjoyment of factual books, $\chi^2(2, n = 57) =$

.463, $p = .729$. However, there was a trend for children with ALD to enjoy websites, $\chi^2 (1, n=57) = 2.99, p = .084, \phi = .29$, and periodicals, $\chi^2 (1, n=56) = 3.36, p = .067, \phi = .29$, less than their non-language impaired (TD and ALN combined) peers, yet enjoy comics more, $\chi^2 (1, n=59) = 3.59, p = .058, \phi = .30$ (see Figure 2).

*****INSERT FIGURE 2 HERE*****

Discussion

This study explored the HLE of school-aged children with ASD, taking into consideration both language phenotype and reading competence. There was an intimate relationship between language and reading abilities; children with ALD were more likely than their ALN and TD peers to demonstrate difficulties with single word reading accuracy, as well as passage reading accuracy and comprehension. This is in-line with previous research (Lindgren et al., 2009; Lucas & Norbury, 2015; Lucas & Norbury, 2014; Norbury & Nation, 2011) and consistent with the Simple View of Reading (Gough & Tunmer, 1986).

The vast majority of children with ASD had literacy rich homes; over 85% of families had more than 50 children's books. However, there were subtle differences in the home literacy practices of children with ASD and their TD peers. Contrary to expectation, children with ALD were engaged in shared reading and reading discussion more frequently than their non-language impaired peers. However, children with ALN and with ALD read with their parents for a shorter duration than their TD peers. Across groups, frequency and duration of independent reading was positively associated with reading ability, as was enjoyment of reading.

Reading Frequency and Duration

To date, the limited research on the HLE of children with ASD has focused on the pre-school years and indicates that the majority of parents read to their child at least twice a week, which is similar to TD families (Dynea et al., 2014; Lanter, Freeman et al., 2012). Likewise, the current study of school-aged children found that 85% of children with ALD participated in shared reading activities on at least a weekly basis. However, less than 50% of TD and ALN children did. As children become more proficient readers, they are less likely to engage in shared reading practices with their parents. Indeed, a recent survey of over 1000 families found that 65% of parents read to their 6–8 year old children on a weekly basis, yet only 37% of parents read to their 9–11 year old children (Scholastic, 2013). Poorer readers and children in the early stages of literacy development will need more support to enable them to access reading

materials and parents may ensure they engage their children with ALD in facilitatory activities as a means of fostering their language and literacy development.

However, whilst children who are proficient readers in late childhood rarely engage in shared reading, this does not mean that reading frequency diminishes from early to late childhood. The majority of TD and ALN children read independently on a daily basis and nearly 50% do so for at least 15 minutes. In contrast, only 25% of children with ALD read independently daily, with most reading for less than 15 minutes. This reduction is likely due to difficulties with decoding and comprehension.

Reading Discussion

When reading is accompanied by questioning and discussion it can facilitate language development (cf. Bus et al., 1995). It is therefore encouraging that over 85% of parents involve their children with ALD in reading discussions on at least a weekly basis. This suggests that parents recognise their child's increased need for literacy and language practice. Future research could explore whether the nature of parents' questions differs as a function of autistic symptomatology. Lanter, Watson et al. (2012) reported that 89% of parents questioned their child with ASD about characters' feelings, but it is uncertain whether parents targeted this concept specifically as it is an area of particular difficulty (Baron-Cohen, 1991). Additionally, it would be informative to determine whether differences are evident for children with Developmental Language Disorder (DLD) and their TD peers. Parents of children with DLD may ask simpler questions to increase the likelihood of a correct response, boosting the child's self-efficacy and potentially resulting in increased literacy attainment (Schunk & Rice, 1993; Shell, Colvin, & Bruning, 1995; Shell, Murphy, & Bruning, 1989). However, avoiding complex language may not stretch language skills sufficiently, limiting exposure to novel vocabulary and sentence structures. Open questions may be optimal to provide opportunities to practice language skill (Dickinson & Smith, 1994; Whitehurst et al., 1994). Indeed, high-quality conversations during shared reading are linked to gains in language production and comprehension (Dickinson, 2011; Dickinson & Tabors, 2001).

Reading Enjoyment

Previous research has indicated that young children with ASD do enjoy shared reading, albeit less than TD children (Dynea et al., 2014; Lanter, Freeman et al., 2012). However the influence of language and literacy competence was not taken into consideration, even though these factors are positively associated with attitude to reading for non-autistic children (Chall &

Jacobs, 2003; Frijeters et al., 2000; Kaderavek & Sulzby, 1998; Sawyer et al., 2014). We found that around three quarters of the ALN and TD participants in the current study enjoy reading, yet less than half of children with ALD do. Statistical analyses determined that the groups did not differ statistically, but future research using but a more sensitive Likert scale is advised, examining independent and shared reading enjoyment separately.

With regards to literature types, enjoyment of factual vs fiction books was a key comparison (cf. Randi et al., 2010); however over 70% of children with ASD like both genres, regardless of language phenotype. Nevertheless, relative to TD and ALN children, fewer children with ALD enjoy periodicals, yet more like comic books. Comic books typically have fewer words so less experienced readers may find them easier to access. Indeed, 70% of primary school pupils enjoy comics, relative to only 44% of secondary school pupils (Clark & Foster, 2005). As vocabulary varies by literature type, interest in a range of materials should be encouraged to facilitate language development. This may be aided by the growing increase in children's engagement with digital media, which can provide access to a range of resources (Ofcom, 2014).

Implications

The results indicate that the children with ASD involved in this study grow up in literacy rich environments, and their parents promote literacy development, and by association, language development. However, it should be noted that the families involved in this study were of relatively high socio-economic status, and previous research suggests that literacy practices vary by SES (Bracken & Fischel, 2008; Sénéchal et al., 1998).

Parents appear to be especially sensitive to their ALD children's additional needs and prepared to spend extra time engaging them in facilitatory literacy practices. This is reinforced by the positive beliefs regarding shared reading expressed by the parents of pre-schoolers with ASD (Dynea et al., 2014). Parents may therefore be ideally placed to assist with/deliver interventions. However, for non-autistic children there is a positive relationship between language competence and the benefit derived from shared literacy practices (Justice, Chow, Capellini, Flanigan, & Colton, 2003; Kaderavek & Sulzby, 2000). This suggests that perhaps children with ALD need more explicit, rather than implicit teaching, with emphasis on language development. Indeed, when parents of non-autistic children with language delays are trained in shared reading techniques, there is an increase in their children's language skills, especially when there is emphasis on questioning, as well as expansion and recasting of children's utterances (Crain-Thoreson & Dale, 1999).

For children with ASD the duration of intervention sessions will require consideration. The current study found that whilst shared reading *frequency* was associated with language and literacy skill, shared reading *duration* was associated with ASD status. Although 23% of TD children usually spend more than 30 minutes reading with parents, only one child with ASD does so. It was hypothesised that this may reflect difficulties with social interaction, but this assertion was not supported by the statistical analyses. Potential reasons for the shorter duration should therefore be explored in future studies.

Limitations and Future Directions

The current study contributes to the scarce literature on the HLE of children with ASD, but there are limitations that require consideration. For example, data regarding the nature of the HLE environment was obtained through parental report. The importance of caregivers reading with children is well-reported within the media (e.g. Burns, 2013), which could bias caregivers into reporting elevated levels of literacy activities. However, parents in the current study reported the full range of responses, with some indicating that they ‘rarely’ engage their children in any literacy activities. Validation via researcher observations was not within the constraints of this study, but could be incorporated into future research. Future research could also explore shared reading practices in more detail, for example by examining who initiates and ends reading sessions, the specific nature of parental input during shared reading, and whether practice differs depending upon the sex of the child.

Inclusion of a group of non-autistic children with DLD would further enable the influence of language competence and autistic symptomatology to be disentangled, and indicate whether the additional input the children with ALD receive is consistent with their developmental level. This will not only increase our theoretical knowledge of the topic, but also have important implications for parental and educational practice. However, this raises the issue of which aspect of language and/or reading to ‘match’ on. Both are multi-faceted constructs and children with developmental disorders often have an uneven profile of development (Jones et al., 2009; Joseph, Tager-Flusberg, & Lord, 2002). The same difficulty arises when considering including a younger language or reading matched comparison group for the ALD sample. Additionally, given the reading level of the children with ALD, TD children with similar reading skill are likely to have had less exposure to text and received less reading instruction. They are also likely to have been exposed to a smaller range of vocabulary, which will alter the nature of the reading process.

Future research will most usefully adopt a longitudinal approach. Documenting the HLE of children from pre-literacy instruction to late childhood and beyond will enable the relationship between the HLE and literacy development to be assessed at multiple time points. This could determine whether diversity in the HLE of children with different linguistic and literacy profiles is a cause or consequence, and provide insight into how parents adapt to the changing needs of their children. Whilst doing this it would be pertinent to consider not only the type of parent-child interactions and independent literacy practices, but also consider the quality of these experiences. Furthermore, valuable information could be attained by including the children's perspectives, as well as those of their parents, and taking a mixed-methods approach comprising both questionnaires and interviews or focus groups.

Conclusion

This study contributes to the minimal literature on the HLE of children with ASD, extending our knowledge to include school-aged children. Children with ALD (who are poorer readers) participate in facilitatory literacy practices, such as shared reading and reading discussion, more frequently than their ALN and TD peers. This suggests that parents are sensitive to their children's needs and may be well placed and willing to assist with interventions. Once children with ASD become competent readers they enjoy reading, and read alone as frequently and for a similar duration, as their TD peers. Future research will most usefully adopt a longitudinal approach, to provide insight into the bi-directional relationship between the HLE and both literacy and language competence for children with ASD.

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Table 1*Child Details*

Variable	TD <i>M</i> (SD) <i>n</i> =20	ALN <i>M</i> (SD) <i>n</i> =20	ALD <i>M</i> (SD) <i>n</i> =20	<i>F</i> -value	<i>p</i> -value	η_p^2
Chronological age (Years)	10.44 ^a (1.06) 8.72-12.51	10.92 ^a (1.79) 7.93-13.30	11.31 ^a (1.28) 8.32-13.22	1.90	.158	.06
Socio-economic status (IDACI rank)	21002 ^a (3970)	24815 ^a (5686)	20815 ^a (8536)	2.32	.108	.08
Matrix Reasoning WASI NVIQ (Raw score)	22.35 ^a (4.08)	24.80 ^a (10.13)	20.75 ^a (4.38)	1.89	.174	.06
Matrix Reasoning WASI NVIQ (T-score)	52.70 ^{ab} (6.34)	55.35 ^a (9.44)	47.05 ^b (9.49)	3.50	.011	.11
Language ability:						
Vocabulary Definitions WASI VIQ (T-score)	58.45 ^a (6.48)	57.80 ^a (9.28)	37.94 ^b (11.22)	28.59	<.001	.52
Expressive one-word picture vocabulary test (Standard score)	112.74 ^a (13.38)	117.94 ^a (14.83)	84.10 ^b (14.22)	25.37	<.001	.51
Receptive one-word picture vocabulary test (Standard score)	110.58 ^a (12.24)	117.45 ^a (17.28)	78.85 ^b (14.54)	38.19	<.001	.54
Recalling Sentences CELF (Scaled score)	10.00 ^a (2.11)	10.73 ^a (3.13)	4.11 ^b (3.58)	32.14	<.001	.58
Reading skill:						
TOWRE SWE (Standard score)	108.37 ^a (11.41)	101.31 ^a (13.07)	80.61 ^b (17.63)	18.82	<.001	.42
TOWRE PDE (Standard score)	108.63 ^a (15.05)	105.47 ^a (13.92)	84.72 ^b (17.75)	12.57	<.001	.33
NARA accuracy (Standard score)	109.24 ^a (9.81)	109.19 ^a (13.78)	83.77 ^b (13.10)	20.13	<.001	.48
NARA comprehension (Standard score)	97.00 ^a (7.45)	97.25 ^a (11.78)	75.77 ^b (7.37)	25.25	<.001	.54
Autistic symptomatology:						
Social Communication Questionnaire (Total)	4.44 ^a (4.36)	19.56 ^b (8.26)	22.22 ^b (8.65)	30.64	<.001	.55
ADOS (Total Score)	—	9.71 ^a (2.80) 7-15	11.83 ^a (3.46) 7-18	1.99	.079	<i>d</i> = .67

Values with the same superscript to do not differ when $p < .05$, as determined by either Games-Howell or Bonferroni ANOVA post hoc comparisons as appropriate.

Table 2*Parental Characteristics*

Variable		TD (%) max n=20	ALN (%) max n=20	ALD (%) max n=20
Percentage of parents who enjoy reading (n = 59)	Yes, a lot	35.00	57.89	65.00
	Yes, a little	55.00	26.32	20.00
	No	10.00	15.78	15.00
Frequency with which parent reads at home (n = 60)	Rarely	0	0	0
	Monthly	10.00	0	0
	Weekly	25.00	10.00	25.00
	Daily	65.00	90.00	75.00
Frequency with which parent encourages their child to read (n = 58)	Rarely	15.00	0	0
	Monthly	10.00	16.67	15.00
	Weekly	55.00	38.89	45.00
	Daily	20.00	44.44	40.00
Number of children's books at home (n = 59)	≤50	5.00	10.53	25.00
	51-100	50.00	36.84	25.00
	>100	45.00	52.63	50.00

Table 3*Child Literacy Practices*

Variable		TD (%) max n=20	ALN (%) max n=20	ALD (%) max n=20	Group differences (Weekly vs not-weekly)
Child reads independently	Rarely	5.00	15.00	20.00	$\chi^2 (2, n=59) = 2.55,$ $p = .280, V = .21$
	Monthly	15.00	5.00	20.00	
	Weekly	15.00	20.00	35.00	
	Daily	65.00	55.00	25.00	
Engaged in shared reading	Rarely	26.32	31.58	5.00	$\chi^2 (2, n=58) = 7.75,$ $p = .021, V = .37$
	Monthly	26.32	21.05	10.00	
	Weekly	36.84	15.79	30.00	
	Daily	10.43	31.58	55.00	
Question during shared reading	Rarely	20.00	26.32	0	$\chi^2 (2, n=59) = 11.71,$ $p = .003, V = .45$
	Monthly	30.00	41.11	15.00	
	Weekly	40.00	5.26	40.00	
	Daily	10.00	26.32	45.00	
Talk about reading	Rarely	15.00	5.00	0	$\chi^2 (2, n=60) = 9.15,$ $p = .010, V = .39$
	Monthly	20.00	50.00	10.00	
	Weekly	45.00	20.00	45.00	
	Daily	20.00	25.00	45.00	

Table 4*Independent reading frequency, duration and reading skill (Mean [SD]) for children with ASD*

Variable	Independently read daily	Independently read less than daily	Group differences
TOWRE Total standard score	102.21 (18.64)	83.19 (21.44)	$t(33) = 2.71, p = .011,$ Cohen's $d = 0.95$
NARA accuracy standard score	107.08 (17.03)	90.25 (16.40)	$t(27) = 2.70, p = .012,$ Cohen's $d = 1.05$
NARA comprehension standard score	93.77 (12.44)	82.63 (14.82)	$t(27) = 2.16, p = .040,$ Cohen's $d = .81$
	Independently read ≥ 15 minutes	Independently read < 15 minutes	Group differences
TOWRE Total standard score	99.05 (20.57)	77.46 (20.68)	$t(31) = 2.94, p = .006,$ Cohen's $d = 1.05$
NARA accuracy standard score	105.63 (17.94)	86.50 (15.51)	$t(24) = 2.78, p = .010,$ Cohen's $d = 1.14$
NARA comprehension standard score	92.50 (14.81)	79.10 (12.09)	$t(24) = 2.40, p = .025,$ Cohen's $d = .99$

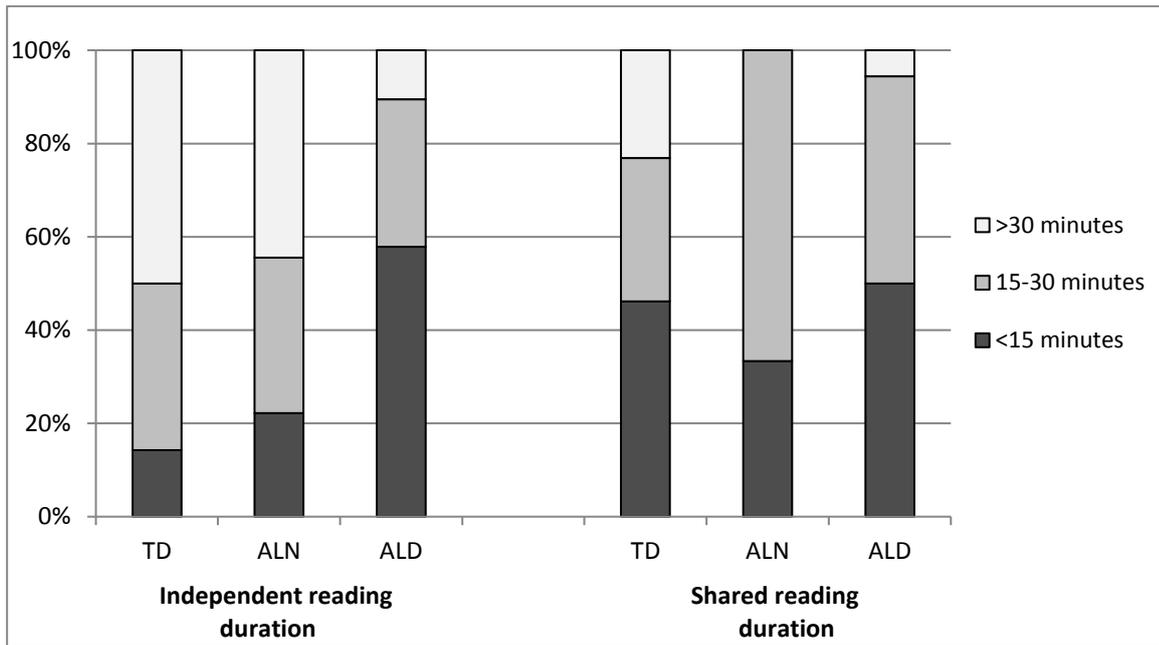


Figure 1 *Reading Duration*

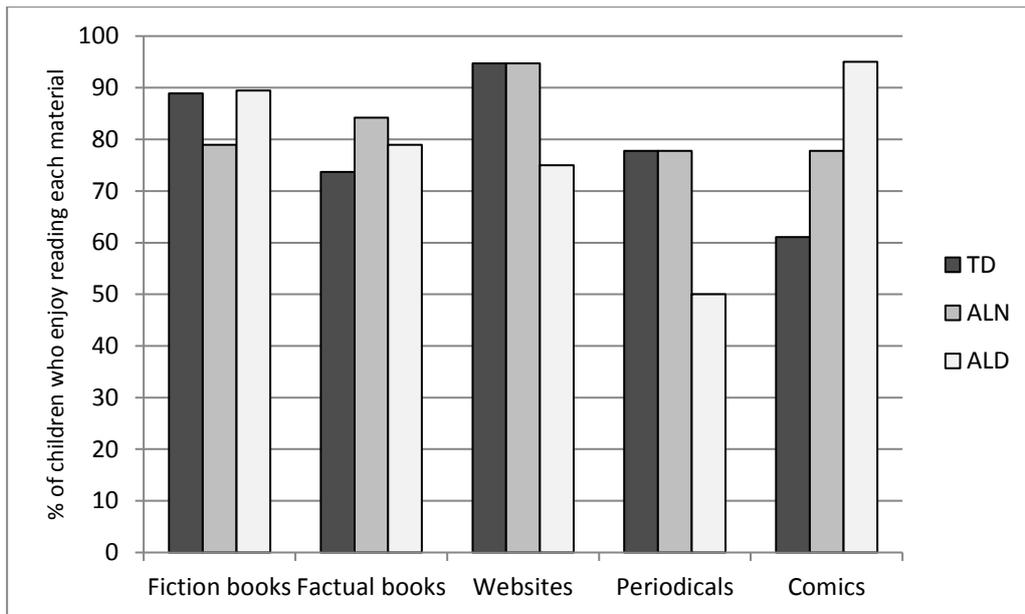


Figure 2 *Percentage of Children who Enjoy Each Type of Literature*