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Open access to living books on the internet: a new chance to bridge the linguistic gap for at-risk preschoolers?

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The Dutch website Bereslim (www.bereslim.nl) provides digital picture story-books for three- to seven-year-olds for daily use. The present study investigates whether this new opportunity to enhance linguistic development actively assists preschool children from low- and high-educated families in an equal manner. We looked closely at the characteristics of the 1781 persons who visited the Bereslim website between March and October 2006, when the digital books were available free of charge. To get access, visitors had to complete a brief questionnaire about characteristics of the child (date of birth, gender, school and grade) and parents (educational level, membership library, number of storybooks bought in the last six months, and how they found the website), how the child spent his or her leisure time, whether he or she used (new) media (i.e. amount of time and content of shows/ games/books and favourite websites, programs and books), whether the parents participated in different activities from their children and if their children already are familiar with the five books on the site. We found that the bulk of low-educated families who most need this additional opportunity of literacy enhancement were absent. Attempts to create new chances for at-risk children from low-educated families have often failed, as it did this time in another natural experiment.

Keywords: digitised picture storybooks; learning through the internet; closing the language gap; low-income preschool children; preschoolers at risk; home literacy environment

The home literacy environment in low-income families is less rich compared with families with a high income (Bradley et al. 2001; Smith and Dixon 1995; Weigel, Martin and Bennett 2006) and therefore children in low-income environments are assumed to run the risk of reading problems (Hecht et al. 2000; Noble, Farah and McCandliss 2006; Snow, Burns and Griffin 1998). According to Stahl (1999), linguistically deprived three-year-old children, (i.e. those eligible for state-funded early and pre-school education) have five times fewer words at their disposal than their peers from higher socio-economic status (SES) families. On average they hear 615 words/hour, whereas a child from middle or high SES families hears 1251 or 2153

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words/hour respectively. When entering school, the difference between linguistically deprived children and children with a rich vocabulary increases in the following years; they learn 750 versus 3000 new words per year (Baker, Simmons and Kame'enui 1998). This means that children from low SES families are not equally equipped to profit from education, putting them at risk for special education referral (Croll 2002; Delgado and Scott 2006; Van der Veen, Smeets and Derriks 2010). When the focus in reading instruction changes from learning to read to reading to learn, language skills and background knowledge become limiting factors (Chall 1983; Cunningham and Stanovich 1998).

New electronic methods may provide young children with alternative language and literacy learning opportunities in preschool age (de Jong and Bus 2003). For instance, Bereslim, sponsored by a private company, constructed a Dutch website with high-quality picture storybooks for three- to seven-year-olds in close collaboration with experts in the field of education. By adding oral instead of written text, digital picture storybooks have the advantage that book reading is less dependent on an adult (Reinking, Labbo and McKenna 1997). Video replaces the illustrations in the print version of the picture storybook while the literary and artistic quality of the original illustrations are retained. Similar electronic books are available in other languages (e.g. the Scholastic Video Collection of award-winning picture storybooks) on DVD as well as through internet. The wealth of these 'living books' available on the internet includes high-quality (e.g. www.storylineonline.net) as well as low-quality books (e.g. <http://tarheelreader.org/>) without video or a speech to text option (e.g. <http://www.bookbox.com>; <http://www.readinga-z.com/>).

The research so far has demonstrated that video additions make digital stories more self-explanatory. Children at risk and scoring at the lower end of standardised language tests benefited from independent encounters with this new generation of living books (Bus, Verhallen and Van der Kooy-Hofland 2009; Verhallen, Bus and de Jong 2006; Verhallen and Bus 2010). Experimental studies showed that it is not just their text comprehension that improved but also their vocabulary as well and that improvements were stronger compared to groups who heard the same stories but saw static pictures.

The investigation of how evidence-based interventions can find their way to children at risk is essential but neglected so far. In this article we report whether free access through the internet promotes book exposure in young at-risk children. During a period of six months some of the electronic storybooks on the Bereslim internet site that were normally only available via subscription (www.Bereslim.nl) were made available free of charge to encourage parents to get to know the website. Visitors were attracted by linking Bereslim to free websites related to TV shows frequently visited by young children in the Netherlands (e.g. peuterplace.nl) and advertisements through schools, libraries and magazines about education. Between March and October 2006 the site presented a series of five recently published and prize-winning picture storybooks appropriate for children in the age range of three to seven. The website thus unlocked living picture storybooks for daily use.

The present study investigates to what extent free of charge computer programs available through the internet may offer a new opportunity to enhance the linguistic development of at-risk children from the lowest-educated families eligible for state-funded early and pre-school education (Voor- en Vroegschoolse Educatie) (VVE). Bereslim is accessible to most children as in the Netherlands, computers are found in 92% of the households with children between 0 and 12 and most families (81%) also

have internet access (Centraal Bureau voor de Statistiek [CBS] 2008). Calvert et al. (2005) reported that children as young as two use computers with the help of their parents, and three year olds already manage to control some functions on their own, such as manipulating the mouse. Anand and Krosnick (2005) found that the usage of the computer increases until children are six years old. These authors did not find a difference in media use between low- or high-income families or between boys and girls.

This is the first natural experiment to test whether free-access internet programs with animated storybooks for young children can reduce the pedagogical divide between groups varying in educational background. In comparison with high-educated parents, low-educated parents may be less inclined to share books with their children or to initiate other literacy promoting activities (e.g. Bradley et al. 2001). However, even when parents do not expose their children to books they may enable their children to 'read' storybooks through the internet especially when authorities - libraries, schools, and magazines for parents - advertise visits to Bereslim in preparation for learning to read in first grade. In line with this argument, the visitors of Bereslim may show a distribution of educational levels that mirrors the distribution in Dutch society. Even children from the lowest-educated families eligible for VVE may visit websites such as Bereslim. Many Bereslim visitors may be deprived of traditional literacy activities such as book sharing but educational programmes through TV and internet may be within reach of this group.

If visits to educational websites such as Bereslim parallel children's television watching patterns, Bereslim visitors might originate more from higher- than lower-educated families. The literature shows that higher-educated parents not only undertake more traditional literacy-promoting activities with their children but also that their children watch relatively more educational programmes that are more supportive of literacy than entertainment programmes (Anand and Krosnick 2005; Ennemoser and Schneider 2007). According to this view, we may expect that visitors from lower-educated families, and especially from the VVE group, form not more than a small minority among Bereslim visitors.

Such differences in internet use refer to the so-called *digital divide*: low-educated families have *access* to computer programs but have fewer benefits *derived from* access. For instance, *Sesame Street*, which was started to bridge the gap between young children growing up in a stimulating home environment and children growing up in a less stimulating environment, did not have the expected effects because high-educated parents exposed their children more to the programme than the low-educated (Cook et al. 1975). More recently, Neuman and Celano (2006) considered the impact of converting neighbourhood branch libraries into technologised modern urban library systems to improve the lives of disadvantaged children and their families. Despite heavy library use by both low-income and middle-income children, quality differences in the way resources were used appeared actually to widen the knowledge gap between these groups.

So far there is no understanding of how lower- and higher-educated families use educational software available through the internet. To investigate the characteristics of those children who visited the Bereslim website, we asked each child's caregiver to complete a questionnaire when they first visited in the period that the digital books were available free of charge. The questions concerned child's age, parental education, home literacy activities, television viewing behaviour and computer activities. Based on this questionnaire, we intended to answer the following research questions:

- (1) Does the group visiting Bereslim show a distribution of educational levels that matches the distribution in Dutch society?
- (2) Do visitors to Bereslim undertake literacy-promoting activities with their children such as sharing books above chance level, and do they have a preference for educational programmes on TV and for educational computer games?
- (3) Is there evidence for a positive relationship between literacy activities and educational level of the parents and likewise between the use of new media for educational purpose and the educational level of the parents?

Method

Participants

Participants included 1512 children and their parents who visited the Bereslim website unprompted and at least once in 2006 between March 1 and September 15 and completed the questionnaire to obtain free access to the electronic books for the period during which the website was accessible. Originally, 1781 respondents filled in the questionnaire, but 269 were excluded from analyses for one of the following reasons:

- (1) Child more than seven years old.
- (2) Users other than parents (e.g. teachers, libraries).
- (3) Respondents who participated for the second or third time and had forgotten their password.
- (4) Respondents who did not fill in the questionnaire seriously, e.g. giving answers such as sfsffdsfdfsdfd.

Measures

In the current study we analysed answers to 23 questions in the questionnaire that were stored in the Bereslim database. The questions concerned characteristics of the children (date of birth, gender, school, and grade) and parents (educational level, membership library, amount of storybooks bought in the last six months, and how they found the website), how the children spent their leisure time, whether they used (new) media (amount of time and content of shows/ games/books, favourite websites, programs and books), whether parents participated in different activities of their children and whether their children were already familiar with the five books on the Bereslim site. As an indicator of media use, parents were asked to name favourite shows, games, websites, programs and books. This was inspired by the finding that the parents' ability to list one or more favourite books is the best indicator of actual book sharing (Bus, Vanijzendoorn and Pellegrini 1995). An earlier draft of the questionnaire was piloted to trace ambiguous questions and to check that completion of the questionnaire took five to minutes at most.

Statistical procedure

The distribution of educational level of parents was compared with the distribution in the Netherlands in general (CBS 2006) and chi-square tested. Literacy activities and the (educational) use of new media were correlated with demographic characteristics. Participants eligible for stimulation programmes (VVE) and considered to be at-risk for learning problems were compared with other participants.

Added or adjusted variables

Some variables from the questionnaire were recoded before analyses.

- (1) The age of the child was calculated by subtracting the date of birth from the mean date participants visited the website (June 8, 2006) and reported in round half-year figures.
- (2) For children younger than three, we created grade 0, since this young group does not yet go to school in the Netherlands.
- (3) The educational level of the participants used in the analyses is identical to the classification made up by CBS (the Dutch department for statistics) in 2006 and consists of three groups (low, middle and high).
- (4) A second variable was constructed to distinguish at-risk children eligible for a stimulation programme from the rest. When both parents have a low educational level children are eligible for a stimulation programme.
- (5) Broadcasting channels were divided into programmes that stimulate cognitive skills and knowledge, hereinafter known as *educational* (Z@ppelin, channels 1 and 2, Belgium 1, BVN, Animal Planet and National Geographic) and *entertaining* programmes (cartoons and similar channels). A new variable was added to indicate if the channel most often viewed was educational or not.
- (6) TV programmes were also divided into *educational* (i.e. promoting cognitive skills and environmental knowledge) and *entertainment* (cartoons and similar programmes). Often-mentioned educational programmes were *Blue's Clues* (in Dutch), *Bruine Beer in het Blauwe Huis*, *De wereld is mooi*, *Dora*, *Flip de beer*, *Huisje, boompje, beestje*, *Jeugdjournaal*, *Journaal*, *Klokhuis*, *Koekoeloe*, *Lingo*, *Puk en ko*, *Sesamstraat*, *Teletubbies*, *Tiktak*, *Tweenies*, *Wawa's*, *Willem Wever* and *Zandkasteel*. A new variable was added to indicate whether the favourite programme of the child mentioned first was educational or not and another variable indicating whether the first mentioned programme watched by the child together with a parent was educational or not.

Results**Demographic characteristics of the participants**

The target audience of the internet site Bereslim was children between three and seven. In total, 1512 respondents were included in the analysis. The number of boys and girls was the same (50.5% boys) and most children were between 3.5 and 5 years old (49.9%). The age was normally distributed with a mean of 4.5. Most parents found the Bereslim site through links on free websites related to entertainment on TV (42.3%). Other had read about it in magazines about education (24.1%). The remaining parents visited the site through school, personal contacts, TV, the newspaper, colleagues or library. The parents' educational level is shown in Table 1. More than 50% of them have received a high education (higher secondary professional education or scientific) and only 12–15% were low educated (lower vocational education).

Leisure time

Most parents undertook literacy-related activities: they were members of the library (75.4%) and had bought one to three (46.1%) or even more than three (33.7%) picture storybooks or other books for their children in the last six months.

Table 1. Distribution (frequency and percentages) of parents' educational level in the sample (N=3024) compared to the distribution in Dutch society (CBS 2006).

Education	Frequency (sample)	% of sample	% of Dutch society ^a
Low (father/mother) (elementary, primary education, lower and middle vocational education)	433 (238/195)	14.3	33.6
Middle (father/mother) (higher general secondary education, lower secondary professional education)	988 (474/514)	32.6	41.2
High (father/mother) (higher secondary professional education, college, university)	1603 (800/803)	53.0	25.2

Note: ^aThe distribution in the sample differed significantly from that in Dutch society ($\chi^2 = 19.25$, $df = 2$, $p < .001$).

Favourite activities

Respondents indicated two of their child's most favourite activities from a choice of nine possibilities (playing outside, playing with toys, reading (being read to), watching TV, playing on the computer, watching DVD/video, sports, listening to music and creative activities). Among activities that visitors of Bereslim liked best in their leisure time were playing outside (60.4%), playing with their toys (34.9%) and being read to (32.7%). They less frequently preferred playing on the computer, watching TV or watching DVD/video (17.4, 15.7 and 14.5% respectively). The least favourite activities were creative, music and sports activities. The chance that an activity was randomly chosen was 22%. On average, reading (to) was chosen in 32.7%, a score that was significantly more than at chance level (binomial test, $p < .001$).

Computer

All children made use of the computer, most of them (59.1%) more than once a week. Parents reported that only 20.6% sat alone at the computer: the others were joined by their parents (67.4%), brother or sister (10.6%) or friends (1.5%). Most children (79.4%) were allowed to play games on the computer and some (27.1%) are even allowed to surf the internet. Also, most children had access to educational computer software (69.0%). Most respondents (58.5%) had one or more favourite computer games and two of the three most favourite computer games mentioned were educational. Most respondents (58.7%) also had one or more favourite websites, all containing educational elements.

Television

A small minority (5.9%) reported that their child did not watch television. When watching television, the most favourite channel mentioned was educational for 65.5% of the children. Also, 69.2% had one or more favourite programmes and 45.8% of these were educational. Most parents reported that they watched one or

more television programmes with their child (54.0%), which were mostly (8 out of 10 times) educational.

Reading behaviour

About 54% of the respondents mentioned one or more favourite books of the child. The books available on the website Bereslim were all familiar to some extent: *Beer is op vlinder* (13.1%), *Bolder en de boot* (3.5%), *Met opa op de fiets* (10.5%), *Rokko krokodil* (8.8%) and *Tim op de tegels* (79.3%). Almost all parents expected that their child would like the books.

Educational level of respondents compared to the distribution in Dutch society

The percentage of low- and moderately educated people who visited Bereslim was lower than might be expected on the basis of the distribution of educational levels in Dutch society (CBS 2006). As can be seen in Table 1, the higher-educated people were overrepresented in our sample survey. The frequency distribution differed significantly from the expected distribution ($\chi^2 = 19.25$, $df = 2$, $p < .001$). Parents visiting Bereslim mainly belonged to the highest educated group in the Netherlands.

Relationship between demographics, literacy and new media variables

The correlations between parents' educational level, literacy and new media variables are summarised in Table 2. Educational levels of both parents were positively related to literacy variables and negatively to the use of new media. It appears that highly educated parents, especially mothers, stimulated or undertook more book-related activities, but were less inclined to use new media (computer activities) than lower-educated mothers. For the highest-educated fathers the same pattern was found, albeit that few correlations were significant, indicating that mothers have more influence on the activities of young children.

Children eligible for stimulation programmes

If both parents received the lowest level of schooling (primary education, lower and middle vocational education) their children were considered at risk for learning problems and eligible for state-funded early and pre-school education (VVE). The current respondent group consisted of significantly fewer VVE participants (7.9%) than may be expected (33.6%; $\chi^2 = 18.84$, $df = 1$, $p < .001$). As is shown hereafter, they differed in several ways from the remaining non-VVE respondents.

Parental literacy

Most parents had a library membership and we found no difference between the (non) groups. Most parents bought some storybooks for their children, but compared to the VVE group, more parents in the non-VVE group had purchased four or more books in the last 6 months (24.2 versus 34.5%), $\chi^2 = 5.27$, $df = 1$, $p = .022$ and fewer parents in non-VVE group bought no books at all (33.3 versus 19.1%), $\chi^2 = 13.85$, $df = 1$, $p < .001$.

Table 2. Correlation between parents' educational level, literacy and new media variables.

	Educational level father	Educational level mother
Literacy		
Membership of the library?	.04	.07*
How many storybooks did you buy last 6 month?	.08**	.15**
What does child likes best: reading (to)?	.04	.11**
How many titles of favourite books are mentioned?	.03	.08**
New Media		
What does child likes best: watching TV?	-.03	-.04
What does child likes best: playing games on computer?	-.03	-.06*
Does the child often use the computer?	-.09**	-.10**
Does the child play games on the computer?	-.03	-.06*
Does the child surf on the internet?	-.07**	-.09**
Does the child have educational CD-ROMs?	-.05	-.03
How many favourite websites of the child are mentioned?	-.05	-.02
How many favourite TV programmes of the child are mentioned?	-.06*	.01
How many favourite TV programmes of the child mentioned are viewed with parent?	-.02	.01

Notes: N = 1512; * $p < .05$; ** $p < .01$.

Leisure time expenditure

Just like non-VVE children, VVE children liked being read to in their leisure time ($\chi^2 = 0.44$, $df = 1$, *n.s.*). On average, reading (being read to) was indicated as a favorite activity in 33.0 and 30.0% respectively, which is significantly higher than at chance level in both groups (binomial test, $p < .001$ and $p = .025$, respectively).

Computer

Among the VVE group, everyday computer use was more frequent than among the non-VVE group (18.3 versus 11.6%), $\chi^2 = 4.76$, $df = 1$, $p = .029$. Also, children in the VVE group played more often with a peer rather than with a parent or older brother or sister (4.5 versus 1.6%), $\chi^2 = 3.79$, $df = 1$, $p = .052$) but were as often on their own compared to the non-VVE group (25.8% versus 20.1%). Both groups played games on the computer and both had educative CD-ROMs, and the top three of favourite computer games contained two educational games in both groups.

Television

Children in the non-VVE group more often mentioned the educative channel as their favourite than children in the VVE group (69.8 vs. 53.6%; $\chi^2 = 12.65$, $df = 1$, $p < .001$). No differences were found between children in the non-VVE group and children in the VVE group in how often they mentioned an educational programme as their favourite. The percentages of children who watched television programmes together with their parents were similar in both groups. The type of programmes children watched with their parents was mainly educative in both groups.

Reading behaviour

Compared to the VVE group, more parents in the non-VVE group mentioned at least two favourite books ($\chi^2 = 5.37$, $df = 1$, $p = .021$). The books available on the Bereslim website were equally familiar to both groups, but more parents in the non-VVE group thought that their children would like them (92.6 versus 87.5%), $\chi^2 = 4.00$, $df = 1$, $p = .046$).

New media activities and literacy activities

Both groups undertook similar numbers of new media activities, (five to six out of nine), but the non-VVE group undertook more literacy activities than the VVE group: $\chi^2 = 4.00$, $df = 1$, $p = .046$. Of the parents in the non-VVE group, 84.5% undertook at least two out of four literacy activities with their children compared to 70.8% of the parents in the VVE group.

Discussion

Living books on the internet do not create new opportunities to close the gap between normally developing and linguistically deprived VVE children, who are considered to be at risk for learning problems. In agreement with the general finding that higher-educated families usually create a richer literacy environment for their children (Bradley et al. 2001; Smith and Dixon 1995; Weigel et al. 2006), Bereslim was mainly visited by children from higher-educated families. Indeed, buying and reading books were favourite literacy activities among Bereslim visitors, and in addition, 75.4% had a library membership whereas only 16.0% of the 25–34-year-olds in the Netherlands are active members of a library (CBS, 2008). Also, watching TV and being at the computer were less favourite activities for the Bereslim group, but the way they use these new media was educative for the greater part.

Online storybook reading is not the panacea to increasing access to books in lower-educated families. Children at risk of a linguistically delayed development – the VVE group – were underrepresented in the group of Bereslim visitors. Overall, the minority of VVE visitors differed from the non-VVE visitors in the usual way (e.g. Ennemoser and Schneider 2007; Smith and Dixon 1995; Weigel et al. 2006), thus validating the self-reported data about literacy learning opportunities: the VVE group bought fewer books, parents were less able to mention favourite books and undertook fewer literacy activities. This group also encouraged watching entertainment programmes rather than the educative channel. On the other hand, the visitors to Bereslim that belong to the VVE group were also unusual. Reading was one of the three most favourite activities mentioned by non-VVE as well as VVE visitors to the site. This indicates that in some respects the limited number of children from lower-educated families visiting Bereslim was a special group with a comparatively high interest in literacy-related activities.

Anyhow, we missed the majority of low-educated families who most needed this new opportunity of literacy enhancement. Although these families usually have access to the internet (Sociaal Cultureel Planbureau [SCP] 2007), and despite the fact that Bereslim is linked to popular sites related to entertainment on TV and the website is advertised through schools, libraries and magazines for parents, this new way of book service is not used to the same extent by low- and high-educated

families. In line with other research (e.g. Cook et al. 1975; Neuman and Celano 2006), we found that equal access to resources for educationally unequal groups does not automatically create new learning opportunities.

The results of this natural intervention thus provide another example of the *digital divide*: children from low-educated families have equal access to the internet but benefits *derived from* access to internet programs lag far behind. New storytelling media on the internet are rarely visited by children from lower-educated families, thus not enhancing the opportunities for reducing the pedagogical divide between groups varying in educational background. The results are analogous to experiments with books (e.g. Raikes et al. 2006). Merely increasing availability of books does not result in more book sharing. Likewise, free access to new storytelling media on the internet does not improve story exposure opportunities in groups that most miss book-reading experiences.

More parental guidance may explain the heightened likelihood that children from higher-educated families visit Bereslim. VVE children play more often with a computer, and are more often joined by peers than supervised by a family member. As young children show an almost universal preference for the exciting commercial programmes on television and on the computer, parental involvement and determination to make choices for educational websites may be the determining factor. It is a somewhat contradictory result that the VVE group reports playing educational games. Two of the top three favourite computer games are educational games in both the VVE and non-VVE groups. One explanation could be that the VVE group prefers skill-learning games (letters, numbers) to book reading programmes as presented by Bereslim, in common with traditional literacy activities (Sonnenschein et al. 1997).

Practical implications

Free access through the internet to storybooks does not reduce the pedagogical divide between groups varying in educational background. Children from lower-educated families benefit from new opportunities offered by high-quality free of charge programs on the internet to a lesser degree than their peers from higher-educated families. Parent education seems critically important for selecting educational internet programs. Without active attempts to narrow differences in activities of children from lower- and higher-educated families, media influences may further widen the digital divide between children, and differences in language and literacy skills will increase rather than decrease. The present results indicate that children from lower-educated families miss adult guidance when they visit the internet. We speculate that lower-educated parents may be less inclined to search actively for educational programs because they are less aware of the beneficial effects of these programs. They rarely come across good examples of media use for educational purpose in their environment, including their children's nursery classrooms. Most teachers ban or ignore popular culture because they assume that traditional literacy activities are preferable to media use (Robinson and Mackey 2003).

Improvement of VVE programs is spearheading Dutch educational policy. VVE started officially in 2000 and since then, a growing number of eligible children follow a special programme in preschool and kindergarten (Sardes 2007). Since 2002, a special component for language development has been built into the VVE programmes supported by educational TV programmes. We recommend that within this

linguistic programme, special attention is focused on the utilisation of new media for educational purposes – especially the use of electronic books.

Limitations and future directions

Even though the questionnaire was brief and easy to complete, lower-educated parents may not have been available to complete the questionnaire. Completion was a condition to enter the Bereslim website and may thus have caused a negative impact on the distribution of educational levels.

Further research is warranted to test the hypothesis that many lower-educated parents do not get help in finding their way in an increasingly complex world of new media to support their children's literacy. In follow-up research, we need to explore this hypothesis by including questions about parental views of the additional value of internet programs.

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